



INDRADHANUSH GAS GRID LIMITED (IGGL)

(Joint Venture of IOCL, ONGC, GAIL, OIL and NRL)
GUWAHATI, ASSAM

NORTH -EAST GAS GRID PIPELINE PROJECT

BID DOCUMENT FOR

SUPPLY OF ORIFICE METER BASED METERING SKIDS ON ANNUAL RATE CONTRACT 2(TWO) YEARS

OPEN DOMESTIC COMPETITIVE BIDDING

Tender Ref. No.: 05/51/23VC/IGGL/030-FL

VOLUME – II OF II



PREPARED AND ISSUED BY

MECON LIMITED

(A Govt. of India Undertaking)

Delhi, India

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MATERIAL REQUISITION

PROJECT : NORTH EAST GAS GRID (PHASE – 1 & 2 P/L SECTION)
ITEM : METERING SKID
MR NO. : MEC/S/05/E5/23VC/030
CLIENT : M/s INDRADHANUSH GAS GRID LIMITED

Item No.	Description	Unit	Qty	Remarks
Under 2 Year ARC				
A	Design, Engineering, Manufacturing, Testing, Nameplate marking, Painting, Inspection, Packaging, Forwarding, Transportation, Transit Insurances, Shipment, Unloading of skid at site, Calibration and Supply of Metering Skid which comprise of Filtration (1W+1S) & Metering (1W+1S) through Single Chamber Orifice Meter with field mounted flowcomputer (alongwith solar panel, batteries, charge controller, JB, etc.)(for item no. A.1 only), panel mounted Flow Computer including Metering Panel along with the accessories (barriers / isolators, SDC, Terminal block duly mounted, wired and fully assembled) (for A.2 to A.7), Gas Detection System (for item nos. A.2 to A.7), Scrubber (for item nos. A.1 to A.6, A.8 & A.9), Gas Chromatograph (for item nos. A.4 to A.7), Water Dew Point Analyzer (for item nos. A.4 to A.7), Hydrocarbon Dew Point Analyzer (for item nos. A.4 to A.7), Consumables, Compulsory & Commissioning Spares, Special Tools Tackles including Assistance in Configuration, Interfacing, Integrated Testing & Commissioning as per Job specifications and Special Instructions enclosed.			
A.1	CHECK METERING FACILITY WITH SCRUBBER AT ONGC KSAB WHI SOURCE JORHAT (Ref P & ID No.: MEC/23VC/05/28/M/001/FEEDER-1001)	Nos.	01	
A.2	CHECK METERING FACILITY WITH SCRUBBER AT ONGC SUAB WHI SOURCE JORHAT (Ref P & ID No.: MEC/23VC/05/28/M/001/FEEDER-1002)	No.	01	
A.3	CHECK METERING FACILITY WITH SCRUBBER AT ONGC BABEJIA WHI SOURCE JORHAT (Ref P & ID No.: MEC/23VC/05/28/M/001/FEEDER-1002)	No.	01	
A.4	CHECK METERING FACILITY WITH SCRUBBER, GAS CHROMATOGRAPH, WATER DEW POINT ANALYZER, HYDROCARBON DEW POINT ANALYZER AT ONGC KORAGHAT WHI SOURCE JORHAT (Ref P & ID No.: MEC/23VC/05/28/M/001/FEEDER-1003)	No.	01	
A.5	CHECK METERING FACILITY WITH SCRUBBER, GAS CHROMATOGRAPH, WATER DEW POINT ANALYZER, HYDROCARBON DEW POINT ANALYZER AT ONGC TULAMURA (Ref P & ID No.: MEC/23VC/05/28/M/001/FEEDER-1004)	No.	01	
A.6	CHECK METERING FACILITY WITH SCRUBBER, GAS CHROMATOGRAPH, WATER DEW POINT ANALYZER, HYDROCARBON DEW POINT ANALYZER AT ONGC KHUBAL	No.	01	

	FIELD (Ref P & ID No.: MEC/23VC/05/28/M/001/FEEDER-1005)			
A.7	CHECK METERING FACILITY WITH GAS CHROMATOGRAPH, WATER DEW POINT ANALYZER, HYDROCARBON DEW POINT ANALYZER AT RT SILCHAR (Ref P & ID No.: MEC/23VC/05/28/M/001/FEEDER-1006)	No.	01	
A.8	SCRUBBER AT ONGC JANTAPATHAR SOURCE (Ref P & ID No.: MEC/23VC/05/28/M/001/FEEDER-1002)	No.	01	
A.9	SCRUBBER AT BANASKHANDI GCS (Ref P & ID No.: MEC/23VC/05/28/M/001/FEEDER-1006)	No.	01	
A.10	Assistance in Installation, Testing and Commissioning of skid at site, consisting of Scrubber, Gas Chromatograph, Water Dew Point Analyzer, Hydrocarbon Dew Point Analyzer, Filtration, Metering through Single Chamber Orifice Meter with field mounted flowcomputer / panel mounted Flow Computer including Metering Panel & Gas Detection System along with the accessories. The price shall be inclusive of Airfare Boarding, Lodging, Local Transport, Incidental, Traveling etc. & all other expenses.	Man Days	49	

Notes:

- 1 Evaluation shall be done for complete Package.
- 2 The Metering skid supplier shall be responsible for assistance in Installation, Testing and Commissioning of quoted MR items. For this purpose, 49 man days are considered for evaluation purpose. However, payment shall be as per actual requirement. Bidders shall indicate separate price for all quoted Item nos. A.1 to A.9 against item no. A.10.
- 3 The Vendor shall be completely responsible for the design, materials, manufacture & fabrication, testing, inspection, preparation for shipment and transport of the above equipment strictly in accordance with the MR and all attachment thereto. All items shall be provided with EN 10204-3.2 certificates.
- 4 Vendor shall appoint any one of the following TPIA for inspection purpose. Vendor has to propose minimum 4 nos. of below listed agencies to be approved by IGGL/MECON.
 - a) Lloyd Register of Industrial Services
 - b) Technische Ulierwachungs Verein (TUV)
 - c) Det Norske Veritas (DNV)
 - d) AB-Vincotte
 - e) Bureau Veritas
 - f) SGS
 - g) American Bureau Services
 - h) Velosi Certification Services

Apart from inspection by TPIA, inspection shall also be performed by MECON / IGGL's delegate, as set out and specified in the codes and particular documents forming this MR.

VENDOR DATA REQUIREMENT

Sl. No.	Description	Prints with Quotes	Certified information required after Purchase Order			
			Soft Copy	Printed Matter	Date needed	Date Promised
a)	Piping/Instruments					
01	Dimensional outline with mounting details for each item with Model No.	5	1	6	2 W	
02	Connection by Purchaser (Piping, Electrical)	5		6	2 W	
03	Wiring Diagrams	5	1	6	2 W	
04	Parts List	5	1	6	2 W	
05	Recommended Spares with Prices	5		6		
06	Installation, operations and maintenance instructions		1	6	W/S	
07	Test certificates			6	A/C	
08	Certificate from statutory bodies	5		6	2 W	
09	Assembly Details	5	1	6	2 W	
10	Technical literature & model decoding for each item	5	1	6	2 W	
*11	Testing and inspection procedures		1	6	2 W	
*12.	Data Sheets of all the Instruments		1	6	2 W	
13.	Software Manual/ Hardware Manual etc.		1	6	2 W	
14	Functional/Loop schematics	5	1	6	2 W	
b)	Skid			6		
*1	Layout of equipment (channel mounted)	5	1	6	2 W	
*2	GA drawing with dimensional details	5	1	6	2 W	
3	Structural details	5	1	6	2 W	
*4	Piping diagrams		1	6	2 W	
5	Foundation details		1	6	2 W	
6	Single line diagram	5	1	6	2 W	

Notes:

- Categories proceeded with "*" will be approved for fabrication by MECON LIMITED. The remaining drawings are needed for information only.
- Fold all drawing to 210mm x 297mm.
- Vendor to provide all printed matter and the soft copy to MECON LIMITED.
- Legends:
A/C = As completed
W/S = With Shipment
W = Weeks

TECHNICAL QUESTIONNAIRE

This questionnaire shall be duly filled in and submitted alongwith unpriced sets of offers to avoid further queries and to ensure proper evaluation of your offer in time. If this is not complied with, your offer is liable to be rejected.

ANSWER 'YES', 'NO' OR 'NOT APPLICABLE'

Sl. No.	Description	Bidder's Response
1.	Have you any deviation to the following :	
i)	General specifications (Clause wise)	
ii)	Special requirements (Clause wise)	
iii)	Mechanical/Instrument specifications indicated in the data sheets/ specifications.	
iv)	The scope of supply as indicated in the material requisition.	
	If 'Yes', have you included the list of deviations? (If no deviations are furnished, It will be assumed that all the specifications and requirements of the subject requisition are complied with and no deviation whatsoever will be accepted after the placement of order. Further, bidder shall give a undertaking separately that in case of any technical deviation observed in the bid document, same shall be treated as null & void and tender conditions shall govern)	
2.	Have you quoted for the spare parts including consumable items required for the startup and normal operation/ maintenance of the instruments?	
3.	Have you quoted for the mounting accessories, special calibration kits and equipment (complete with technical details) required, if any, for the erection, commissioning and maintenance of the instruments?	
4A)	Have you enclosed the relevant technical catalogue/ literature in ENGLISH language including model-decoding details, drawings etc. necessary for the evaluation of your offer? (Note : In case of line-mounted instruments, viz. control valves, positive displacement meters, pressure relief valves etc. for all the lines quoted, relevant dimensional details required for the installation must be furnished along with the offer)	
4B)	Have you confirmed that the documents required as per the vendor data requirements will be supplied after placement of order?	
4C)	If so, have you indicated the extra price applicable, if any?	

Sl. No.	Description	Bidder's Response
5.	Have you furnished sizing, noise calculations and certified capacity curves for the instruments wherever applicable?	
6.	Have you furnished separately the shop inspection charges, if any, for inspection at your works by MECON/ Third party? (The details of the tests to be carried out on the instruments during shop inspection are to be furnished).	
7.	Have you furnished the certificates from statutory bodies viz. BASEEFA, FM, CSA etc. for the explosion proof construction/ intrinsically safe design of the instruments wherever specified?	
8.	Have you confirmed that IBR certification in form III (C) or equivalent certification from statutory bodies viz. Lloyds, Bureau Veritas, TUV etc. will be furnished wherever specified?	
9.	Have you indicated separately the Supervision charges for installation, testing and commissioning, in case the same are included in your scope of work?	
10.	Have you furnished the estimated power/utility consumption and special cable requirements, if any, for the instruments quoted?	
11.	Have you furnished the customer reference list in India/ abroad ?	

Note: If the answer is in negative, then furnish response thereof.

VENDOR DRAWING/ DATA APPROVAL PROCEDURE

1. Vendor must take care of the following while submitting drawings and documents for review as indicated in Vendor Data Requirements enclosed.

A blank space measuring 75mm W x 40mm H shall be provided on all vendor drawings for marking review codes etc. by MECON LIMITED.

The review of vendor drawings shall be done as applicable under the following review codes:

- a) Review Code Approved : Approved
 - b) Review Code Approved As Noted: Proceed with manufacture/ fabrication as per commented drawings. Revised drawing required.
 - c) Review Code Not Approved: Document does not conform to basic requirements as marked. Resubmit it for review.
2. Review of the vendor drawings by MECON would be only to check compatibility with basic design and concepts and would in no way absolve the manufacturer/ fabricator of his responsibility to meet applicable codes, specification and statutory rules/ regulations.
 3. For drawings/ documents indicated as FOR INFORMATION in the Vendor Data Requirement, Vendor must mark FOR INFORMATION ONLY on the submitted drawings/ documents.

<u>CHECK LIST (Technical)</u>		
Bidder shall positively include all the information / documents asked in this check list for proper evaluation.		
Sl. No.	Description	Bidder's response
a)	P&ID of each Quoted Skid enclosed	Yes / No
b)	Tentative Bill of Material for each Quoted items (Skid) as per the MR.	Yes / No
c)	Make, Model No. and decoding details of each supplied items.	Yes / No
d)	Letter of confirmation for "No Deviation" enclosed separately for each skid.	Yes / No
e)	Filled in data sheets of each supplied item submitted.	Yes / No
f)	Letter of confirmation that offered materials are as per data sheets enclosed separately	Yes / No
g)	GA drawing (with dimensional details)/ Catalogue of each supplied item like Cartridge Filter, PCVs, SDVs, Valves, PSV, Meters etc. submitted separately.	Yes / No
h)	Signed & Stamped copy of Tender Document including MR for Quoted section.	Yes / No
i)	Contents / Index sheets with page numbering details for attached documents / drawings / certificate enclosed	Yes / No
j)	Sizing/ Design calculation for each supplied item like Cartridge Filter, PCV & SDV, PSV, Meters etc., submitted	Yes / No
k)	Flow computer sizing details submitted.	Yes / No
l)	Documents submitted as per "Vendor Data requirement" sheets	Yes / No
m)	Filled-in Technical Questionnaire submitted	Yes / No
n)	Separate list for 2-years' recommended spares with printed price-list enclosed	Yes / No
o)	Letter of confirmation that make of the various items shall be as per "Approved Vendor List" enclosed with this tender document.	Yes / No
p)	Items and vendor list for approval of MECON / Client or the items and vendors not covered in "Approved Vendor List" of this tender document	Yes / No
q)	Estimated shipping weight & volume of each item furnished with the office	Yes / No
r)	Quoted for each supplied items as per Schedule of rates.	Yes / No

Check List (BEC DOCUMENT)							ANNEXURE - A
NAME OF BIDDER:							
OFFER NO & DATE :							
QUOTED FOR ITEM NO. : (AS PER SOR)							
Furnished By Bidder							
Item No.	BEC CLAUSE NO.	REFERENCE DOCUMENT AGAINST THE CLAUSE	P.O. REF. NO. & DATE	INLET / OULET SIZE & RATING OF SUPPLIED SKID	SUPPLIED TO (NAME OF CUSTOMER)	Page No. Ref (Attachment Bid Document)	
1	CLAUSE NO. - 3.1						
2	CLAUSE NO. - 3.1.1 (a)						
3	CLAUSE NO. - 3.1.1 (b)						
4	CLAUSE NO. - 3.1.2						
5	CLAUSE NO. - 3.1.3						
6	CLAUSE NO. - 3.1.4						
NOTE : BIDDER SHALL SUBMIT THE SEPARATE CHECK LIST (BEC) FOR EACH QUOTED SKID.							

Check List (Mechanical & Instrumentation Items)							ANNEXURE - B
NAME OF BIDDER:							
OFFER NO & DATE :							
QUOTED FOR ITEM NO. : (AS PER SOR)							
Item No.	ITEM DESCRIPTION	Furnished By Bidder				Remarks	
		SIZE & Rating	Make	Offered Model No.	Page No. Ref (Attached with Bid Document)		
1	Catridge Filter						
2	Pressure safety Valve / CRV						
3	Slam Shut Valve						
4	Pressure Control Valve						
5	Flow Meter (USM / Turbine / RPD)						
6	Flow Control Valve						
7	Ball valve	NB > 2" , 150#					
		NB > 2" , 300#					
		NB > 2" , 600#					
		NB<2" , 800#					
8	Plug Valve	NB > 2" , 150#					
		NB > 2" , 300#					
		NB > 2" , 600#					
		NB ½" - 1½" , 800#					
9	Check Valve	NB > 2" , 150#					
		NB > 2" , 300#					
		NB > 2" , 600#					
		NB<2" , 800#					

27	Solar Panel (if applicable)								
28	Battery (if applicable)								
29	Junction Box								
30	Cable Glands								
31	Battery Charger (if applicable)								
32	Cables (signal / serial / power)								
33	SS tubes								
34	SS fittings, valves & manifolds								
35	Barriers & SDC								
NOTE : BIDDER SHALL SUBMIT THE SEPARATE CHECK LIST (Mechanical & Instrumentation Items) FOR EACH QUOTED SKID.									



**SCOPE OF WORK
FOR
METERING SKID**



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JOB SPECIFICATION

(Spec. No. - MEC/05/ 21/E5/JS-030)



SCOPE OF WORK FOR METERING SKID



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SCOPE OF WORK FOR METERING SKID



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1.0 GENERAL

This specification together with all annexure enclosed cover the requirement for the design, engineering, manufacturing, testing, inspection and supply of **Single chamber Orifice meter-based Metering Skid**, along with all accessories for different location as per P & IDs. Each stream of Skid shall be designed to cater flow of 100% of max. (Rated) flow capacity (as per P&ID).

The scope of work / supply includes Design, Engineering, Manufacturing, Inspection, Testing and Supervision for Installation & commissioning of metering skid consisting of (1W + 1S) Filtration, (1W + 1S) Flow measurement through Single chamber Orifice meter with field mounted flow computer (alongwith solar panel, batteries, charge controller, JB, etc.) (for item no. A.1 only), panel mounted Flow Computer with Metering Panel & its accessories (for item nos. A.2 to A.7), Gas Chromatograph (for item nos. A.4 to A.7), Water Dew Point Analyzer (for item nos. A.4 to A.7), Hydrocarbon Dew Point Analyzer (for item nos. A.4 to A.7), LEL Detection System (for item nos. A.2 to A.7), Scrubber (for item nos. A.1 to A.6, A.8 & A.9) and valves, piping, instruments & fittings as per P & ID's. The Required capacity, Pressure Rating, Quantity and Location of the Skids shall be as per P & ID.

- 1.1 The description and requirements contained in this specification are concise by necessity and cannot include all the details. However, it is the responsibility of the bidder to execute the job on a turnkey basis in accordance with the specifications and internationally recognized good engineering practices.
- 1.2 Any activity specifically not listed in this document, does not absolve the bidder of their responsibility to include such activities in their scope of work and supply, which otherwise is necessary, to complete instrumentation work for the project. All such activities shall be carried out by the bidder without any cost/ time implication.
- 1.3 In the event of any conflict between these specifications, related standards and codes, any other attachment to this package, the bidder shall follow the following documents in the order of their priority:
 - a) Job Specifications for Gas metering package
 - b) Data Sheets and Typical P&ID
 - c) Standard specifications and Technical Specification attached in the tender document.

In case of any conflict in various documents, same shall be referred to CLIENT/Mecon for clarification. Bidder shall not proceed without getting written approval in such a case.

2.0 SCOPE OF WORK & RESPONSIBILITY OF BIDDER

2.1 Scope of Work

- 2.1.1 General: Bidder shall be responsible for execution of the package on turnkey basis with scope of work as listed below but not limited to the following: -

- a) Design and Engineering
- b) Procurement/ Supply, Inspection, Factory testing and Acceptance
- c) Supervision for Installation, field calibration/ testing and commissioning.

2.1.2 Design and Engineering:

- (a) Owner shall provide the bidder with this bid package consisting of typical Piping & Instrumentation Diagrams and process data sheets. The bidder shall be responsible to carryout the design and detailed engineering based on the data provided in the bid package and in line with other technical requirements specified elsewhere in this document. Scope shall also include sizing and sizing verification for all items including where data is dependent upon detailed engineering, detailing of basic engineering designs, preparation of data sheets, coordination drawings for instruments and system-oriented items, engineering drawings etc.

(b) Residual Engineering

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



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(c) Control Room Engineering

Scope of skid supplier (bidder) for control room engineering is as explained below:

The complete skid / Metering System data (including gas composition, flow computer data and differential pressure, Pressure, Temperature and valve status) is required to be sent to remote station through CLIENT's RTU / SCADA. Gas metering panel shall be complete with Flow computers, Receiver instruments like signal selector, Power supplies, Isolating IS barriers & accessories, lamps, LEL gas monitor/ controller, converters etc. duly mounted completely wired & GC Controllers shall be mounted in same metering Panel, A separate terminal strip (designate as Telemetry Interface to RTU) shall be provided for terminating the signals to/from SCADA in this metering panel, Suitable hardware/ software is to be supplied for SCADA/RTU connectivity.

For Supervisory monitoring and control, a SCADA system is envisaged to ensure effective and reliable control, management and supervision of the consumers from centralized location. The SCADA system along with RTUs shall be provided by CLIENT. However, the bidder shall be responsible for configuring their systems and providing all the necessary details of their systems to the SCADA vendor.

(d) Engineering Drawings & Documents

- i) Vendor Data Requirements indicate the list of drawings and documents required to be supplied by the bidder, as a minimum. Bidder to note that list specifies only the major deliverables. Documents and drawings not listed but necessary for proper engineering, construction, operation and maintenance shall also be prepared by the bidder.
 - ii) Bidder shall be responsible for preparation of all engineering drawings and documents including those necessary for construction like instrument index, tray layouts, location plans, cable schedules, installation standards, bill of material etc.
 - iii) Bidder shall also be responsible for providing all drawings and documents for package/ sub package units
 - iv) It is expected that bidder utilizes uniform data sheet formats enclosed along with this document, for preparing specifications for various instruments, including those, which are being prepared by package/ sub package vendors. Items for which no format has been attached with the document, bidder may use standard ISA formats. Use of manufacturer standard formats shall be avoided.
 - v) The bidder shall supply all the documents in both hard copy and soft copy. This includes all the documentation including those for package units.
- e) The design and engineering work shall also include review of post-order vendor drawings and documents for all instruments and system-oriented items. Following methodology must be followed for drawings and documents being forwarded to Mecon.
- i) The Bidder shall thoroughly review and approve vendor drawings for all instruments including sub-package items, before forwarding to Mecon. Only the approved drawings duly stamped and signed by a competent representative/ engineer of Bidder shall be forwarded.
 - ii) The Bidder shall be responsible for all System Engineering documents for the Gas metering systems. This shall include all related documents such Functional design specifications, sizing calculations, pressure drop calculation etc. and Engineering documents such as functional loop schematics, instrument details and cable schedule, Power supply distribution schemes etc. These documents shall be reviewed and approved by Bidder based on philosophy specified/ agreed for the engineering before forwarding to Mecon.
 - iii) All multidisciplinary fabrication and construction drawings shall be reviewed and signed by bidder's respective departmental representatives before forwarding to Mecon for review/ approval/record.
- f) Bidder shall be fully responsible for co-coordinating with all agencies concerned to ensure proper, uniform and smooth engineering. This shall include coordination with:



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- i) All individual item suppliers for uniformity in engineering and documentation supplied by them including P&ID's, instrument specifications, installation standards etc. and obtaining all requisite drawing and documents for review, record and final documentation.
- ii) All instrument item suppliers including suppliers/ manufacturers of various system-oriented items.
- iii) Bidder's own inter-departmental coordination with departments like mechanical, piping, electrical, QC, pressure vessel, heater group etc. This shall include furnishing all necessary engineering data in the form of drawings & documents and review of drawings & data supplied by other departments.
- g) Bidder shall be responsible for preparation of all As-Built drawing / documents including
 - i) All P&IDs and GADs
 - ii) All Datasheets, specifications of instruments
 - iii) All Purchase documents.
 - iv) All System documents including hardware and software documentation.

2.1.3 Procurement/ Supply, Factory testing and Acceptance

- a) Engineering for procurement shall include preparation of various material requisitions which shall include process data sheets, typical data sheets for instruments, instrument standard specifications, special requirements etc., evaluation of offers received from various manufacturers/vendors, preparation of Technical Bid Analysis, preparation of purchase requisition and review/ approval of vendor drawings, incorporation of Mecon comments.
- b) All Instrument items and Gas metering systems shall be procured from vendor list attached elsewhere in this package. Bidder must desist from procuring any items from vendors not approved by Mecon. Along with the bid, the bidder has to provide the list of items/ equipments with size, Make and Model Number selected from the approved vendor list only. Non-compliance to this may result into rejection of bid.
- c) Bidder shall prepare purchase requisitions for all instruments/ systems which shall consist of a consolidated purchase document including all purchase specifications including data sheets, special instructions/ requirements (if any), standard specifications/ purchase specifications, testing requirements, quality requirements etc. All purchase requisitions shall be furnished to Mecon for information/ review/ approval.
- d) Testing & calibration of all instruments, Factory Acceptance Test (FAT) and Site acceptance Test (SAT) shall be carried out by the bidder. Range/ calibration span, set points, reports etc shall be modified as per CLIENT's requirement by the bidder during FAT and SAT. CLIENT / Mecon shall witness testing of any or all items at various stages during manufacture and/or at final stage before shipment at their discretion. Testing shall be carried out as per approved procedures. No instrument shall leave manufacturer's works without factory acceptance test. All necessary changes shall be incorporated/ implemented as suggested by CLIENT / Mecon during FAT/ SAT etc. As build drawing/ documentation to be submitted by the bidder shall contain all such changes.

2.1.4 Installation, Field Calibration/ Testing and Commissioning

- a) Bidder shall carryout installation of all instruments in the skid as described in this document. Installation shall include but not limited to installation of all supplied items, installation skid assemblies explained in this package, installation of junction boxes, interconnection between instruments and junction boxes, fabrication, laying and painting of cable trays, laying of all single pair and multi pair cables in the skid, JB earthing/ grounding, Field Instruments/ signal earthing/ Grounding, tagging, ferruling, cable glanding and pair/ core identification of all field cables.
- b) Distribution of power to various instruments in the skid from single point in the skid. Separate JB is required for different type of signals and also for power to field instruments (Power supply to Meter, GC and other Field Instruments shall be in separate JBs).



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- c) Installation shall be carried out as per Mecon standards or as recommended in the tender. For special instruments, the installation may be carried out as per vendor/ manufacturer's recommendations however all such installation standards shall be subject to Mecon review.
- d) Bidder's scope of supply/ work shall include earthing cable/ strips etc. (along with cable tray with supports for installation) in the skid/ JB/ control room, as per the requirements of various instruments.
- e) Due to limitations in transportation of the skid, the skid has to be transported to site in different modules. Individual modules shall be so designed that there are no / minimum cabling interconnections between various modules and such interconnections if any shall be in the bidder's scope.
- f) Bidder shall quote for man day rates as per SOR for installation supervision and commissioning of the complete skids. The quoted man-day rates for installation supervision and commissioning shall be valid for 24 months from date of issuance of FOI. Bidder shall depute qualified and competent person for installation supervision / commissioning.
- g) Testing & Calibration

Bidder scope of work includes testing of all supplied items and systems including impulse lines, pneumatic signal tubes and instrument cables and special instruments/ items if any. Bidder shall also carryout testing and calibration of all instruments as per the requirements specified elsewhere in tender document. Testing and calibration of Gas metering system shall be as described elsewhere in the document.

- h) Commissioning

It is the responsibility of Bidder to co-ordinate and make available the services of vendors/ sub-vendors for gas metering system package, control system, etc. and other special instruments/ equipments like Gas Chromatographs, Gas flow meters, Flow computers, during installation, testing, FAT, Site acceptance, startup/ commissioning of the station. The bidder shall provide assistance during commissioning without any condition/ pre-requisite. It is the responsibility of the vendor to get the certification from site Engineer. Installation of all the loose supplied items, its interconnection etc (except control panel erection, skid erection, construction of earth pit, cabling / cable tray laying from Metering skid to control panel) shall be in the scope of supplier. In case of any dispute / conflict arising due to difference in opinion/ interpretation, the interpretation of CLIENT /Mecon shall be considered final.

2.2 SCOPE OF SUPPLY

Supply of all items as indicated on the typical Piping & Instrumentation diagrams (P&ID) and other technical documents attached with this document.

1) The scope of supply shall include but not limited to the following as a minimum:

- a) Skid mounted Custody transfer Gas metering system package inclusive of Gas filtration & Gas metering (through Single chamber Orifice meter) complete in all respect as per P & IDs, Process data sheets & as described in Job specification for Gas metering system package.
- b) All field instruments such as Pressure Transmitters, Differential pressure transmitters, pressure gauges, temperature gauge, Temperature Transmitters & RTDs, Pressure Safety Valve, Creep relief valves, LEL Gas detectors, etc.
- c) Supply of Gas Chromatograph is envisaged for item nos. A.4 to A.7 as per MR. The G.C Controller to be mounted in the same metering panel.
- d) Supply of fully wired metering panel for Metering skid (for item nos. A.2 to A.7) as per MR with receiver instruments & accessories such as, indicating LED lamps, required intrinsic safety barriers, isolators, TB, tube light, space heater, cable ducts & Panel Mounted Flow computers and Color Printer and its accessories, signal converters, hub, hardware required to establish various serial link / connectivity with different instruments/ items (like Printers, GSM Modem, Single chamber Orifice meter, Laptop, SCADA/ RTU, GC, FC, LEL Controller etc) mentioned elsewhere. All the control room hardware (GC controllers, LEL controller, GSM Modem, FC, printer, laptop,



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communication cable required for control panel items) to be installed in the supplied metering panel. All hardware and software required for using diagnostic features of supplied instruments like Flow meters, Flow computers, GC, etc. shall be provided by the bidder.

- e) **GSM Modem** shall be provided with each flow computer for polling data from master control station (previous 35 days data) and remote data monitoring.
- f) All installation and erection materials such as impulse piping, pipe fittings and valves, copper jumpers, anchor fastener, tubes, tube fittings, SS valves & manifolds, cable tray and supports (for JB, vents, tubing etc.), cable glands, ferrules, lugs, cable ties, cable sleeves, TBs, earthing cable, foundation bolts of the skid, gaskets, companion flanges for inlet and outlet of the skid, all type of consumables and accessories for mounting of instruments, instrument supports, tray supports, canopies/ sunshields for all field mounted instruments.
- g) Supply of all types of cables such as signal, alarm, control, earthing cable, power cables. For supply of cables with each skid, Distance between metering skid (field) and Control room/ Metering panel shall be approx. **250 Meters**. Supplied cables shall be intrinsically safe and shall be as per Mecon Specification. Preparation of cable trench and laying of cables and cable trays between skid and control room is not in the Scope of bidder. However, supply of all the materials like cable ferrules, cable lugs, cable ties, cable sleeves, TBs, earthing cable, cable tray supports, anchor fastener, cable trays including cable glands at both ends is in bidder's scope. Bidder shall also supply suitable power cable (for supply of UPS/ Non-UPS power to control panel, power distribution etc.) and also cable required for SCADA/ RTU connectivity. Separate runs (from field to metering panel) of cables to be considered for each Metering stream & metering to be send directly to the metering panel i.e. not through JB.
- h) The distance between Power distribution/ UPS and Control panel/metering panel shall be approx. 50 meters. The distance between Control panel/Metering panel and SCADA/ RTU panel shall be approx. 30 meters. Supply of all the materials like cable ferrules, cable lugs, cable ties, cable sleeves, TBs, earthing cable, cable tray supports, anchor fastener, cable trays including cable glands at both ends is in bidder's scope. Suitable cables of suitable length to be supplied as follow:
 - i. All type of cable from field to control room.
 - ii. Communication and signal cable from control panel to SCADA/ RTU panel, Printer & Laptop etc.
 - iii. Power supply to control panel, field instruments considering the above indicated distances.
- i) All field Instruments of Metering i.e. PT impulse line & TT Thermowell along with flange, Meter run, meters (Single chamber Orifice meter), flanges, fittings & GC impulse line shall be Cold Insulated. Extra care should be taken by the bidder to avoid damage of insulation during transportation.
- j) Perforated tray, angle tray, accessories required for cable laying and routing up to the control room through cable trench. (Only supply of these material is in bidder's scope, however cable laying, tray work and cable/ tray erection/ installation is not in bidder's scope)
- k) Junction boxes and cable glands (as per the requirement of area classification) for different types of signals such as intrinsically safe, alarm, power etc. should be supplied and mounted/ installed in metering skid. Preferably, all JBs shall be mounted in skid at height of 1.3 meter from ground/ finished floor level/ skid base frame and accessible / approachable from outside. JBs shall not to be installed inside Skid.
- l) Painting of pipes, equipments, instruments, control panel, enclosures, platforms, jump-over/ crossovers, as required in line with the painting specifications attached elsewhere in this document. Also flow direction to be marked on mainline piping.
- m) Galvanized iron/ copper earthing strip and earthing cables for earthing of all instrumentation items including junction boxes etc. to instrument earthing system. (Supply of earthing strip / cable is in bidder's scope. Earthing pit at a distance of 50 meters shall be considered). Making of earth pit and laying of earthing cable/ strips is not in bidder's scope.
- n) Suitable environmental enclosure for custody transfer field instruments for environmental effect protection with a provision of locking. Any other erection material necessary for installation and commissioning of special instruments, if any.



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- o) Platforms & cross-over(s) / Jump-over(s) to be provided for the operation and maintenance of the equipments/ instruments/ JBs installed in the skid. Proper spacing to be maintained between the equipments for operation & maintenance. The vent & drains shall be properly supported in the skid. All the vents shall be at a height of minimum 3 meters above the working platforms. All flanges shall be connected through flexible jumpers of Minimum 3 mm thickness and 20 mm wide copper strips. Neoprene rubber sheet to be provided at all the supports for mainline pipe / valves / tubes / equipments etc. U turn flanged spool piece to be provided as spare to change the orientation of skid & the dimensions of the spool piece to be decided during detail engineering. All the extra tappings to be plugged & sealed (if not used).
- p) Any special tools/ tackles required shall be in scope of vendor.
- q) All the software used in the system and as specified elsewhere, shall be licensed in the name of CLIENT.
- r) One number of Laptop & Color Desk Jet / LaserJet Printer to be supplied with Metering skid (for item nos. A.2 to A.7) for panel mounted Flow Computers with auto switch between flow computers.
- s) Compulsory spares and commissioning spares (for each skid separately) as listed elsewhere in this document.
- t) Drawings and documents as listed elsewhere in this document.
- u) All pipes, tubing, fittings, valves, gaskets, bolts, nuts, spades, etc.
- v) A structural skid complete with necessary drip pan, walkways, staircase, platforms, gratings, handrails for access for operation and maintenance.
- w) Earth bonding system and earthing boss.
- x) Lifting lugs and spreader beam / frame, foundation Anchor bolts for the skid.
- y) Stainless steel nameplate for each skid, each tagged equipment and component.
- z) All Tie-ins (flanged connections) with nuts and bolts.
- aa) Inlet and Outlet matching flanges and Studs & nuts shall also be supplied along-with the skid.
- bb) The sun/ rain protection shed for Gas chromatograph field unit and for electronic instruments shall also be supplied by the bidder.
- cc) Operation and maintenance manual, for instruments/ equipments, as built drawing/ documentation.
- dd) The direction of Inlet & outlet is fixed. However, the orientation and detailed GAD will be approved as per the plot details and will be dealt during detailed engineering.
- ee) **Please note that Bidder shall submit hard copies of all documents/ drawings to MECON. The date of receipt of these documents/ drawings at MECON shall be deemed as the date of submission. If any documents/ drawings require re-submission due to any error/ deficiency noticed during review/ approval stage, in that event the additional time required by the bidder/supplier to get the revised document/ drawing reviewed/approved by MECON shall be solely to bidder's/supplier's account and in no case the bidder/supplier shall be entitled for any time or cost benefit. Also, P&ID shall be submitted within 2 weeks from the date of award of contract & GAD shall be submitted (after approval of P&ID & mainline equipments only) within 1 week and will be considered accordingly.**

2.3 Further Scope of Work and supply:

- a) Vendor scope includes Design, Engineering, Manufacturing, Inspection, Testing, Transportation, Supervision for Installation & commissioning of complete supplied items (Filtration , flow measurement, Stream Flow computers (for each stream), IR type LEL Detection system, safety valves, Pressure Instruments, Temperature Instruments



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Control Panel, complete integrated field instruments, piping, fittings and valves in a skid and a control room equipment with the following items described below as a minimum and as shown on the P&ID) of metering skids / metering system.

- b) Metering skids shall consist of complete metering package (consisting of Filtration and Metering. Each Metering streams of Skid should be designed for 100% of maximum flow capacity as per P& ID. Each of the Gas filtration and Metering Section shall be of required design flow capacity meeting the specified operating design conditions as per process data of respective skids. The Vendor's scope of work shall include supply of the complete Gas Filtration & Metering Skid in accordance with this specification and any other codes, standards and regulations stated herein. In each metering skid, one complete stream will be kept on a hot stand-by mode (including filtration, Metering etc.)
- c) The scope of supply as a minimum and as shown on the P& ID shall include, but not limited to the following.
- d) One gas filtration system with two gas filters (1 operating + 1 standby stream) (for each skid), each of 100 % of maximum flow capacity.
- e) One Gas metering system with two metering streams (for each skid) of Single chamber Orifice meter (1 operating + 1 stand by stream). Flow computer shall be provided for each meter stream with all interface accessories. Each metering stream shall be designed for 100 % of capacity.
- f) Gas Chromatograph system (for item nos. A.4 to A.7) shall consist of complete field mounted GC analyzer cabinet (closed from 3 sides with door/ access from 1 sides) and carrier and calibration gas cylinders assembled on a skid, retractable sample probe, sample tubing, sample conditioning system, and remote interface / display unit (control panel mounted) shall be supplied by the bidder along with each skid. Gas Chromatograph shall be used for Calculation of Gas Composition. The GC probe shall be installed at least 20D downstream from any flow disturbing elements such as elbows, valves, headers, tees as per ISO 10715. Separate Flanged Outlet pipe with provision for GC probe installation shall be provided for the same (It can be supplied loose). The calibration gas shall have 3 years stability with complete traceability. The on-line GC shall be certified for custody transfer application by a certifying agency equivalent to Nmi/ PTB/ NPL. The Helium Gas cylinders and Calibration Gas cylinders shall be approved by CCOE or equivalent body. The Gas Chromatograph shall be interfaced with all the Flow computers and on-line GC data to all the Flow computers shall be available all the time.
- g) The Gas Flow Meter shall be certified for custody transfer application by a certifying agency equivalent to Nmi/ PTB/ NPL. The maximum permitted velocity through meter shall be 20 meter per sec.
- h) Skid mounted field instruments like pressure gauges, Temperature gauges, Pressure & diff. Pressure transmitters, Temperature transmitters, temperature elements & thermo wells, shall be supplied along-with the skid.
- i) The metering stream (flow meter, up-stream & down stream meter tube, flow profiler, impulse tubing of Pressure transmitter, thermo- well, impulse tubing of on-line GC) shall be completely insulated to ensure an even heat transfer throughout the meter run when subjected to ambient environment.
- j) The custody transfer equipments at field like transmitters (pressure & temperature) shall be installed in an environmental enclosure to minimize the effects of ambient temperature variations and shall be lockable for prevention of unauthorized data entry.
- k) LEL gas detectors (IR Type point detectors) (quantity as per datasheet) on the skid and LEL Gas monitor in the control panel shall be provided as per data sheet and applicable standards / codes.
- l) Panel mounted Flow computer along with printer, GSM Modem & its accessories shall be supplied for Metering Skids (for item nos. A.2 to A.7) as per MR. The flow computers shall be control room mounted. 230 VAC, 50 Hz power supply shall be available for Control panel to be installed in control room. Flow computers and all other accessories for Metering system shall be installed in control panel. The system shall be designed in such a way that it should operate at 230VAC-50 Hz. Signal converter, signal selector, Isolating IS barriers & accessories, a separate terminal strip for all SCADA signals to/ from CLIENT's RTU duly mounted completely wired also to be provided. The entire system shall be mounted on control panels. PID controller shall be inbuilt within the flow computer, in case the supplied flow computer does not have PID control functionality, separate PID controller shall be supplied.



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- m) Supply of on-line Solar Panel & Batteries alongwith field mounted Flow Computer for Metering skid (for item no. A.1 only) as per MR.
- n) On line Solar Panel & Batteries along with field mounted Flow Computer & its accessories shall be supplied for Metering skid (for item no. A.1 only) as per MR. The system shall be designed in such a way that it should operate through battery. Bidder shall submit the Battery sizing calculation, Details of battery & Solar Panel, Product Technical Literature along with offer. The Rating, make and other necessary details in support of selected model for Battery & Solar Panel shall also be submitted. The power consumption of Flow Computer, Modem and other associated utilities of online system shall be considered for Backup calculation and finalization of sizing of Battery. Charger for batteries to be kept in separate JB & Battery JB's to be provided with breathing valves.
- o) Supply of metering panel (for item nos. A.2 to A.7) to house all the required control room components including LEL detection system, GC, Flow computers, Ball valve status indication, other hard-wares like signal converter, barriers, relays, cables, connectors, power supply, modem etc. to ensure completeness of metering system is in scope of bidder. Cable gland for connecting Field signal/ control cables, power cable in control panel is also in the scope of bidder.
- p) Internal or external USB converter and cable shall also be provided with each flow computer for connecting it to USB port of Laptop for configuration.
- q) Supply of all pipes, tubing, fittings, valves, gaskets, bolts, nuts, spades, etc, are in bidder's scope.
- r) All cables (including earthing cable), cable trays, earthing strips for grounding/ earthing of skid/ panel and wiring within the skid and from skid to metering control panel (Only approved, standard armoured cable to be considered for this project). All Interconnecting cables between skid Instrument/ Junction boxes to metering control panel and inside control panel (to be located in Local equipment room in safe area). Bidder to supply required mounting accessories for Cabling, tray work etc. Supply of Cables (signal/ communication cable etc) from Metering panel to RTU/ SCADA panel is also in the scope of bidder. Distance of 30 meters between Metering panel and RTU/ SCADA panel shall be considered for supply of such cable. Suitable Power cables (UPS/ Non-UPS) for metering panel and field Instruments shall also be supplied by the bidder.
- s) Junction boxes (as per the requirement of area classification) for power, signal, alarm, instrument and control cables with suitable cable glands are in bidder's scope.
- t) A structural skid complete with necessary drip pan, walkways, staircase, platforms, crossover, gratings, handrails for access for operation and maintenance are in bidder's scope. Details of skid assembly, supporting positions, Anchor bolt layout and equipment weights to be provided prior to equipment supply.
- u) Lifting lugs and spreader beam / frame, foundation Anchor bolts, copper jumpers for flanges for the skid, Stainless steel nameplate for each tagged equipment and component; All Tie-ins with flanged connections shall be in bidder's scope. Earth bonding system and earthing boss for metering skid are in bidder's scope.
- v) Inlet and Outlet matching flanges and Studs & nuts (for skid interconnection and Inlet & Outlet piping connection), suitable Gaskets shall also be supplied along-with the skid.
- w) The sun/ rain protection shed for Gas chromatograph field unit and for electronic instruments shall also be supplied by the bidder.
- x) **Softwares:**
 - a) Flow Computer shall have type approval for flow calculation (as per AGA-3) from the internationally accredited laboratory for custody transfer application.
 - b) Vendor to provide the necessary hardware/ software (licensed in favor of CLIENT) for configuration of Flow computer and Gas chromatograph. Vendor to provide all the details and required soft-wares for SCADA communication.



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- c) Vendor to provide the necessary software (licensed in favor of CLIENT) for accessing all data including flow computer and Gas chromatograph.
- y) The Vendor's scope of work shall also include:
 - a) Inspection and testing of all components, sub-assemblies, and complete assemblies of items manufactured at Vendor's works, and other sub-vendor's works in accordance with approved QA/QC procedure;
 - b) Shop assembly and hydro-test.
 - c) Factory Acceptance Test (FAT) for the complete package at Vendor's works as per approved FAT procedure.
 - d) Supervision of Installation, start-up and commissioning of the complete package at site. Site acceptance test (SAT) for the complete skid as per approved SAT procedure
 - e) Preparation for shipment, packing and delivery of all packages, equipment and material to site.
 - f) Installation assistance, Start-up and commissioning assistance at site.
 - g) Preparation and submission of all documents as per requisition with the bid and after award of contract.
 - h) Preparation and submission Final Documentation / Completion files as per this specification. Two copies (hard copy and soft copy) shall be submitted along with the complete system at stores / site for each skid.
- 2.3.1 Any work not specifically mentioned but otherwise required, as per statutory rules/ codes and standards/ specifications and/or for the completion and operation of equipment to the entire satisfaction of CLIENT/Mecon have to be done by the VENDOR without any commercial implications.
- 2.3.2 The scope of work also includes the mechanical and structural detailed design of the skid, procurement of materials, preparation of fabrication drawings, detailing of internals, fabrication, inspection and testing of the piping and structural items at fabrication shop, painting, internal coating if any, preservation, transportation and undertaking Guarantee for the equipment.
- 2.3.3 The scope of supply of metering skid also includes mandatory spares mentioned elsewhere.
- 2.3.4 The VENDOR shall assume single point responsibility for all aspects of the work. This shall include timely completion, liaison with CONTRACTOR, liaison with VENDOR of specified items, co-ordination of the work, quality and guarantee for the equipment.
- 2.3.5 Where parts of the package are subcontracted and purchased by the VENDOR, these become part of the Vendor's package and it is the Vendor's responsibility to ensure that the complete package complies with the specifications, codes and standards and statutory regulations.
- 2.3.6 Scope to include all instruments shown in the P&ID/ schematic, as within the Vendor's scope.
- 2.3.7 The Vendor shall be responsible for obtaining necessary approvals, authorization and certification from local Government / Local Statutory bodies, Authorized Inspector and Third-Party Inspection Agency as applicable.
- 2.3.8 The equipment shall be suitable for the site conditions specified. All components/ consumables used shall be new and of current manufacture.
- 2.3.9 In the event of any conflict between this specifications, data sheets, related standards codes etc., vendor shall refer the matter to the PURCHASER for clarifications and only after obtaining the clarification shall proceed with the manufacture of the items in question.
- 2.3.10 Vendor shall take single point responsibility for the engineering, design, certification, procurement, inspection, testing,



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supply & performance of the Gas Metering System skids along with all instruments, equipment and valves of the skids, Gas chromatographs and Metering control panels based on the data sheets and the specifications furnished and taking into consideration successful operation, safety and the established international standards for the complete skids. As a part of skid design & engineering, the following shall be undertaken/ decided/ furnished by vendor:

- a) Calculation of metering system uncertainty based on the approved design and it shall be within $\pm 1\%$. (Vendor shall submit the Calculation for overall system uncertainty including all components of the metering system). The calibration shall be done at minimum 7 points initially. The calibration shall be done at the following nominal flow rates: $0.025 q_{max}$, $0.05 q_{max}$, $0.1 q_{max}$, $0.25 q_{max}$, $0.5 q_{max}$, $0.75 q_{max}$, and q_{max} . The calibration reports should also contain verification for minimum two flow readings after adjustment of factors as per AGA 3.
 - b) Based on the approved design Sizing of flow meters, Pressure relief valves.
 - c) Instrument ranges to meet the Process operating and design conditions
 - d) Vendor to provide detailed Noise calculation and standard used and any assumption considered.
 - e) Response and transportation time calculation for Gas chromatograph
 - f) All the instruments/ equipments to be procured as per the approved vendor list of CLIENT/Mecon.
- 2.3.11 Typical instrument data sheets for Single chamber Orifice meter, Gas chromatograph, pressure relief valves, field transmitters, pressure gauges, and accessories indicate materials for body, internals etc. However, this does not absolve the Vendor of the responsibility for proper selection with respect to the fluid and its operating and design conditions. Proper sizing and selection of the pipe, isolation valves, Single chamber Orifice meter, and pressure relief valves and accessories are vendor's responsibility.
- 2.3.12 All the major items like valves (Plug, Ball, Globe and Check), Filtration, Single chamber Orifice meter, Flow computers, Gas chromatograph, Pressure Safety valves, Pressure & diff. Pressure transmitters, Temperature instruments, LEL detection system etc. shall be supplied from the vendor list attached elsewhere and the offered model of equipments shall have proven track record of successful operation for at least 6 months till bid submission date.
- 2.4 Vendor shall be fully responsible for proper integration of their supplied systems with CLIENT's SCADA (RTU) systems and shall provide all the technical details to CLIENT for configuration at SCADA end. Configuration in the supplied control panel shall be bidders' responsibility.

3.0 DESIGN PHILOSOPHY

3.1 GENERAL

- 3.1.1 This Document together with the attachments covers the minimum requirements for the design and engineering of metering skid complete with all accessories. Bidder shall be responsible for Design, engineering, sizing, selection, manufacture and/ or procurement, of materials, components and equipment necessary for complete package.
- 3.1.2 This document provides in detail, the minimum qualitative requirements of most of the instruments. For instruments, where no such requirements are indicated in this document, the bidder shall submit the same for CLIENT's/ Mecon approval. For metering system, vendor shall submit the complete design and engineering of the metering skid for custody transfer application. The total uncertainty calculation of the metering system to be submitted as per the design data prior to the fabrication of skid.

3.2 CODES AND STANDARDS

- 3.2.1 Design and terminology shall comply, as a minimum, with the latest edition prior to the date of bid enquiry of following codes, standard practices and publications:

AGA American Gas Association, Gas Measurement Committee



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Report No.3 – Orifice Metering of Natural Gas.
Report No.7 - Measurement of Gas by Turbine Meters.
Report No.9 - Measurement of Gas by Ultrasonic Meters

ANSI / ASME	American National Standards Institute/ American Society of Mechanical Engineers. B 1.20.1 Pipe Threads. B 16.47 Steel Pipe Flanges and Flanged Fittings. B 16.20 Ring Joint Gaskets and Grooves for Steel Pipe Flanges.
ANSI/FCI	American National Standards Institute/Fluid Controls Institute 70.2 Control valve seat leakage classification.
API	American Petroleum Institute
RP 520	Sizing, selection and installation of pressure relieving system in refineries. Part-I - Sizing and selection Part-II - Installation
RP 521	Guide for pressure relieving and depressurizing systems
P 526	flanged steel safety relief valves.
RP 527	Seat tightness of pressure relief valves.
MPMS	Manual of Petroleum Measurement Standards.
RP 551	Process Measurement Instrumentation. Part 1 - Process Control and Instrumentation
RP 552	Transmission Systems
S 1101	Measurement of Petroleum liquid hydrocarbon by Positive Displacement meter.
S 2000	Venting Atmospheric and low-pressure storage tank.
S 2534	Measurement of liquid hydrocarbons by turbine meter systems.
S 670	Vibration, Axial-Position and Bearing-Temperature Monitoring Systems.
ASTM	American Society for Tests and Materials.
BS	British Standards
BS-1042	Measurement of fluid flow in closed conduits.
BS-4368	Compression coupling for tubes.
BS-4800	Colours for ready mixed paint.
BS-5308	Part-2 Specification for PVC insulated cables.
BS-6364	Specification for valves for cryogenic service.
BS-7244	Flame Arrestors for general use
DIN-43760	Temperature vs Resistance curves for RTDs.
DIN-19234	Electrical Distance Sensors; DC interface for Distance Sensor and Signal Convertor.
IBR	Indian Boiler Regulations.
IEC	International Electro-technical Commission.
IEC 60079	Electrical Apparatus for Explosive Gas atmosphere
IEC 60085	Thermal Evaluation and Classification of Electrical Insulation
IEC 60332	Test on bunched wires or cables. Part 3 Cat 1
IEC 60331	Fire resistance characteristics of electrical cables
IEC 60529	Classification of degree of protection provided by enclosures.
	IEC 60534-2 Industrial Process Control Valves-Flow capacity
	IEC 60584-2 Thermocouples - Tolerances
	IEC 60584-3 Thermocouples extension and compensating cables, tolerances and Identification system.



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IEC 60751 Industrial platinum resistance thermometer sensors

IS	Indian Standard
IS-5	Colours for ready mixed paints.
IS-319	Specification for free cutting Brass bars, rods and sections
IS-1239	Mild steel tubes, tubulars and other wrought steel fittings.
IS-1271	Specification of Thermal Evaluation and Classification of Electrical Insulation.
IS-1554-	PVC insulated (heavy duty) electric cables-working Part I voltage up to and including 1100 V.
IS-2074	Ready mixed paints, air drying, red oxide- zinc chrome.
IS-13947	Degree of Protection provided by enclosures for low voltage switch gear and control gear.
IS-2148	Flame proof enclosures for electrical apparatus.
IS-3624	Specification for pressure and vacuum gauges
IS-5831	PVC insulation and sheath of electric cables.
IS-7358	Specifications for Thermocouples
ISA	Instrument Society of America.
S-5.2	Binary logic diagrams for process operations.
S-7.3	Quality standard for instrument air.
S-75.01	Flow equations for sizing control valves.
ISO 5167	Measurement of fluid flow by means of orifice plates, nozzles and venturi tubes inserted in circular cross-section conduits.
NEC	National Electric Code.
NFPA	National Fire Protection Association.
	NFPA-496 Purged and pressurized enclosures for electrical equipment.
EN	European Standard
EN334	European standard for pressure regulators upto 100 bar
EN12186	Gas Pressure Regulating Stations for Transmission and distribution
EN14382	Safety systems for Gas distribution

3.2.2 In general, Bidder shall carryout engineering as per IEC/ BIS standards.

Any other standard, if necessary, can also be referred by bidder during the execution of the job, without diluting the basic requirements, however with prior information to Owner/ Owner's Representative. In any case bidder must furnish a list of codes and standards other than those specified in this document, which shall be followed by them during engineering.

3.3. INSTRUMENT DESIGN CRITERIA

3.3.1 No instrument air shall be provided by CLIENT. Suitable high pressure gas supply trains / systems two stage pressure regulation shall be installed by vendor for proper operation of the control valves. Special care to be paid for dealing the problem arising from possible condensation due to pressure reduction. A well proven system to be used for this application. I/P converters/ Electro pneumatic positioner, Filter regulators, Actuators, positioner shall be suitable for Natural gas (sour) application.

3.3.2 The Equipments and instrumentation selected for the metering skids shall be rugged in design and must be well proven in the hydrocarbon industry. Prototype design or equipment of experimental nature or design undergoing testing etc. shall not be selected and supplied. Following criteria must be applied before selecting a particular instrument item: "The instruments as being offered/ supplied should have been operating satisfactorily in hydrocarbon industry like Refinery, Petrochemical and Gas Processing Plant under similar process conditions for at least 4000 hrs. from the bid due date."

3.3.3 The complete station shall be designed in such a way that the mean gas velocity remains within 20 Meter per second. The complete skid shall be designed for 100% of the maximum flow capacity.

3.3.4 Instrument Requirements for classified area:

- a) All electronic/electrical instruments and equipments shall be suitable for area classification as per IEC codes and shall be tested by any recognized authority like BASEEFA, FM, PTB, CMRI etc. and shall be certified by CCOE.



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- All the configurators, gas cylinders shall be certified by CCOE.
- b) Certified Intrinsically Safe (IS) equipment as per IEC-60079-11 shall be used, in general, in hazardous area. In case intrinsically safe equipment is not available, flameproof enclosures as per IEC-60079.01 may be considered.
 - c) Junction boxes and accessories required for flameproof instruments shall also be certified flameproof.
 - d) All non flameproof panels and cabinets installed in classified area shall be purged as per requirements specified in NFPA-496, as a minimum.
 - e) Other type of protection as specified in IEC-60079 shall not be used.

3.3.5 Statutory Approvals

- a) Bidder shall be responsible for obtaining all statutory approvals, as applicable for all instruments, equipments, calibration gas cylinders and control systems.
- b) In addition, equipments/instruments/systems located in the hazardous area shall be certified by the local statutory authorities for their use in the area of their installation. In general, following certification shall be given:
 - For all intrinsically safe/ explosion proof/ flameproof equipments/ instruments/ systems or equipments with any other type of protection allowable as per this package which are manufactured abroad and certified by any statutory authority like BASEEFA, FM, UL, PTB, LCIE etc. should also have the approval of Chief Controller of Explosives (CCOE), Nagpur.
 - For all flame proof equipments manufactured locally (indigenously), the testing shall be carried out by any of the approved test house like CMRI/ERTL etc. The equipment shall in addition bear the valid approval from Chief Controller of Explosives, Nagpur and a valid BIS license.
 - For all intrinsically safe equipment manufactured locally (indigenously), the testing shall be carried out by any of the approved test house like CMRI/ERTL etc. The equipment shall in addition bear the valid approval from Chief Controller of Explosives, Nagpur.
 - Custody transfer approval from NMI/ PTB/ NPL or equivalent body from the country of origin.
 - All the supplied gas cylinders shall have CCOE approval.
 - CCOE certificate for the foreign items shall be submitted during detailed engineering, however Appropriate approval certificates from the country of origin shall be provided with the bid

3.3.6 In general, intrinsically safe philosophy shall be followed for all transmitters. Bidder to note that external barriers shall be selected based on entity concept.

Typically, barrier selection must be made based on the following:

- i) Analog Inputs (4-20 mA): Series 5000 of MTL/ P&F KFD series/ Eqv.
- ii) Analog Outputs (4-20 mA): Series 5000 of MTL/P&F KFD series/ Eqv.
- iii) Proximity Inputs: Series 5000 of MTL/ P&F KFD series/ Eqv.

3.3.7 All instruments in the skid shall be certified for IEC Zone 1 Gas Group IIA/IIB, T3.

3.3.8 Instruments, which are not available as per their standard design from any reputed manufacturer as intrinsic safe, can be supplied in flameproof design. All such instruments shall be certified flameproof for the area classification and requirements indicated in clause 3.3.4 above.

3.3.9 Flame-proof (explosion proof) junction boxes as applicable shall be certified for IEC-Zone-1, IIA/IIB for all the classified areas for flame proof instruments.

3.3.10 The sizing for PIPES, Safety valves, Single chamber Orifice meter is bidder's responsibility.

3.3.11 Any change in instrument size or revision in line sizes because of sizing shall be carried out by bidder without any financial implications to CLIENT.



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- 3.3.12 All line mounted temperature elements shall be RTD type as per IEC 60751.
- 3.3.13 All the instruments shall be provided with canopies of adequate size to protect instruments from direct rain & sunlight. All such canopies shall be prefabricated type.
- 3.3.14 All the field switches shall be suitable for Flameproof and weather proof enclosure contacts. The process switch shall be silver plated with contacts rated for rating of 30 V DC, 1 Amp. This requirement shall also be applicable for any other switch contact like push button, selector switches in the intrinsically safe service. The field switches shall be normally closed type and open to alarm. Switch contacts shall be SPDT. For all field switches (except Limit Switches), differential of switch shall be less than 60% of difference between set value & operating value.
- 3.3.15 Tube Fittings used for the installation of instruments shall be tested as per BS 4368 or equivalent standards.

3.4 JUNCTION BOXES AND CABLING PHILOSOPHY

3.4.1 Cable Routing

- 3.4.1.1 Single / multiple pair cables from instrument to junction box shall be through perforated trays. Cable glands shall be provided at instrument end and junction box end. Supply of Cables from Skid to the control panel and Cable glands (required for control panel end and skid end) for these cables shall be in bidder's scope. However, cable laying shall not be in scope of vendor.

3.4.2 Junction Box

- 3.4.2.1 In general separate junction boxes shall be used for the following:

- a) 4-20 mA DC signals (IS)
- b) LEL detector signals
- c) Metering Signal
- d) GC Signals
- e) Contact signals (Field switches, Limit switches, push buttons etc.)
- f) Interlock and shutdown signals (Solenoid valves)
- g) Power supply to various instruments (GC, Meters)

Separate JB's and cable are required for power supply to Meters and GC. The JB's shall have side entry for Branch cable/ single pair cable and Bottom entry for multi-pair cable entry. No top entry shall be considered.

- 3.4.2.2 The multi-cable entry for 6-pair JB and 12 pair JB shall be 1" NPT (F) and 1.5" NPT (F) respectively. Each junction box shall be provided with 2 multi-cable entries from the bottom of the junction box with one plugged with weather proof plugs.
- 3.4.2.3 Junction boxes, cable glands and accessories shall be weather proof in general. Slipper type PVC sleeves shall be used over cable glands for all cable entries in junction boxes to avoid water entry in junction boxes. In case of explosion-proof components used (only for packages), the respective junction boxes, cable glands and accessories shall be certified weatherproof and explosion proof.
- 3.4.2.4 Only one multi-cable entry shall be used in the junction box. The other cable entry shall be plugged.
- 3.4.2.5 The junction boxes in the field as well as in local panel shall be provided with sufficient number of terminals to terminate all the pairs of multi-cable (including spare pairs) and shields of individual pairs as applicable.

3.5 INSTRUMENT PAINTING REQUIREMENTS

- 3.5.1 All instrument impulse lines (except SS 316 Tubing) and instrument structural items shall be painted by the bidder.
- 3.5.2 The painting/ coating shall be performed in totality for all instrument items such as:
- a) All line mounting and equipment mounted instruments.



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- b) All instrument impulse piping (except SS 316 Tubing)
- c) All instrument structural items like M.S. cable trays, instrument supports and tray supports, instrument stanchion, impulse line supports etc.
- d) All surfaces of GI items wherever repair has been carried out shall also undergo painting.
- e) All cabinets/panels, base frames which have undergone repair at site shall also be painted.
- f) The final coating on external surfaces shall be applied just before handing over the plant or commissioning of the plant.
- g) Name of the manufacturer, colour and quality of all types of primers and paints shall be subject to approval of the owner/owner's representative.

3.5.3 Painting of other equipments shall be as per Painting specifications attached elsewhere.

3.6 POWER SUPPLY & POWER SUPPLY DISTRIBUTION

3.6.1 230 V AC shall be available for control Panel. Vendor to suitably install Rectifiers in the control panel for powering panel and field instruments both.

3.6.2 Bidder to note that 230 volts power supply shall be floating neutral type. Vendor to provide isolation transformer, in case vendor requires grounded neutral.

3.6.3 One feeder shall be provided by Bidder in the Control panel for connecting incoming power cable. Further distribution for all the vendor supplied instruments/ equipments in control room and at field are in Bidder's scope. 24 V DC power required for the barriers, isolators and field contact interrogation and relays etc. shall be provided by the vendor through dual redundant power packs. Power packs shall be sized with the safety factor of 1.5 of the actual load requirements.

3.6.4 *Max. 800 W solar system power shall be provided to power up the Metering panel wherever considered. Vendor to select low powered instruments & design instrumentation system to accommodate total power consumption in Max. 800 watts. Vendor to submit power consumption calculation.*

4.0 PROCESS DESCRIPTION

4.1. The bidders shall design the skid considering the worst-case process condition scenario.

- The PSV to be designed in such a way that the set pressure can be adjusted within the operating pressure range/ set points. Separate spring(s) shall be provided, if one spring is not sufficient to meet the requirement.
- 10 % of the maximum flow capacity shall be considered as the minimum flow.
- Design Temperature: -29 to 65 deg C.
- Design flow: 100% of maximum flow capacity.
- The maximum permissible pressure drop across the complete Single chamber Orifice meter-based metering skid is 3.0 kg/cm²g.

4.2. Detailed Process conditions:

The quoted skid shall be designed for flow capacity of 100% of maximum flow mentioned above and shall be suitable for Gas compositions attached with bid documents. The Heating value of Natural gas (GCV) shall be 9200 to 9880 Kcal/SCM.

4.3. The bidder shall provide certification from Original Equipment manufacturer of gas flow meter/ calibrating agency that the performance/ accuracy and repeatability of the Meters shall be within the prescribed limit as mentioned in tender during operation with above mentioned Natural gas composition. The Material (and its composition) used in Metering skids shall be suitable for Natural gas of above-mentioned composition. The bidders shall provide written confirmation



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from the Original Meter Manufacturer that the meters offered by the bidder shall perform within the specified accuracy limit with the above-mentioned Gas composition.

- 4.4. All the calculations for the sizing of the valves, meters etc shall be based on the design flow capacity with worst case Process Temperature and Pressure, however for mechanical strength of the equipments, design temperature / pressure shall be considered.
- 4.5. All the Equipments shall be able to withstand maximum/ minimum design Pressure and temperature. Worst case process pressure and temperature with design flow is to be considered for noise calculation of valves.

5.0 JOB SPECIFICATION

5.1 GENERAL

This document defines the instrument Job requirements over and above various Standards attached along with this document.

The selection of type of instruments is Bidder's responsibility. For the instruments where type is already identified in the P & IDs / data sheets, the Bidder shall follow the same. However, during the engineering procurement stage if it is found that a different type of instrument is most suited for a particular application then the same shall be referred to Mecon for review, and if suitable, the changed instrument shall be supplied by the bidder. Bidder shall also be responsible for selecting and reviewing the type of instrument where specifically indicated in P& ID.

Instrument selection and specifications shall be carried out as per specification, typical instrument data sheets and Standard Specifications in general, as appended by special requirements specified here in.

The referred Standard specification, Technical Specification together with the P&IDs, Process data sheets, data sheets, standard specifications attached with the Package, defines the requirement for the design, engineering, manufacture, fabrication & assembly, integration, calibration, factory testing, supply, packaging, shipping and documentation including deliverables, statutory and other special approval, inspection, testing overall skid performance guarantee of Gas custody transfer. If required, then installation supervision, commissioning of the same at the same terms & condition of the contract/ tender.

6.0 TESTING AND INSPECTION

6.1 GENERAL

- 6.1.1 All pressure boundary materials shall have certified material test reports (CMTRs) or certificate of compliance per the design code. Certifications shall be to **EN 10204 Type 3.2 for pressure parts and Type 2.2 for other parts**.
- 6.1.2 Vendor shall submit the QAP & FAT Manual / procedure to Mecon for review and approval. A typical Mecon QAP and FAT Manual/ procedure is attached elsewhere.
- 6.1.3 All materials and equipment shall be factory tested before shipment in the presence of Purchaser's representative. No material shall be transported to site until all required tests have been carried out and equipment is certified as ready for shipment. Acceptance of equipment or the exemption of inspection or tests thereof, shall in no way absolve vendor of the responsibility for delivering equipments meeting the requirements of the specifications.
- 6.1.4 Vendor shall furnish the following
- Material test certificate, Hydrostatic test certificate, certificates of radiography for all line mounted items/ instruments on the skid.
 - Certificates from statutory body for hazardous area approval for all electrical items mounted on the skid.
 - Calibration certificates, certificates for custody transfer, certificates for the conformity to the standards to be submitted.
 - All other certificates mentioned in individual general specification.
- 6.1.5 Supplier shall perform the usual standard tests to maintain quality control procedures. These test certificates shall be



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submitted for review before starting inspection by Purchaser. Supplier shall be responsible for testing and complete integration of the system. Detailed procedures of test and inspection shall be submitted by the supplier for review before order and mutually agreed upon.

- 6.1.6 Vendor shall include inspection by Mecon/ third party personnel at vendor's shop. For this inspection, labour, consumable, equipment and utilities as required shall be in vendor's scope. Third Party Inspectors shall be deployed by the bidder. Vendor to propose minimum 03 TPI agencies, from which one shall be selected/ approved by Client/Mecon.
- 6.1.7 Other inspection and testing requirements shall be as per respective Standard specifications of various instrument items.
- 6.1.8 Qualification of the TPI appointed by the Vendor/ supplier and deputed for witnessing at various stages of Fabrication (like Hydro-test, FAT etc) shall be provided by the supplier well in advance for our review and confirmation. The TPI involved to witness shall have relevant experience. In case of any deviation / discrepancy observed while carrying out the inspection by TPI, bidder has to take clearance for the same by MECON / CLIENT. No TPI shall be deployed for our approval and FAT shall not commence without this.

6.2 **SKID:**

The following tests shall be conducted for the skid

- Hydro testing for the integrated skid / individual pipe spools.
- Pneumatic Leak test of complete skid at 7 Kg/cm²g pressure.
- Skid functional testing considering metering, limiting and safety characteristics.
- Skid piping material testing and NDT of welds as per Piping material specifications. Radiography/ X-ray shall be carried out for all welded joints and vendor shall furnish test certificate for the same. Dye-penetration test certificate shall be provided for joints wherever radiography/ X-ray is not possible.
- Radiography/ X-ray, Charpy impact testing for line mounted instrument items such as pressure relief valves, Single chamber Orifice meter and meter runs etc.
- Testing and inspection requirements for skid piping materials shall be as per specifications attached else where in the bid package.

6.3 **Skid Equipments**

The following tests shall be conducted:

- 6.3.1 Requirements of non-destructive testing like radiography, magnetic particle test, hardness test, hydro-test, Charpy test for pressure relief valves, Single chamber Orifice meter, Profiler and meter runs shall be carried out strictly as per following specification.
- 100% radiography shall be carried out on all casting. Radiography procedure and area of casting to be radiographed shall be as per ANSI B16.34 and acceptance criteria shall be as per ANSI B16.34 Annexure B. Two shots shall be taken for each area to be radiographed, as a minimum.
 - Radiography/ X-ray shall be carried out for all welded joints and vendor shall furnish test certificate for the same. Dye-penetration test certificate shall be provided for joints wherever radiography/ X-ray is not possible.
 - Each Single chamber Orifice meter along with meter runs shall be subjected to hydrostatic test with a pressure of 1.5 times the design pressure.
 - Charpy impact test on each heat of base material shall be conducted as per A370 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. The Charpy impact test specimen shall be taken in the direction of principal grain flow and notched perpendicular to the original surface of plate or forging. The minimum average absorbed energy per set of three specimens shall be 27J with an individual minimum per specimen of 22 J.
- 6.3.2 Flow Meter, Meter run, Flow computer and accessories shall be offered for pre-dispatch inspection to CLIENT and / or CLIENT's representatives. Following tests, checks shall be conducted:
- Physical/ dimensional checks and workmanship. Checking of meter tube roughness. Calibration including establishing linearity and repeatability over the entire range.



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- b) The calibrating agency/ Laboratory / OEM of meter shall certify that the flow meter being calibrated shall work with specified accuracy/ repeatability with the actual gas composition mentioned elsewhere in the tender documents.
- c) Functional and simulation tests including checking of hardware and software for Flow computers including Single chamber Orifice meter and gas chromatographs with all its sub-systems in fully integrated configuration.
- d) All the panels along with all instruments mounted on it including flow computers, GC controllers, LEL monitors, barriers, isolators, power supplies, Printers, Modem, LED (clustered) Lamp as applicable and accessories etc.
- e) Review of all certificates and test reports.
- f) In the event the purchaser is unable to witness a test, the test shall anyway be completed by the vendor and documents for the same shall be submitted for scrutiny before shipment.
- g) All tests as per Standard specifications attached with this bid document.

6.3.3 Following tests shall be carried out by vendor at their works and test certificates shall be furnished:

Calibration/ test certificates for all instruments. Calibration test reports for flow meters duly signed and certified from the recognized international laboratories / statutory weights and measures authority. Statutory body certificates for instruments. Type test report for enclosure of all electronics/ electrical equipments. Radiographic / Charpy test certificates for flow meters and meter runs. Material test certificate for all line mounted instruments. Dimensional test report Certificates for custody transfer application and other certificates mentioned elsewhere.

6.3.4 In addition, vendor shall also refer the inspection & testing requirements of the standard specifications attached to this requisition and follow the same.

6.3.5 Vendor shall include in his scope the shop inspection charges including factory acceptance test (FAT) inspection by Client's representative at vendor's works.

6.3.6 Inspection of Pressure Relief Valves includes:

- a. Testing to demonstrate set point accuracy and actuation time
- b. Calibration certificate for Pressure relief valve set pressure
- c. Seat tightness test for pressure relief valves (shall be conducted at manufacturer's shop and certificates shall be submitted)

6.3.7 The following certificates are required to be submitted during inspection for review before dispatch of materials:

- Verification of certificates as applicable for the material certificates, NDT reports like radiography/ X-ray/ die-penetration/ MP, etc., statutory certificates (from CCOE) for intrinsic safety and explosion proof, certificates of conformity etc.
- Visual verification for quantity, quality and workmanship.
- Hydro testing and pneumatic testing.
- Functional and performance testing including calibration, accuracy, repeatability testing.
- Seat leakage tests & hydraulic Pressure test, actuator cycling & fail condition tests for control valves
- Set pressure, reseal pressure & seat leakage for pressure relief valves.
- Calibration report of PT, TT, Flow Meters with meter run and profiler
- Radiographic test for thermo-wells etc.
- Bidder must detail out performance specifications of each item which shall be verified by bidder or bidder appointed agency/ Owner/ PMC during factory testing.
- Inspection and testing requirements as per the respective standard specification shall be referred.
- Bidder shall submit all test records / test results for records to purchaser as bound volume along with the test procedure for each test carried out.
- Acceptable criteria for Radiography and other NDT requirements for all the instruments / instrument castings shall be inline with those specified in 'valve/ piping specifications' for the similar service. Valve specifications/piping



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- specifications have been attached elsewhere in this package.
- CCOE certificate shall be supplied by the bidder for all instruments installed in hazardous area.
- Custody transfer application certificate for meters & GC
- Approval of skid design from approving agencies mentioned elsewhere.

- 6.3.8 Wherever inspection at manufacturer's shop is waived because of any reason, the bidder shall carry out the inspection at vendor/ sub-vendor's shop and Bidder shall forward these inspection reports for verification by CLIENT before dispatch. In no case, items shall be released without proper inspection/ verification.
- 6.3.9 The inspection and testing shall be carried out as per related specifications, international codes and practices/standards, approved documents and/or any other document attached along-with specifically suggesting extent of testing to be carried out at manufacturer's works.
- 6.3.10 Items for which 'Witness Inspection' is specifically exempted, manufacturer shall forward the test certificates as desired for review.
- 6.3.11 Testing and inspection for all items shall be carried out as per approved factory testing procedures. The material shall be dispatched only after obtaining written dispatch clearance. For items where no testing is witnessed by the purchaser test certificate shall be forwarded for review before dispatch of such equipment
- 6.3.12 Contractor must detail out performance specifications of each item which shall be verified by contractor or contractor appointed agency/ Owner/ PMC during factory testing.
- 6.3.13 Inspection and testing requirements as per the respective standard specification shall be referred.
- 6.3.14 Contractor shall submit all test records / test results for records to purchaser as bound volume along with the test procedure for each test carried out.
- 6.3.15 Acceptable criteria for Radiography and other NDT requirements for all the instruments/ instrument castings shall be inline with those specified in 'valve/ piping specifications' for the similar service. Valve specifications/piping specifications have been attached elsewhere in this package.
- 6.3.16 CCOE certificate shall be supplied by the contractor for all instruments, HHC, cylinders installed/ for use in hazardous area.

7.0 DOCUMENTATION

- 7.1 Detailed drawings, data and catalogues required from the Vendor are indicated by the PURCHASER in vendor data requirement sheet. The required number of reproducible and prints should be dispatched to the address mentioned, adhering to the time limits indicated.
- 7.2 Final drawings from the Vendor shall include dimensional details, weight, mounting details and any other special requirements etc for the skids. All dimensions in general shall be in millimeters.
- 7.3 Vendor shall furnish all the required software, manuals necessary to test, operate and maintain the system. All the certificates, licensed softwares etc shall be provided in name of CLIENT.

8.0 MISCELLANEOUS

8.1 NAMEPLATE IDENTIFICATION

In addition to the instruments and equipment nameplate, the structural skid shall be supplied with a permanent, weather resistant, stainless-steel nameplate affixed to the skid, with the following details, as a minimum: Project title and number

- Owner and Owner name
- Equipment name and tag number
- Manufacturer's name and serial number
- Skid overall dimension data.



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- Skid weight data.

Each skid and all the instruments in the skid shall have a S.S nameplate attached firmly to it at a visible place furnishing the following information:

- Tag number of the skid.
- Project Name with location: "CLIENT, -----(name of site/ station)"
- Inlet size (in inch) and Outlet Size (in inch) with class rating
- Min/ Normal/ Max. Flow capacity in SM3/Hr.
- Tag number of Instruments, JB as per purchaser's data sheets
- Body sizes with class rating in inches and the Valve Cg value or meter G rating
- Set pressure range and flow capacity of pressure safety valves
- Flow range in SM3/hr for Flow meters
- Rating for all the individual instruments
- Manufacturer's name and model number

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

9.0 SHIPPING & PACKAGING

- Vendor shall indicate the shipping and packaging methodology for Metering system / Each piece of skid along with its size, weight and no. of pieces.
- Vendor shall try to fix as many types of equipment/ instruments as possible in skid and control panel before shipment.
- If any of the items are shipped loose, then it shall be properly packed inside metallic or wooden cartoon with identification tags painted on it. Loose materials, spares etc for any two skids shall not be mixed in one cartoon/ package. A System of tagging, segregation to be followed for easy identification of parts and due care to be taken to avoid intermixing of some parts of different skids.

10.0 PERFORMANCE GUARANTEE

- 10.1 The VENDOR shall guarantee that all work/ job will be performed in accordance with good and sound engineering and construction practices and within the requirements of this specification. The equipment, accessories and all the materials supplied by the VENDOR shall be free from defects, shall be suitable for the use for which they are intended and shall perform in accordance with the requirements of this specification.
- 10.2 The VENDOR shall furnish a guarantee for the entire skid package comprising of all of its component/ equipments including instruments, piping, valves, fittings, internals, etc., for a period of 12 months from the date of commissioning or 24 months from the date of receipt at CLIENT store/ site, whichever is earlier.
- 10.3 The VENDOR shall take single point responsibility for the complete skid, including the sub contractor supplied components, the proprietary equipment and components included in skid package and supplied loose in accordance with this specification.

11.0 INSTALLATION AND COMMISSIONING OF METERING SKID

- 11.1 The VENDOR shall provide **qualified and experienced** personnel for installation, field-testing and commissioning of the equipments.

11.2 INSTALLATION REQUIREMENTS:

- All instruments shall be accessible from grade or a platform for operation and maintenance.
- Bidder shall consider the, "MECON installation standards "as attached or equivalent for installation of each instrument. In case, any instrument requires a special installation or any instrument not provided with installation standard the bidder shall prepare the standard and get it approved from MECON along with other documents.
- Impulse tube/ pipe of size ½" shall be used as impulse lines. The Impulse pipe/ pipe fittings for instrument installation



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shall be as per the piping material specifications of respective process lines. Tubing when used between manifold and the instrument shall be, 12mm OD with SS316 material of construction as a minimum. The material selected shall be suitable for the process fluid conditions.

- Instrument in gas service are to be installed only above or at least parallel to the tapping with a slope in the impulse towards the tapping to achieve self draining condition.
- Pressure Relief valves to be installed in line only after proper flushing of the lines.
- No unions shall be used in impulse lines instead break flanges shall be used.
- Combination of Ball & Globe or plug is acceptable for drain & vent line, Gate valves in combination with Plug/ ball / globe valve shall be used for isolation, however combination of plug valve and ball/ globe valves shall be used for equalizing service.
- Minimum ½" sized valves shall be used for Instrument isolation.
- Impulse piping is to be suitably painted (except SS 316 tubing)
- Schedule 80 seamless pipe with at least 3000 lb rating fittings should be used as a minimum for impulse piping.
- Tube fitting shall be double ferrule type.
- Based on the installation standards for each type of instrument, bidder shall prepare Bill of materials (BOM) which indicates the requirements of different materials for installation of each instrument. However, completeness of BOM is bidder's responsibility.
- Mounting of field instruments (if remote mounted)/ JB's on the stanchion or instrument support shall be at the height of 1.3M from the grade level / finished floor level.
- The installation and erection materials like, cables (signal, control, thermocouple extension and power), cable glands, junction boxes, instrument valves and manifolds, impulse pipe and pipe fittings, pneumatic signal tubes, instrument air line fittings and valves and cable trays required for installation of complete instrumentation shall be as per standard specifications enclosed in this tender. Power supply for different instruments/ equipments having different power/ voltage rating shall be installed in different JB's.

11.3 LOOP CHECKING AND COMMISSIONING

- 11.3.1 Bidder is fully responsible for all work related to loop checking (inside the skid), including cable laying, tray work, dressing, identification, ferruling, calibrations, loop testing. However, cable laying from skid JB to control panel in control room is not in bidder's scope.
- 11.3.2 Bidder shall be responsible for commissioning of each & every equipments installed in the skid and control panel. (Functionality, simulation for these equipments shall be demonstrated during FAT).

12.0 BIDS: -

Bidders Proposal shall include the following (as minimum):

- 12.1 Bidder's proposal shall include the detailed specifications for all items of filtration and Metering skids packages and Metering packages. The proposal shall include:
- a) Make, Model number and detailed specification along with technical details and catalogue for each applicable item of metering skid like filter, flow meter, meter tube details, flow computer, pressure relief valve, gas chromatograph, pressure/ differential pressure transmitter, Temperature transmitters, hydrocarbon (LEL) detector and pressure/ temperature gauges, limit switches, control panels, Ball valves, plug valves, Globe valves, Check valves etc.
 - b) Sizing calculations and pressure drop calculations for inlet and outlet pipeline, filtration system, Flow meters and Pressure relief valves. Calculation for Gas velocities and Pressure drop across meter runs at maximum flow and minimum pressure to be submitted. The entire system (including all the components, equipments, Instruments) shall be selected and offered in such a way that the overall pressure drop across the entire skid shall be minimum. Detailed sizing calculation for individual components and pressure drop for entire skid (including diff. Pressure across individual components of metering skid) to be provided.



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- c) Vendor to provide Detailed Noise level calculations (and standards used and assumptions considered, if any).
 - d) All design and performance characteristics.
 - e) P&ID for metering skid shall be as per Bid document attached.
 - f) Completely filled Datasheet of all the supplied components/ items of skid with selected single and Model of equipment/ Instrument. (Multiple make/ models shall not be mentioned/ offered).
 - g) Overall dimensions of each supplied items.
 - h) Overall dimensions of each skid with proposed modules of each skid considered along with estimated dimensions.
 - i) Weight of each skid.
 - j) Foundation details (suggestive) of Metering skid
- 12.2 All units of measurements in vendor's specification sheets shall be same as those in purchaser's data sheets.
- 12.3 All material specifications for the various parts in the vendor's specification sheets shall be to the same standard as those in purchaser's data sheets
- 12.4 Vendor shall enclose catalogues giving detailed technical specifications, selection guide for decoding Model no. of offered equipments/ instruments and other information for Single chamber Orifice meter flow meters, flow computers, pressure relief valve, gas chromatograph, LEL gas detection system, pressure/ differential pressure transmitter, temperature transmitters, Ball valves, plug valves, temperature gauges, pressure gauges, portable configurator, laptop, receiver switches, barriers and isolators, Modem, Printers etc. covered in the bid.
- 12.5 Vendor's proposal including catalogues, drawings, operating and maintenance manuals etc. shall be in ENGLISH language ONLY.
- 12.6 Vendor shall submit the sizing, rating details & specifications of all the instruments, fittings and piping items, make & model, skid details etc., subsequent to award of contract. The relevant catalogue, technical literature shall also be furnished. MECON shall review the above and vendor to note that "No post order deviation shall be granted". Vendor shall change the make and/or models of items and specifications to meet the requirement of contract without any price and delivery implications.
- 12.7 The Single chamber Orifice meter, flow computers and online Gas chromatograph shall be approved for custody transfer application. Type approval certificate for offered make & model of Flow computer, Gas Chromatograph and the quoted make & model and size of Single chamber Orifice meter to be submitted along with the bid.
- 12.8 It is compulsory that bidder utilizes uniform data sheet formats enclosed along-with this document, for preparing specifications for various instruments, including those, which are being prepared by package/ sub package vendors. Additional information shall be provided in the given data sheets, if necessary. Items for which no format has been attached with the document, bidder may use standard ISA formats. Use of manufacturer standard formats shall be avoided.
- 12.9 Vendor's shall submit details of the only offered make and model of equipment/ instrument along-with the bid. Multiple makes and / or equivalent for any item shall not be mentioned in the bid.
- 12.10 The Bidder shall submit all filled and signed formats including Data sheet, List of items etc
- 12.11 The Bidder shall provide Type approval for quoted make and model.
- 12.12 The Bidder shall furnish details mentioned in Technical questionnaire attached with tender doc.
- 12.13 VENDOR shall include in the bid, list of specific deviations, separately, if any, to this specification and all attachment



SCOPE OF WORK FOR METERING SKID



**MECON LIMITED
DELHI**

thereof, otherwise, the quotation will be deemed to be in compliance with the specification requirements and subsequent claims for extra arising out of non-compliance with the specification will not be considered.

13.0 SPARES PHILOSOPHY:

Mandatory spares, commissioning spares and materials required for Erection and commissioning of Metering skid shall be provided with Metering skid. In case the tender consists of more than one SOR item (for supply portion), Bidder shall provide all the relevant skid-wise spares for all the SOR items.

13.1 Mandatory Spares: Shall be provided separately with each skid as per the following list.

The list of Mandatory spares to be supplied with each quoted skid.

- a) Filter element- 02 set. (One set means all the elements required for one stream)
- b) All type of gasket and studs- 1 set (One set means a pair of gaskets of all sizes & all the studs & nuts required for each size of flanged joint)
- c) O-ring for Filter end closure -02 set (one set means one stream)
- d) All type of IO barrier/ relay/ terminal (max. of 20% or 01 no.)
- e) GC spares like Column set, Solenoid Valve, Filter, Repair Kits etc. (for item nos. A.4 to A.7).

14.0 ATTACHMENTS

- a) TECHNICAL SPECIFICATION FOR ORIFICE METER (TS No.: MEC / 05 / E5/ TS / ORFM)
- b) TECHNICAL SPECIFICATION OF CONTROL PANEL (REF.: TS No.- MEC/05/E5/TS/CP -030)
- c) TECHNICAL SPECIFICATION OF GAS CHROMATOGRAPHS (REF.: TS No. - MEC/ 05/E5/ TS/ GC - 030)
- d) PIPING MATERIAL SPECIFICATION

ANNEXURE

- Annexure-I - DATASHEETS
- Annexure-II- GAS COMPOSITION PARAMETERS
- Annexure-III- P & ID
- Annexure – IV - INSTALLATION DRAWINGS
- Annexure –V - APPROVED VENDOR LIST
- Annexure -VI - QAPs
- Annexure -VII - FAT PROCEDURE/ FAT MANUAL
- Annexure -VIII - STANDARD SPECIFICATIONS

INSTRUMENTATION SECTION

TECHNICAL SPECIFICATION FOR ORIFICE METER

TS No.: MEC / 05 / E5/ TS / ORFM



MECON LIMITED
DELHI - 110 092

0	14.03.2013		Ritish	Vikas	Rakesh
Revision	Date	Description	Prepared by	Checked by	Approved by

MECON LIMITED DELHI	TECHNICAL SPECIFICATION FOR ORIFICE METER		
INSTRUMENTATION SECTION	SPEC. No. : MEC / 05 / E5/ TS / ORFM		
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TECHNICAL SPECIFICATION FOR ORIFICE METER

General:

1. Single Chamber Orifice Fitting body shall be inline mounting with flow direction clearly marked on the flow meter body to ensure correct installation for custody transfer.
2. Single Chamber Orifice Fitting will house and accurately position an orifice plate for differential pressure measurement.
3. Single Chamber Orifice Fitting design shall ensure orifice plate changing - safe, quick and easy with minimum downtime.
4. Single Chamber Orifice Fitting body shall be of Carbon Steel A352 LCC / ASTM A 216 Gr. WCB, Carrier & Cover Plate shall be 304 SS. Body and flange rating shall be as indicated in P&ID.
5. Each meter shall be based on a Single chamber orifice fitting with a square edged concentric orifice plate and flange pressure taps, designed and fabricated to be fully compliant with all requirements of API MPMS 14.3 and shall include both upstream and downstream meter tubes.
6. Meter tube and orifice fitting material shall be carbon steel. Orifice plate material shall be 316 SS.
7. Dual process taps shall be provided for pressure and differential pressure connections to a second set of instrument transmitters as back up to the primary instruments.
8. Meter Tube Diameter and Orifice Sizing - Orifice bore to meter tube diameter ratio (β ratio) shall be kept between 0.4 and 0.6 for all combinations of orifice plates and the meter tube.
9. VENDOR shall submit final orifice meter sizing calculation (using actual planned wall thickness orifice bore sizes) to PURCHASER for review and approval prior to final design and fabrication.
10. Vendor shall submit meter uncertainty calculation based on the final design of the meter system shall consider the effects of upstream & downstream piping beyond the actual meter tubes, of the selected field instruments & the inherent inaccuracies of the API/AGA database.

1	22.02.2024			
Revision	Date	Prepared by	Checked by	Approved by

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Orifice Plates:

1. Orifice plate shall be thin square edged concentric orifice plate. The material of the orifice plate shall be normally SS 316, as a minimum. These shall be fabricated as per BS 1042 Part I.
2. Sizing of orifice plate shall be carried out in accordance with ISO – 5167. Other sizing methods like AGA Report No. 3, BS – 1042. 'Flow measurement – Engineering Handbook' by R.W. Miller shall be used when specified. Supplier shall size and select appropriate orifice plate for a maximum turndown ratio of 1:3. Orifice plate(s) shall be sized for a nominal differential pressure of 2500 mm water at maximum flow and a preferred beta ratio (β) of 0.55 (allowable range 0.4 to 0.6).
3. Upstream and downstream straight length shall be provided based on maximum d/D ratio of 0.75 in general. Where it is difficult to meet this requirement, the actual d/D ratio can be considered for reducing the straight length as permitted by the codes. The recommended practice shall be as per API-MPMS. Recommended Practices and AGA Report No. 3 mentions the consideration of flow strengtheners where straight runs are difficult to achieve, otherwise.

Fabrication:

1. Fabrication of the orifice plate shall be in accordance with AGA – Gas Measurement Committee, Report No. 3, latest edition.
2. The Orifice meter shall in general comprise of a concentric square edged orifice plate designed for flange tap except for particular process requirements. (Eccentric, segmental or quadrant edged orifices may be used for special services such as slurry, wet gas or highly viscous service)
3. Where the orifice plate flow element is coupled with a force balanced or bellows type meter, the meter shall be with a built-in adjustable dampening device.
4. The Orifice Plate Assembly shall be capable of withstanding differential pressure equal to full line pressure without zero or calibration change.
5. Orifice plate beta ratio (orifice diameter/ inside pipe diameter) shall be between 0.4 and 0.6.
6. Vendor may choose to increase the length of the upstream and downstream piping attached to the orifice fitting to be beyond the minimum required by API.
7. Meter tube shall be equipped with a reliable method to ensure correct alignment

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between two sections. Dowel pins and an annular groove / ring combination are two acceptable methods of achieving meter tube alignment.

8. Each upstream & downstream sections of the meter tube shall be made from one continuous length of select straight and round pipe.
9. After confirmation of compliance for roundness and straightness for the pipes, the orifice fitting shall be bored to match the internal diameter of the meter tube pipes.
10. After fabrication and assembly (including grinding of weld seams) of the meter tubes and fittings, the entire meter tube shall be honed. Meter tube inner surface finish shall be better than 6.35 microns (250 micro inches) as per API MPMS 14.3. Part 2 for all cases. While API allows for a surface finish of 7.6 microns (300 micro inch) when the β ratio is less than 0.6, for the purpose of surface roughness measurement, the β ratio shall be assumed to be higher than 0.6. This will allow the future possibility of selecting orifice plates with a higher β ratio without any additional uncertainty in the flow measurement.
11. Internal surface of the finished "meter tube" shall be free from any irregularities and defects such as encrustation, deposits, pits, grooves, ridges, offsets, scoring and protrusions that may result from casting problems, welding and other manufacturing activities.
12. Thermowell shall be located downstream of the orifice at the recommended distance from the orifice plate. Thermowells shall be designed for full flow and the resulting increased flow velocities, which may occur during maintenance procedures.
13. Internal surface of the finished "meter tube" shall be free from any irregularities and defects such as encrustation, deposits, pits, grooves, ridges, offsets, scoring and protrusions that may result from casting problems, welding and other manufacturing activities.
14. Thermowell shall be located downstream of the orifice at the recommended distance from the orifice plate. Thermowells shall be designed for full flow and the resulting increased flow velocities, which may occur during maintenance procedures.
15. Flange / NPT thread pressure taps shall be located 25 mm (approx. 1 inch) from the upstream and downstream faces of the respective faces of the orifice plate. The linear dimensional tolerance shall be 1 inch ± 0.03 inch as per API 14.3.2 using the recommended design factor of $\beta = 0.7g$.
16. All the pressure taps shall be equipped with full bore valves for isolation.
17. VENDOR shall consider guidelines from ISO 5167-2 in the layout and design of the

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station piping connecting to the meter runs and shall maximize straight run piping and minimize bends and elbows upstream of the orifice meter to allow the flow to achieve as close as possible a fully developed flow profile. When bends and elbows are necessary, they shall be kept in the same plane to reduce their effects on the flow profile.

Range:

1. Differential ranges for orifice flow meters shall not exceed 5000 mm (200 inches) of water.

Typical meter ranges for gas, steam or vapor streams shall be as follows:

STATIC PRESSURE (Kg / cm ² g (PSIG)	DIFFERENTIAL PRESSURE (mm of Water (inches)
0.35 to 2.5 (5-35)	500 - 1250 (20 - 50)
2.5 to 6 (35 - 85)	1250 - 2500 (50 - 100)
Above 6 (Above 85)	As per AGA-3 guidelines

2. The range 2500 mm (100 inches) is desirable wherever possible.
3. 5.21.4.3 Orifice meter ranges shall be chosen such that the normal flow is between 60% and 80% of the meter range.

Meter Runs:

1. All meter runs (Upstream & Downstream) shall be designed for flange tap differential measurement unless otherwise specified and fabricated as per AGA - Gas measurement committee report No. 3, latest edition.
2. Orifice meter runs shall not be less than 1 - ½" nominal pipe size. Where required, the piping diameter shall be blown up to the required size for installing the meter run / orifice, in line with the applicable standards.
3. The straight length of upstream & downstream pipe works shall be in accordance with the standard AGA-3. Connections shall be made in either the upstream or downstream straight pipe work, other than the orifice flange tapplings. In case sufficient straight run is not available for the given piping geometry, meter runs with straightening vanes may be used. These straightening vanes shall be as per AGA 3. The straightening vane material shall be 316 SS or better to suit the process conditions. The location of Temperature sensor (on the downstream only) shall be within 5 to 20 D internal diameter of the pipe run.

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Orifice Flow Meters (Typical)

UNITS: Flow> Liquid m ³ /hr Gas– Sm ³ /hr Steam – Kg/hr Pressure> Kg/cm ² G Temperature > Deg C Level/Length			
General / Process	1.	Tag No.	**
	2.	Line No.	**
	3.	Line size & Sch	**
	4.	Service (Fluid)	CUSTODY TRANSFER of WET NATURAL
	8.	Application Standard	ANSI, API 14.3, ASTM, ISO 5176, AGA 3 latest reports / standards, ASME 16.34 and ASME 16.5
	5.	Size	*
	9.	End Connection	Flanged (RF),
	10.	Max. Flow Rate	**
	11.		
	12.	Temperature Range	-20 Deg C to +50 Deg C
	13.	Max. Working Pressure (Kg/cm ² g)	**
Meter	19.	Meter type	Single chamber Orifice meter (fittings with orifice plate, holder, meter run and flow conditioner from same OEM)
	20.	Diff. Pressure Tapping	Flanged taps; Inbuilt (1/2" NPTF) ; to be provided on flanges
	21.	Thermo-well	Inbuilt; to be provided
	22.		
	23.	Facing & Finish	RF serrate
	24.	Flow Direction	To be marked on Orifice plate
	25.	Meter maximum	*
	26.	Diff Pressure at Max. Flow	*(Normal is 2500 mmWC)
	27.	Beta Ratio (d/D)	*(Normal range is 0.4 to 0.6)
	28.	Enclosure protection	WEATHER PROOF, IP65
Service	29.	Material – Body	C S
	31.		
	32.		
	33.	Orifice Plate	SS 316 / suitable for the service
	42.	Oper. Visc (cP)/Density (Kg/m ³)	**
	43.	System Pressure Drop	**
	44.	Gas – Mol Wt.	**
	45.	Compressibility Factor	**
	46.	Cp/CV	**
	47.	Area Classification	IEC ZONE 1 GR IIA, IIB T3
Sealing	50.	Seal Bar O ring, Orifice plate seals	
	51.		
	53.	Unit	M3
	55.	Transmitters (for Flow measurement)	1 PT, 1 DPT and 1 TT
Important			
	58.	Manufacturer Report/ Certificate	To be Supplied along with each meter
	59.	Warranty Certificate	To be Supplied along with each meter
	60.	Operation And Maintenance Manual	To be Supplied along with each meter
	61.	Make offered	*
	62.	Model Offered	*

Notes

*** By Vendor

**** As per P&ID

- METER SHALL BE RATED FOR THE MAXIMUM DESIGN PRESSURE AS INDICATED ABOVE.
- THE OFFERED METER MUST BE DESIGNED AS PER APPLICABLE STANDARDS.
- THE ORIFICE METER SHALL HAVE PIPE TAPS (1/2" NPTF) FOR DP/ FLOW COMPUTER INTERFACE.
- DP THROUGH METER SHALL NOT EXCEED 2500 mmWC. FOR OPERATING PRESSURE BELOW 4 KG/CM²G DP THROUGH ORIFICE METERING SYSTEM SHALL NOT EXCEED 1000 MMWC.
- BIDDER TO PROVIDE COMPLETE METERING SYSTEM (EXCEPT FOR TRANSMITTERS/ FLOW COMPUTERS) FROM ONE MAKE ONLY.
- FOR EACH METER, BIDDER TO PROVIDE REPORT/ CERTIFICATE WITH FLOW CALCULATION.
- METER CASING SHALL BE TAMPER PROOF & CORROSION RESISTANT OR STEEL SUITABLE FOR OUTDOOR INSTALLATION
- LOCATION TOLERANCE FOR METERS SHALL BE AS AGA 3.
- LINE BORE I.D TOLERANCE AND ECCENTRICITY REPEATABILITY SHALL BE IN CONFORMANCE WITH AGA-3 AND ISO-5167 LATEST EDITIONS.
- AS A MINIMUM THE REPORT/ CERTIFICATE OF METER SHALL INCLUDE ID, OD, ID BORE TOLERANCE, INSTRUMENT TAP DIAMETER AND LOCATION, PLATE SEAL TEST, SEAL PROTRUSION, ORIFICE ECCENTRICITY, BORE INSIDE DIAMETER, BORE ROUGHNESS, BETA RATIO, MAX. DIFFERENTIAL PRESSURE (AT DESIGN FLOW RATE)

1	22.02.2024			
Revision	Date	Prepared by	Checked by	Approved by

INSTRUMENTATION SECTION

TECHNICAL SPECIFICATION FOR CONTROL PANEL & ACCESSORIES

TS. No. : MEC/05/E5/TS /CP - 030



MECON LIMITED

DELHI - 110 092

0	20.01.10				
Revision	Date	Description	Prepared by	Checked by	Approved by

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**SPECIFICATIONS
FOR
CONTROL PANEL & ACCESSORIES**

GENERAL

Site of Installation

1. Plant and Location	:	As per P&ID
2. Consultant	:	MECON LIMITED.
3. Location of control panel	:	Control Room and accessories.
4. Floor	:	Concrete (By client)
5. Air Conditioning	:	Yes (By client)
6. Control Panels Quantity	:	One for each skid (As applicable)

Scope of Work :

- a) Supply of 1 No. of Metering Panel (free standing, cubicle type) for each quoted item (As applicable) along with all accessories like Power Supply Distribution Box (PDB), Lamps, MCBs, Relays, Barriers / Isolators, Selector Switch, Signal Multipliers (SDC), Supervisory System, LEL Controller, GC Controller, FC etc. as per this Technical specification.
- b) Client will provide 230 VAC, 50 Hz. at control room for Control panel and utilities respectively. Further distribution and necessary surge protection device shall be part of panel vendor.
- c) Separate Terminal Blocks shall be provided for RTU signals with 20% spare terminals & all the signals to be terminated upto RTU TB.
- d) Quantities of control panel accessories (Push Buttons, Lamps, Relays, Zener Barriers, and SDC Cards etc.) shall be as per the Technical Requirements during drawing approval/detail engineering.
- e) Mounting heights :

i) Miniature and subminiature instruments (3 rows)	Bottom row	1100mm
	Middle row	1350mm
	Top row	1600mm
ii) Electric push buttons	--	700mm

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INST CONTROL PANEL CONSTRUCTION

1. Type : Self-supported, Free Standing, enclosed cubicle and Non-graphic.
2. Lighting : Required for inside panel with door switch.
3. Ventilation : Required with louvers backed by wire fly screen & fan.
4. Doors : Glass doors in the front of the Panel with locking arrangement.
5. Door width : Each max. of 600mm and shall suit width of the panel. Panel width is indicative only. The sizes shall be sufficient to accommodate the required hardware specified in MR. However the depth and height shall be 800 & 2200 respectively.
6. Cable Entry : Bottom, Cable Glands shall be double compression type for external armoured cables. All unused entries shall be plugged.
7. Receptacles : Required for 230VAC (UPS).
8. Painting : The finish shall include sand blasting, grinding, chemical cleaning, surface finishing by suitable filter and two coats of high grade lacquer with wet sanding between coats.. Two coats of paint in panel colour shall be given for Non-glossy high stain finish. Panel face final colour shall be of the following:
 - a) Siemens Grey (RAL 7032)
 - b) Panel internal shall have a finish color of pale cream – IS 352
 - c) Channel Base shall have a finish color of black
9. Channel Base : 100X50X6 MM, MS material
10. Name Plates : Front of Panel Instrument name plates shall be black laminated plastic with white core. Nameplate shall be provided on the rear of the panel also.

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11 Dimensions & Material of Construction

- a) Panel dimension : 1200(W) mm x 2100(H) mm x 800(D) mm (Including channel base) Finalized during detail engineering.
- b) Control Panel : 3 mm thick CRCA steel/5.0 mm thick HRCA steel, Welded to frame
- c) Side & Top plates : 2 mm thick CRCA steel, Welded to frame
- d) Door panel : Glass doors in the front of the Panel
- e) Cable gland plate : 3 mm thick CRCA steel
- f) Anchor Bolt Size : By vendor
- g) Lifting Eye Bolt : Required
- h) Anti Vibration Pad : Required (15mm thick rubber pad).

Note :

***Panel shall be electrically isolated from base frame.**

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12 WIRING

- a) **Type** : General purpose, Intrinsically safe
- b) **Wiring details**
- 110 VAC UPS Wiring
- External to Cabinet : Min. 3x2.5 mm²/copper conductor PVC insulated armoured
- Inside the cabinet : Min. 19 Strands, 16 AWG copper conductor PVC insulated
- 230 VAC Wiring (Non UPS) : 3x2.5mm² copper conductor PVC insulated armoured
- Low Voltage internal : Min. 19 Strands, 16 AWG copper conductor PVC insulated to cabinet
- c) **Signal Wiring**
- External to Cabinet : 1.0 mm² twin twisted individual shielded overall shielded with overall drain PVC insulated armoured
- Inside the cabinet : Multi stranded min. 1.0 mm² copper conductor PVC insulated twin twisted and shielded.
- d) **Terminal type** : Screw clamp type with Pressure Plate
- Terminal size for signal : Suitable for min. 2.5 mm² size conductor
- Terminal size for power dist. : Suitable for min. 4.0 mm² size conductor and higher as per actual cable sizes.
- Terminal block : Clip-on type
- e) **Wiring colour code**
- Power Supply : Hot – Red, Neutral - Black, Earth – Green
- DC Wiring : Positive – Red, Negative – Black
- Alarm System : White
- Control & shutdown : Yellow
- Analog signals (IS) : Light blue
- Identification of Cable Termination : Criss – Crossing PVC tube ferruling.
- f) **Power Indication Lamps** : 230VAC UPS – Red color, 230VAC NUPS – Red Color
24VDC – Green Color

Note: Dedicated terminal for SCADA (for future) has to be Provided

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A) POWER SUPPLY DISTRIBUTION BOXES FOR PANELS

1. Function : Distribute power to Individual instruments
2. Mounting : Mounted at the panel inside
3. Door : Front single door
4. Painting : As per panel painting specifications.
- 5. Dimensions and material construction**
 - 5.1. Box dimension : By vendor.
 - 5.2. Box plate thickness : 3mm hot rolled steel.
6. Cable entry : By vendor
7. Accessories : 600V Grade DPST MCB for power Distribution and SP MCB for barriers & Suitable MCB for Control panel Instruments
8. Special requirements : MCBs for incoming feeder.

B) BULK POWER SUPPLY UNIT

1. Input : 230 V AC, 50 Hz.
2. Output : 24 V
3. Rating : By Vendor
4. Quantity : Dual Redundant as per requirement

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SPECIFICATIONS FOR ACCESSORIES

- 1. MCB**
 Make : HAVELL'S/ INDO ASIAN/ MDS.
 Qty. : As required + 20% spare
- 2. Lamps**
 Type : LED Clustered Type
 Voltage : 24 VDC
 Make / Model No. : SIEMENS / L & T
 Quantity : As required + 20% spare
- 3 Relays**
 Type : Plug in relays
 Contact Type : Potential free contact
 Contact No. : 3 NO. + 3 NC
 Rating : 24V DC, 5.0 A
 Make / Model No. : OEN/ OMRON.
 Quantity : As required + 20% spare
- 4. Space Heater**
 Rating : 60W, 230 V AC with Thermostat.
 Make : KEC
- 5 Power Supply Unit:**
 Make / Model No. : ELNOVA/ APLAB

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SPECIFICATION FOR SIGNAL DISTRIBUTION CARDS

SL.NO.	DESCRIPTION	DETAILS
1.	TYPE	DUAL OUTPUT CURRENT ISOLATOR
2.	INPUT	4-20 mA D.C
3.	OUTPUT	TWO NOS. 4-20 mA ISOLATED OUTPUTS AS MINIMUM
4.	ISOLATION	BETWEEN INPUT & OUTPUT, BETWEEN INPUT & OUTPUT WITH POWER SUPPLY, BETWEEN OUTPUT & OUTPUT
5.	ACCURACY	$\pm 0.1\%$
6.	POWER SUPPLY	24 V D.C
7.	TRANSMITTER POWER SUPPLY	24 V D.C
8.	OUTPUT LOAD DRIVING CAPACITY	600 Ohms MINIMUM FOR EACH OUTPUT
9.	MOUNTING	DIN RAIL (BACK OF THE PANEL)
10.	MAKE	MTL/P&F
11.	MODEL NO	*

NOTES:-

* - BY VENDOR

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SPECIFICATION FOR ISOLATING BARRIERS

SL.NO.	DESCRIPTION	DETAILS
1.	TYPE	SHUNT DIODE SAFETY BARRIER
2.	APPLICATION INSTRUMENT TYPE & QUANTITY	(i) 4-20 mA Analog I/P from 2 wire transmitter– As required + 20% Spare (ii) 4-20 mA Analog O/P to I/P Converter – As required +20% Spare
3.	HAZARDOUS AREA CLASSIFICATION	ZONE-I, GR. I, IIA & IIB, T3
4.	APPROVAL AUTHORITY	FM/BASEEFA/CSA/SA/CMRS
5.	SUPPLY VOLTAGE	24 V DC
6.	FUSE RATING	*
7.	END TO END RESISTANCE	*
8.	POLARITY	*
9.	MOUNTING	DIN RAIL (BACK OF THE PANEL)
10.	OPERATING TEMP	0 TO 60° C
11.	OPEN CIRCUIT VOLTAGE	*
12.	SHORT CIRCUIT CURRENT	*
14.	MAKE	MTL/P&F
15.	MODEL NO	*

NOTES:- * --By Vendor

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SPECIFICATION FOR ISOLATING BARRIERS

SL.NO.	DESCRIPTION	DETAILS
1.	TYPE	SHUNT DIODE SAFETY BARRIER
2.	APPLICATION INSTRUMENT TYPE & QUANTITY	4-20 mA Analog I/P from Temperature Transmitter
3.	HAZARDOUS AREA CLASSIFICATION	ZONE-I, GR. I, IIA & IIB, T3
4.	APPROVAL AUTHORITY	FM/BASEEFA/CSA/SA/CMRS
5.	SUPPLY VOLTAGE	24VdC
6.	FUSE RATING	*
7.	END TO END RESISTANCE	*
8.	POLARITY	*
9.	MOUNTING	DIN RAIL (BACK OF THE PANEL)
10.	OPERATING TEMP	0 TO 65° C
11.	OPEN CIRCUIT VOLTAGE	*
12.	SHORT CIRCUIT CURRENT	*
13.	MAKE	MTL/P&F
14.	MODEL NO	*

NOTES:- * --By Vendor

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SPECIFICATION FOR ISOLATING BARRIERS

SL.NO.	DESCRIPTION	DETAILS
1.	TYPE	SHUNT DIODE SAFETY BARRIER
2.	APPLICATION INSTRUMENT TYPE & QUANTITY	Limit switches (SPDT snap action Micro type) - As required + 20% Spare
3.	HAZARDOUS AREA CLASSIFICATION	ZONE-I, GR. I, IIA & IIB, T3
4.	APPROVAL AUTHORITY	FM/BASEEFA/CSA/SA/CMRS
5.	SUPPLY VOLTAGE	24 V DC
6.	FUSE RATING	*
7.	END TO END RESISTANCE	*
8.	POLARITY	*
9.	MOUNTING	DIN RAIL (BACK OF THE PANEL)
10.	OPERATING TEMP	0 TO 60° C
11.	OPEN CIRCUIT VOLTAGE	*
12.	SHORT CIRCUIT CURRENT	*
14.	MAKE	MTL/P&F
15.	MODEL NO	*

NOTES:- * --By Vendor

INSTRUMENTATION SECTION

TECHNICAL SPECIFICATION FOR ON LINE GAS CHROMATOGRAPH

TS. No. : MEC/05/E5/TS/GC - 030



**MECON LIMITED
DELHI - 110 092**

0	27.11.2019				
Revision	Date	Description	Prepared by	Checked by	Approved by

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TECHNICAL SPECIFICATION FOR ON LINE GAS CHROMATOGRAPH

1.0 GENERAL

1.1 These Online gas chromatograph systems shall comprise of following components:

- a) Sample conditioning system
- b) Analyzer unit and Programmable control unit
- c) Control room mounted Interface and display unit.
- d) Portable configurator and Printer
- e) Cables, cable glands, junction box, tubing, fitting etc.
- f) Calibration gas (with 03 years stability and traceability to NPL) cylinder and carrier gas cylinders

Sample Conditioning System:

- i. It shall be provided to avoid all undesirable gas contamination including liquid, oil mist etc and to ensure that the gas sample is supplied at suitable pressure and temperature. It shall have fast loop wherever required. It should have a regulator with isolation valves and PSV for regulating the sample pressure & flow. The sample flow should be controlled by a needle valve and flow should be indicated through Rota meter. The enclosure for calibration gas system should have heating system with insulating jacket (uniformly to all parts of cylinders) so as to maintain minimum temperature required for stability of certified composition..
- ii. The sampling system shall be engineered, designed, fabricated and furnished completely assembled as an integral part of the Gas Chromatograph Analyser or as a separate Unit. The sampling system shall be designed on the basis of the utilities available as indicated in the job specifications.
- iii. Each sampling system component shall be capable of being removed without disassembling the entire system.
- iv. Sampling system shall be designed for easy integration with the Gas Chromatograph Analyser in the field.
- v. Sampling system design shall be such that the sample drawn for analysis is truly representative of the process stream. Extra care shall be exercised in the selection of the various components forming the sampling system.
- vi. The sampling system shall be designed to move the sample from the process to the Gas Chromatograph in the shortest possible time. Due consideration shall be given to the size of the sample tubing to avoid possible plugging. Any requirement of steam tracing of sample tubing shall be indicated in the bid.
- vii. Vendor shall clearly indicate the details of sample disposal to be provided by purchaser. When details of sample return points are indicated in purchaser's data sheet, sampling system shall be designed to meet the requirement.
- viii. Sampling system shall consist of one or more of the following components as required by the service conditions shown on the instrument data sheets : filters (coarse and fine), pressure regulators, relief valves, flow indicators, flow controllers, temperature indicators, scrubbers, heaters, coolers, dryers, sample pumps, aspirators etc. Vendor in the bid with proper reasoning shall include any additional requirement.
- ix. Where purchaser's data sheets indicate the possibility of polymer formation or presence of excess polymers, Vendor shall offer suitable design features to minimize plugging because of polymer residue.
- x. Filters shall be always dual and it shall be possible to remove and replace one of the filters without upsetting the operation of the Gas Chromatograph.

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Analyzer Unit and Programmable control Unit

The function of this unit will be to analyze the gas sample, do the calculation of Heating Value, Relative Density (specific gravity), Compressibility Factor etc. and provide information to interface / display unit. The technical details of this unit are given as under:

- i. Type: Continuous On-line Gas Chromatograph microprocessor controlled.
- ii. No. of streams: single stream
- iii. Column: Micro pack / MEMS column with high resolution and low carrier gas consumption, Column size (length / diameter): By vendor
- iv. Detector: Thermal conductivity detector
- v. Carrier gas:
 - a) Ultra-pure Helium gas along with pressure regulators and Rota Meter flow-indication. The consumption of carrier gas should be as low as possible.
 - b) Flow rate: the minimum possible (to be defined by the bidder)
- vi. Cycle time: Operator / user assignable (5 minutes maximum).
- vii. Analyser:
 - a) The design of Analyser should be based on solid-state electronics with protection from industrial EMI /RFI Interference.
 - b) Inputs / Outputs: It should communicate digitally to interface / display unit to send the analysis related information.
 - c). Analyzer & analyzer electronics should be supplied with prefabricated / installed tube connection etc., so that field tubing etc. to be done as minimum as possible at site for connection of sample line & carrier gas and calibration gas cylinders
 - d) Functions: Control of all analysis functions in a cycle from operation of sampling valves to detection of peaks and precise calculations for peak measurements, area integration and internal normalization. Average values of analysis and computed results for 8 and 24 hours shall be available automatically or on-demand. Also generation of gas analysis report (scheduled or on-demand) and average report (8 hourly average, 24 hourly averages) for gas composition, calorific values and specific gravity.
- viii. Calibration: Automatic calibration with user selectable time intervals or manually on demand as & when required. To accurately determine the relative response factors with/without single component calibrations such as high purity methane. Vendor shall indicate the accuracy and repeatability of the measurement achieved by the calibration method adopted. Also during calibration period the stream composition data of previous analysis shall be used in Flow computer. Also if the calibration results are out of range then it shall be alarmed. The composition data during alarm condition shall be rejected and shall not be used for Flow computation.
- ix. Calculations : The Analyzer should have the facility of calculating Real Net dry Heating Value, Real gross heating value, Real relative density, base compressibility factor at base pressure = 1.0332 kg/cm² abs, base temperature=15.56 deg C as per latest standard of ISO-6976 /GPA2145-GPA2172 (user configurable) & optionally ASTM D3588 if available as standard with the GC. The tables used for these calculations should be user configurable. Initially the method table shall be configured with base pressure 1.0332 kg/cm² abs and base

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temperature 15.56 Deg.C and the heating value shall be in Kcal/scm. Provision to change to any other configuration/ standard as per site requirement

- x. The analyzer should have the facility for remote communication through CLIENT's SCADA/ RTU system.
- xi. The analyzer should be supplied with a calibration gas stand equipped with a heating system/ plate with insulating Jacket so as to ensure that calibration gas cylinder is uniformly maintained at minimum required temperature required for stable composition. Please note that GC system shall be installed in the Hazardous area. Bidder should ensure that the heating system comply the relevant standard requirement.
- xii. The analyzer should have the facility for storing at least last 480 analysis reports (last 36 hrs continuous analysis) and should have the facility for giving the average report for last 24 hours.
- xiii. Diagnostics: Online automatic diagnostics for self checking of system integrity periodically for giving alarms.
- xiv. Area classification: IEC Zone 1 Gas Group IIA / II B Temp Class T3
- xv. The offer GC should have extensive data storage/retrieval capacity to keep valuable data / results for future use. The GC archive shall store minimum most recent 1200 cycles & last 400 calibration and average result of last 64 days. Details have to be furnished in the offer.
- xvi. The Gas Chromatograph shall have retention time reproducibility character with analyzer programs stored in EEPROM and with battery backed CMOS memory. The GC shall store the data (of 3 shifts per day of 4 minute cycle average up to a month) for minimum one month. Vendor shall furnish the maximum capacity of the GC to store the data in the offer.

Type of enclosure / protection: Sample conditioning unit, analyzer, analyzer electronics shall be mounted in an enclosure certified as weather proof (NEMA-12) and explosion proof from statutory body. The field mounted equipments shall be suitable for ambient temperature 0-60 degree Celsius and under a shed of suitable size and design, so that there should not be any direct environmental effect.

A suitable selector switch JB for Isolation of Power supply to Analyser Field unit shall be provided. All Power and communication cable for Analyser/ GC shall be provided by bidder.

Communication Interface / Display unit:

The main function of this shall be to access all the gas analysis related parameters from field analyzer unit, send the required O/P in Analog/Digital form to Flow Computers and provide the display in control room for the composition of all the components. It should also provide the facility for calibration of analog outputs. It should have separate processor and memory boards, which should operate independent of analyzer. It can be configured to support various options selected by the user via keypad or configurator.

- i. Type: A Microprocessor based unit with alphanumeric / CRT display for input, output signals and analysis results and other parameters.
- ii. Inputs / Outputs:

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- a) Operator inputs via keyboard and / or configurator/ Laptop through serial port..
- b) Potential free contact output for malfunction.
- c) Four nos. 4 to 20 mA (isolated) output signals for driving 600 Ohms load resistance. Outputs will be used for: (and shall be user configurable):
 - I Gross calorific value
 - II. Relative density (specific gravity)
 - III. Mole % CO₂
 - IV. Mole % N₂
 Each output should be user assignable.
- d) Dedicated 1 No. RS 485 / 232 C for metering supervisory system & 1 No. RS 485 (MODBUS ASCII) serial link for transmission of the following signals to CLIENT SCADA:
 - Complete gas composition
 - Calorific value (GCV and NCV)
 - Relative density (specific gravity)
 - Compressibility factor
- e) RS485/RS-232C communication ports with modbus protocols to communicate with Flow Computers of various make like Instromet, RMG, Daniel, Bristol Babcock, FMC, OMNI, PIETRO etc. installed in the same control room.
- f) It should communicate to CLIENT SCADA through serial communication.
- g) Complete details and documentation with respect to protocol details with message structures, frame structures, synchronizing / timing signals, memory locations for data addressability and interface software driver details shall be furnished in order to successfully implement a serial LINK & GSM link with the RTU/ SCADA (by owner).
- h) Separate port for Laptop and Printer (if provided against integral printer)

iii. **Interface:**

- a) Digital link with analyzer electronics in the field.
 - b) Also the communication between analyzer & control room mounted interface/ display unit shall be either through OFC or copper cable.
- iv. **Printing:** The Color Desk Jet Printer shall be for printing the Gas Analysis Report, an average report in a format indicating data, time & day, type of analysis etc. The Printer shall also be for Alarm Printing, Alarm Reports, Event log etc.
- v. **Mounting:** All mounting accessories to be supplied by vendor.
- vi. All the analysis results shall be stored in the Field Unit / control room unit and it should be retrieved through interface unit to portable configurator. The configurator should have provision to take print out of chromatograms, results etc.
- vii. Programmable control unit can be either part of the analyzer in the field or it can be part of the control room mounted interface / display unit.

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PORTABLE CONFIGURATOR:

- i. The Portable configurator should have at least Pentium-4 processor, 10 GB hard disk, 128 MB internal RAM, serial port, CD Combo Drive, 17" LCD display. Other details are as under:
 - a) The portable configurator should provide the facility to store all the analysis results made in the past. They can be retrieved and printed out at any time. This PC will be used for following functions:
 - i) Any modification in the programs, which will be used by the analyzer.
 - ii) To Retrieve all data from the analyzer including the chromatogram and should have the facility to configure/ change user related data and should have diagnostic features to face any trouble shootings.
 - b) Power Supply: 230 V AC, 50 Hz with allowable voltage variation of +/- 10%.
 - c) All the software and operating system (Minimum Windows Vista/XP) shall be licensed in the name of CLIENT.
- ii. Cabling: Vendor to provide required interconnecting cables.

The enclosure for sampling system, Analyser & Electronics shall be complete in all respects, ready for quick installation at site.

- 1.2 Each gas chromatograph shall complete the analysis of sample in a maximum time of 5 minutes to a repeatability $\pm 0.05\%$ (± 5 Kcal at 10,000 Kcal/SCM), based on ambient temperature at site between 0°C to 50°C . The computed GHV shall not exceed an uncertainty of $\pm 0.5\%$. The performance and repeatability of each analyser employed in the metering system must be third party/ factory tested in an Environmental Test Chamber, from $0-50^{\circ}\text{C}$ for at least 24 hours to verify repeatability data as a part of the inspection. Manufacturer shall provide a test certificate showing, 24-hour test data with calibration gas analyzed live under flowing conditions for few GC as a sample along with the bid. Ambient temperatures will be included along with repeatability data.
- 1.3 Vendor to note that the GC skid in field consisting of analyzer field cabinet, sample conditioning system, calibration (3 years stability with traceability to NPL or equivalent) & carrier gas cylinder racks etc. shall be assembled together and mounted on a single steel structure by vendor. This skid shall be suitable for floor mounting in a rain/sun shed provided by the Vendor.
- 1.4 Gas chromatograph shall be compact, rugged and of proven design to meet the specified needs of energy measurement for natural gas.
- 1.5 Vendor to indicate the distance limitation, if any, for the communication cable. Cable shall be armoured. Vendor shall furnish complete specification of these cables and supply the same.
- 1.6 All sample tubing and the tubing between the calibration & carrier gas cylinders and analyser shall be included in the scope of supply. The tubing shall be SS316. Vendor to indicate that the distance limitation, if any, for the sample tubing.
- 1.7 Provision shall be made in the sample handling system for manual injection of grab sample in the analyzer.
- 1.8 Vendor to supply Qty of carrier gas (with 99.99% purity) suitable for 2 year continuous operation of Gas Chromatograph with regulator mechanism and automatic switch over including pressure gauges on cylinder with 3 way valve for auto switching over of standby cylinder. Gas volume per cylinder is 7 M^3 . The certificate for purity to be submitted from a reputed third party.
- 1.9 The vendor shall supply Qty of calibration gas (composition as mentioned in process data elsewhere) suitable for 2 year continuous operation & with regulator mechanism. A recognized laboratory must certify the calibration gas. The calibration gas specification must be approved by the purchaser prior to purchase. The calibration gas shall have a minimum certification accuracy of $\pm 0.2\%$ for components (mole %) greater than 10 % and $\pm 0.5\%$ for components (mole%) between 1 % to 10% and $\pm 1.0\%$ for components (mole%) below 1%. The calibration shall be traceable to NPL or

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- equivalent (the traceability certificate to be submitted) with 03 years stability. Gas volume per cylinder shall be approximately 2.13 M³.
- 1.10 Vendor to include 1½" full bore ball valve with flanged ends for probe connections at the tapping point. Fully retractable probe shall be supplied along with suitable probe housing. However online extraction tool is not envisaged.
 - 1.11 Vendor to include for electrical tracing of the sample tubing, in case required for the optimal performance of the system for the given operating conditions. Electrical tracing, if required, shall be certified from statutory body for the given area classification and shall be included.
 - 1.12 Vendor shall note that there is no low-pressure process line to which the bypass loop can be connected and hence the same shall also be connected by vendor to the common atmosphere vent header (approximately at 3 meters height from ground) to be supplied by vendor.
 - 1.13 Gas chromatograph shall be serially interfaced to all the Flow computers simultaneously for transfer of gas compositions etc. Vendor shall be totally responsible for this interface and the same shall be demonstrated by vendor during FAT.
 - 1.14 Vendor shall note that the test samples to be used during inspection for testing and calibration shall be certified for the concentration of the gas components and shall have traceability. Vendor shall furnish the certificate at the time of inspection.
 - 1.15 Vendor shall provide an interconnection diagram for all components from sample take off up to the analyser and also showing interconnection of analyser with programmer in control room.
 - 1.16 Material of construction shall be SS316 as a minimum for sampling system, isolation valves, instrument fittings, vent lines etc. and shall be included in scope of supply by vendor. All fittings shall be double compression type Swagelok or equivalent.
 - 1.17 Sample shall be returned to sample return header located in the analyser cabinet in the field. From sample header, sample shall be vented to atmosphere at a safe height. All interconnection, tubing/fittings /piping/ valves between analyser and return header shall be in vendor's scope of supply.
 - 1.18 Vendor to note that separate cable entries shall be provided for power supply and signal cables in Gas Chromatograph system. All cable glands shall be weather proof and explosion proof to NEMA 4 and NEMA 7. Cable entries and cable gland sizes shall be in NPT standards. Vendor shall provide cable entry sizes and cable gland sizes as specified in the respective data sheet.
 - 1.19 All the electrical items of the gas chromatograph system in the field (sampling system, analyser, electronics, isolation transformer, power switches, flame proof Lighting, junction box, glands etc) shall be certified flame proof suitable for the specified hazardous area (IEC Zone-1, Gas Gr. IIA & IIB, Temperature T3) from statutory body such as Nmi, FM, CENELEC, UL, BASEEFA, PTB etc. and shall be suitable for ambient conditions as given else where.
 - 1.20 Vendor to mount the analyser, sampling system with explosion proof NEMA 7 enclosure which shall be weather proof to NEMA 4/IP 55 with suitable mounting arrangement for gas cylinders.
 - 1.21 Vendor to note that for analyser, programmer and accessories shall be powered from control panel, where at one point supply of 230/110 V AC $\pm$ 10%, 50 Hz $\pm$ 3 % will be given by owner. Further rectifier / transformer if required shall be provided by the vendor in their panel.
 - 1.22 Vendor to ensure that Gas Chromatograph system shall not be damaged because of black outs / brown outs. Vendor to indicate steps to be taken for fail safe operation under power failure.
 - 1.23 The application programs to be stored in RAM for 6 months battery backup and also for reloading without any external storage device.
 - 1.24 All controller software and firmware with licenses shall be in the name of CLIENT. The system shall be supplied with an undertaking from the vendor to upgrade all software and firmware to the latest version and to incorporate all algorithm corrections and changes in line with latest industry standards. Such upgrade shall be supplied and executed free of charge by the vendor for ten years from the date of supply of the system
 - 1.25 Vendor to indicate time period between successive calibrations of analyser and time period for routine preventive maintenance.
 - 1.26 Vendor shall submit the certificate confirming that the natural gas analysis done by the on line GC confirms to ISO 6974-4 /IS 15130-4.

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- 1.27 Gas Chromatograph shall transmit data to remotely mounted flow computers through serial link. Required hardware/ software for serial communication Flow computers shall be provided by the bidder. Bidder to note that the GC shall also provide the gas data to flow computers (2 nos.) supplied with SOR item. All the requisite hardware / software shall be supplied by the bidder.

- 1.28 The on line Gas chromatograph shall be certified for custody transfer application from Nmi/ PTB.

2.0 CODES & STANDARD

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

IEC – 79	Electrical Apparatus for Explosive Gas Atmosphere.
IEC – 529	Degree of Protection provided by Enclosures.
ANSI/ASME	American National Standards Institute/ American Society of Mechanical Engr.
B. 1.20.1	Pipe Thread
B 16.5	Steel Pipe Flanges and Flanged Fitting
B 16.20	Ring joint Gaskets and Groove for Steel Pipe Flanges
API	American Petroleum Institute MPMS (Relevant Portions)
CENELEC	EN 50020 Electrical Apparatus for Potentially Explosive Atmospheres
DIN 50049	Document on Material Testing
IS- 2147	Degree of Protection Provided for Enclosures
IS – 2148	Flame proof Enclosures of Electrical Apparatus
IEC – 801	Electromagnetic compatibility for Industrial Process Measurement and Control Equipment.

3.0 DESIGN AND CONSTRUCTION

- In general Gas Chromatograph and sampling systems shall be designed and constructed in accordance with API – MPMS (Relevant portions).
- Process Stream sampling shall be continuous.
- The Gas Chromatograph performance shall be within specifications when the supply voltage varies by $\pm 10\%$ of specified value and supply frequency varies by ± 3 HZ of specified value.
- Unless otherwise specified material of all components wetted by sample shall be ANSI – 316 SS.
- Programmable control unit can be either part of the analyzer in the field or it can be part of the control room mounted interface / display unit.
- Unless otherwise specified, the following shall govern :
 - Threaded connections shall be NPT to ANSI / ASME B 1.20.
 - Flanged connection shall be as per ANSI / ASME B 16.5
 - Grooves of ring type joint flanges shall be octagonal as per ANSI /ASME B 16.20.
 - Flange face finish shall be serrated concentric to paragraphs 6.3.4.1, 6.3.4.2, and 6.3.4.3 of ANSI / ASME B 16.5. The face finish as specified in data sheet shall have serration as follows :

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

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- 3.1** Gas Chromatograph enclosures and accessories shall be suitable for the electrical area classification indicated in purchaser's data sheets. Unless otherwise specified, the enclosures shall be to the following standards:

Weather proof housing : IP 55 as per IEC – 529 / IS – 2147
 Flame proof housing : Flame proof Ex (d) as per IEC – 79/IS-2148
 Flameproof equipment shall also be made weatherproof.

- 3.2** Intrinsically safe version of Gas Chromatograph shall be suitable for the area classification indicated in purchaser's data sheets. Unless otherwise specified, the intrinsic safety shall be to the following standards:

- a) Intrinsically safe BS 5501/CENELEC EN 50020. All such Gas Chromatographs shall also be weatherproof to IP 55 as per IEC- 79 / IS – 2147
- b) The intrinsically safe and explosion proof equipment shall be certified by statutory bodies like BASEEFA, FM, PTB, CMRI etc.

- 3.3** In addition to the certificate from statutory body, for instruments supplied for projects in India, approval from CCOE (Chief Controller of Explosives) shall also be furnished by Vendor irrespective of their place of manufacture and the same is mandatory. In case CCOE certificate is not available now, Vendor to confirm to supply the same for each item before shipment.

- 3.4** All interconnecting wiring shall be colour coded / numbered and terminal blocks clearly identified.

- 3.5** The sampling system, Gas Chromatograph Analyser, Bottles etc. shall be supplied pre – mounted on cabinet of self-standing skid, in general. The foundation of skid shall have holes to anchor it to the ground with anchor bolts. The enclosure to skid shall be weatherproof to IP 55, as a minimum.

- 3.6** The design of Gas Chromatograph system shall be in compliance with the electromagnetic compatibility requirements as per IEC – 801.

- 3.7** The Gas Chromatograph shall provide isolated analog current output.

- 3.8** Process sample return point and utilities as required will be made available near the Gas Chromatograph at pressure and temperature conditions specified in the data sheet for each Gas Chromatograph as single point supply and return. In general, all the offered items are to comply with maximum pressure and temperature data specified in data sheets. In exceptional cases, standard cell or such part of instrument with a rating lower than maximum pressure and temperature can be offered provided suitable conditioning means and hardware are provided and adequate safety devices with proper hook up enabling discharge to a flare header is provided. Multi – point distribution of utilities and process sample, is to be arranged by Vendor following good engineering practices.

4.0 NAMEPLATE

The Gas Chromatograph and its accessories shall have a SS nameplate firmly attached to it at a visible place, furnishing the following information as applicable:

- a. Tag number as per purchaser's data sheets.
- b. Manufacturer's Serial No. and Model No.
- c. Manufacturer's name / trade mark.
- d. Range
- e. Area classification in which the equipment can be used.

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5.0 SHIPPING

All threaded and flanged openings shall be suitably covered to prevent entry of foreign material. Each major part shall be sealed in thick plastic bags. Suitable moisture absorbent shall be provided for electronic components.

6.0 REJECTION

Vendor shall make his offer in detail, with respect to every item of the purchaser's specifications. Any offer not confirming to this shall be summarily rejected

All documents and literatures are to be supplied in English Language. The Unit of measurement for all the parameters will be as per Data sheet.

All the Field mounted equipments, Control room mounted instruments and necessary tubing, cables, enclosures, mounting accessories are in vendors scope. The system should be supplied in a ready to installed condition at site. All the operation, performance and maintenance guideline to be demonstrated during Inspection and documents to be furnished along with dispatch of the Equipments.



PIPELINE LAYING AND TERMINAL WORKS FOR
NORTH EAST GAS GRID PIPELINE PROJECT

Doc. No. MEC/23UU/05/28/M/000/1092, R0



MECON LIMITED

PIPING MATERIAL SPECIFICATION (NORTH EAST GAS GRID PIPELINE PROJECT)

DOC. NO. MEC/23UU/05/28/M/000/1092, R0



(PROCESS & PIPELINE DESIGN SECTION)

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**PIPELINE LAYING AND TERMINAL WORKS FOR
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PREPARED BY KRISHNA PATEL MANAGER	CHECKED BY HEMANT KUMAR SR. MANAGER	APPROVED BY AMIT GANGAL SR. GM (O&G)	DATE ISSUED DECEMBER, 2021



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1.0 SCOPE

This specification covers the requirements of various piping materials used in piping/ pipeline system handling Natural Gas / Re-gasified Liquid Natural Gas (RLNG) and associated utilities in the pipeline.

2.0 CODES AND STANDARDS

2.1 Pipeline and terminal facilities envisaged as a part of this project shall be designed and Engineered primarily in accordance with the provision of ASME B 31.8 – Gas Transmission & Distribution Piping System - Latest edition and OISD Standard 226-Natural Gas Transmission Pipeline and City Gas Distribution Networks.

2.2 All codes standards and specifications referred herein shall be the latest edition of such documents.

2.3 For sake of brevity, the initials of the society to which the codes are referred are omitted in the specification, for example, B16.5 is a code referring to ANSI/ ASME, A 105 is a code referring to ASTM.

2.4 In addition, MECON specifications for various piping and pipeline materials shall also be applicable.

3.0 MATERIAL SPECIFICATION

Piping material specifications are classified for the general purpose of selection of material for the class of services. The maximum design pressure and design temperature together with the fluid in line governs the selection of material specifications. Deviation of materials from class specifications may occur due to specific design condition. These deviations are permissible if they are equal or better than the individual class requirements.

4.0 CLASS DESIGNATION CODE

The piping class designation consist of three digits numbering system made up of letter, number and letter e. g. A1A, B1A, D1A, etc as follows:

First letter indicates ANSI class rating e. g.

A-Class 150

B-Class 300

D-Class 600



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The middle number indicates differences in the specification within the same rating and material.

The last letter indicates type of material e. g.

A-Carbon Steel

5.0 PIPELINE

The material for linepipe shall be as per the requirements of specification as indicated in Table-1.

6.0 PIPING

6.1 Carbon steel pipe shall be made by open hearth, electric furnace or basic oxygen process only. The steel used shall be fully killed and made with fine grain structure. The grade and wall thickness of various sizes of pipes shall be as per piping material specification for the applicable class.

6.2 Pipe dimension shall be in accordance with ANSI B 36.10 for carbon steel pipes and ANSI B 36.19 for stainless steel pipes.

6.3 All pipe threads shall conform to American Standard taper as per ANSI B 1.20.1 NPT, unless otherwise specified.

6.4 For butt weld end, bevel shall be in accordance to ANSI B 16.25/ API 5L as applicable.

7.0 FITTINGS

7.1 Fully killed carbon steel shall be used in the manufacture of fittings.

7.2 Threaded joints, if used shall conform to American Standard taper as per ANSI 1.20.1 NPT.

7.3 Dimension of socket weld/ screwed fittings shall conform to ASME B 16.11

7.4 Bore of socket welded fittings shall suit O. D. of pipe and its thickness.

7.5 Dimensions of butt welded carbon steel fittings shall be as per ASME B 16.9 / MSS-SP-75, as applicable.



**PIPELINE LAYING AND TERMINAL WORKS FOR
NORTH EAST GAS GRID PIPELINE PROJECT**

Doc. No. MEC/23UU/05/28/M/000/1092, R0



MECON LIMITED

- 76 But welding ends shall conform to ANSI B 16.25/ API 5L. In case of difference in thickness of matching ends, requirements of ASME B 31.8 shall apply.
- 7.7 Integrally reinforced forged branch fittings such as sockolet, threadolet, weldolet, nipple etc. shall be as per MSS-SP-97. Fittings not covered in ASME B 16.9 and MSS-SP-97 shall conform to manufacturer's standard.
- 7.8 Fittings thickness tolerances shall match pipe thickness tolerance.
- 8.0 **BENDS**
- 8.1 Unless otherwise specified for terminal piping, the elbow of radius $R=1.5 D$ shall only be used.
- 8.2 The radius of cold field bends shall not be less than 30 times the nominal diameter for pipes upto nominal diameter of 16" and shall not be less than 40 times the nominal diameter for pipes of nominal diameter of 18" and above. Limited use of long radius bends ($R = 6D$) may be permitted for reason of space constraints.
- 9.0 **FLANGES**
- 9.1 Flange rating shall be same as ANSI B 16.5/MSS-SP-44/ B 16.47 Series A as specified.
- 9.2 Dimensions of flanges shall be in accordance with ANSI B 16.5/ B 16.47 Series A, as applicable.
- 9.3 Neck of Weld Neck (WN) flanges to suit pipe bore and thickness.
- 9.4 Bore of Socket Welded (SW) flanges shall suit pipe O.D. and its thickness.
- 9.5 Threads for screwed flanges if used shall conform to American Standard taper as per ANSI B 1.20.1 NPT.
- 9.6 Sizes for blind flanges shall be indicated by nominal pipe sizes.
- 9.7 Carbon steel flanges faces shall have smooth finish as indicated in the material specification. Flanges faces shall have smooth finish to 125-250 micro inches AARH as per MSS-SP-6.
- 9.8 But welding ends of WN flanges shall conform to ANSI B 16.25.



PIPELINE LAYING AND TERMINAL WORKS FOR
NORTH EAST GAS GRID PIPELINE PROJECT

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MECON LIMITED

9.9 Spectacle blind/ spacer & blinds shall be in accordance with ASME B 16.48 / Manufacturer's Standard. Spectacle blind shall be used for sizes up to 8" NB and spacer & blind for 10" & above shall be used.

9.10 Two jack screws 180° apart shall be provided for all spectacle blind assemblies. The jack screws shall be as per MECON's standard.

10.0 **GASKETS**

10.1 Spiral wound metallic gaskets shall conform to B 16.20 and API 601 shall be provided with graphite filler. All spiral wound gaskets shall be provided with stainless steel centering ring.

11.0 **BOLTING**

11.1 Nuts for stud bolts shall be American Standard Hexagonal Heavy series and double chamfered.

11.2 Dimension and tolerances for stud bolts and nuts shall be as per ANSI B 18.2.1 and 18.2.2 with full threading to ANSI B 1.1 Class 2A thread for bolts and Class 2B for nuts. Diameter and length of stud bolts shall be as per ANSI B 16.5/ ASME B 16.47 with full threading.

11.3 Threads for nuts shall be as per ANSI B 1.1, as follows:

Nuts for stud dia 1/4" to 1"	:	UNC-2B
Nuts for stud bolts dia 1 1/8" to 3 1/4"	:	8UN-2B

11.4 Threads for stud bolts shall be as per ANSI B 1.1, as follows.

Studs bolts dia 1/4" to 1"	:	UNC-2A
Stud bolts dia 1 1/8" to 3 1/4"	:	8UN-2A

11.5 Heads of jack screws shall be heavy hexagonal type. Jack screw end shall be rounded. Stud bolts shall be fully threaded with two hexagonal nuts.

12.0 **THREAD SEALANT**

12.1 Threaded joints shall be made with 1" wide PTFE Jointing tape.



PIPELINE LAYING AND TERMINAL WORKS FOR
NORTH EAST GAS GRID PIPELINE PROJECT

Doc. No. MEC/23UU/05/28/M/000/1092, R0



MECON LIMITED

13.0 VALVES

13.1 Valve ends shall be as per piping material specifications (Appendices).

13.2 Flange dimensions and face finish of flanged end valves shall confirm to clause 9.0 of this specification.

13.3 Butt welding ends of Butt Welded valves shall conform to ANSI B 16.25.

13.4 Face to face and end to end dimensions shall conform to applicable standards.

13.5 Buried valves on mainline shall be provided with stem extension, sealant, vent/drain & shall have butt welded ends.

13.6 Sectionalizing Valves (Block valves) installed on the main pipeline shall be Ball valves with butt welded ends and shall be full bore to allow smooth passage of cleaning pigs as well as intelligent pigs.

13.7 Unless specified otherwise. Valves shall confirm to the following standards:

Screwed / Socket welded / Flanged end valves (1 ½" and below)

Ball Valves	-	BS 5351(latest)
Plug Valves	-	BS 5353(latest)
Globe Valves	-	BS 5352(latest)
Gate Valves	-	API 602(latest)

Flanged / Butt weld end Valves (2" and above)

Ball Valves	-	API 6D
Plug Valves	-	API 6D
Check Valves	-	API 6D
Globe Valves	-	BS 1873
Gate Valves	-	API 6D

13.8 Manual Valve operators shall be as indicated below, unless specified otherwise in the P&ID.



PIPELINE LAYING AND TERMINAL WORKS FOR
NORTH EAST GAS GRID PIPELINE PROJECT

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MECON LIMITED

a) **Gate and Globe Valves**

i) For ANSI class 150 & 300 - Hand Wheel operated for size ≤ 12 "NB.
Gear operated for size ≥ 14 " NB.

ii) For ANSI class 600 - Hand Wheel operated for size ≤ 10 "NB.
Gear operated for size ≥ 12 " NB.

b) **Ball and Plug Valves**

i) For ANSI class 150, 300, 600 – Wrench operated for size ≤ 4 "NB.
Gear operated for size ≥ 6 "NB.

c) **Actuated Valves**- Actuated valves shall be as per P & ID.

14.0 QUICK OPENING END CLOSURE

Quick opening end closure to be installed on scrapper traps shall be equipped with safety locking devices in compliance with section VIII, division 1, UG-35.2 of ASME Boiler and Pressure Vessel code.

15.0 HYDRO TESTING VENTS AND DRAINS

High point vents and low point drains required for the purpose of hydro testing shall be of size 3/4" and consist of sockolet, Plug/ Ball valve for vent, Globe / Ball Valve for drain, flange & blind flange.

16.0 PIPELINE SPECIALITY ITEMS

Pipeline Specialty items viz., Scrapper Traps, Flow Tee, Insulating Joints, LR bends, QOEC for Venting shall be as per respective data sheets, specifications and Project Specific drawing showing Mainline & Terminal materials.



**PIPELINE LAYING AND TERMINAL WORKS FOR
NORTH EAST GAS GRID PIPELINE PROJECT**

Doc. No. MEC/23UU/05/28/M/000/1092, R0



TABLE-1
PIPE WALL THICKNESS DETAILS FOR MAINLINE/SPURLINE

Sl. No.	Pipe Material Description	Size (NB)	Thickness (mm)	Length
1	API 5L Gr. X-70, PSL-2	18"	7.92	As per SOR Quantity
2	API 5L Gr. X-70, PSL-2	18"	9.53	As per SOR Quantity
3	API 5L Gr. X-70, PSL-2	18"	12.7	As per SOR Quantity
4	API 5L Gr. X-70, PSL-2	12"	7.14	As per SOR Quantity
5	API 5L Gr. X-70, PSL-2	12"	9.53	As per SOR Quantity
6	API 5L Gr. X-56, PSL-2	8"	7.04	As per SOR Quantity

TABLE-2
INDEX OF PIPING MATERIAL SPECIFICATIONS

Class	Service	C.A. (mm)	Basic Material	Design Code	Enclosed as
D1A	Natural Gas / RLNG	1.5	ASTM A 106 Gr. B/ API 5L Gr. B/	ASME B31.8	Appendix-I
D4A	Natural Gas / RLNG	1.5	ASTM A 333 Gr. 6	ASME B31.8	Appendix-II
B1A	Natural Gas / RLNG	1.5	ASTM A 106 Gr. B/ API 5L Gr. B	ASME B31.8	Appendix-III
B4A	Natural Gas / RLNG	1.5	ASTM A 333 Gr. 6	ASME B31.8	Appendix-IV
A1A	Natural Gas / RLNG	1.5	ASTM A 106 Gr. B/ API 5L Gr. B	ASME B31.8	Appendix-V
A4A	Natural Gas / RLNG	1.5	ASTM A 333 Gr. 6	ASME B31.8	Appendix-VI

[illegible]

A		B		C		D		E		F		G		H		I																							
6		5		4		3		2		1																													
APPROVED		DRWN		DSGN		NAME		SECTION: OIL & GAS		DATE		CHKD		DATE		REV																							
A.CANGAL				K.P.				H.K.								0																							
PIPING MATERIAL SPECIFICATIONS		600# (D1A)		NATURAL GAS PIPELINE PROJECT		SCALE : N.T.S.		APPENDIX-I		MECON LIMITED		मेकॉन लिमिटेड		DRG. NO.		(SH. 2 OF 2)																							
REV NO		DATE		ZONE		DESCRIPTIONS		BY		APPRD		REFERENCES																											
PIPELINE/PIPING DESIGN CODE		ASME B 31.8/ OISD 226		DESIGN FACTOR – 0.5																																			
ITEM		NOMINAL DIAMETER (INCHES)		0.50		0.75		1.00		1.50		2.00		3.00		4.00		6.00		8.00		10.0		12.0		14.0		16.0		18.0		20.0		24.0		28.0		30.0	
PIPE		WALL THICKNESS (MM/SCH)		S160		S160		S80		S80		S80		XS		XS		XS		14.3		XS		S60		14.3		17.5		S60		S60		19.1		22.2		23.8	
		MATERIAL		ASTM A106 GR.B		ASTM A106 GR.B		(CHARPY)		API 5L GR.B PSL2		API 5L GR.X-52 PSL2																											
		DIMENSION STD.		B36.10		API 5L																																	
		METHOD OF MANUFACTURE, ENDS		SEAMLESS PE		SEAMLESS BE		BE SAW																															
FLANGE		MATERIAL AND GRADE		ASTM A 105		ASTM A 105 (CHARPY)		ASTM A 694 GR.F-52 (CHARPY)																															
		TYPE, FLANGE FACING		SW. RF 125AARH		WN. THICKNESS TO MATCH PIPE THICKNESS,RF 125AARH																																	
		DIMENSION STD.		B16.5																																			
BLIND FLANGE		MATERIAL AND GRADE		ASTM A 105		ASTM A 105 (CHARPY)																																	
		FLANGE FACING		RF 125AARH																																			
		DIMENSION STD.		B16.5																																			
BLANK		MATERIAL AND GRADE		ASTM A 105		ASTM A 105 (CHARPY)																																	
		FLANGE FACING		FF 125AARH																																			
		DIMENSION STD.		B16.48																																			
		TYPE		FIG.8 FLANGE																																			
BOLTING		STUD BOLTS (FULLY THREADED)		A 193 GR B7, B-18.2																																			
		NUTS (HEAVY HEXAGONAL)		A 194 GR 2H, B-18.2																																			
GASKET		TYPE ,MATERIAL AND Dmn. STD.		SPIRAL 600# , SP.WND SS316+GRAPHITE FILLED, B-16.20-ANSI B16.5,																																			
ELBOW-90		MATERIAL		ASTM A 105		ASTM A 234 GR.WPB (CHARPY)		MSS-SP-75 GR.W PHY-52																															
ELBOW-45		END DETAIL		SW,6000#		SW,3000#		BW, 1.5D																															
		DIMENSION STD.		B-16.11		B-16.9		MSS-SP-75																															
T-EQUAL		MATERIAL		ASTM A 105		ASTM A 234 GR.WPB (CHARPY)		MSS-SP-75 GR.W PHY-52																															
T-RED		END DETAIL		SW,6000#		SW,3000#		BW																															
		DIMENSION STD.		B-16.11		B-16.9		MSS-SP-75																															
CAP		MATERIAL		ASTM A 105		ASTM A 234 GR.WPB (CHARPY)		MSS-SP-75 GR.W PHY-52																															
		END DETAIL		SCRF6000		SCRF3000		BW,THICKNESS TO MATCH PIPE THICKNESS																															
		DIMENSION STD.		B-16.11		B-16.9		MSS-SP-75																															
FITTING		MATERIAL		ASTM A 105		ASTM A 234 GR.WPB (CHARPY)		MSS-SP-75 GR.W PHY-52																															
		END DETAIL		SW-6000#		SW-3000#		BW,THICKNESS TO MATCH PIPE THICKNESS																															
		DIMENSION STD.		B-16.11		B-16.9		MSS-SP-75																															
		TYPE		COUPLING FULL,HALF LH.,RED.		RED. CON. RED. ECC.																																	
O'LET		MATERIAL		ASTM A 105		ASTM A 105 (CHARPY)		ASTM A 694 GR.F-52 (CHARPY)																															
		END DETAIL		SW,6000#		SW,3000#		BW																															
		DIMENSION STD.		MSS-SP97		MSS-SP97		MSS-SP97																															
		TYPE		SOCKOLET		WELDOLET		WELDOLET																															

6	5	4	3	2	1	A	B	C	D	E	F	G	H																							
						<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:15%;">ANSI CLASS: 600#</td> <td style="width:15%;">CORROSION ALLOWANCE: 1.5MM</td> <td style="width:10%;">TEMP °C</td> <td style="width:5%;">-45</td> <td style="width:5%;">38</td> <td style="width:5%;">50</td> <td style="width:5%;">100</td> <td style="width:5%;">150</td> <td style="width:5%;">200</td> <td style="width:5%;"></td> </tr> <tr> <td colspan="3">PRESS. KG/CM² g</td> <td>97.89</td> <td>97.89</td> <td>96.77</td> <td>92.48</td> <td>89.63</td> <td>87.02</td> <td></td> </tr> </table>		ANSI CLASS: 600#	CORROSION ALLOWANCE: 1.5MM	TEMP °C	-45	38	50	100	150	200		PRESS. KG/CM ² g			97.89	97.89	96.77	92.48	89.63	87.02		<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:40%;">SERVICE : RLNG</td> <td style="width:60%;">BASE MATERIAL: CARBON STEEL (MATERIAL GROUP 1.3)</td> </tr> </table>		SERVICE : RLNG	BASE MATERIAL: CARBON STEEL (MATERIAL GROUP 1.3)					
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						PRESS. KG/CM ² g			97.89	97.89	96.77	92.48	89.63	87.02																						
SERVICE : RLNG	BASE MATERIAL: CARBON STEEL (MATERIAL GROUP 1.3)																																			
NOTES: - - ALL VENTS & DRAIN SHALL BE PROVIDED WITH PLUG VALVE UNLESS MENTIONED OTHERWISE IN P&IDs. - FITTINGS SHALL BE OF SEAMLESS CONSTRUCTION UP TO 16" AND SHALL BE OF WELDED CONSTRUCTION 18" AND ABOVE. - WALL THICKNESS FOR LINEPIPE USED IN VARIOUS SECTIONS SHALL BE AS PER TABLE-1 OF PMS. - BALL VALVE TO BE USED IN MAINLINE SHALL HAVE BUTT WELDED ENDS EXCEPT FOR THE VALVES USED FOR HOT TAPPING WHICH SHALL BE ONE SIDE BUTT WELDED AND OTHER SIDE FLANGED. - PROCUREMENT OF MATERIALS SHALL BE AS PER DETAILED RELEVANT SPECIFICATIONS. - DESIGN PRESSURE & TEMP. FOR PIPELINE AND RELATED FACILITIES ARE 92 Kg/cm² g & (-45° TO +65°C) RESPECTIVELY. - PRESSURE-TEMPERATURE RATING INDICATED ARE FOR FLANGES ONLY IN ACCORDANCE WITH ANSI B 16.5 - FOR VALVES,STEELPIPE AND ASSOCIATED STEEL COMPONENTS OF 2" AND LARGER NOTCH TOUGHNESS PROPERTIES SHALL BE AS SPECIFIED IN RELEVANT SPECIFICATIONS/CODES, MECON'S STANDARD TECHNICAL SPECIFICATIONS AND DATA SHEETS ETC. - AT STATIONS, BRANCH CONNECTIONS SHALL BE AS PER BRANCH CONNECTION TABLE BELOW - ALL BUTT WELDS SHALL BE 100% RADIOGRAPHED. 100% OF SOCKET WELD SHALL BE SUBJECTED TO MPI/DPT. - PRESSURE-TEMPERATURE RATING OF VALVE BODY SHALL BE AS PER API 6D. - PIPELINE DESIGN CODE - ASME B 31.8 & OISD 226. - FOR PIPELINE SPECIALITY ITEMS (SCRAPPER TRAP, FLOW TEE, IJ, LR BENDS ETC.) AND THEIR MATERIAL DESCRIPTIONS REFER DATA SHEET OF RESPECTIVE ITEMS.																																				
STATION PIPING MATERIAL SPECIFICATION <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>ITEM</th> <th>SIZE</th> <th>DESCRIPTION</th> </tr> </thead> <tbody> <tr> <td>MAINTENANCE JOINTS</td> <td>ALL</td> <td>FLGD., BUT TO BE KEPT MINIMUM</td> </tr> <tr> <td rowspan="2">PIPE JOINTS</td> <td>1.5" & BELOW</td> <td>SOCKET WELD</td> </tr> <tr> <td>2" & ABOVE</td> <td>BUTT WELDED</td> </tr> <tr> <td rowspan="2">DRAINS</td> <td>ON LINES ≤ 1.5"</td> <td>3/4", AS PER MEC/SD/05/21/15/03</td> </tr> <tr> <td>ON LINES ≥ 2"</td> <td>3/4" OR AS PER P&ID, MEC/SD/05/21/15/01</td> </tr> <tr> <td rowspan="2">VENTS</td> <td>ON LINES ≤ 1.5"</td> <td>3/4", AS PER MEC/SD/05/21/15/03</td> </tr> <tr> <td>ON LINES ≥ 2"</td> <td>3/4" OR AS PER P&ID, MEC/SD/05/21/15/01</td> </tr> <tr> <td>TEMP. CONN.</td> <td>1.5"</td> <td>FLGD. INSTL. AS PER MEC/SD/05/21/15/02</td> </tr> <tr> <td>PRESS CONN.</td> <td>3/4"</td> <td>NIPPLE WITH BALL VALVE TO SPEC. INSTALLATION AS PER MEC/SD/05/21/15/05</td> </tr> </tbody> </table>										ITEM	SIZE	DESCRIPTION	MAINTENANCE JOINTS	ALL	FLGD., BUT TO BE KEPT MINIMUM	PIPE JOINTS	1.5" & BELOW	SOCKET WELD	2" & ABOVE	BUTT WELDED	DRAINS	ON LINES ≤ 1.5"	3/4", AS PER MEC/SD/05/21/15/03	ON LINES ≥ 2"	3/4" OR AS PER P&ID, MEC/SD/05/21/15/01	VENTS	ON LINES ≤ 1.5"	3/4", AS PER MEC/SD/05/21/15/03	ON LINES ≥ 2"	3/4" OR AS PER P&ID, MEC/SD/05/21/15/01	TEMP. CONN.	1.5"	FLGD. INSTL. AS PER MEC/SD/05/21/15/02	PRESS CONN.	3/4"	NIPPLE WITH BALL VALVE TO SPEC. INSTALLATION AS PER MEC/SD/05/21/15/05
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REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRO	REFERENCES	DRG. NO.																	
SECTION: OIL & GAS <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:15%;">NAME</td> <td style="width:15%;">DATE</td> <td style="width:15%;">CHKD</td> <td style="width:15%;">DATE</td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table> REVISED <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:15%;">A.CANCEL</td> </tr> </table>								NAME	DATE	CHKD	DATE													A.CANCEL
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A.CANCEL																								

NATURAL GAS PIPELINE PROJECT

PIPING MATERIAL SPECIFICATIONS
LOW TEMP SERVICE 600# (D4A)

SCALE : N.T.S.

APPENDIX-II

मेकॉन लिमिटेड

MECON LIMITED

(SH. 1 OF 2)

BRANCH CONNECTIONS

E	TEES BW	36
H	H. COUPLING	34
P	PIPE TO PIPE	32
R	REINFORCED	30
S	SOCKETLETS	28
T	TEES SW/	24
W	WELDOLETS	22
D	TEE WITH RED.	20

RUN PIPE NOMINAL DIA (INCHES)

BRANCH PIPE NOMINAL DIA (INCHES)

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REV NO

DATE

ZONE

DESCRIPTIONS

BY

APPROD

REFERENCES

DRG. NO.

SECTION:

OIL & GAS

NATURAL GAS PIPELINE PROJECT

PIPING MATERIAL SPECIFICATIONS LOW TEMP SERVICE 600# (D4A)

SCALE : N.T.S.

APPENDIX-II

मेकॉन लिमिटेड

MECON LIMITED

NAME

DATE

CHKD

DATE

DSGN

K.P.

H.K.

DRWN

APPROVED

A.GANGAL

PIPELINE/PIPING DESIGN CODE		ASME B 31.8/ OISD 226										DESIGN FACTOR – 0.5												
ITEM	NOMINAL DIAMETER (INCHES)	0.50	0.75	1.00	1.50	2.00	3.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0	24.0						
PIPE	WALL THICKNESS (MM/SCH)	S160	S160	XS	XS	XS	STD	XS	XS	XS	XS	19.0	20.6	22.2	25.4	22.2	25.4	26.3						
	MATERIAL	ASTM A333 GR.6																						
	DIMENSION STD.	B36.10																						
	METHOD OF MANUFACTURE, ENDS	SEAMLESS PE					SEAMLESS BE					BE SAW												
FLANGE	MATERIAL AND GRADE	ASTM A 350 GR. LF2, CL-I																						
	TYPE, FLANGE FACING	SW. RF 125AARH					WN. THICKNESS TO MATCH PIPE THICKNESS, RF 125AARH																	
	DIMENSION STD.	B16.5																						
BLIND FLANGE	MATERIAL AND GRADE	ASTM A 350 GR. LF2, CL-I																						
	FLANGE FACING	RF 125AARH																						
	DIMENSION STD.	B16.5																						
BLANK	MATERIAL AND GRADE	ASTM A 350 GR. LF2, CL-I																						
	FLANGE FACING	FF 125AARH																						
	DIMENSION STD.	B16.48																						
	TYPE	FIG.8 FLANGE					SPACER & BLIND																	
BOLTING	STUD BOLTS (FULLY THREADED)	A 320 GR L7, B-18.2																						
	NUTS (HEAVY HEXAGONAL)	A 194 GR 4, B-18.2																						
GASKET	TYPE, MATERIAL AND Dmn. STD.	SPIRAL, SP.WND SS316+GRAPHITE FILLED, B-16.20-ANSI B16.5,																						
ELBOW-90 ELBOW-45	MATERIAL	ASTM A350 GR.LF2					ASTM A 420 GR.WPL6					A 420 GR.WPL6.W												
	END DETAIL	SW,6000# SW,3000#					BW, 1.5D																	
	DIMENSION STD.	B-16.11					B-16.9																	
T-EQUAL T-RED	MATERIAL	ASTM A350 GR.LF2					ASTM A 420 GR.WPL6					ASTM A 420 GR.WPL6.W												
	END DETAIL	SW,6000# SW,3000#					BW																	
	DIMENSION STD.	B-16.11					B-16.9																	
CAP & PLUG (UPTO 1.5")	MATERIAL	ASTM A350 GR.LF2					ASTM A 420 GR.WPL6																	
	END DETAIL	SCRF6000 SCRF3000					BW, THK TO MATCH PIPE THICKNESS																	
	DIMENSION STD.	B-16.11					B-16.9																	
FITTING	MATERIAL	ASTM A350 GR.LF2					ASTM A 420 GR.WPL6					ASTM A 420 GR.WPL6.W												
	END DETAIL	SW-6000 SW-3000					BW, THICKNESS TO MATCH PIPE THICKNESS																	
	DIMENSION STD.	B-16.11					B-16.9																	
	TYPE	COUPLING FULL, HALF LH., RED.					RED. CON. RED. ECC.																	
O'LET	MATERIAL	ASTM A350 GR.LF2																						
	END DETAIL	SW,6000# SW,3000#					BW																	
	DIMENSION STD.	MSS-SP97					MSS-SP97																	
	TYPE	SOCKOLET					WELDOLET																	

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A		B		C		D		E		F		G		H	
APPROVED		REV NO		DATE		ZONE		ANSI CLASS: 300 #		CORROSION ALLOWANCE: 1.5 MM		TEMP °C		-29.0 38.0 50 100 150 200	
DRWN		NAME		DATE		CHKD		DATE		PRESS. KG/CM ² g		52.1 52.1 51.10 47.52 45.98 44.60			
A.CANGAL		OIL & GAS								SERVICE : NATURAL GAS		BASE MATERIAL: CARBON STEEL (MATERIAL GROUP 1.1)			
PIPING MATERIAL SPECIFICATIONS 300# (B1A)		NATURAL GAS PIPELINE PROJECT		DESCRIPTIONS		BY		APPRO		NOTES: -					
SCALE : N.T.S.		MECON LIMITED		REFERENCES		DRG. NO.				1. ALL VENTS & DRAIN SHALL BE PROVIDED WITH PLUG VALVE UNLESS MENTIONED OTHERWISE IN P&IDs.					
APPENDIX-III										2. FITTINGS SHALL BE OF SEAMLESS CONSTRUCTION UP TO 16" AND SHALL BE OF WELDED CONSTRUCTION 18" AND ABOVE.					
										3. WALL THICKNESS FOR LINEPIPE USED IN VARIOUS SECTIONS SHALL BE AS PER TABLE-1 OF PMS.					
										4. BALL VALVE TO BE USED IN MAINLINE SHALL HAVE BUTT WELDED ENDS EXCEPT FOR THE VALVES USED FOR HOT TAPPING WHICH SHALL BE ONE SIDE BUTT WELDED AND OTHER SIDE FLANGED.					
										5. PROCUREMENT OF MATERIALS SHALL BE AS PER DETAILED RELEVANT SPECIFICATIONS.					
										6. DESIGN PRESSURE & TEMP. FOR PIPELINE AND RELATED FACILITIES ARE 49 Kg/cm ² g & (-29° TO +65°C) RESPECTIVELY.					
										7. PRESSURE-TEMPERATURE RATING INDICATED ARE FOR FLANGES ONLY IN ACCORDANCE WITH ANSI B 16.5					
										8. FOR VALVES,STEELPIPE AND ASSOCIATED STEEL COMPONENTS OF 2" & LARGER NOTCH TOUGHNESS PROPERTIES SHALL BE AS SPECIFIED. IN RELEVANT SPECIFICATIONS/CODES, MECON'S STANDARD TECHNICAL SPECIFICATIONS AND DATA SHEETS ETC.					
										9. AT STATIONS, BRANCH CONNECTIONS SHALL BE AS PER BRANCH CONNECTION TABLE BELOW					
										10. ALL BUTT WELDS SHALL BE 100% RADIOGRAPHED.					
										11. 100% OF SOCKET WELD SHALL BE SUBJECTED TO MPI/DPT.					
										12. PRESSURE-TEMPERATURE RATING OF VALVE BODY SHALL BE AS PER API 6D.					
										13. PIPELINE DESIGN CODE - ASME B 31.8 & OISD 226.					
										14. FOR PIPELINE SPECIALITY ITEMS (SCRAPPER TRAP, FLOW TEE, IJ, LR BENDS ETC.) AND THEIR MATERIAL DESCRIPTIONS REFER DATA SHEET OF RESPECTIVE ITEMS.					
										STATION PIPING MATERIAL SPECIFICATION					
										ITEM		SIZE		DESCRIPTION	
										MAINTENANCE JOINTS		ALL		FLGD., BUT TO BE KEPT MINIMUM	
										PIPE JOINTS		1.5" & BELOW		SOCKET WELD	
												2" & ABOVE		BUTT WELDED	
										DRAINS		ON LINES ≤ 1.5"		3/4", AS PER MEC/SD/05/21/15/03	
												ON LINES ≥ 2"		3/4" OR AS PER P&ID, MEC/SD/05/21/15/01	
										VENTS		ON LINES ≤ 1.5"		3/4", AS PER MEC/SD/05/21/15/03	
												ON LINES ≥ 2"		3/4" OR AS PER P&ID, MEC/SD/05/21/15/01	
										TEMP. CONN.		1.5"		FLGD. INSTL. AS PER MEC/SD/05/21/15/02	
										PRESS CONN.		3/4"		SCH. 160 NIPPLE WITH BALL VALVE TO SPEC. INSTALLATION AS PER MEC/SD/05/21/15/05	
6		5		4		3		2		1					
A		B		C		D		E		F		G		H	

BRANCH CONNECTIONS

E	TEES BW	36
H	H. COUPLING	34
P	PIPE TO PIPE	32
R	REINFORCED	30
S	SOCKETLETS	28
T	TEES SW/	24
W	WELDOLETS	22
D	TEE WITH RED.	20
		18
		16
		14
		12
		10
		8.0
		6.0
		5.0
		4.0
		3.50
		3.00
		2.50
		2.00
		1.50
		1.25
		1.00
		0.75
		0.50

BRANCH PIPE NOMINAL DIA (INCHES)

RUN PIPE NOMINAL DIA (INCHES)

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A		B		C		D		E		F		G		H																			
REV NO		DATE		ZONE		DESCRIPTIONS		BY		APPROD		REFERENCES		DRG. NO.																			
SECTION: OIL & GAS		NAME		DATE		CHKD		DATE		H.K.		DATE		A.CANGAL																			
DSGN		K.P.				H.K.																											
DRWN																																	
APPROVED																																	
6		5		4		3		2		1																							
NATURAL GAS PIPELINE PROJECT		PIPING MATERIAL SPECIFICATIONS 300# (B1A)		SCALE : N.T.S.		APPENDIX-III		MECON LIMITED		मेकॉन लिमिटेड																							
REV 0		(SH. 2 OF 2)																															
PIPELINE/PIPING DESIGN CODE		ASME B 31.8/ OISD 226		DESIGN FACTOR – 0.5																													
ITEM		NOMINAL DIAMETER (INCHES)		0.50		0.75		1.00		1.50		2.00		3.00		4.00		6.00		8.00		10.0		12.0		14.0		16.0		18.0		20.0	
PIPE		WALL THICKNESS (MM/SCH)		S160		S160		XS		XS		XS		STD		S40		S40		7.9		STD		S40		S40		S40		S40		15.9	
		MATERIAL		ASTM A106 GR.B		ASTM A106 GR.B		(CHARPY)		API 5L GR.B PSL2																							
		DIMENSION STD.		B36.10						API 5L																							
		METHOD OF MANUFACTURE, ENDS		SEAMLESS PE		SEAMLESS BE		BE SAW																									
FLANGE		MATERIAL AND GRADE		ASTM A 105		ASTM A 105 (CHARPY)																											
		TYPE, FLANGE FACING		SW. RF 125AARH		WN. THICKNESS TO MATCH PIPE THICKNESS,RF 125AARH																											
		DIMENSION STD.		B16.5																													
BLIND FLANGE		MATERIAL AND GRADE		ASTM A 105		ASTM A 105 (CHARPY)																											
		FLANGE FACING		RF 125AARH																													
		DIMENSION STD.		B16.5																													
BLANK		MATERIAL AND GRADE		ASTM A 105		ASTM A 105 (CHARPY)																											
		FLANGE FACING		FF 125AARH																													
		DIMENSION STD.		B16.48																													
		TYPE		FIG.8 FLANGE		SPACER & BLIND																											
BOLTING		STUD BOLTS (FULLY THREADED)		A 193 GR B7, B-18.2																													
		NUTS (HEAVY HEXAGONAL)		A 194 GR 2H, B-18.2																													
GASKET		TYPE ,MATERIAL AND Dmn. STD.		SPIRAL 300# , SP.WND SS316+GRAPHITE FILLED, B-16.20-ANSI B16.5,																													
ELBOW-90		MATERIAL		ASTM A 105		ASTM A 234 GR.WPB (CHARPY)																											
ELBOW-45		END DETAIL		SW,6000#		SW,3000#		BW, 1.5D																									
		DIMENSION STD.		B-16.11		B-16.9																											
T-EQUAL		MATERIAL		ASTM A 105		ASTM A 234 GR.WPB (CHARPY)																											
T-RED		END DETAIL		SW,6000#		SW,3000#		BW, THICKNESS TO MATCH PIPE THICKNESS																									
		DIMENSION STD.		B-16.11		B-16.9																											
CAP		MATERIAL		ASTM A 105		ASTM A 234 GR.WPB (CHARPY)																											
		END DETAIL		SCRF6000#		SCRF3000#		BW,THICKNESS TO MATCH PIPE THICKNESS																									
		DIMENSION STD.		B-16.11		B-16.9																											
FITTING		MATERIAL		ASTM A 105		ASTM A 234 GR.WPB (CHARPY)																											
		END DETAIL		SW,6000#		SW,3000#		BW,THICKNESS TO MATCH PIPE THICKNESS																									
		DIMENSION STD.		B-16.11		B-16.9																											
		TYPE		COUPLING FULL,HALF LH.,RED.		RED. CON. RED. ECC.																											
O'LET		MATERIAL		ASTM A 105		ASTM A 105 (CHARPY)																											
		END DETAIL		SW,6000#		SW,3000#		BW																									
		DIMENSION STD.		MSS-SP97		MSS-SP97																											
		TYPE		SOCKOLET		WELDOLET																											

SECTION: OIL & GAS		REV NO		DATE		ZONE	
DESIGN K.P.		DATE		CHKD		DATE	
DRAWN				H.K.			
APPROVED				A.CANGAL			
NATURAL GAS PIPELINE PROJECT		PIPING MATERIAL SPECIFICATIONS LOW TEMP SERVICE 300# (B4A)		SCALE : N.T.S.		REV 0	
MECON LIMITED		मेकॉन लिमिटेड		DRG. NO.			
REFERENCES		BY		APPRO			
DESCRIPTIONS							
REV NO		DATE		ZONE			

ANSI CLASS: 300#	CORROSION ALLOWANCE: 1.5MM	TEMP °C	-45	38	50	80	100	120	150
		PRESS. KG/CM ² g	48.95	48.95	48.44	46.72	46.19	45.54	44.76

SERVICE : RLNG

BASE MATERIAL: CARBON STEEL (MATERIAL GROUP 1.3)

NOTES: -

1. ALL VENTS & DRAIN SHALL BE PROVIDED WITH PLUG VALVE UNLESS MENTIONED OTHERWISE IN P&IDs.
2. FITTINGS SHALL BE OF SEAMLESS CONSTRUCTION UP TO 16" AND SHALL BE OF WELDED CONSTRUCTION 18" AND ABOVE.
3. WALL THICKNESS FOR LINEPIPE USED IN VARIOUS SECTIONS SHALL BE AS PER TABLE-1 OF PMS.
4. BALL VALVE TO BE USED IN MAINLINE SHALL HAVE BUTT WELDED ENDS EXCEPT FOR THE VALVES USED FOR HOT TAPPING WHICH SHALL BE ONE SIDE BUTT WELDED AND OTHER SIDE FLANGED.
5. PROCUREMENT OF MATERIALS SHALL BE AS PER DETAILED RELEVANT SPECIFICATIONS.
6. PRESSURE-TEMPERATURE RATING INDICATED ARE FOR FLANGES ONLY IN ACCORDANCE WITH ANSI B 16.5
7. FOR VALVES,STEELPIPE AND ASSOCIATED STEEL COMPONENTS OF 2" & LARGER NOTCH TOUGHNESS PROPERTIES SHALL BE AS SPECIFIED. IN RELEVANT SPECIFICATIONS/CODES, MECON'S STANDARD TECHNICAL SPECIFICATIONS AND DATA SHEETS ETC.
8. AT STATIONS, BRANCH CONNECTIONS SHALL BE AS PER BRANCH CONNECTION TABLE BELOW
9. ALL BUTT WELDS SHALL BE 100% RADIOGRAPHED.
10. 100% OF SOCKET WELD SHALL BE SUBJECTED TO MPI/DPT.
11. PRESSURE-TEMPERATURE RATING OF VALVE BODY SHALL BE AS PER API 6D.
12. PIPELINE DESIGN CODE - ASME B 31.8 & OISD 226.
13. FOR PIPELINE SPECIALITY ITEMS (SCRAPPER TRAP, FLOW TEE, IJ, LR BENDS ETC.) AND THEIR MATERIAL DESCRIPTIONS REFER DATA SHEET OF RESPECTIVE ITEMS.
14. DESIGN PRESSURE &TEMP. FOR PIPELINE AND RELATED FACILITIES ARE 49 KG/cm²g &(-45° TO +65° C) RESPECTIVELY.

STATION PIPING MATERIAL SPECIFICATION

ITEM	SIZE	DESCRIPTION
MAINTENANCE JOINTS	ALL	FLGD., BUT TO BE KEPT MINIMUM
PIPE JOINTS	1.5" & BELOW	SOCKET WELD
	2" & ABOVE	BUTT WELDED
DRAINS	ON LINES ≤ 1.5"	3/4", AS PER MEC/SD/05/21/15/03
	ON LINES ≥ 2"	3/4" OR AS PER P&ID, MEC/SD/05/21/15/01
VENTS	ON LINES ≤ 1.5"	3/4", AS PER MEC/SD/05/21/15/03
	ON LINES ≥ 2"	3/4" OR AS PER P&ID, MEC/SD/05/21/15/01
TEMP. CONN.	1.5"	FLGD. INSTL. AS PER MEC/SD/05/21/15/02
PRESS CONN.	3/4"	NIPPLE WITH BALL VALVE TO SPEC. INSTALLATION AS PER MEC/SD/05/21/15/05

BRANCH CONNECTIONS

E	TEES BW
H	H. COUPLING
P	PIPE TO PIPE
R	REINFORCED
S	SOCKETLETS
T	TEES SW/
W	WELDOLETS
D	TEE WITH RED.

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A		B		C		D		E		F		G		H	
6		5		4		3		2		1					
APPROVED		DRWN		DSGN		NAME		SECTION:		OIL & GAS		REV NO		DATE	
A.GANGAL				H.K.		CHKD		DATE		DATE		ZONE			
PIPING MATERIAL SPECIFICATIONS LOW TEMP SERVICE 300# (B4A)		NATURAL GAS PIPELINE PROJECT		BY		APPROD		DESCRIPTIONS		REVISIONS		REFERENCES		DRG. NO.	
SCALE : N.T.S. APPENDIX-IV															
MECON LIMITED		मेकॉन लिमिटेड													
(SH. 2 OF 2)															
REV 0															

PIPELINE/PIPING DESIGN CODE		ASME B 31.8/ OISD 226												DESIGN FACTOR – 0.5							
ITEM	NOMINAL DIAMETER (INCHES)	0.50	0.75	1.00	1.50	2.00	3.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0	24.0			
PIPE	WALL THICKNESS (MM/SCH)	S160	S160	XS	XS	XS	STD	STD	STD	STD	STD	S40	S40	S30	S30	S30	S30	S30			
	MATERIAL	ASTM A333 GR.6																			
	DIMENSION STD.	B36.10																			
	METHOD OF MANUFACTURE, ENDS	SEAMLESS PE						SEAMLESS BE						BE, SAW							
FLANGE	MATERIAL AND GRADE	ASTM A 350 GR. LF2, CL-I																			
	TYPE, FLANGE FACING	SW. RF 125AARH						WN. THICKNESS TO MATCH PIPE THICKNESS, RF 125AARH													
	DIMENSION STD.	B16.5																			
BLIND FLANGE	MATERIAL AND GRADE	ASTM A 350 GR. LF2, CL-I																			
	FLANGE FACING	RF 125AARH																			
	DIMENSION STD.	B16.5																			
BLANK	MATERIAL AND GRADE	ASTM A 350 GR. LF2, CL-I																			
	FLANGE FACING	FF 125AARH																			
	DIMENSION STD.	B16.48																			
	TYPE	FIG.8 FLANGE										SPACER BLIND									
BOLTING	STUD BOLTS (FULLY THREADED)	A 320 GR L7, B-18.2																			
	NUTS (HEAVY HEXAGONAL)	A 194 GR 4, B-18.2																			
GASKET	TYPE, MATERIAL AND Dmn. STD.	SPIRAL, SP.WND SS316+GRAPHITE FILLED, B-16.20-ANSI B16.5,																			
ELBOW-90 ELBOW-45	MATERIAL	ASTM A350 GR.LF2						ASTM A 420 GR.WPL6						ASTM A 420 GR.WPL6W							
	END DETAIL	SW,6000# SW,3000#						BW, 1.5D													
	DIMENSION STD.	B-16.11						B-16.9													
T-EQUAL T-RED	MATERIAL	ASTM A350 GR.LF2						ASTM A 420 GR.WPL6						ASTM A 420 GR.WPL6W							
	END DETAIL	SW,6000# SW,3000#						BW													
	DIMENSION STD.	B-16.11						B-16.9													
CAP & PLUG (UPTO 1.5")	MATERIAL	ASTM A350 GR.LF2						ASTM A 420 GR.WPL6						ASTM A 420 GR.WPL6W							
	END DETAIL	SCRF6000 SCRF3000						BW, THK TO MATCH PIPE THICKNESS													
	DIMENSION STD.	B-16.11						B-16.9													
FITTING	MATERIAL	ASTM A350 GR.LF2						ASTM A 420 GR.WPL6						ASTM A 420 GR.WPL6W							
	END DETAIL	SW-6000 SW-3000						BW, THICKNESS TO MATCH PIPE THICKNESS													
	DIMENSION STD.	B-16.11						B-16.9													
	TYPE	COUPLING FULL, HALF LH., RED.						RED. CON. RED. ECC.													
O'LET	MATERIAL	ASTM A350 GR.LF2																			
	END DETAIL	SW,6000# SW,3000#						BW													
	DIMENSION STD.	MSS-SP97						MSS-SP97													
	TYPE	SOCKOLET						WELDOLET													

SECTION: OIL & GAS		REV NO		DATE		ZONE	
NAME	DATE	CHKD	DATE	DESCRIPTIONS			
DSGN	K.P.		H.K.	BY	APPRD	REVISIONS	
DRWN				REFERENCES			
APPROVED		A.GANGAL		NATURAL GAS PIPELINE PROJECT			
PIPING MATERIAL SPECIFICATIONS		150# (A1A)		MECON LIMITED			
SCALE : N.T.S.		APPENDIX - V		मेकॉन लिमिटेड			
REV 0				DRG. NO.			

ANSI CLASS: 150 #	CORROSION ALLOWANCE: 1.5 MM	TEMP °C	-29	38.0	50	100	150	200
		PRESS. KG/CM ² g	19.98	19.98	19.57	18.05	16.11	14.07

SERVICE : NATURAL GAS

BASE MATERIAL: CARBON STEEL (MATERIAL GROUP 1.1)

NOTES: -

- ALL VENTS & DRAIN SHALL BE PROVIDED WITH PLUG VALVE UNLESS MENTIONED OTHERWISE IN P&IDs.
- FITTINGS SHALL BE OF SEAMLESS CONSTRUCTION UP TO 16" AND SHALL BE OF WELDED CONSTRUCTION 18" AND ABOVE.
- WALL THICKNESS FOR LINEPIPE USED IN VARIOUS SECTIONS SHALL BE AS PER TABLE-1 OF PMS.
- BALL VALVE TO BE USED IN MAINLINE SHALL HAVE BUTT WELDED ENDS EXCEPT FOR THE VALVES USED FOR HOT TAPPING WHICH SHALL BE ONE SIDE BUTT WELDED AND OTHER SIDE FLANGED.
- PROCUREMENT OF MATERIALS SHALL BE AS PER DETAILED RELEVANT SPECIFICATIONS.
- DESIGN PRESSURE & TEMP. FOR PIPELINE AND RELATED FACILITIES ARE 19 Kg/Cm²g & (-29° TO +65°C) RESPECTIVELY.
- PRESSURE-TEMPERATURE RATING INDICATED ARE FOR FLANGES ONLY IN ACCORDANCE WITH ANSI B 16.5
- FOR VALVES,STEELPIPE AND ASSOCIATED STEEL COMPONENTS OF 2" AND LARGER NOTCH TOUGHNESS PROPERTIES SHALL BE AS SPECIFIED IN RELEVANT SPECIFICATIONS/CODES, MECON'S STANDARD TECHNICAL SPECIFICATIONS AND DATA SHEETS ETC.
- AT STATIONS, BRANCH CONNECTIONS SHALL BE AS PER BRANCH CONNECTION TABLE BELOW
- ALL BUTT WELDS SHALL BE 100% RADIOGRAPHED.
- 100% OF SOCKET WELD SHALL BE SUBJECTED TO MPI/DPT.
- PRESSURE-TEMPERATURE RATING OF VALVE BODY SHALL BE AS PER API 6D.
- PIPELINE DESIGN CODE - ASME B 31.8 & OISD 226.
- FOR PIPELINE SPECIALITY ITEMS (SCRAPPER TRAP, FLOW TEE, IJ, LR BENDS ETC.) AND THEIR MATERIAL DESCRIPTIONS REFER DATA SHEET OF RESPECTIVE ITEMS.

STATION PIPING MATERIAL SPECIFICATION

ITEM	SIZE	DESCRIPTION
MAINTENANCE JOINTS	ALL	FLGD., BUT TO BE KEPT MINIMUM
PIPE JOINTS	1.5" & BELOW	SOCKET WELD
	2" & ABOVE	BUTT WELDED
DRAINS	ON LINES ≤ 1.5"	3/4", AS PER MEC/SD/05/21/15/03
	ON LINES ≥ 2"	3/4" OR AS PER P&ID, MEC/SD/05/21/15/01
VENTS	ON LINES ≤ 1.5"	3/4", AS PER MEC/SD/05/21/15/03
	ON LINES ≥ 2"	3/4" OR AS PER P&ID, MEC/SD/05/21/15/01
TEMP. CONN.	1.5"	FLGD. INSTL. AS PER MEC/SD/05/21/15/02
PRESS CONN.	3/4"	SCH. 160 NIPPLE WITH BALL VALVE TO SPEC. INSTALLATION AS PER MEC/SD/05/21/15/05

BRANCH CONNECTIONS

E	TEES BW
H	H. COUPLING
P	PIPE TO PIPE
R	REINFORCED
S	SOCKETLETS
T	TEES SW/
W	WELDOLETS
D	TEE WITH RED.

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A		B		C		D		E		F		G		H	
6		5		4		3		2		1		6		5	
A		B		C		D		E		F		G		H	
REV NO		DATE		ZONE		DESCRIPTIONS		BY		APPROD		REFERENCES		DRG. NO.	
SECTION:		OIL & GAS		NATURAL GAS PIPELINE PROJECT		PIPING MATERIAL SPECIFICATIONS		SCALE : N.T.S.		(SH. 2 OF 2)		REV 0		MECON LIMITED	
NAME		DATE		CHKD		DATE		H.K.		H.K.		H.K.		H.K.	
DSGN		K.P.		H.K.		H.K.		H.K.		H.K.		H.K.		H.K.	
DRWN		H.K.		H.K.		H.K.		H.K.		H.K.		H.K.		H.K.	
APPROVED		A.GANGAL		150# (A1A)		APPENDIX-V		SCALE : N.T.S.		(SH. 2 OF 2)		REV 0		MECON LIMITED	
PIPELINE/PIPING DESIGN CODE		ASME B 31.8/ OISD 226		DESIGN FACTOR – 0.5											
ITEM		NOMINAL DIAMETER (INCHES)		0.50 0.75 1.00 1.50 2.00 3.00 4.00 6.00 8.00 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0											
PIPE		WALL THICKNESS (MM/SCH)		S160 S160 XS XS XS STD STD STD S20 S20 S20 S10 S10 S10 7.1 7.9 8.7											
MATERIAL		ASTM A106 GR.B		ASTM A106 GR.B (CHARPY)		API 5L GR.B PSL2									
DIMENSION STD.		B36.10		API 5L											
METHOD OF MANUFACTURE, ENDS		SEAMLESS PE		SEAMLESS BE		SAW, BE									
FLANGE		MATERIAL AND GRADE		ASTM A 105		ASTM A 105 (CHARPY)									
TYPE, FLANGE FACING		SW. RF 125AARH		WN. THICKNESS TO MATCH PIPE THICKNESS, RF 125AARH											
DIMENSION STD.		B16.5													
BLIND FLANGE		MATERIAL AND GRADE		ASTM A 105		ASTM A 105 (CHARPY)									
FLANGE FACING		RF 125AARH													
DIMENSION STD.		B16.5													
BLANK		MATERIAL AND GRADE		ASTM A 105		ASTM A 105 (CHARPY)									
FLANGE FACING		FF 125AARH													
DIMENSION STD.		B16.48													
TYPE		FIG.8 FLANGE		SPACER & BLIND											
BOLTING		STUD BOLTS (FULLY THREADED)		A 193 GR B7, B-18.2											
NUTS (HEAVY HEXAGONAL)		A 194 GR 2H, B-18.2													
GASKET		TYPE, MATERIAL AND Dmn. STD.		SP. WND SS 316+GRAPHITE FILLED AS PER B 16.20/ANSI B 16.5											
ELBOW-90		MATERIAL		ASTM A 105		ASTM A 234 GR.WPB (CHARPY)		ASTM A 234 GR.WPB-W (CHARPY)							
ELBOW-45		END DETAIL		SW,6000# SW,3000#		BW, 1.5D									
DIMENSION STD.		B-16.11		B-16.9											
T-EQUAL		MATERIAL		ASTM A 105		ASTM A 234 GR.WPB (CHARPY)		ASTM A 234 GR.WPB-W (CHARPY)							
T-RED		END DETAIL		SW,6000# SW,3000#		BW									
DIMENSION STD.		B-16.11		B-16.9											
CAP		MATERIAL		ASTM A 105		ASTM A 234 GR.WPB (CHARPY)		ASTM A 234 GR.WPB-W (CHARPY)							
END DETAIL		SCRF6000 SCRF3000		BW, THICKNESS TO MATCH PIPE THICKNESS											
DIMENSION STD.		B-16.11		B-16.9											
FITTING		MATERIAL		ASTM A 105		ASTM A 234 GR.WPB (CHARPY)		ASTM A 234 GR.WPB-W (CHARPY)							
END DETAIL		SW,6000# SW,3000#		BW, THICKNESS TO MATCH PIPE THICKNESS											
DIMENSION STD.		B-16.11		B-16.9											
TYPE		COUPLING FULL,HALF LH.,RED.		RED. CON. RED. ECC.											
O'LET		MATERIAL		ASTM A 105		ASTM A 105 (CHARPY)									
END DETAIL		SW,6000# SW,3000#		BW											
DIMENSION STD.		MSS-SP97		MSS-SP97											
TYPE		SOCKOLET		WELDOLET											

6 5 4 3 2 1	A	B	C	D	E	F	G	H																																																																														
	SECTION: OIL & GAS NAME DATE CHKD DATE DSGN K.P. H.K. DRWN APPROVED A.CANGAL		REV NO DATE ZONE DESCRIPTIONS BY APPROD		REVISIONS REFERENCES DRG. NO.																																																																																	
	NATURAL GAS PIPELINE PROJECT PIPING MATERIAL SPECIFICATIONS LOW TEMP SERVICE 150# (A4A)		SCALE : N.T.S. APPENDIX-VI		 मेकॉन लिमिटेड MECON LIMITED (SH. 1 OF 2)																																																																																	
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NOTES: - - ALL VENTS & DRAIN SHALL BE PROVIDED WITH PLUG VALVE UNLESS MENTIONED OTHERWISE IN P&IDs. - FITTINGS SHALL BE OF SEAMLESS CONSTRUCTION UP TO 16" AND SHALL BE OF WELDED CONSTRUCTION 18" AND ABOVE. - WALL THICKNESS FOR LINEPIPE USED IN VARIOUS SECTIONS SHALL BE AS PER TABLE-1 OF PMS. - BALL VALVE TO BE USED IN MAINLINE SHALL HAVE BUTT WELDED ENDS EXCEPT FOR THE VALVES USED FOR HOT TAPPING WHICH SHALL BE ONE SIDE BUTT WELDED AND OTHER SIDE FLANGED. - PROCUREMENT OF MATERIALS SHALL BE AS PER DETAILED RELEVANT SPECIFICATIONS. - PRESSURE-TEMPERATURE RATING INDICATED ARE FOR FLANGES ONLY IN ACCORDANCE WITH ANSI B 16.5 - FOR VALVES, STEELPIPE AND ASSOCIATED STEEL COMPONENTS OF 2" AND LARGER NOTCH TOUGHNESS PROPERTIES SHALL BE AS SPECIFIED IN RELEVANT SPECIFICATIONS/CODES, MECON'S STANDARD TECHNICAL SPECIFICATIONS AND DATA SHEETS ETC. - AT STATIONS, BRANCH CONNECTIONS SHALL BE AS PER BRANCH CONNECTION TABLE BELOW - ALL BUTT WELDS SHALL BE 100% RADIOGRAPHED. 100% OF SOCKET WELD SHALL BE SUBJECTED TO MPI/DPT. - PRESSURE-TEMPERATURE RATING OF VALVE BODY SHALL BE AS PER API 6D. - PIPELINE DESIGN CODE - ASME B 31.8 & OISD 226. - FOR PIPELINE SPECIALITY ITEMS (SCRAPPER TRAP, FLOW TEE, IJ, LR BENDS ETC.) AND THEIR MATERIAL DESCRIPTIONS, REFER DATA SHEET OF RESPECTIVE ITEMS. - DESIGN PRESSURE&TEMP. FOR PIPELINE AND RELATED FACILITIES ARE 19 KG/cm²g & (-45° TO +65° C) RESPECTIVELY.																																																																																						
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SECTION: OIL & GAS

NAME

DATE

CHKD

DATE

DSGN

K.P.

H.K.

DRWN

APPROVED

6

5

4

3

2

1

A.GANGAL

PIPING MATERIAL SPECIFICATIONS
LOW TEMP SERVICE 150# (A4A)

SCALE : N.T.S.
APPENDIX-VI

REV
0

NATURAL GAS PIPELINE
PROJECT



मेकॉन लिमिटेड
MECON LIMITED

REV NO

DATE

ZONE

DESCRIPTIONS

BY

APPRD

REFERENCES

DRG. NO.

PIPELINE/PIPING DESIGN CODE		ASME B 31.8/ OISD 226										DESIGN FACTOR – 0.5														
ITEM	NOMINAL DIAMETER (INCHES)	0.50	0.75	1.00	1.50	2.00	3.00	4.00	6.00	8.00	10.0	12.0	14.0													
PIPE	WALL THICKNESS (MM/SCH)	S160	S160	XS	XS	XS	STD	STD	STD	STD	STD	STD	STD													
	MATERIAL	ASTM A333 GR.6																								
	DIMENSION STD.	B36.10																								
	METHOD OF MANUFACTURE, ENDS	SEAMLESS PE					SEAMLESS BE																			
FLANGE	MATERIAL AND GRADE	ASTM A 350 GR. LF2, CL-I																								
	TYPE, FLANGE FACING	SW. RF 125AARH					WN. THICKNESS TO MATCH PIPE THICKNESS, RF 125AARH																			
	DIMENSION STD.	B16.5																								
BLIND FLANGE	MATERIAL AND GRADE	ASTM A 350 GR. LF2, CL-I																								
	FLANGE FACING	RF 125AARH																								
	DIMENSION STD.	B16.5																								
BLANK	MATERIAL AND GRADE	ASTM A 350 GR. LF2, CL-I																								
	FLANGE FACING	FF 125AARH																								
	DIMENSION STD.	B16.48																								
	TYPE	FIG.8 FLANGE										SPACER & BLIND														
BOLTING	STUD BOLTS (FULLY THREADED)	A 320 GR L7, B-18.2																								
	NUTS (HEAVY HEXAGONAL)	A 194 GR 4, B-18.2																								
GASKET	TYPE, MATERIAL AND Dmn. STD.	SPIRAL, SP.WND SS316+GRAPHITE FILLED, B-16.20-ANSI B16.5,																								
ELBOW-90 ELBOW-45	MATERIAL	ASTM A350 GR.LF2					ASTM A 420 GR.WPL6																			
	END DETAIL	SW,6000# SW,3000#					BW, 1.5D																			
	DIMENSION STD.	B-16.11					B-16.9																			
T-EQUAL T-RED	MATERIAL	ASTM A350 GR.LF2					ASTM A 420 GR.WPL6																			
	END DETAIL	SW,6000# SW,3000#					BW																			
	DIMENSION STD.	B-16.11					B-16.9																			
CAP & PLUG (UPTO 1.5")	MATERIAL	ASTM A350 GR.LF2					ASTM A 420 GR.WPL6																			
	END DETAIL	SCRF6000 SCRF3000					BW, THK TO MATCH PIPE THICKNESS																			
	DIMENSION STD.	B-16.11					B-16.9																			
FITTING	MATERIAL	ASTM A350 GR.LF2					ASTM A 420 GR.WPL6																			
	END DETAIL	SW-6000 SW-3000					BW, THICKNESS TO MATCH PIPE THICKNESS																			
	DIMENSION STD.	B-16.11					B-16.9																			
	TYPE	COUPLING FULL, HALF LH., RED.					RED. CON. RED. ECC.																			
O'LET	MATERIAL	ASTM A350 GR.LF2					ASTM A 350 GR.LF2																			
	END DETAIL	SW,6000# SW,3000#					BW																			
	DIMENSION STD.	MSS-SP97					MSS-SP97																			
	TYPE	SOCKOLET					WELDOLET																			

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ANNEXURE - I

DATA SHEETS

DATA SHEET INDEX

Sr. No.	Data Sheet No.	Description	REV.
1.	MEC/WINO/05/28/M/001/DS/BV/76 - 83	Ball Valve	0
2.	MEC/WINO/05/28/M/001/DS/PV/76 - 83	Plug valve	0
3.	MEC/WINO/05/28/M/001/DS/CV/76 - 81	Check valve	0
4.	MEC/WINO/05/28/M/001/DS/GV/76 - 83	Globe valve	0
5.	MEC/23SF/05/28/M/001/DS/001	Pressure Safety Valves & CRV	0
6.	MEC/23SF/05/28/M/001/DS-017/001	Cartridge Filter	0
7.	MEC/05/E5/DS – PG	Pressure Gauges	1
8.	MEC/05/E5/DS – TG	Temperature Gauges	1
9.	MEC/05/E5/DS – PT	Pressure Transmitter	1
10.	MEC/05/E5/DS – RTD	Resistance Temperature Detector	1
11.	MEC/05/E5/DS – TT	Temperature Transmitter	1
12.	MEC/05/E5/DS – DPT	Diff. Pressure Transmitter	1
13.	MEC/05/E5/DS/DPG-01	Diff. Pressure Gauge	0
14.	MEC/05/E5/DS – LS	Limit Switch	1
15.	MEC/05/E5/DS – PCV	Pressure Control Valve	1
16.	MEC/05/E5/DS – SDV	Slam Shut Valve	1
17.	MEC/ 05/E5/DS-UFM	ULTRASONIC FLOW METERS	1
18.	MEC/05/E5/FC-SIV	Special Instruction to Vendor for FC	1

Sr. No.	Data Sheet No.	Description	REV.
19.	MEC/05/E5/DS – FC/02	Panel Mounted Flow Computer	1
20.	MEC/05/E5/DS-MSS	METERING SUPERVISORY SYSTEM	1
21.	MEC/05/E5/DS – LEL	LEL Detection System	1
22.	MEC/05/E5/GC-SIV	SPECIAL INSTRUCTIONS TO THE VENDOR (FOR GAS CHROMATOGRAPH - GC)	1
23.	MEC/ 05/E5/DS-GC	GAS CHROMATOGRAPH	1
24.	MEC/ 05/E5/Spec.- Laptop	LAPTOP (TYPICAL)	1
25.	MEC/SD/05/E5/I/SA-01	Proposed System Architecture for Metering Skid	0
26.	-	TYPICAL DATA SHEET FOR HYDRAULIC ACTUATOR	-
27.	MEC/ 05/E5/DS-H2S	ONLINE H2S ANALYSER	0
28.	MEC/ 05/E5/DS-MA	ONLINE MOISTURE ANALYZER SYSTEM	0

1.0	Valve Manufacturer	:		
2.0	Valve Size (NB), mm (inch)	:	ANSI Rating : 150#	Design Standard : API 6D
3.0	MECON's Technical Specification No.	:	MEC/TS/05/21/002, Rev-1, Ed-1	
4.0	Connecting Pipeline Design Pressure, bar	:	19 kg/cm2	Design Temperature, °C : -29°C to +65°C
5.0	Connecting Pipe Specification			
5.1	Material	:		
5.2	Diameter (OD), mm (inch)	:		
5.3	Thickness, mm	:		
6.0	Valve Construction Design			
6.1	Configuration	:	Reduced Bore ☐	Full Bore ☐
6.2	End Connections	:	Flanged as per ASME B16.5 ☐ Butt Welded as per ASME B16.25 ☐	
6.3	Flanges (wherever applicable)	:	a) RF ☐ FF ☐ RT ☐ NA ☐ b) Serrated ☐ Smooth (125 to 200 microinches AARH) ☐ NA ☐	
6.4	Ball Mounting	:	Floating Ball upto 8" and Trunnion Mounted for above 8"	
6.5	Valve body type	:	Fully Welded ☐	Two/Three Piece Bolted ☐ Either ☐
7.0	Valve Material Specification			
	Part		Specified Material	Material Offered (Equivalent or superior)
7.1	Body		A 216 Gr. WCB/A 234 Gr. WPB/ A 352 Gr. LCB/A 350 Gr. LF2	
7.2	Ball		(A 216 Gr.WCB/A 234 Gr.WPB/ A 352 Gr.LCB/AISI 4140)+75 µENP coating/AISI410	
7.3	Body Seat Rings		VITON/ DEVLON for Floating type & AISI 4140 + 75µENP coating/AISI 410 for Trunnion Mounted type	
7.4	Seat Seat		VITON for TMBV	
7.5	Stem		AISI 4140 + 75 micron ENP coating/AISI 410 (No casting)	
7.6	Stem Seals		VITON/PTFE	
7.7	Stud Bolts/ Nuts		ASTM A 193 Gr. B7/ A194 Gr. 2H	
	NOTE : AISI 410 has min. 35 HRC hardness			
8.0	Corrosion Allowance	:	1.5 mm	Service :
9.0	Location	:	Above Ground ☐	Buried ☐
10.0	Stem Extension Requirement	:	Yes ☐	No ☐
11.0	Gear Operator Requirement	:	Yes ☒ for 6" and above	No ☒ for 4" and below
12.0	Actuator Requirement	:	Yes ☐	No ☐
13.0	Fire Resistant Design Requirement	:	Type test as per API 607 for Floating Ball Valve Type test as per API 6FA for Trunnion Mounted Ball Valve	
14.0	Valve Testing Requirement			
			Test Pressure (min.), kg/cm ² (g)	Minimum Duration, minutes
14.1	Hydrostatic Test	Body	32	As per API 6D
		Seat	23	As per API 6D
14.2	Air Test		5.6 - 7	As per API 6D
15.0	Anti-Static Testing Requirement	:	As per Standard API 6D (Latest Ed.)	
16.0	Valve Painting Specification			
16.1	Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.			
16.2	For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.			
17.0	Lock Open/ Lock Close/Normally Close Requirement : As indicated in P&ID.			
	Notes: Vent & Drain connection for floating & trunnion mounted valves shall be provided as per details mentioned in MECON's TS.			
	1. This Valve Data Sheet shall be read in conjunction with MECON's Technical Specification No. MEC/TS/05/21/002, Rev-1,Ed-1.			
	2. Inspection and Testing shall be as per attached QAP, this Data Sheet, MECON's T.S., API 6D and other relevant standards.			
	3. Stops shall be provided for positive alignment of ball with ports and ensure proper installation of handle.			
	4. Short pattern valves (as per API 6D or otherwise) are not permitted. Only long pattern valves are to be supplied.			
	5. Charpy V-notch & Hardness test for body, body adaptor, end flanges, ball, body seat rings, stem & studs / nuts shall be conducted as per Cl. 3.4 & 3.6 of TS respectively. Min. Valve Body Wall Thickness as per ASME B16.34 .			
	6. Compressed asbestos fibre (CAF) shall not be used for body sealing / gasket materials.			
	7. Material for body shall have a guaranteed minimum yield strength of psi. In case the same cannot be guaranteed, valves shall be provided with a 500 mm pup piece (integrally welded to the valve on each side) with strength equivalent to that of the connecting pipe - N.A.			
	8. For welding end, the out of roundness (i. e. difference between maximum and minimum ID at pipe end) shall not be more than 0.5% of pipe OD.			
	9. Valves shall be inspected and approved by Purchaser before despatch.			

REV. NO.	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.
REVISIONS							
SECTION PROCESS & PIPING					CLIENT :		
	NAME	DATE	CHKD	DATE	MECON LIMITED		
DSGN	PM	25.04.12	AKJ	25.04.12			
DRWN							
APPROVED					O.P. Jain		DATA SHEET FOR BALL VALVES (NB≥ 2")
SCALE :						REV 0	
DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/BV/76							

1.0 Valve Manufacturer :

2.0 Valve Size (NB), mm (inch) : ANSI Rating : **150#** Design Standard : **API 6D**

3.0 MECON's Technical Specification No. : **MEC/TS/05/21/002, Rev-1, Ed-1**

4.0 Connecting Pipeline Design Pressure, bar : **19 kg/cm²** Design Temperature, °C : **-45 to 65°C**

5.0 **Connecting Pipe Specification***

5.1 Material

5.2 Diameter (OD), mm (inch)

5.3 Thickness, mm

6.0 Valve Construction Design

6.1. Bore* : Reduced ☐ Full ☐

6.2. End Connections* :

6.3. Flanges (wherever applicable) : a) RF ☐ FF ☐ RT ☐ NA ☐
b) Serrated ☐ Smooth (125 to 200 microinches AARH) ☐ NA ☐

6.4 Valve Type : **Floating upto 8" and Trunnion Mounted above 8"**

7.0 Valve Material Specification

Part	Specified Material	Material Offered
7.1 Body	ASTM A350 Gr. LF2/ A352 Gr. LCB	
7.2 Ball	[(ASTM A350 Gr. LF2/ A352 Gr. LCB/SS 316)+75 microns ENP]	
7.3 Body Seat Rings	VITON/DEVILON for Floating type and (ASTM A350 Gr. LF2/ A352 Gr. LCB/SS 316)+75 microns ENP coating for Trunnion Mounted type	
7.4 Seat Seal	VITON for TMBV	
7.5 Stem	[(ASTM A350 Gr. LF2/SS 316)+75 microns ENP](No casting)	
7.6 Stem Seals	VITON/ PTFE	
7.7 Stud Bolts/ Nuts	ASTM A320 Gr. L7/ A194 Gr. 4	

NOTE : AISI 410 has min. 35 HRC hardness

8.0 Corrosion Allowance : **1.5 mm** Service :

9.0 Location : Above Ground ☐ Buried ☐

10.0 Stem Extension Requirement : Yes ☐ No ☐

11.0 Gear Operator Requirement : Yes ☒ for 6" and above No ☒ upto 4"

12.0 Gas Powered Actuator Requirement : Yes ☐ No ☐

13.0 Fire Resistant Design Requirement : Type test as per API 607 for Floating Ball Valve
: Type test as per API 6FA for Trunion Mounted Ball Valve

14.0 Valve Testing Requirement

	Test Pressure (min.), kg/cm ² (g)	Minimum Duration, minutes
14.1 Hydrostatic Test Body	32	As per API 6D
Seat	23	As per API 6D
14.2 Air Test	5.6-7	As per API 6D

15.0 Anti-Static Testing Requirement : **As per Standard API 6D (2002 Ed.)**

16.0 Valve Painting Specification

- Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.
- For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.

17.0 Lock Open/ Lock Close Requirement : **As indicated in P&ID**

Notes: Vent & Drain connection for floating & trunnion mounted valves shall be provided as per details mentioned in MECON's TS.

- This Valve Data Sheet shall be read in conjunction with MECON's Technical Specification No. MEC/TS/05/21/002,Rev 1 ,Ed. 1
- Inspection and Testing shall be as per attached QAP, this Data Sheet, MECON's T.S., API 6D and other relevant standards.
- Stops shall be provided for positive alignment of ball with ports and ensure proper installation of handle.
- Short pattern valves (as per API 6D or otherwise) are not permitted. Only long pattern valves are to be supplied.
- Charpy V-notch & Hardness test for body, body adaptor, end flanges, ball, body seat rings, stem & studs / nuts shall be conducted as per Cl. 3.4 & 3.6 of TS respectively. Min. Valve Body Wall Thickness as per ASME B16.34 .
- Compressed asbestos fibre (CAF) shall not be used for body sealing / gasket materials.
- Material for body shall have a guaranteed minimum yield strength of psi. In case the same cannot be guaranteed, valves shall be provided with a 500 mm pup piece (integrally welded to the valve on each side) with strength equivalent to that of the connecting pipe - **N.A.**
- For welding end, the out of roundness (i. e. difference between maximum and minimum ID at pipe end) shall not be more than 0.5% of pipe OD.
- Valves shall be inspected and approved by Purchaser before despatch.

REV. NO.	DATE	ZONE	DESCRIPTIONS	BY	APPRD
REVISIONS					
SECTION PROCESS & PIPING			CLIENT :		
NAME	DATE	CHKD	DATE		
DSGN	PM	25.04.12	AKJ	25.04.12	PROJECT :
DRWN					
APPROVED			O. P. Jain	DATA SHEET FOR BALL VALVES (NB ≥ 2")	
				DATA SHEET NO.: MEC/ WINO/05/28/M/001/DS/BV/77	
				REV 0	

1.0 Valve Manufacturer :

2.0 Valve Size (NB), mm (inch) : **ANSI Rating : 150#** Design Standard : **API 6D**

3.0 MECON's Technical Specification No. : **MEC/TS/05/62/003, Rev-2**

4.0 Connecting Pipeline Design Pressure, kg/cm²(g) : **19 kg/cm2(g)** Design Temperature, °C : **-29°C to 65°C**

5.0 **Connecting Pipe Specification**

5.1 Material :

5.2 Diameter (OD), mm (inch) :

5.3 Thickness, mm :

6.0 **Valve Construction Design**

6.1. Pattern : Short ☐ Regular ☐ Venturi ☐

6.2. End Connections : **Flanged both ends** ☐ Flanged as per ASME B 16.5
Butt Weld both ends ☐ Butt Weld as per ASME B16.25
Flanged one end, butt weld other end ☐

6.3. Flanges (wherever applicable) : a) RF ☐ FF ☐ RTJ ☐ NA ☐
b) Serrated ☐ Smooth (125 to 200 microinches AARH) ☐ NA ☐

7.0 **Valve Material Specification**

Part	Material	Material Offered (Equivalent or Superior)
7.1 Body	ASTM A216 Gr. WCB/ A234 Gr. WPB	
7.2 Plug	(ASTM A216 Gr. WCB/ A234 Gr. WPB) + 75 microns ENP Coating	
7.3 Cover	ASTM A216 Gr. WCB/ A234 Gr. WPB	
7.4 Stem	(AISI 4140 + 75 microns ENP Coating)/ AISI 410 (No Casting)	
7.5 Stem Seal	PTFE/Graphite	
7.6 Stud Bolts/ Nuts	ASTM A193 Gr. B7/ A194 Gr. 2H	

NOTE : AISI 410 has min. 35 HRC hardness

8.0 Corrosion Allowance : **1.5 mm** Service :

9.0 Location : Above Ground ☐ Buried ☐

10.0 Stem Extension Requirement : Yes ☐ No ☐

11.0 Gear Operator Requirement : Yes ☐ No ☐

12.0 Gas Powered Actuator Requirement : Yes ☐ No ☐

13.0 Fire Resistant Design Requirement : **Type-Test as per Standard API 6FA/ BS EN: 10497**

14.0 **Valve Testing Requirement**

	Test Pressure (min.), kg/cm2(g)	Minimum Duration, minutes
14.1 Hydrostatic Test Body	32	As per API 6D
Seal	23	As per API 6D
14.2 Air Test	5.6 - 7	As per API 6D

15.0 **Valve Painting Specification**

15.1 Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.

15.2 For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.

16.0 Lock Open/ Lock Close Requirement : **As indicated in P&ID.**

Notes:

1. This Valve Data Sheet shall be read in conjunction with MECON's Technical Specification No. MEC/TS/05/62/003, Rev2
2. Inspection and Testing shall be as per attached QAP, this Data Sheet, MECON's T.S., API 6D and other relevant standards.
3. Stops shall be provided for positive alignment of plug with ports and ensure proper installation of handle.
4. Charpy V- notch & Hardness test for body, plug, cover, stem & studs/nuts shall be conducted as per Clause No.: 3.4 & 3.5 of TS respectively. Min. Valve Body Wall Thickness as per ASME B16.34 .
5. Material of the body shall have equivalent to that of the connecting pipe.- **Not Applicable**
6. Bidder shall clearly write valves material (equivalent or superior) offered by them against each part/material of valve in the space provided for. Wherever bidder agrees with valves material as mentioned above in MECON's data sheet, bidder shall clearly indicate **"AGREED"**.

REV. NO.	DATE	ZONE	DESCRIPTIONS	BY	APPRD																																															
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APPROVED		O. P. JAIN																																																		

1.0 Valve Manufacturer :
 2.0 Valve Size (NB), mm (inch) : ANSI Rating : 150# Design Standard : API 6D
 3.0 MECON's Technical Specification No. : MEC/TS/05/62/003, Rev-2
 4.0 Connecting Pipeline Design Pressure, kg/cm²(g) : 19 kg/cm²(g) Design Temperature, °C : -45°C to 65°C

5.0 Connecting Pipe Specification

5.1 Material :
 5.2 Diameter (OD), mm (inch) :
 5.3 Thickness, mm :

6.0 Valve Construction Design

6.1. Pattern : Short ☐ Regular ☐ Venturi ☐
 6.2. End Connections : Flanged both ends ☐ Flanged as per ASME B 16.5
 : Butt Weld both ends ☐ Butt Weld as per ASME B16.25
 : Flanged one end, butt weld other end ☐
 6.3. Flanges (wherever applicable) : a) RF ☐ FF ☐ RTJ ☐ NA ☐
 b) Serrated ☐ Smooth (125 to 200 microinches AARH) ☐ NA ☐

7.0 Valve Material Specification

Part	Material	Material Offered (Equivalent or Superior)
7.1 Body	A 352 Gr. LCB/A 350 Gr. LF2	
7.2 Plug	SS316/ A 352 Gr.LCB/A 350 Gr. LF2 with 75 µENP coating	
7.3 Cover	ASTM A216 Gr. WCB/ A234 Gr. WPB	
7.4 Stem	SS 316 (No casting) / A 350 Gr. LF2	
7.5 Stem Seal	PTFE/Graphite	
7.6 Stud Bolts/ Nuts	ASTM A320 Gr.L7 / ASTM A194 Gr.4	

8.0 Corrosion Allowance : 1.5 mm Service :

9.0 Location : Above Ground ☐ Buried ☐

10.0 Stem Extension Requirement : Yes ☐ No ☐

11.0 Gear Operator Requirement : Yes ☐ No ☐

12.0 Gas Powered Actuator Requirement : Yes ☐ No ☐

13.0 Fire Resistant Design Requirement : Type-Test as per Standard API 6FA/ BS EN: 10497

14.0 Valve Testing Requirement

	Test Pressure (min.), kg/cm ² (g)	Minimum Duration, minutes
14.1 Hydrostatic Test Body	32	As per API 6D
Seal	23	As per API 6D
14.2 Air Test	5.6 - 7	As per API 6D

15.0 Valve Painting Specification

15.1 Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.

15.2 For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.

16.0 Lock Open/ Lock Close Requirement : As indicated in P&ID.

Notes:

1. This Valve Data Sheet shall be read in conjunction with MECON's Technical Specification No. MEC/TS/05/62/003, Rev2
2. Inspection and Testing shall be as per attached QAP, this Data Sheet, MECON's T.S., API 6D and other relevant standards.
3. Stops shall be provided for positive alignment of plug with ports and ensure proper installation of handle.
4. Charpy V- notch & Hardness test for body, plug, cover, stem & studs/nuts shall be conducted as per Clause No.: 3.4 & 3.5 of TS respectively. Min. Valve Body Wall Thickness as per ASME B16.34 .
5. Material of the body shall have equivalent to that of the connecting pipe.- **Not Applicable**
6. Bidder shall clearly write valves material (equivalent or superior) offered by them against each part/material of valve in the space provided for. Wherever bidder agrees with valves material as mentioned above in MECON's data sheet, bidder shall clearly indicate **"AGREED"**.

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REVISIONS					REFERENCES	DRG. NO.													
SECTION OIL & GAS CLIENT : PROJECT : APPROVED O. P. JAIN					 MECON LIMITED	SCALE : DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/PV/77 REV 0													

1.0	Valve Manufacturer	:				
2.0	Valve Size (NB), mm (inch)	:	ANSI Rating : 300#	Design Standard : API 6D		
3.0	MECON's Technical Specification No.	:	MEC/TS/05/21/002, Rev-1, Ed-1			
4.0	Connecting Pipeline Design Pressure, bar	:	49 kg/cm2	Design Temperature, °C : -29°C to +65°C		
5.0	Connecting Pipe Specification					
5.1	Material	:				
5.2	Diameter (OD), mm (inch)	:				
5.3	Thickness, mm	:				
6.0	Valve Construction Design					
6.1.	Configuration	:	Reduced Bore ☐	Full Bore ☐		
6.2.	End Connections	:	Flanged as per ASME B16.5 ☐ Butt Welded as per ASME B16.25 ☐			
6.3.	Flanges (wherever applicable)	:	a) RF ☐ FF ☐ RT ☐ NA ☐ b) Serrated ☐ Smooth (125 to 200 microinches AARH) ☐ NA ☐			
6.4	Ball Mounting	:	Floating Ball upto 4" and Trunnion Mounted above 4"			
6.5	Valve body type	:	Fully Welded ☐	Two/Three Piece Bolted ☐ Either ☐		
7.0	Valve Material Specification					
	Part		Specified Material	Material Offered (Equivalent or superior)		
7.1	Body		A 216 Gr. WCB/A 234 Gr. WPB/ A 352 Gr. LCB/A 350 Gr. LF2			
7.2	Ball		(A 216 Gr.WCB/A 234 Gr.WPB/ A 352 Gr.LCB/AISI 4140)+75 µENP coating/AISI 410			
7.3	Body Seat Rings		VITON/DEVILON for Floating type and AISI 4140 + 75 micron ENP coating/AISI 410 for Trunnion Mounted type			
7.4	Seat Seat		VITON for TMBV			
7.5	Stem		AISI 4140 + 75 micron ENP coating/AISI 410 (No casting)			
7.6	Stem Seals		VITON/PTFE			
7.7	Stud Bolts/ Nuts		ASTM A 193 Gr. B7/ A194 Gr. 2H			
NOTE : AISI 410 has min. 35 HRC hardness .						
8.0	Corrosion Allowance	:	1.5 mm	Service :		
9.0	Location	:	Above Ground ☐	Buried ☐		
10.0	Stem Extension Requirement	:	Yes ☐	No ☐		
11.0	Gear Operator Requirement	:	Yes ☒ for 6" and above	No ☒ for 4" and below		
12.0	Actuator Requirement	:	Yes ☐	No ☐		
13.0	Fire Resistant Design Requirement	:	Type test as per API 607 for Floating Ball Valve Type test as per API 6FA for Trunnion Mounted Ball Valve			
14.0	Valve Testing Requirement					
			Test Pressure (min.), kg/cm ² (g)	Minimum Duration, minutes		
14.1	Hydrostatic Test	Body	76	As per API 6D		
		Seat	57	As per API 6D		
14.2	Air Test		5.6-7	As per API 6D		
15.0	Anti-Static Testing Requirement	:	As per Standard API 6D (Latest Ed.)			
16.0	Valve Painting Specification					
16.1	Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.					
16.2	For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.					
17.0	Lock Open/ Lock Close/Normally Close Requirement : As indicated in P&ID.					
	Notes: Vent & Drain connection for floating & trunnion mounted valves shall be provided as per details mentioned in MECON's TS.					
	1. This Valve Data Sheet shall be read in conjunction with MECON's Technical Specification No. MEC/TS/05/21/002,Rev 1 ,Ed. 1					
	2. Inspection and Testing shall be as per attached QAP, this Data Sheet, MECON's T.S., API 6D and other relevant standards.					
	3. Stops shall be provided for positive alignment of ball with ports and ensure proper installation of handle.					
	4. Short pattern valves (as per API 6D or otherwise) are not permitted. Only long pattern valves are to be supplied.					
	5. Charpy V-notch & Hardness test for body, body adaptor, end flanges, ball, body seat rings, stem & studs / nuts shall be conducted as per Cl. 3.4 & 3.6 of TS respectively. Min. Valve Body Wall Thickness as per ASME B16.34 .					
	6. Compressed asbestos fibre (CAF) shall not be used for body sealing / gasket materials.					
	7. Material for body shall have a guaranteed minimum yield strength of psi. In case the same cannot be guaranteed, valves shall be provided with a 500 mm pup piece (integrally welded to the valve on each side) with strength equivalent to that of the connecting pipe - N.A.					
	8. For welding end, the out of roundness (i. e. difference between maximum and minimum ID at pipe end) shall not be more than 0.5% of pipe OD.					
	9. Valves shall be inspected and approved by Purchaser before despatch.					
REV. NO.	DATE	ZONE	DESCRIPTIONS	BY	APPRD	
			REVISIONS			
SECTION PROCESS & PIPING			CLIENT :	 MECON LIMITED		
	NAME	DATE	CHKD			DATE
DSGN	PM	25.04.12	AKJ			25.04.12
DRWN						
APPROVED			O.P. Jain	DATA SHEET FOR BALL VALVES (NB ≥ 2")		
			SCALE :		REV	
			DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/BV/78		0	

1.0	Valve Manufacturer	:		
2.0	Valve Size (NB), mm (inch)	:	ANSI Rating : 300#	Design Standard : API 6D
3.0	MECON's Technical Specification No.	:	MEC/TS/05/21/002, Rev-1, Ed-1	
4.0	Connecting Pipeline Design Pressure, bar	:	49 kg/cm2	Design Temperature, °C : -45°C to + 65°C
5.0	Connecting Pipe Specification	:		
5.1	Material	:		
5.2	Diameter (OD), mm (inch)	:		
5.3	Thickness, mm	:		
6.0	Valve Construction Design	:		
6.1.	Configuration	:	Reduced Bore ☐	Full Bore ☐
6.2.	End Connections	:	Flanged as per ASME B16.5 ☐	Butt Welded as per ASME B16.25 ☐
6.3.	Flanges (wherever applicable)	:	a) RF ☐	RT ☐ NA ☐
		:	b) Serrated ☐	Smooth (125 to 200 microinches AARH) ☐ NA ☐
6.4	Ball Mounting	:	Floating upto 4" and Trunnion Mounted 6" and above	
6.5	Valve body type	:	Fully Welded ☐	Two/Three Piece Bolted ☐ Either ☐
7.0	Valve Material Specification	:		

Part	Specified Material	Material Offered (Equivalent or superior)
7.1 Body	A 352 Gr. LCB/A 350 Gr. LF2	
7.2 Ball	SS316/ A 352 Gr.LCB/A 350 Gr. LF2 with 75 µENP coating	
7.3 Body Seat Rings	VITON/DEVILON for Floating type and SS316/ ASTM A352 Gr. LCB / A 350 GR. LF2 with 75 Micron ENP coating for Trunnion Mounted type	
7.4 Seat Seal	VITON/DEVILON for TMBV	
7.5 Stem	[(ASTM A350 Gr. LF2/SS 316)+75 microns ENP](No casting)	
7.6 Stem Seals	VITON/PTFE	
7.7 Stud Bolts/ Nuts	ASTM A320 Gr.L7 / ASTM A194 Gr.4	

NOTE : AISI 410 has min. 35 HRC hardness

8.0	Corrosion Allowance	:	1.5 mm	Service :
9.0	Location	:	Above Ground ☐	Buried ☐
10.0	Stem Extension Requirement	:	Yes ☐	No ☐
11.0	Gear Operator Requirement	:	Yes ☒ for 6" and above	No ☒ for 4" and below
12.0	Actuator Requirement	:	Yes ☐	No ☐
13.0	Fire Resistant Design Requirement	:	Type test as per API 607 for Floating Ball Valve Type test as per API 6FA for Trunnion Mounted Ball Valve	
14.0	Valve Testing Requirement	:		

		Test Pressure (min.), kg/cm ² (g)	Minimum Duration, minutes
14.1	Hydrostatic Test	76	As per API 6D
	Body		
	Seat	57	As per API 6D
14.2	Air Test	5.6-7	As per API 6D

15.0	Anti-Static Testing Requirement	:	As per Standard API 6D (Latest Ed.)	
16.0	Valve Painting Specification	:		
16.1	Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.			
16.2	For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.			
17.0	Lock Open/ Lock Close/Normally Close Requirement :	:	As indicated in P&ID.	

Notes: Vent & Drain connection for floating & trunnion mounted valves shall be provided as per details mentioned in MECON's TS.

1. This Valve Data Sheet shall be read in conjunction with MECON's Technical Specification No. MEC/TS/05/21/002,Rev 1 ,Ed. 1
2. Inspection and Testing shall be as per attached QAP, this Data Sheet, MECON's T.S., API 6D and other relevant standards.
3. Stops shall be provided for positive alignment of ball with ports and ensure proper installation of handle.
4. Short pattern valves (as per API 6D or otherwise) are not permitted. Only long pattern valves are to be supplied.
5. Charpy V-notch & Hardness test for body, body adaptor, end flanges, ball, body seat rings, stem & studs / nuts shall be conducted as per relevant material code. Min. Valve Body Wall Thickness as per ASME B16.34 .
6. Compressed asbestos fibre (CAF) shall not be used for body sealing / gasket materials.
7. Material for body shall have a guaranteed minimum yield strength of psi. In case the same cannot be guaranteed, valves shall be provided with a 500 mm pup piece (integrally welded to the valve on each side) with strength equivalent to that of the connecting pipe - **N.A.**
8. For welding end, the out of roundness (i. e. difference between maximum and minimum ID at pipe end) shall not be more than 0.5% of pipe OD.

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REVISIONS							
SECTION PROCESS & PIPING							MECON LIMITED
CLIENT :							
PROJECT :							
APPROVED O.P. Jain						SCALE :	REV 0
DATA SHEET FOR BALL VALVES (NB ≥ 2")						DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/BV/79	

1.0 Valve Manufacturer :
 2.0 Valve Size (NB), mm (inch) : **ANSI Rating : 300#** Design Standard : **API 6D**
 3.0 MECON's Technical Specification No. : **MEC/TS/05/62/003, Rev-2**
 4.0 Connecting Pipeline Design Pressure, kg/cm²(g) : **49 kg/cm2(g)** Design Temperature, °C : **-45°C to 65°C**

5.0 Connecting Pipe Specification

5.1 Material :
 5.2 Diameter (OD), mm (inch) :
 5.3 Thickness, mm :

6.0 Valve Construction Design

6.1. Pattern : Short ☐ Regular ☐ Venturi ☐
 6.2. End Connections : **Flanged both ends** ☐ Flanged as per ASME B 16.5
 : **Butt Weld both ends** ☐ Butt Weld as per ASME B16.25
 : **Flanged one end, butt weld other end** ☐
 6.3. Flanges (wherever applicable) : a) RF ☐ FF ☐ RTJ ☐ NA ☐
 b) Serrated ☐ Smooth (125 to 200 microinches AARH) ☐ NA ☐

7.0 Valve Material Specification

Part	Material	Material Offered (Equivalent or Superior)
7.1 Body	A 352 Gr. LCB/A 350 Gr. LF2	
7.2 Plug	SS316/ A 352 Gr.LCB/A 350 Gr. LF2 with 75 µENP coating	
7.3 Cover	ASTM A216 Gr. WCB/ A234 Gr. WPB	
7.4 Stem	SS 316 (No casting) / A 350 Gr. LF2	
7.5 Stem Seal	PTFE/Graphite	
7.6 Stud Bolts/ Nuts	ASTM A320 Gr.L7 / ASTM A194 Gr.4	

8.0 Corrosion Allowance : **1.5 mm** Service :

9.0 Location : Above Ground ☐ Buried ☐

10.0 Stem Extension Requirement : Yes ☐ No ☐

11.0 Gear Operator Requirement : Yes ☐ No ☐

12.0 Gas Powered Actuator Requirement : Yes ☐ No ☐

13.0 Fire Resistant Design Requirement : **Type-Test as per Standard API 6FA/ BS EN: 10497**

14.0 Valve Testing Requirement

	Test Pressure (min.), kg/cm2(g)	Minimum Duration, minutes
14.1 Hydrostatic Test Body	76	As per API 6D
Seal	57	As per API 6D
14.2 Air Test	5.6 - 7	As per API 6D

15.0 Valve Painting Specification

15.1 Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.

15.2 For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.

16.0 Lock Open/ Lock Close Requirement : **As indicated in P&ID.**

Notes:

1. This Valve Data Sheet shall be read in conjunction with MECON's Technical Specification No. MEC/TS/05/62/003, Rev2
2. Inspection and Testing shall be as per attached QAP, this Data Sheet, MECON's T.S., API 6D and other relevant standards.
3. Stops shall be provided for positive alignment of plug with ports and ensure proper installation of handle.
4. Charpy V- notch & Hardness test for body, plug, cover, stem & studs/nuts shall be conducted as per Clause No.: 3.4 & 3.5 of TS respectively. Min. Valve Body Wall Thickness as per ASME B16.34 .
5. Material of the body shall have equivalent to that of the connecting pipe.- **Not Applicable**
6. Bidder shall clearly write valves material (equivalent or superior) offered by them against each part/material of valve in the space provided for. Wherever bidder agrees with valves material as mentioned above in MECON's data sheet, bidder shall clearly indicate **"AGREED"**.

REV. NO.	DATE	ZONE	DESCRIPTIONS	BY	APPRD														
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REVISIONS					REFERENCES	DRG. NO.													
SECTION OIL & GAS CLIENT : PROJECT : APPROVED O. P. JAIN					 MECON LIMITED	SCALE : DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/PV/79 REV 0													

- 1.0 Valve Manufacturer :
- 2.0 Valve Size (NB), mm (inch) : **ANSI Rating : 300#** Design Standard : **API 6D**
- 3.0 MECON's Technical Specification No. : **MEC/TS/05/62/003, Rev-2**
- 4.0 Connecting Pipeline Design Pressure, kg/cm²(g) : **49 kg/cm2(g)** Design Temperature, °C : **-29°C to 65°C**
- 5.0 **Connecting Pipe Specification**
- 5.1 Material :
- 5.2 Diameter (OD), mm (inch) :
- 5.3 Thickness, mm :
- 6.0 **Valve Construction Design**
- 6.1. Pattern : Short ☐ Regular ☐ Venturi ☐
- 6.2. End Connections : **Flanged both ends** ☐ Flanged as per ASME B 16.5
Butt Weld both ends ☐ Butt Weld as per ASME B16.25
Flanged one end, butt weld other end ☐
- 6.3. Flanges (wherever applicable) : a) RF ☐ FF ☐ RTJ ☐ NA ☐
b) Serrated ☐ Smooth (125 to 200 microinches AARH) ☐ NA ☐

7.0 **Valve Material Specification**

Part	Material	Material Offered (Equivalent or Superior)
7.1 Body	ASTM A216 Gr. WCB/ A234 Gr. WPB	
7.2 Plug	(ASTM A216 Gr. WCB/ A234 Gr. WPB) + 75 microns ENP Coating	
7.3 Cover	ASTM A216 Gr. WCB/ A234 Gr. WPB	
7.4 Stem	(AISI 4140 + 75 microns ENP Coating)/ AISI 410 (No Casting)	
7.5 Stem Seal	PTFE/Graphite	
7.6 Stud Bolts/ Nuts	ASTM A193 Gr. B7/ A194 Gr. 2H	

NOTE : AISI 410 has min. 35 HRC hardness

- 8.0 Corrosion Allowance : **1.5 mm** Service :
- 9.0 Location : Above Ground ☐ Buried ☐
- 10.0 Stem Extension Requirement : Yes ☐ No ☐
- 11.0 Gear Operator Requirement : Yes ☐ No ☐
- 12.0 Gas Powered Actuator Requirement : Yes ☐ No ☐
- 13.0 Fire Resistant Design Requirement : **Type-Test as per Standard API 6FA/ BS EN: 10497**

14.0 **Valve Testing Requirement**

	Test Pressure (min.), kg/cm2(g)	Minimum Duration, minutes
14.1 Hydrostatic Test Body	76	As per API 6D
Seal	57	As per API 6D
14.2 Air Test	5.6 - 7	As per API 6D

15.0 **Valve Painting Specification**

- 15.1 Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.
- 15.2 For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.
- 16.0 Lock Open/ Lock Close Requirement : **As indicated in P&ID.**

Notes:

- This Valve Data Sheet shall be read in conjunction with MECON's Technical Specification No. MEC/TS/05/62/003, Rev2
- Inspection and Testing shall be as per attached QAP, this Data Sheet, MECON's T.S., API 6D and other relevant standards.
- Stops shall be provided for positive alignment of plug with ports and ensure proper installation of handle.
- Charpy V- notch & Hardness test for body, plug, cover, stem & studs/nuts shall be conducted as per Clause No.: 3.4 & 3.5 of TS respectively. Min. Valve Body Wall Thickness as per ASME B16.34 .
- Material of the body shall have equivalent to that of the connecting pipe.- **Not Applicable**
- Bidder shall clearly write valves material (equivalent or superior) offered by them against each part/material of valve in the space provided for. Wherever bidder agrees with valves material as mentioned above in MECON's data sheet, bidder shall clearly indicate **"AGREED"**.

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1.0	Valve Manufacturer	:			
2.0	Valve Size (NB), mm (inch)	:	ANSI Rating : 600#	Design Standard : API 6D	
3.0	MECON's Technical Specification No.	:	MEC/TS/05/21/002, Rev-1, Ed-1		
4.0	Connecting Pipeline Design Pressure, bar	:	92 kg/cm2	Design Temperature, °C : -29°C to +65°C	
5.0	Connecting Pipe Specification				
5.1	Material	:			
5.2	Diameter (OD), mm (inch)	:			
5.3	Thickness, mm	:			
6.0	Valve Construction Design				
6.1	Configuration	:	Reduced Bore ☐	Full Bore ☐	
6.2	End Connections	:	Flanged as per ASME B16.5 ☐	Butt Welded as per ASME B16.25 ☐	
6.3	Flanges (wherever applicable)	:	a) RF ☐ FF ☐ RT ☐	NA ☐	
		:	b) Serrated ☐ Smooth (125 to 200 microinches AARH) ☐	NA ☐	
6.4	Ball Mounting	:	Trunnion Mounted		
6.5	Valve body type	:	Fully Welded ☐	Two/Three Piece Bolted ☐ Either ☐	
7.0	Valve Material Specification				
	Part		Specified Material	Material Offered (Equivalent or superior)	
7.1	Body		A 216 Gr. WCB/A 234 Gr. WPB/ A 352 Gr. LCB/A 350 Gr. LF2		
7.2	Ball		(A 216 Gr.WCB/A 234 Gr.WPB/ A 352 Gr.LCB/AISI 4140)+75 µENP coating/AISI410		
7.3	Body Seat Rings		AISI 4140 + 75 micron ENP/AISI 410		
7.4	Seat Seal		VITON/DEVILON		
7.5	Stem		AISI 4140 + 75 micron ENP coating/AISI 410 (No casting)		
7.6	Stem Seals		VITON/PTFE		
7.7	Stud Bolts/ Nuts		ASTM A 193 Gr. B7/ A194 Gr. 2H		
	NOTE : AISI 410 has min. 35 HRC hardness				
8.0	Corrosion Allowance	:	1.5 mm	Service :	
9.0	Location	:	Above Ground ☐	Buried ☐	
10.0	Stem Extension Requirement	:	Yes ☐	No ☐	
11.0	Gear Operator Requirement	:	Yes ☒ for 6" and above	No ☒ for 4" and below	
12.0	Actuator Requirement	:	Yes ☐	No ☐	
13.0	Fire Resistant Design Requirement	:	Type test as per API 6FA		
14.0	Valve Testing Requirement				
			Test Pressure (min.), kg/cm ² (g)	Minimum Duration, minutes	
14.1	Hydrostatic Test	Body	157	As per API 6D	
		Seat	114	As per API 6D	
14.2	Air Test		5.6-7	As per API 6D	
15.0	Anti-Static Testing Requirement	:	As per Standard API 6D (Latest Ed.)		
16.0	Valve Painting Specification				
16.1	Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.				
16.2	For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.				
17.0	Lock Open/ Lock Close/Normally Close Requirement : As indicated in P&ID.				
	Notes: Vent & Drain connection for floating & trunnion mounted valves shall be provided as per details mentioned in MECON's TS.				
	1. This Valve Data Sheet shall be read in conjunction with MECON's Technical Specification No. MEC/TS/05/21/002,Rev 1 ,Ed. 1 2. Inspection and Testing shall be as per attached QAP, this Data Sheet, MECON's T.S., API 6D and other relevant standards. 3. Stops shall be provided for positive alignment of ball with ports and ensure proper installation of handle. 4. Short pattern valves (as per API 6D or otherwise) are not permitted. Only long pattern valves are to be supplied. 5. Charpy V-notch & Hardness test for body, body adaptor, end flanges, ball, body seat rings, stem & studs / nuts shall be conducted as per Cl. 3.4 & 3.6 of TS respectively. Min. Valve Body Wall Thickness as per ASME B16.34 . 6. Compressed asbestos fibre (CAF) shall not be used for body sealing / gasket materials. 7. Material for body shall have a guaranteed minimum yield strength of psi. In case the same cannot be guaranteed, valves shall be provided with a 500 mm pup piece (integrally welded to the valve on each side) with strength equivalent to that of the connecting pipe - N.A. 8. For welding end, the out of roundness (i. e. difference between maximum and minimum ID at pipe end) shall not be more than 0.5% of pipe OD. 9. Valves shall be inspected and approved by Purchaser before despatch.				
REV. NO.	DATE	ZONE	DESCRIPTIONS	BY	APPRD
REVISIONS					REFERENCES
SECTION PROCESS & PIPING					DRG. NO.
	NAME	DATE	CHKD	DATE	
DSGN	PM	25.04.12	AKJ	25.04.12	
DRWN					
APPROVED					SCALE :
O.P. Jain					DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/BV/80
DATA SHEET FOR BALL VALVES (NB ≥ 2")					REV 0

1.0	Valve Manufacturer	:						
2.0	Valve Size (NB), mm (inch)	:	ANSI Rating : 600#	Design Standard : API 6D				
3.0	MECON's Technical Specification No.	:	MEC/TS/05/21/002, Rev-1, Ed-1					
4.0	Connecting Pipeline Design Pressure, bar	:	92 kg/cm²	Design Temperature, °C : -45°C to + 65°C				
5.0	Connecting Pipe Specification							
5.1	Material	:						
5.2	Diameter (OD), mm (inch)	:						
5.3	Thickness, mm	:						
6.0	Valve Construction Design							
6.1	Configuration	:	Reduced Bore ☐	Full Bore ☐				
6.2	End Connections	:	Flanged as per ASME B16.5 ☐	Butt Welded as per ASME B16.25 ☐				
6.3	Flanges (wherever applicable)	:	a) RF ☐ FF ☐ RT ☐	NA ☐				
		:	b) Serrated ☐ Smooth (125 to 200 microinches AARH) ☐	NA ☐				
6.4	Ball Mounting	:	Trunnion Mounted					
6.5	Valve body type	:	Fully Welded ☐	Two/Three Piece Bolted ☐ Either ☐				
7.0	Valve Material Specification							
	Part		Specified Material	Material Offered (Equivalent or superior)				
7.1	Body		A 352 Gr. LCB/A 350 Gr. LF2					
7.2	Ball		SS316/ A 352 Gr.LCB/A 350 Gr. LF2 with 75 µENP coating					
7.3	Body Seat Rings		SS316/ ASTM A352 Gr. LCB / A 350 GR. LF2 with 75 Micron ENP coating					
7.4	Seat Seal		VITON/DEVLO					
7.5	Stem		[(ASTM A350 Gr. LF2/SS 316)+75 microns ENP](No casting)					
7.6	Stem Seals		VITON/PTFE					
7.7	Stud Bolts/ Nuts		ASTM A320 Gr.L7 / ASTM A194 Gr.4					
NOTE : ASTM A194 has min 35 HRC hardness : 1.5 mm Service :								
9.0	Location	:	Above Ground ☐	Buried ☐				
10.0	Stem Extension Requirement	:	Yes ☐	No ☐				
11.0	Gear Operator Requirement	:	Yes ☒ for 6" and above	No ☒ for 4" and below				
12.0	Actuator Requirement	:	Yes ☐	No ☐				
13.0	Fire Resistant Design Requirement	:	Type test as per API 6FA					
14.0	Valve Testing Requirement							
			Test Pressure (min.), kg/cm ² (g)	Minimum Duration, minutes				
14.1	Hydrostatic Test	Body	157	As per API 6D				
		Seat	114	As per API 6D				
14.2	Air Test		5.6-7	As per API 6D				
15.0	Anti-Static Testing Requirement	:	As per Standard API 6D (Latest Ed.)					
16.0	Valve Painting Specification							
16.1	Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.							
16.2	For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.							
17.0	Lock Open/ Lock Close/Normally Close Requirement : As indicated in P&ID/ Material Requisition							
	Notes: Vent & Drain connection for floating & trunnion mounted valves shall be provided as per details mentioned in MECON's TS.							
	1. This Valve Data Sheet shall be read in conjunction with MECON's Technical Specification No. MEC/TS/05/21/002,Rev 1 ,Ed. 1							
	2. Inspection and Testing shall be as per attached QAP, this Data Sheet, MECON's T.S., API 6D and other relevant standards.							
	3. Stops shall be provided for positive alignment of ball with ports and ensure proper installation of handle.							
	4. Short pattern valves (as per API 6D or otherwise) are not permitted. Only long pattern valves are to be supplied.							
	5. Charpy V-notch & Hardness test for body, body adaptor, end flanges, ball, body seat rings, stem & studs / nuts shall be conducted as per relevant material code. Min. Valve Body Wall Thickness as per ASME B16.34 .							
	6. Compressed asbestos fibre (CAF) shall not be used for body sealing / gasket materials.							
	7. Material for body shall have a guaranteed minimum yield strength of psi. In case the same cannot be guaranteed, valves shall be provided with a 500 mm pup piece (integrally welded to the valve on each side) with strength equivalent to that of the connecting pipe - N.A.							
	8. For welding end, the out of roundness (i. e. difference between maximum and minimum ID at pipe end) shall not be more than 0.5% of pipe OD.							
	9. Valves shall be inspected and approved by Purchaser before despatch.							
REV. NO.	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.	
SECTION PROCESS & PIPING			CLIENT :		 MECON LIMITED			
	NAME	DATE	CHKD	DATE				PROJECT :
DSGN	PM	25.04.12	AKJ	25.04.12				
DRWN								
APPROVED		O.P. Jain		DATA SHEET FOR BALL VALVES (NB≥ 2")		SCALE :	REV	
						DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/BV/81	0	

1.0 Valve Manufacturer :

2.0 Valve Size (NB), mm (inch) : ANSI Rating : 600# Design Standard : API 6D

3.0 MECON's Technical Specification No. : MEC/TS/05/62/003, Rev-2

4.0 Connecting Pipeline Design Pressure, kg/cm²(g) : 92 kg/cm2(g) Design Temperature, °C : -29°C to 65°C

5.0 **Connecting Pipe Specification**

5.1 Material :

5.2 Diameter (OD), mm (inch) :

5.3 Thickness, mm :

6.0 **Valve Construction Design**

6.1. Pattern : Short ☐ Regular ☐ Venturi ☐

6.2. End Connections : Flanged both ends ☐ Flanged as per ASME B 16.5
Butt Weld both ends ☐ Butt Weld as per ASME B16.25
Flanged one end, butt weld other end ☐

6.3. Flanges (wherever applicable) : a) RF ☐ FF ☐ RTJ ☐ NA ☐
b) Serrated ☐ Smooth (125 to 200 microinches AARH) ☐ NA ☐

7.0 **Valve Material Specification**

Part	Material	Material Offered (Equivalent or Superior)
7.1 Body	ASTM A216 Gr. WCB/ A234 Gr. WPB	
7.2 Plug	(ASTM A216 Gr. WCB/ A234 Gr. WPB) + 75 microns ENP Coating	
7.3 Cover	ASTM A216 Gr. WCB/ A234 Gr. WPB	
7.4 Stem	(AISI 4140 + 75 microns ENP Coating)/ AISI 410 (No Casting)	
7.5 Stem Seal	PTFE/Graphite	
7.6 Stud Bolts/ Nuts	ASTM A193 Gr. B7/ A194 Gr. 2H	

NOTE : AISI 410 has min. 35 HRC hardness

8.0 Corrosion Allowance : 1.5 mm Service :

9.0 Location : Above Ground ☐ Buried ☐

10.0 Stem Extension Requirement : Yes ☐ No ☐

11.0 Gear Operator Requirement : Yes ☐ No ☐

12.0 Gas Powered Actuator Requirement : Yes ☐ No ☐

13.0 Fire Resistant Design Requirement : Type-Test as per Standard API 6FA/ BS EN: 10497

14.0 **Valve Testing Requirement**

	Test Pressure (min.), kg/cm2(g)	Minimum Duration, minutes
14.1 Hydrostatic Test Body	157	As per API 6D
Seal	114	As per API 6D
14.2 Air Test	5.6 - 7	As per API 6D

15.0 **Valve Painting Specification**

15.1 Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.

15.2 For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.

16.0 Lock Open/ Lock Close Requirement : As indicated in P&ID.

Notes:

1. This Valve Data Sheet shall be read in conjunction with MECON's Technical Specification No. MEC/TS/05/62/003, Rev2
2. Inspection and Testing shall be as per attached QAP, this Data Sheet, MECON's T.S., API 6D and other relevant standards.
3. Stops shall be provided for positive alignment of plug with ports and ensure proper installation of handle.
4. Charpy V- notch & Hardness test for body, plug, cover, stem & studs/nuts shall be conducted as per Clause No.: 3.4 & 3.5 of TS respectively. Min. Valve Body Wall Thickness as per ASME B16.34 .
5. Material of the body shall have equivalent to that of the connecting pipe.- **Not Applicable**
6. Bidder shall clearly write valves material (equivalent or superior) offered by them against each part/material of valve in the space provided for. Wherever bidder agrees with valves material as mentioned above in MECON's data sheet, bidder shall clearly indicate **"AGREED"**.

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REVISIONS					REFERENCES	DRG. NO.													
SECTION OIL & GAS CLIENT : PROJECT : APPROVED O. P. JAIN					 MECON LIMITED	SCALE : DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/PV/80 REV 0													

1.0 Valve Manufacturer :
 2.0 Valve Size (NB), mm (inch) : ANSI Rating : 600# Design Standard : API 6D
 3.0 MECON's Technical Specification No. : MEC/TS/05/62/003, Rev-2
 4.0 Connecting Pipeline Design Pressure, kg/cm²(g) : 92 kg/cm²(g) Design Temperature, °C : -45°C to 65°C

5.0 Connecting Pipe Specification

5.1 Material :
 5.2 Diameter (OD), mm (inch) :
 5.3 Thickness, mm :

6.0 Valve Construction Design

6.1. Pattern : Short ☐ Regular ☐ Venturi ☐
 6.2. End Connections : Flanged both ends ☐ Flanged as per ASME B 16.5
 : Butt Weld both ends ☐ Butt Weld as per ASME B16.25
 : Flanged one end, butt weld other end ☐
 6.3. Flanges (wherever applicable) : a) RF ☐ FF ☐ RTJ ☐ NA ☐
 b) Serrated ☐ Smooth (125 to 200 microinches AARH) ☐ NA ☐

7.0 Valve Material Specification

Part	Material	Material Offered (Equivalent or Superior)
7.1 Body	A 352 Gr. LCB/A 350 Gr. LF2	
7.2 Plug	SS316/ A 352 Gr.LCB/A 350 Gr. LF2 with 75 µENP coating	
7.3 Cover	ASTM A216 Gr. WCB/ A234 Gr. WPB	
7.4 Stem	SS 316 (No casting) / A 350 Gr. LF2	
7.5 Stem Seal	PTFE/Graphite	
7.6 Stud Bolts/ Nuts	ASTM A320 Gr.L7 / ASTM A194 Gr.4	

8.0 Corrosion Allowance : 1.5 mm Service :

9.0 Location : Above Ground ☐ Buried ☐

10.0 Stem Extension Requirement : Yes ☐ No ☐

11.0 Gear Operator Requirement : Yes ☐ No ☐

12.0 Gas Powered Actuator Requirement : Yes ☐ No ☐

13.0 Fire Resistant Design Requirement : Type-Test as per Standard API 6FA/ BS EN: 10497

14.0 Valve Testing Requirement

	Test Pressure (min.), kg/cm ² (g)	Minimum Duration, minutes
14.1 Hydrostatic Test Body	157	As per API 6D
Seal	114	As per API 6D
14.2 Air Test	5.6 - 7	As per API 6D

15.0 Valve Painting Specification

15.1 Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.

15.2 For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.

16.0 Lock Open/ Lock Close Requirement : As indicated in P&ID.

Notes:

1. This Valve Data Sheet shall be read in conjunction with MECON's Technical Specification No. MEC/TS/05/62/003, Rev2
2. Inspection and Testing shall be as per attached QAP, this Data Sheet, MECON's T.S., API 6D and other relevant standards.
3. Stops shall be provided for positive alignment of plug with ports and ensure proper installation of handle.
4. Charpy V- notch & Hardness test for body, plug, cover, stem & studs/nuts shall be conducted as per relevant material code of TS respectively. Min. Valve Body Wall Thickness as per ASME B16.34 .
5. Material of the body shall have equivalent to that of the connecting pipe.- **Not Applicable**
6. Bidder shall clearly write valves material (equivalent or superior) offered by them against each part/material of valve in the space provided for. Wherever bidder agrees with valves material as mentioned above in MECON's data sheet, bidder shall clearly indicate "AGREED".

REV. NO.	DATE	ZONE	DESCRIPTIONS	BY	APPRD																												
<table border="1"> <tr> <th colspan="5">REVISIONS</th> <th>REFERENCES</th> <th>DRG. NO.</th> </tr> <tr> <td colspan="5"> SECTION OIL & GAS CLIENT : PROJECT : APPROVED O. P. JAIN </td> <td>  MECON LIMITED </td> <td rowspan="2"> SCALE : DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/PV/81 REV 0 </td> </tr> <tr> <td>DSGN</td> <td>PM</td> <td>25.04.12</td> <td>AKJ</td> <td>25.04.12</td> <td colspan="2"></td> </tr> <tr> <td>DRWN</td> <td></td> <td></td> <td></td> <td></td> <td colspan="2"></td> </tr> </table>						REVISIONS					REFERENCES	DRG. NO.	SECTION OIL & GAS CLIENT : PROJECT : APPROVED O. P. JAIN					 MECON LIMITED	SCALE : DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/PV/81 REV 0	DSGN	PM	25.04.12	AKJ	25.04.12			DRWN						
REVISIONS					REFERENCES	DRG. NO.																											
SECTION OIL & GAS CLIENT : PROJECT : APPROVED O. P. JAIN					 MECON LIMITED	SCALE : DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/PV/81 REV 0																											
DSGN	PM	25.04.12	AKJ	25.04.12																													
DRWN																																	
DATA SHEET FOR PLUG VALVES (NB ≥ 2")																																	

1.0 Valve Manufacturer :			
2.0 Valve Size (NB), mm (inch) :	ANSI Rating : 800#	Design Standard : BS 5351/BS EN ISO 17292	
3.0 MECON's Technical Specification No. :			
4.0 Connecting Pipeline Design Pressure, k :	Design Temperature, °C : -29°C to +65°C		
5.0 Connecting Pipe Specification :			
5.1 Diameter (OD), mm :			
5.2 Material :			
5.3 Wall Thickness, mm :			
6.0 Valve Construction Design			
6.1. Configuration :	Reduced Bore ☐	Full Bore ☒	
6.2. End Connections :	Socket Welded as per ASME B16.11		
	100mm Extension Pups in ASTM A106 Gr.B (Sch. 160) at both ends		
6.3.1 Flanges (wherever applicable) :	RF ☐	FF ☐	RTJ ☐ NA ☐
6.3.2 Flange Face Finish :	Serrated ☐	Smooth (125 to 200 microinches AARH) ☐	NA ☐
6.4 Ball Mounting :	Floating Ball		
7.0 Valve Material Specification			

Part	Specified Material	Material Offered (Equivalent or superior)
7.1 Body	ASTM A105	
7.2 Ball	13% Cr Steel	
7.3 Body Seat	RPTFE/ DELRIN	
7.4 Gland	13% Cr Steel	
7.5 Stem	13% Cr Steel (No Casting)	
7.6 Body Seal	Grafoil	
7.7 Stem Seal	Grafoil	
7.8 Body Studs/Nuts	ASTM A193 Gr. B7/ A194 Gr. 2H	

8.0 Corrosion Allowance :	1.5 mm	Service :
9.0 Location :	Above Ground ☐	Buried ☐
10.0 Stem Extension Requirement :	Yes ☐	No ☐
11.0 Gear Operator Requirement :	Yes ☐	No ☐
12.0 Gas Operated Actuator Requirement :	Yes ☐	No ☐
13.0 Fire Resistant Design Requirement :	Type-Test as per API 607 / BS EN ISO 10497	
14.0 Valve Testing Requirement		

	Test Pressure (min.) (kg/cm ² (g))	Minimum Duration (minutes)
14.1 Hydrostatic Test	210	2
14.2 Air Test	5.6 - 7	15

15.0 Anti-Static Testing Requirement :	As per BS EN ISO 17292
16.0 Valve Painting Specification	
16.1 Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.	
16.2 For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.	
17.0 Lock Open/ Lock Close/Normally Close Requirement :	As indicated in P&ID.

Notes:

1. Charpy V-notch test for body, ball, body seat, gland, stem & studs/nuts shall be conducted as per A370. The test shall be conducted at 0°C. The minimum average absorbed energy per set of three specimen shall be 27 J with an individual minimum per specimen of 22 J.
2. Material test certificates and hydrostatic test reports shall be furnished prior to despatch.
3. Detailed dimensional drawings showing cross-section with part numbers and materials shall be submitted for Purchaser's approval prior to manufacture of the valves. Min. Valve Body Wall Thickness as per ISO 17292 .
4. All tests shall be as per BS EN 12266.
5. Valves shall have ball position indicator.
6. Stops shall be provided for positive alignment of ball with ports and ensure proper installation of handle.
7. Each valve shall be provided with a wrench.
8. Valves shall be inspected and approved by Purchaser before despatch.
9. Gland packing assembly shall permit repair of gland packing under full line pressure.
10. Inspection and Testing shall be as per attached QAP, this datasheet, BS EN 12266, other relevant standards&clause no. 5.0 of TS No.: MEC/TS/05/21/002, Rev. 1, Ed. 1.

REV. N	DATE	ZONE	DESCRIPTIONS	BY	APPRD
SECTION					
			CLIENT :	REFERENCES	
			PROJECT :	DRG. NO.	
DSGN	PM	25.04.12	AKJ	 MECON LIMITED	
DRWN					
APPROVED			O.P. JAIN	DATA SHEET FOR BALL VALVES (NB < 2")	
				SCALE : DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/BV/82	
				REV 0	

1.0 Valve Manufacturer :
 2.0 Valve Size (NB), mm (inch) : ANSI Rating : **800#** Design Standard : **BS EN ISO 17292**
 3.0 MECON's Technical Specification No. : ---
 4.0 Connecting Pipeline Design Pressure, bar : **92 kg/cm2** Design Temperature, °C : **-45 to 65°C**

5.0 **Connecting Pipe Specification** N.A
 5.1 Material
 5.2 Diameter (OD), mm (inch)
 5.3 Thickness, mm

6.0 **Valve Construction Design**
 6.1. Bore : Reduced ☐ Full ☒
 6.2. End Connections : **Socket welded as per ASME B16.11**
100mm Extension Pups in ASTM A333 Gr.6 Sch. 160

6.3.1 Flanges (wherever applicable) : a) RF ☐ FF ☐ RTJ ☐ NA ☐
 6.3.2 Flange Face Finish : Serrated ☐ Smooth (125 to 200 microinches AARH) ☐ NA ☐
 6.4 Ball Mounting : **Floating Ball**

7.0 **Valve Material Specification**

Part	Specified Material	Material Offered
7.1 Body	ASTM A350 GR. LF2	
7.2 Ball	SS 304/316 with 75µENP Coating	
7.3 Body Seat	RPTFE/ DELRIN	
7.4 Gland	SS304/SS316	
7.5 Stem	SS 304/316 + 75 µENP(No casting)	
7.6 Body Seal	Grafoil	
7.7 Stem Seal	Grafoil	
7.8 Body Studs/Nuts	ASTM A320 Gr. 7/ A194 Gr. 4	

8.0 Corrosion Allowance : **1.5 mm** Service :

9.0 Location : Above Ground ☐ Buried ☐

10.0 Stem Extension Requirement : Yes ☐ No ☐

11.0 Gear Operator Requirement : Yes ☐ No ☐

12.0 Gas Powered Actuator Requirement : Yes ☐ No ☐

13.0 Fire Resistant Design Requirement : **Type-Test as per Standard API 607**

14.0 **Valve Testing Requirement**

		Test Pressure (min.), kg/cm2(g)	Minimum Duration, minutes
14.1 Hydrostatic Test	Body	210	2
	Seat	155	2
14.2 Air Test		5.6-7.0	15

15.0 Anti-Static Testing Requirement : **As per Standad BS EN ISO 17292**

16.0 **Valve Painting Specification**

- Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.
- For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.

17.0 Lock Open/ Lock Close Requirement : **As indicated in P&ID**

Notes:

- Material test certificates and hydrostatic test reports shall be furnished prior to despatch.
- Detailed dimensional drawings showing cross-section with part numbers and materials shall be submitted for Purchaser's approval prior to manufacture of the valves. Min. Valve Body Wall Thickness as per ISO 17292 .
- All tests shall be as per BS:6755 (Part-I).
- Valves shall have ball position indicator.
- Stops shall be provided to ensure positive alignment of ball with ports and ensure proper installation of handle.
- Each valve shall be provided with a wrench.
- Valves shall be inspected and approved by Purchaser before despatch.
- Gland packing assembly shall permit repair of gland packing under full line pressure.
- Inspection and Testing shall be as per this specification, BS:6755 (Part-I) and other relevant standards and clause no. 5.0 of T.S. No.: MEC/TS/05/21/002,Rev-1,Ed-1.
- Charpy V-notch & Hardness test for body, body adaptor, end flanges, ball, body seat rings, stem & studs / nuts shall be conducted as per relevant material code.

REV. NO.	DATE	ZONE	DESCRIPTIONS	BY	APPRD		
REVISIONS						REFERENCES	DRG. NO.
SECTION PROCESS & PIPING			CLIENT :				
	NAME	DATE	CHKD	DATE			
DSGN	PM	25.04.12	AKJ	25.04.12	PROJECT :		
DRWN							
APPROVED			O. P. JAIN			DATA SHEET FOR BALL VALVES (NB<2")	
						MECON LIMITED	
						DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/BV/83	
						REV 0	

1.0	Valve Manufacturer :		
2.0	Valve Size (NB), mm (inch) :	ANSI Rating : 800#	Design Standard : BS:5353
3.0	MECON's Technical Specification No. :		
4.0	Connecting Pipeline Design Pressure, kg/cm ² (g) :	Design Temperature, °C : -29°C to 65°C	
5.0	Connecting Pipe Specification : N.A.		
5.1	Material :		
5.2	Diameter (OD), mm (inch) :		
5.3	Thickness, mm :		
6.0	Valve Construction Design		
6.1.	Pattern :	Short ☐	Regular ☐ Venturi ☐
6.2.	End Connections :	Flanged both ends ☐ Flanged as per ASME B 16.5 Butt Weld both ends ☐ Butt Weld as per ASME B16.25 Socket Weld both ends ☐ Socket Welded 3000# (as per ASME B16.11) Socket welded with Pup Piece of 100mm length of A333 Gr.6 Sch. 160	
6.3.	Flanges (wherever applicable) :	a) RF ☐ FF ☐ RTJ ☐ b) Serrated ☐ Smooth (125 to 200 microinches AARH) ☐	NA ☐ NA ☐
7.0	Valve Material Specification		
	Part	Specified Material	Material Offered
7.1	Body	ASTM A 105	
7.2	Plug (Lubricated)	ASTM A 105 + 75 µENP Coating	
7.3	Stem (No Casting)	(AISI 4140 + 75 µENP Coating) /AISI 410 (No Casting)	
7.4	Gland	ASTM A105	
7.5	Gland Packing	Graphite/ PTFE	
7.6	Gasket	N.A.	
7.7	Body Studs/Nuts	ASTM A193 Gr. B7/ A194 Gr. 2H	
7.8	Lubricant Screw	Manufacturer's Standard	
	NOTE : AISI 410 has min. 35 HRC hardness		
8.0	Corrosion Allowance :	1.5 mm	
9.0	Location :	Above Ground ☐	Buried ☐
10.0	Stem Extension Requirement :	Yes ☐	No ☐
11.0	Gear Operator Requirement :	Yes ☐	No ☐
12.0	Gas Powered Actuator Requirement :	Yes ☐	No ☐
13.0	Fire Resistant Design Requirement :	Type-Test as per Standard API 607/BS EN: 10497	
14.0	Valve Testing Requirement		
		Test Pressure (min.), kg/cm2(g)	Minimum Duration, minutes
14.1	Hydrostatic Test		
	Body	210	
	Seat	155	
14.2	Air Test	5.6 - 7	
15.0	Valve Painting Specification		
15.1	Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.		
15.2	For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.		
16.	Lock Open/Lock Close Requirement: As indicated in P&ID		
	<u>Notes:</u>		
1.	Valves shall have an inherent feature using the line pressure to ensure that the line pressure cannot cause taper locking of the plug/ plug movement into the taper, i.e., valves shall be of "pressure-balanced design".		
2.	Painting procedure of valves shall be as per Manufacturer's standard.		
3.	Material test certificates and hydrostatic test reports shall be furnished prior to despatch.		
4.	Charpy V-notch test for body, plug, stem & studs/nuts will be conducted as per relevant material code.		
5.	Detailed dimensional drawings showing cross-section with part numbers and materials shall be submitted for Purchaser's approval prior to manufacture of the valves.Min. Shell Wall Thickness as per BS 5353.		
6.	Valves shall have valve position indicator.		
7.	Stops shall be provided to ensure positive alignment of plug with ports and ensure proper installation of handle.		
8.	Each valve shall be provided with a wrench.		
9.	Valves shall be inspected and approved by Purchaser before despatch.		
10.	Gland packing assembly shall permit repair of gland packing under full line pressure.		
11.	Inspection and Testing shall be done as per data sheet, specification & BS:12266 (Part-I).		
12.	Minimum port area for regular pattern shall be 55%.		
13	Bidder shall clearly write valves material (equivalent or superior) offered by them against each part/material of the valve in the space provided for. Wherever bidder agrees with valves material as mentioned above in Mecon's datasheet, bidder shall clearly indicate "Agreed" .		

REV. NO.	DATE	ZONE	DESCRIPTIONS	BY	REFERENCES
REVISIONS					DRG. NO.
SECTION OIL & GAS CLIENT : PROJECT : APPROVED O. P. JAIN DATA SHEET FOR PLUG VALVES (NB < 2")					 MECON LIMITED SCALE : DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/PV/82 REV 0

1.0	Valve Manufacturer :		
2.0	Valve Size (NB), mm (inch) :	ANSI Rating : 800#	Design Standard : BS:5353
3.0	MECON's Technical Specification No. :		
4.0	Connecting Pipeline Design Pressure, kg/cm ² (g) :	Design Temperature, °C : -45°C to 65°C	
5.0	Connecting Pipe Specification : N.A.		
5.1	Material :		
5.2	Diameter (OD), mm (inch) :		
5.3	Thickness, mm :		
6.0	Valve Construction Design		
6.1.	Pattern :	Short ☐	Regular ☐ Venturi ☐
6.2.	End Connections :	Flanged both ends ☐ Flanged as per ASME B 16.5 Butt Weld both ends ☐ Butt Weld as per ASME B16.25 Socket Weld both ends ☐ Socket Welded 3000# (as per ASME B16.11) Socket welded with Pup Piece of 100mm length of A333 Gr.6 Sch. 160	
6.3.	Flanges (wherever applicable) :	a) RF ☐ FF ☐ RTJ ☐ NA ☐ b) Serrated ☐ Smooth (125 to 200 microinches AARH) ☐ NA ☐	
7.0	Valve Material Specification		
	Part	Specified Material	Material Offered
7.1	Body	A 352 Gr. LCB/A 350 Gr. LF2	
7.2	Plug (Lubricated)	SS316/ A 352 Gr.LCB/A 350 Gr. LF2 with 75 µENP coating	
7.3	Stem (No Casting)	SS 316 (No casting) / A 350 Gr. LF2	
7.4	Gland	ASTM A105	
7.5	Gland Packing	Graphite/ PTFE	
7.6	Gasket	N.A.	
7.7	Body Studs/Nuts	ASTM A320 Gr.L7 / ASTM A194 Gr.4	
7.8	Lubricant Screw	Manufacturer's Standard	
8.0	Corrosion Allowance :	1.5 mm	
9.0	Location :	Above Ground ☐	Buried ☐
10.0	Stem Extension Requirement :	Yes ☐	No ☐
11.0	Gear Operator Requirement :	Yes ☐	No ☐
12.0	Gas Powered Actuator Requirement :	Yes ☐	No ☐
13.0	Fire Resistant Design Requirement :	Type-Test as per Standard API 607/BS EN: 10497	
14.0	Valve Testing Requirement		
		Test Pressure (min.), kg/cm2(g)	Minimum Duration, minutes
14.1	Hydrostatic Test		
	Body	210	
	Seat	155	
14.2	Air Test	5.6 - 7	
15.0	Valve Painting Specification		
15.1	Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.		
15.2	For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.		
16.	Lock Open/Lock Close Requirement: As indicated in P&ID		
Notes:			
1.	Valves shall have an inherent feature using the line pressure to ensure that the line pressure cannot cause taper locking of the plug/ plug movement into the taper, i.e., valves shall be of "pressure-balanced design".		
2.	Painting procedure of valves shall be as per Manufacturer's standard.		
3.	Material test certificates and hydrostatic test reports shall be furnished prior to despatch.		
4.	Charpy V-notch test for body, plug, stem & studs/nuts will be conducted as per relevant material code.		
5.	Detailed dimensional drawings showing cross-section with part numbers and materials shall be submitted for Purchaser's approval prior to manufacture of the valves. Min. Valve Body Wall Thickness as per ASME B16.34 .		
6.	Valves shall have valve position indicator.		
7.	Stops shall be provided to ensure positive alignment of plug with ports and ensure proper installation of handle.		
8.	Each valve shall be provided with a wrench.		
9.	Valves shall be inspected and approved by Purchaser before despatch.		
10.	Gland packing assembly shall permit repair of gland packing under full line pressure.		
11.	Inspection and Testing shall be done as per data sheet, specification & BS:12266 (Part-I).		
12.	Minimum port area for regular pattern shall be 55%.		
13	Bidder shall clearly write valves material (equivalent or superior) offered by them against each part/material of the valve in the space provided for. Wherever bidder agrees with valves material as mentioned above in Mecon's datasheet, bidder shall clearly indicate "Agreed" .		

REV. NO.	DATE	ZONE	DESCRIPTIONS	BY	REFERENCES											
REVISIONS					DRG. NO.											
SECTION OIL & GAS					 MECON LIMITED											
CLIENT :																
PROJECT :																
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>NAME</th> <th>DATE</th> <th>CHKD</th> <th>DATE</th> </tr> <tr> <td>DSGN</td> <td>PM</td> <td>25.04.12</td> <td>AKJ</td> </tr> <tr> <td>DRWN</td> <td></td> <td></td> <td></td> </tr> </table>						NAME	DATE	CHKD	DATE	DSGN	PM	25.04.12	AKJ	DRWN		
NAME	DATE	CHKD	DATE													
DSGN	PM	25.04.12	AKJ													
DRWN																
APPROVED O. P. JAIN					SCALE : DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/PV/83											
DATA SHEET FOR PLUG VALVES (NB < 2")					REV 0											

DATA SHEET FOR CHECK VALVE										
1.0	Valve Manufacturer	:								
2.0	Service	:								
3.0	Valve Size (NB), mm (inch)	:	ANSI Rating : 150#			Design Standard : API 6D				
4.0	MECON's Technical Specification No.	:	MEC/TS/05/62/004,Rev-2							
5.0	Connecting Pipeline Design Pressure, bar	:	19 kg/cm2		Design Temperature, °C	: -29°C to + 65°C				
6.0	Connecting Pipe Specification									
6.1	Material	:								
6.2	Diameter (OD), mm (inch)	:								
6.3	Thickness, mm	:								
7.0	Valve Construction Design									
7.1	Type	:								
7.2	End Connections	:	Flanged both ends		☐					
		:	Butt Weld both ends		☐					
		:	Flanged one end, butt weld other end		☐					
		:	Socket Weld as per ASME B 16.11		☐					
7.3	Flanges (wherever applicable)	:	a) RF ☐	FF ☐	RTJ ☐	NA ☐				
		:	b) Serrated ☐	Smooth (125 to 200 microinches AARH) ☐	NA ☐					
8.0	Valve Material Specification									
	Part		Specified Material				Material Offered (Equivalent or Superior)			
8.1	Body		ASTM A 216 Gr.WCB							
8.2	Cover		ASTM A 216 Gr.WCB							
8.3	Disc/ Plates		(ASTM A 216 Gr. WCB + 13% Cr Steel Facing) / 13% Cr Steel (Stellited)							
8.4	Body Seat Rings (See Note-3)		ASTM A 216 Gr. WCB+13% Cr Steel Facing (Stellited)							
8.5	Disc Hinge		ASTM A 216 Gr. WCB/ A 515 Gr. 70/ 13% Cr Steel							
8.6	Hinge Pin		13% Cr Steel (No Casting)							
8.7	Cover Stud Bolts		ASTM A 193 Gr. B7							
8.8	Nuts		ASTM A 194 Gr. 2H							
8.9	Cover Gasket		SS 304/316 Spiral Wound with Grafoil							
8.1	Spring		Inconel X-750							
9.0	Corrosion Allowance	:	1.5 mm							
10.0	Location	:	Above Ground ☐		Buried ☐					
11.0	Stem Extension Requirement	:	Yes ☐		No ☐					
12.0	Gear Operator Requirement	:	Yes ☐		No ☐					
13.0	Gas Powered Actuator Requirement	:	Yes ☐		No ☐					
14.0	Fire Resistant Design Requirement	:								
15.0	Valve Testing Requirement									
			Test Pressure (min.), kg/cm2(g)				Minimum Duration, minutes			
15.1	Hydrostatic Test	Body	32				API 6D			
		Seat	23				API 6D			
16.0	Valve Painting Specification									
	i) Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.									
	ii) For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron).									
17.0	Lock Open/ Lock Close Requirement	:	N.A.							
Notes:										
1. This Valve Data Sheet shall be read in conjunction with MECON's Technical Specification No. MEC/TS/05/62/004,Rev-2.										
2. Inspection and Testing shall be as per attached QAP, this Data Sheet, MECON's Technical Specification No. MEC/TS/05/62/004,Rev-2, API 6D, BS EN 12266 and other relevant standards. Min. Valve Body Wall Thickness as per ASME B16.34 .										
3. Seats shall be non-renewable integral type. Drain Plug shall be provided to drain valve cavity .										
4. 5% of valves shall undergo radiographic examination.										
5. Bidder shall clearly write all/ any deviation against each part/ material of valve in the space provided for .										
Wherever bidder agrees with MECON's data sheet, bidder shall clearly indicate "agreed".										
6. Charpy 'V' notch test on each heat of base material shall be conducted for all pressure containing & controlling parts such as body, bonnet, stem, disc, body seat, end flange, welding ends as well as the bolting material as per ASTM A370. The test shall be conducted at 0°C. The minimum average absorbed energy per set of three specimen shall be 27 J with an individual minimum per specimen of 22 J.										
7. Hardness test shall be carried out on each heat of base material for all pressure containing parts of the valve. A full thickness cross section shall be taken for this purpose and the maximum hardness shall not exceed 248 HV10 based on minimum four measurements representing the entire thickness.										
8. Painting procedure of the valves shall be as per Manufacturer's Standard.										
9. Material Test Certificates and Hydro Test Reports shall be furnished prior to dispatch.										
REV. NO.	ZONE	DESCRIPTIONS	BY	APPRD						
REVISIONS					REFERENCES					
SECTION PROCESS & PIPING					DRG. NO.					
					CLIENT :					
					PROJECT :					
NAME	DATE	CHKD	DATE	 MECON LIMITED						
DSGN	PM	25.04.12	AKJ							25.04.12
DRWN										
APPROVED					O.P. Jain					
DATA SHEET FOR CHECK VALVES					(NB ≥ 2")					
					SCALE :					
					DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/CI/76					
					REV 0					

DATA SHEET FOR CHECK VALVE									
1.0	Valve Manufacturer	:							
2.0	Service	:							
3.0	Valve Size (NB), mm (inch)	:	ANSI Rating : 150#				Design Standard : API 6D		
4.0	MECON's Technical Specification No.	:	MEC/TS/05/62/004,Rev-2						
5.0	Connecting Pipeline Design Pressure, kg/cm ² (g)	:	19		Design Temperature, °C	:	-45°C to + 65°C		
6.0	Connecting Pipe Specification								
6.1	Material	:							
6.2	Diameter (OD), mm (inch)	:							
6.3	Thickness, mm	:							
7.0	Valve Construction Design								
7.1	Type	:							
7.2	End Connections	:	Flanged both ends ☐ Butt Weld both ends ☐ Flanged one end, butt weld other end ☐ Socket Weld as per ASME B 16.11 ☐						
7.3	Flanges (wherever applicable)	:	a) RF ☐ FF ☐ RTJ ☐ NA ☐ b) Serrated ☐ Smooth (125 to 200 microinches AARH) ☐ NA ☐						
8.0	Valve Material Specification								
	Part		Specified Material				Material Offered (Equivalent or Superior)		
8.1	Body		ASTM A352 Gr. LCB/ A 350 GR. LF2						
8.2	Cover		ASTM A352 Gr. LCB/ A 350 GR. LF2						
8.3	Disc/ Plates		SS316/ ASTM A352 Gr. LCB / A 350 GR. LF2 +Stellited						
8.4	Body Seat Rings (See Note-3)		SS316/ ASTM A352 Gr. LCB / A 350 GR. LF2 + Stellited						
8.5	Disc Hinge		SS316/ ASTM A352 Gr. LCB / A 350 GR. LF2						
8.6	Hinge Pin		SS 316 (No casting) / A 350 Gr. LF2						
8.7	Cover Stud Bolts		ASTM A320 Gr.L7						
8.8	Nuts		ASTM A194 Gr.4						
8.9	Cover Gasket		SS 304/316 Spiral Wound with Grafoil						
8.1	Spring		Inconel X-750						
9.0	Corrosion Allowance	:	1.5 mm						
10.0	Location	:	Above Ground ☐ Buried ☐						
11.0	Stem Extension Requirement	:	Yes ☐ No ☐						
12.0	Gear Operator Requirement	:	Yes ☐ No ☐						
13.0	Gas Powered Actuator Requirement	:	Yes ☐ No ☐						
14.0	Fire Resistant Design Requirement	:							
15.0	Valve Testing Requirement								
			Test Pressure (min.), kg/cm2(g)		Minimum Duration, minutes				
15.1	Hydrostatic Test	Body	32		As per API 6D				
		Seat	23		As per API 6D				
16.0	Valve Painting Specification								
	i) Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.								
	ii) For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron).								
17.0	Lock Open/ Lock Close Requirement	:	N.A.						
Notes:									
1. This Valve Data Sheet shall be read in conjunction with MECON's Technical Specification No. MEC/TS/05/62/004,Rev-2.									
2. Inspection and Testing shall be as per attached QAP, this Data Sheet, MECON's Technical Specification No. MEC/TS/05/62/004,Rev-2, API 6D, BS EN 12266 and other relevant standards. Min. Valve Body Wall Thickness as per ASME B16.34 .									
3. Seats shall be non-renewable integral type. Drain Plug shall be provided to drain valve cavity .									
4. 5% of valves shall undergo radiographic examination.									
5. Bidder shall clearly write all/ any deviation against each part/ material of valve in the space provided for .									
Wherever bidder agrees with MECON's data sheet, bidder shall clearly indicate "agreed".									
6. Charpy 'V' notch test on each heat of base material shall be conducted for all pressure containing & controlling parts such as body, bonnet, stem, disc, body seat, end flange, welding ends as well as the bolting material as per relevant material code.									
7. Hardness test shall be carried out as per relevant material code									
8. Painting procedure of the valves shall be as per Manufacturer's Standard.									
9. Material Test Certificates and Hydro Test Reports shall be furnished prior to dispatch.									
REV. NO. DATE ZONE DESCRIPTIONS BY APPRD									
REVISIONS									
SECTION PROCESS & PIPING					CLIENT :				
NAME DATE CHKD DATE					PROJECT :				
DSGN PM 25.04.12 AKJ 25.04.12					REFERENCES				
DRWN					DRG. NO.				
APPROVED					O. P. JAIN				
DATA SHEET FOR CHECK VALVES (NB ≥ 2")					SCALE :				
					DATA SHEET NO.: MEC/MNO/05/28/M/001/DS/CV/77				
					REV 0				

DATA SHEET FOR CHECK VALVE									
1.0	Valve Manufacturer	:							
2.0	Service	:							
3.0	Valve Size (NB), mm (inch)	:				ANSI Rating : 300#	Design Standard : API 6D		
4.0	MECON's Technical Specification No.	:	MEC/TS/05/62/004,Rev-2						
5.0	Connecting Pipeline Design Pressure, kg/cm ² (g)	:	49	Design Temperature, °C			: -29°C to + 65°C		
6.0	Connecting Pipe Specification								
6.1	Material	:							
6.2	Diameter (OD), mm (inch)	:							
6.3	Thickness, mm	:							
7.0	Valve Construction Design								
7.1	Type	:							
7.2	End Connections	:	Flanged both ends ☐ Butt Weld both ends ☐ Flanged one end, butt weld other end ☐ Socket Weld as per ASME B 16.11 ☐						
7.3	Flanges (wherever applicable)	:	a) RF ☐ FF ☐ RTJ ☐ NA ☐ b) Serrated ☐ Smooth (125 to 200 microinches AARH) ☐ NA ☐						
8.0	Valve Material Specification								
	Part		Specified Material				Material Offered (Equivalent or Superior)		
8.1	Body		ASTM A 216 Gr.WCB						
8.2	Cover		ASTM A 216 Gr.WCB						
8.3	Disc/ Plates		(ASTM A 216 Gr. WCB + 13% Cr Steel Facing) / 13% Cr Steel (Stellited)						
8.4	Body Seat Rings (See Note-3)		ASTM A 216 Gr. WCB+13% Cr Steel Facing (Stellited)						
8.5	Disc Hinge		ASTM A 216 Gr. WCB/ A 515 Gr. 70/ 13% Cr Steel						
8.6	Hinge Pin		13% Cr Steel (No Casting)						
8.7	Cover Stud Bolts		ASTM A 193 Gr. B7						
8.8	Nuts		ASTM A 194 Gr. 2H						
8.9	Cover Gasket		SS 304/316 Spiral Wound with Grafoil						
8.1	Spring		Inconel X-750						
9.0	Corrosion Allowance	:	1.5 mm						
10.0	Location	:	Above Ground ☐			Buried ☐			
11.0	Stem Extension Requirement	:	Yes ☐			No ☐			
12.0	Gear Operator Requirement	:	Yes ☐			No ☐			
13.0	Gas Powered Actuator Requirement	:	Yes ☐			No ☐			
14.0	Fire Resistant Design Requirement	:							
15.0	Valve Testing Requirement								
			Test Pressure (min.), kg/cm2(g)				Minimum Duration, minutes		
15.1	Hydrostatic Test	Body	76				API 6D		
		Seat	57				API 6D		
16.0	Valve Painting Specification								
	i) Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.								
	ii) For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron).								
17.0	Lock Open/ Lock Close Requirement	:	N.A.						
Notes:									
1. This Valve Data Sheet shall be read in conjunction with MECON's Technical Specification No. MEC/TS/05/62/004,Rev-2.									
2. Inspection and Testing shall be as per attached QAP, this Data Sheet, MECON's Technical Specification No. MEC/TS/05/62/004,Rev-2, API 6D, BS EN 12266 and other relevant standards.Min. Valve Body Wall Thickness as per ASME B16.34 .									
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7. Hardness test shall be carried out on each heat of base material for all pressure containing parts of the valve. A full thickness cross section shall be taken for this purpose and the maximum hardness shall not exceed 248 HV10 based on minimum four measurements representing the entire thickness.									
8. Painting procedure of the valves shall be as per Manufacturer's Standard.									
9. Material Test Certificates and Hydro Test Reports shall be furnished prior to dispatch.									
REV. NO.	ZONE	DESCRIPTIONS	BY	APPRD					
REVISIONS					REFERENCES				
DRG. NO.									
SECTION PROCESS & PIPING					CLIENT :				
	NAME	DATE	CHKD	DATE					
DSGN	PM	25.04.12	AKJ	25.04.12					
DRWN									
PROJECT :					MECON LIMITED				
APPROVED O.P. Jain DATA SHEET FOR CHECK VALVES (NB ≥ 2")					SCALE :				REV
					DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/CI/78				0

DATA SHEET FOR CHECK VALVE																																																											
1.0	Valve Manufacturer	:																																																									
2.0	Service	:																																																									
3.0	Valve Size (NB), mm (inch)	:	ANSI Rating : 300#			Design Standard : API 6D																																																					
4.0	MECON's Technical Specification No.	:	MEC/TS/05/62/004,Rev-2																																																								
5.0	Connecting Pipeline Design Pressure, bar	:	49 kg/cm2			Design Temperature, °C	: -45°C to + 65°C																																																				
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DATA SHEET FOR CHECK VALVE									
1.0	Valve Manufacturer	:							
2.0	Service	:							
3.0	Valve Size (NB), mm (inch)	:	ANSI Rating : 600#				Design Standard : API 6D		
4.0	MECON's Technical Specification No.	:	MEC/TS/05/62/004,Rev-2						
5.0	Connecting Pipeline Design Pressure, bar	:	92 kg/cm2				Design Temperature, °C		: -29°C to + 65°C
6.0	Connecting Pipe Specification		:						
6.1	Material	:							
6.2	Diameter (OD), mm (inch)	:							
6.3	Thickness, mm	:							
7.0	Valve Construction Design		:						
7.1	Type	:							
7.2	End Connections	:	Flanged both ends		☐				
		:	Butt Weld both ends		☐				
		:	Flanged one end, butt weld other end		☐				
		:	Socket Weld as per ASME B 16.11		☐				
7.3	Flanges (wherever applicable)	:	a) RF ☐	FF ☐	RTJ ☐	NA ☐			
		:	b) Serrated ☐	Smooth (125 to 200 microinches AARH) ☐	NA ☐				
8.0	Valve Material Specification								
	Part		Specified Material				Material Offered (Equivalent or Superior)		
8.1	Body		ASTM A 216 Gr.WCB						
8.2	Cover		ASTM A 216 Gr.WCB						
8.3	Disc/ Plates		(ASTM A 216 Gr. WCB + 13% Cr Steel Facing) / 13% Cr Steel (Stellited)						
8.4	Body Seat Rings (See Note-3)		ASTM A 216 Gr. WCB+13% Cr Steel Facing (Stellited)						
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8.6	Hinge Pin		13% Cr Steel (No Casting)						
8.7	Cover Stud Bolts		ASTM A 193 Gr. B7						
8.8	Nuts		ASTM A 194 Gr. 2H						
8.9	Cover Gasket		SS 304/316 Spiral Wound with Grafoil						
8.1	Spring		Inconel X-750						
9.0	Corrosion Allowance	:	1.5 mm						
10.0	Location	:	Above Ground ☐		Buried ☐				
11.0	Stem Extension Requirement	:	Yes ☐		No ☐				
12.0	Gear Operator Requirement	:	Yes ☐		No ☐				
13.0	Gas Powered Actuator Requirement	:	Yes ☐		No ☐				
14.0	Fire Resistant Design Requirement	:							
15.0	Valve Testing Requirement								
			Test Pressure (min.), kg/cm2(g)				Minimum Duration, minutes		
15.1	Hydrostatic Test	Body	157				As per API 6D		
		Seat	114				As per API 6D		
16.0	Valve Painting Specification								
i)	Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.								
ii)	For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron).								
17.0	Lock Open/ Lock Close Requirement	:	N.A.						
Notes:									
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9. Material Test Certificates and Hydro Test Reports shall be furnished prior to dispatch.									
REV. NO.	DATE	ZONE	DESCRIPTIONS		BY	APPRD			
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SECTION PROCESS & PIPING					CLIENT :				
	NAME	DATE	CHKD	DATE	PROJECT :				
DSGN	PM	25.04.12	AKJ	25.04.12					
DRWN									
APPROVED					DATA SHEET FOR CHECK VALVES (NB ≥ 2")			 MECON LIMITED	
					SCALE :			REV	
					DATA SHEET NO.: MEC/WNO/05/28/M/001/DS/01/80			0	

DATA SHEET FOR CHECK VALVE										
1.0	Valve Manufacturer	:								
2.0	Service	:								
3.0	Valve Size (NB), mm (inch)	:	ANSI Rating : 600#				Design Standard : API 6D			
4.0	MECON's Technical Specification No.	:	MEC/TS/05/62/004,Rev-2							
5.0	Connecting Pipeline Design Pressure, kg/cm ² (g)	:	92	Design Temperature, °C	:	-45°C to + 65°C				
6.0	Connecting Pipe Specification									
6.1	Material	:								
6.2	Diameter (OD), mm (inch)	:								
6.3	Thickness, mm	:								
7.0	Valve Construction Design									
7.1	Type	:								
7.2	End Connections	:	Flanged both ends							
		:	Butt Weld both ends							
		:	Flanged one end, butt weld other end							
		:	Socket Weld as per ASME B 16.11							
7.3	Flanges (wherever applicable)	:	a) RF		FF		RTJ		NA	
		:	b) Serrated		Smooth (125 to 200 microinches AARH)				NA	
8.0	Valve Material Specification									
	Part	Specified Material	Material Offered (Equivalent or Superior)							
8.1	Body	ASTM A352 Gr. LCB/ A 350 GR. LF2								
8.2	Cover	ASTM A352 Gr. LCB/ A 350 GR. LF2								
8.3	Disc/ Plates	SS316/ ASTM A352 Gr. LCB / A 350 GR. LF2 + Stellite								
8.4	Body Seat Rings (See Note-3)	SS316/ ASTM A352 Gr. LCB / A 350 GR. LF2 + Stellite								
8.5	Disc Hinge	SS316/ ASTM A352 Gr. LCB / A 350 GR. LF2								
8.6	Hinge Pin	SS 316 (No casting) / A 350 Gr. LF2								
8.7	Cover Stud Bolts	ASTM A320 Gr.L7								
8.8	Nuts	ASTM A194 Gr.4								
8.9	Cover Gasket	SS 304/316 Spiral Wound with Grafoil								
8.1	Spring	Inconel X-750								
9.0	Corrosion Allowance	:	1.5 mm							
10.0	Location	:	Above Ground				Buried			
11.0	Stem Extension Requirement	:	Yes				No			
12.0	Gear Operator Requirement	:	Yes				No			
13.0	Gas Powered Actuator Requirement	:	Yes				No			
14.0	Fire Resistant Design Requirement	:								
15.0	Valve Testing Requirement									
			Test Pressure (min.), kg/cm2(g)				Minimum Duration, minutes			
15.1	Hydrostatic Test	Body	157				As per API 6D			
		Seat	114				As per API 6D			
16.0	Valve Painting Specification									
	i) Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.									
	ii) For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron).									
17.0	Lock Open/ Lock Close Requirement	:	N.A.							
Notes:										
1. This Valve Data Sheet shall be read in conjunction with MECON's Technical Specification No. MEC/TS/05/62/004,Rev-2.										
2. Inspection and Testing shall be as per attached QAP, this Data Sheet, MECON's Technical Specification No. MEC/TS/05/62/004,Rev-2, API 6D, BS EN 12266 and other relevant standards. Min. Valve Body Wall Thickness as per ASME B16.34 .										
3. Seats shall be non-renewable integral type. Drain Plug shall be provided to drain valve cavity .										
4. 5% of valves shall undergo radiographic examination.										
5. Bidder shall clearly write all/ any deviation against each part/ material of valve in the space provided for .										
Wherever bidder agrees with MECON's data sheet, bidder shall clearly indicate "agreed".										
6. Charpy 'V' notch test on each heat of base material shall be conducted for all pressure containing & controlling parts such as body, bonnet, stem, disc, body seat, end flange, welding ends as well as the bolting material as per relevant material code.										
7. Hardness test shall be carried out as per relevant material code										
8. Painting procedure of the valves shall be as per Manufacturer's Standard.										
9. Material Test Certificates and Hydro Test Reports shall be furnished prior to dispatch.										
REV. NO.	DATE	ZONE	DESCRIPTIONS				BY	APPRD		
REVISIONS										
SECTION PROCESS & PIPING							CLIENT :		REFERENCES	
	NAME	DATE	CHKD	DATE						
DSGN	PM	25.04.12	AKJ	25.04.12						
DRWN										
APPROVED							O. P. JAIN		DATA SHEET FOR CHECK VALVES (NB ≥ 2")	
									SCALE :	
									DATA SHEET NO.: MEC/MNO/05/28/M/001/DS/CV/81	
									REV 0	

DATA SHEET FOR GLOBE VALVES

1. Valve Manufacturer : _____
2. Size : _____ Rating : ANSI 150# Design Standard : BS:1873
3. Purchaser's Specification : Refer Technical notes for Gate & Globe Valves
4. Design Pressure : 19kg/cm²(g) Design Temperature : -29°C to + 65°C
5. Corrosion Allowance : 1.5mm Service : _____
6. End Connections : Flanged both ends as per ASME B 16.5 ☐
 Butt Weld both ends as A-16.25 ☐
 Flanged one end butt weld other end ☐
 Socket weld both ends as per ASME B16.11 ☐
7. Flanges (where applicable) : a) RF ☐ FF ☐ RTJ ☐
 b) Serrated ☐ Smooth (125 to 200 AARH) ☐
8. Connecting Pipe Specification : _____
9. Valve Material Specification :

	Part	Material	Material Offered (Equivalent or Superior)
9.1	Body	ASTM A 216 Gr.WCB	
9.2	Bonnet (Bolted)	ASTM A 216 Gr.WCB	
9.3	Stem (Rising)	13% Cr. Steel (No Casting)	
9.4	Disc(Loose Plug/Ball Type)	(ASTM A 216 Gr. WCB + 13% Cr Steel Facing) / 13% Cr Steel (Stellited)	
9.5	Body Seat Ring	ASTM A 216 Gr. WCB+13% Cr Steel Facing (Stellited)	
9.6	Stem Packing (Renewable with valve open on stream)	Corrosion inhibited die formed flexible graphite with braided anti extrusion rings	
9.7	Hand Wheel (Rising)	Malleable Iron/ Cast Steel/ Fab. Steel	
9.8	Bonnet Bolts	A 193 Gr. B7	
9.9	Bonnet Nuts	A194 Gr. 2H	
9.10	Bonnet Gasket	Spiral Wound SS 316 + Grafoil	

10. Hydrostatic Test Pressure
 a) Body : 32 kg/cm²(g)
 b) Seat : 23 kg/cm²(g)
11. Pneumatic Test Pressure with : 5.6 - 7 kg/cm² (g).
 Air
12. Painting Specifications:
 i) Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.
 ii) For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron
 (Permissible thickness in each coat shall be within 80 to 120 micron).

Notes:

- Valve specification sheet shall be read in conjunction with technical notes for Gate and Globe valves.
- Valve shall be designed for intrinsically fire safe. Min. Body & Bonnet Thickness as per BS 1873 .
- Testing shall be as per BS EN 12266-1, approved QAP, this specification and other relevant standards.
- Bidder shall clearly write all/ any deviation against each part/ material of valve in the space provided for .
 Wherever bidder agrees with MECON's data sheet, bidder shall clearly indicate "agreed".
- Charpy 'V' notch test on each heat of base material shall be conducted for all pressure containing parts such as body, end flange, welding ends as well as the bolting material as per ASTM A370. The test shall be conducted at 0°C. The minimum average absorbed energy per set of three specimen shall be 27 J with an individual minimum per specimen of 22 J.
- Hardness test shall be carried out on each heat of base material for all pressure containing parts of the valve. A full thickness cross section shall be taken for this purpose and the maximum hardness shall not exceed 248 HV10 based on minimum four measurements representing the entire thickness.
- Stem packing shall be renewable with valve open on stream .
- Painting procedure of the valves shall be as per Manufacturer's Standard.
- Material Test Certificates and Hydro Test Reports shall be furnished prior to dispatch.

REV. NO.	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.
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	NAME	DATE	CHKD	DATE	CLIENT :		
DSGN	PM	25.04.12	AKJ	25.04.12	PROJECT :		
DRWN							
APPROVED O. P. JAIN						DATA SHEET FOR GLOBE VALVES (NB≥2")	
						SCALE :	REV
						DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/GV/76	0

DATA SHEET FOR GLOBE VALVES

1. Valve Manufacturer : _____
2. Size : _____ Rating : ANSI 150# Design Standard : BS:1873
3. Purchaser's Specification : Refer Technical notes for Gate & Globe Valves
4. Design Pressure : 19 kg/cm²(g) Design Temperature : -45°C to + 65°C
5. Corrosion Allowance : 1.5mm Service : _____
6. End Connections : Flanged both ends as per ASME B 16.5 ☐
 Butt Weld both ends as A-16.25 ☐
 Flanged one end butt weld other end ☐
 Socket weld both ends as per ASME B16.11 ☐ with 100mm pup pieces of A106 Gr. B Sch160
7. Flanges (where applicable) : a) RF ☐ FF ☐ RTJ ☐
 b) Serrated ☐ Smooth (125 to 200 AARH) ☐
8. Connecting Pipe Specification : _____

9. Valve Material Specification :

	Part	Material	Material Offered (Equivalent or Superior)
9.1	Body	ASTM A352 Gr. LCB/ A 350 GR. LF2	
9.2	Bonnet (Bolted)	ASTM A352 Gr. LCB/ A 350 GR. LF2	
9.3	Stem (Rising)	SS316 (No casting) / A 350 GR. LF2	
9.4	Disc(Loose Plug/Ball Type)	SS316 + Stellite/ ASTM A352 Gr. LCB / A 350 GR. LF2 with 75 Micron ENP coating	
9.5	Body Seat Ring	SS316 + Stellite/ ASTM A352 Gr. LCB / A 350 GR. LF2 with 75 Micron ENP coating	
9.6	Stem Packing (Renewable with valve open on stream)	Graphited Braided Asbestos with sacrificial inhibitor & Inconel wire reinforcement	
9.7	Hand Wheel (Rising)	Malleable Iron/ Cast Steel/ Fab. Steel	
9.8	Bonnet Bolts	ASTM A320 Gr.L7	
9.9	Bonnet Nuts	ASTM A194 Gr.4	
9.10	Bonnet Gasket	Spiral Wound SS 316 + Grafoil	

10. Hydrostatic Test Pressure
 - a) Body : 32 kg/cm²(g)
 - b) Seat : 23 kg/cm²(g)
11. Pneumatic Test Pressure with : 5.6-7 kg/cm² (g).
Air
12. Painting Specifications:
 - i) Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.
 - ii) For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron).

Notes:

1. Valve specification sheet shall be read in conjunction with technical notes for Gate and Globe valves.
2. Valve shall be designed for intrinsically fire safe.Min. Body & Bonnet Thickness as per BS 1873 .
3. Testing shall be as per BS EN 12266-1.
4. Bidder shall clearly write all/ any deviation against each part/ material of valve in the space provided for .
Wherever bidder agrees with MECON's data sheet, bidder shall clearly indicate "agreed".
5. Charpy 'V' notch test on each heat of base material shall be conducted as per relevant material code.
6. Hardness test shall be carried out on each heat of base material for all pressure containing parts of the valve as per relevant material code.
7. Stem packing shall be renewable with valve open on stream .
8. Painting procedure of the valves shall be as per Manufacturer's Standard.
9. Material Test Certificates and Hydro Test Reports shall be furnished prior to dispatch.

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DRWN							
APPROVED			O. P. JAIN			SCALE : DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/GV/77	
DATA SHEET FOR GLOBE VALVES (NB≥ 2")						REV 0	

DATA SHEET FOR GLOBE VALVES

1. Valve Manufacturer : _____
2. Size : _____ Rating : ANSI 300# Design Standard : BS:1873
3. Purchaser's Specification : Refer Technical notes for Gate & Globe Valves
4. Design Pressure : 49 kg/cm²(g) Design Temperature : -29°C to + 65°C
5. Corrosion Allowance : 1.5mm Service : _____
6. End Connections : Flanged both ends as per ASME B 16.5 ☐
 Butt Weld both ends as A-16.25 ☐
 Flanged one end butt weld other end ☐
 Socket weld both ends as per ASME B16.11 ☐
7. Flanges (where applicable) : a) RF ☐ FF ☐ RTJ ☐
 b) Serrated ☐ Smooth (125 to 200 AARH) ☐
8. Connecting Pipe Specification : _____
9. Valve Material Specification :

	Part	Material	Material Offered (Equivalent or Superior)
9.1	Body	ASTM A 216 Gr.WCB	
9.2	Bonnet (Bolted)	ASTM A 216 Gr.WCB	
9.3	Stem (Rising)	13% Cr. Steel (No Casting)	
9.4	Disc(Loose Plug/Ball Type)	(ASTM A 216 Gr. WCB + 13% Cr Steel Facing) / 13% Cr Steel (Stellited)	
9.5	Body Seat Ring	ASTM A 216 Gr. WCB+13% Cr Steel Facing (Stellited)	
9.6	Stem Packing (Renewable with valve open on stream)	Corrosion inhibited die formed flexible graphite with braided anti extrusion rings	
9.7	Hand Wheel (Rising)	Malleable Iron/ Cast Steel/ Fab. Steel	
9.8	Bonnet Bolts	A 193 Gr. B7	
9.9	Bonnet Nuts	A194 Gr. 2H	
9.10	Bonnet Gasket	Spiral Wound SS 316 + Grafoil	

10. Hydrostatic Test Pressure
 a) Body : 76 kg/cm²(g)
 b) Seat : 57 kg/cm²(g)
11. Pneumatic Test Pressure with : 5.6 - 7 kg/cm² (g).
 Air
12. Painting Specifications:
 i) Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.
 ii) For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron
 (Permissible thickness in each coat shall be within 80 to 120 micron).

Notes:

- Valve specification sheet shall be read in conjunction with technical notes for Gate and Globe valves.
- Valve shall be designed for intrinsically fire safe. Min. Body & Bonnet Thickness as per BS 1873 .
- Testing shall be as per BS EN 12266-1, approved QAP, this specification and other relevant standards.
- Bidder shall clearly write all/ any deviation against each part/ material of valve in the space provided for .
 Wherever bidder agrees with MECON's data sheet, bidder shall clearly indicate "agreed".
- Charpy 'V' notch test on each heat of base material shall be conducted for all pressure containing parts such as body, end flange, welding ends as well as the bolting material as per ASTM A370. The test shall be conducted at 0°C. The minimum average absorbed energy per set of three specimen shall be 27 J with an individual minimum per specimen of 22 J.
- Hardness test shall be carried out on each heat of base material for all pressure containing parts of the valve. A full thickness cross section shall be taken for this purpose and the maximum hardness shall not exceed 248 HV10 based on minimum four measurements representing the entire thickness.
- Stem packing shall be renewable with valve open on stream .
- Painting procedure of the valves shall be as per Manufacturer's Standard.
- Material Test Certificates and Hydro Test Reports shall be furnished prior to dispatch.

REV. NO.	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.																								
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SECTION PROCESS & PIPING					CLIENT :	 MECON LIMITED																									
NAME	DATE	CHKD	DATE	PROJECT :																											
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APPROVED _____ O. P. JAIN						DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/GV/78																									
DATA SHEET FOR GLOBE VALVES (NB≥2")						SCALE : _____ REV 0																									

DATA SHEET FOR GLOBE VALVES

1. Valve Manufacturer : _____
2. Size : _____ Rating : ANSI 300# Design Standard : BS:1873
3. Purchaser's Specification : Refer Technical notes for Gate & Globe Valves
4. Design Pressure : 49 kg/cm²(g) Design Temperature : -45°C to + 65°C
5. Corrosion Allowance : 1.5mm Service : _____
6. End Connections : Flanged both ends as per ASME B 16.5 ☐
 Butt Weld both ends as A-16.25 ☐
 Flanged one end butt weld other end ☐
 Socket weld both ends as per ASME B16.11 ☐ with 100mm pup pieces of
 A106 Gr. B Sch160
7. Flanges (where applicable) : a) RF ☐ FF ☐ RTJ ☐
 b) Serrated ☐ Smooth (125 to 200 AARH) ☐
8. Connecting Pipe Specification : _____
9. Valve Material Specification :

	Part	Material	Material Offered (Equivalent or Superior)
9.1	Body	ASTM A352 Gr. LCB/ A 350 GR. LF2	
9.2	Bonnet (Bolted)	ASTM A352 Gr. LCB/ A 350 GR. LF2	
9.3	Stem (Rising)	SS316 (No casting) / A 350 GR. LF2	
9.4	Disc(Loose Plug/Ball Type)	SS316 / ASTM A352 Gr. LCB / A 350 GR. LF2 + Stellited	
9.5	Body Seat Ring	SS316 / ASTM A352 Gr. LCB / A 350 GR. LF2 + Stellited	
9.6	Stem Packing (Renewable with valve open on stream)	Corrosion inhibited die formed flexible graphite with braided anti extrusion rings	
9.7	Hand Wheel (Rising)	Malleable Iron/ Cast Steel/ Fab. Steel	
9.8	Bonnet Bolts	ASTM A320 Gr.L7	
9.9	Bonnet Nuts	ASTM A194 Gr.4	
9.10	Bonnet Gasket	Spiral Wound SS 316 + Grafoil	

10. Hydrostatic Test Pressure
 - a) Body : 76 kg/cm²(g)
 - b) Seat : 57 kg/cm²(g)
11. Pneumatic Test Pressure with : 5.6-7 kg/cm² (g).
Air
12. Painting Specifications:
 - i) Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.
 - ii) For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron
(Permissible thickness in each coat shall be within 80 to 120 micron).

Notes:

1. Valve specification sheet shall be read in conjunction with technical notes for Gate and Globe valves.
2. Valve shall be designed for intrinsically fire safe. Min. Body & Bonnet Thickness as per BS 1873 .
3. Testing shall be as per BS EN 12266-1, approved QAP, this specification and other relevant standards.
4. Bidder shall clearly write all/ any deviation against each part/ material of valve in the space provided for .
Wherever bidder agrees with MECON's data sheet, bidder shall clearly indicate "agreed".
5. Charpy 'V' notch test on each heat of base material shall be conducted as per relevant material code.
6. Hardness test shall be carried out on each heat of base material for all pressure containing parts of the valve as per relevant material code.
7. Stem packing shall be renewable with valve open on stream .
8. Painting procedure of the valves shall be as per Manufacturer's Standard.
9. Material Test Certificates and Hydro Test Reports shall be furnished prior to dispatch.

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APPROVED						REV 0	
O. P. JAIN						DATA SHEET FOR GLOBE VALVES (NB ≥ 2")	
						SCALE : DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/GV/79	

DATA SHEET FOR GLOBE VALVES

1. Valve Manufacturer : _____
2. Size : _____ Rating : ANSI 600# Design Standard : BS:1873
3. Purchaser's Specification : Refer Technical notes for Gate & Globe Valves
4. Design Pressure : 92 kg/cm²(g) Design Temperature : -29°C to + 65°C
5. Corrosion Allowance : 1.5mm Service : _____
6. End Connections : Flanged both ends as per ASME B 16.5 ☐
 Butt Weld both ends as A-16.25 ☐
 Flanged one end butt weld other end ☐
 Socket weld both ends as per ASME B16.11 ☐
7. Flanges (where applicable) : a) RF ☐ FF ☐ RTJ ☐
 b) Serrated ☐ Smooth (125 to 200 AARH) ☐
8. Connecting Pipe Specification : _____
9. Valve Material Specification :

	Part	Material	Material Offered (Equivalent or Superior)
9.1	Body	ASTM A 216 Gr.WCB	
9.2	Bonnet (Bolted)	ASTM A 216 Gr.WCB	
9.3	Stem (Rising)	13% Cr. Steel (No Casting)	
9.4	Disc(Loose Plug/Ball Type)	(ASTM A 216 Gr. WCB + 13% Cr Steel Facing) / 13% Cr Steel (Stellited)	
9.5	Body Seat Ring	ASTM A 216 Gr. WCB+13% Cr Steel Facing (Stellited)	
9.6	Stem Packing (Renewable with valve open on stream)	Corrosion inhibited die formed flexible graphite with braided anti extrusion rings	
9.7	Hand Wheel (Rising)	Malleable Iron/ Cast Steel/ Fab. Steel	
9.8	Bonnet Bolts	A 193 Gr. B7	
9.9	Bonnet Nuts	A194 Gr. 2H	
9.10	Bonnet Gasket	Spiral Wound SS 316 + Grafoil	

10. Hydrostatic Test Pressure
 a) Body : 157 kg/cm²(g)
 b) Seat : 114 kg/cm²(g)
11. Pneumatic Test Pressure with : 5.6 - 7 kg/cm² (g).
 Air
12. Painting Specifications:
 i) Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.
 ii) For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron
 (Permissible thickness in each coat shall be within 80 to 120 micron).

Notes:

- Valve specification sheet shall be read in conjunction with technical notes for Gate and Globe valves.
- Valve shall be designed for intrinsically fire safe. Min. Body & Bonnet Thickness as per BS 1873 .
- Testing shall be as per BS EN 12266-1, approved QAP, this specification and other relevant standards.
- Bidder shall clearly write all/ any deviation against each part/ material of valve in the space provided for .
 Wherever bidder agrees with MECON's data sheet, bidder shall clearly indicate "agreed".
- Charpy 'V' notch test on each heat of base material shall be conducted for all pressure containing parts such as body, end flange, welding ends as well as the bolting material as per ASTM A370. The test shall be conducted at 0°C. The minimum average absorbed energy per set of three specimen shall be 27 J with an individual minimum per specimen of 22 J.
- Hardness test shall be carried out on each heat of base material for all pressure containing parts of the valve. A full thickness cross section shall be taken for this purpose and the maximum hardness shall not exceed 248 HV10 based on minimum four measurements representing the entire thickness.
- Stem packing shall be renewable with valve open on stream .
- Painting procedure of the valves shall be as per Manufacturer's Standard.
- Material Test Certificates and Hydro Test Reports shall be furnished prior to dispatch.

REV. NO.	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.
SECTION PROCESS & PIPING							MECON LIMITED
	NAME	DATE	CHKD	DATE	CLIENT :		
DSGN	PM	25.04.12	AKJ	25.04.12	PROJECT :		
DRWN							
APPROVED O. P. JAIN						SCALE : _____ DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/GV/80	
DATA SHEET FOR GLOBE VALVES (NB≥2")						REV 0	

DATA SHEET FOR GLOBE VALVES

1. Valve Manufacturer : _____
2. Size : _____ Rating : **ANSI 600#** Design Standard : **BS:1873**
3. Purchaser's Specification : **Refer Technical notes for Gate & Globe Valves**
4. Design Pressure : **92 kg/cm²(g)** Design Temperature : **-45°C to + 65°C**
5. Corrosion Allowance : **1.5mm** Service : _____
6. End Connections : Flanged both ends as per ASME B 16.5 ☐
 Butt Weld both ends ☐
 Flanged one end butt weld other end ☐
7. Flanges (where applicable) : a) RF ☐ FF ☐ RJ ☐
 b) Serrated ☐ Smooth (125 to 200 AARH) ☐
8. Pipe Specification : _____
9. Valve Material Specification (or Equivalent/ Superior) :

	Part	Material	Material Offered (Equivalent or Superior)
9.1	Body	ASTM A352 Gr. LCB/ A 350 GR. LF2	
9.2	Bonnet (Bolted)	ASTM A352 Gr. LCB/ A 350 GR. LF2	
9.3	Stem (Rising)	SS316 (No casting) / A 350 GR. LF2	
9.4	Disc(Loose Plug/Ball Type)	SS316/ ASTM A352 Gr. LCB / A 350 GR. LF2 + Stellite	
9.5	Body Seat Ring	SS316/ ASTM A352 Gr. LCB / A 350 GR. LF2 + Stellite	
9.6	Stem Packing (Renewable with valve open on stream)	Corrosion inhibited die formed flexible graphite with braided anti extrusion rings	
9.7	Hand Wheel (Rising)	Malleable Iron/ Cast Steel/ Fab. Steel	
9.8	Bonnet Bolts	ASTM A320 Gr.L7	
9.9	Bonnet Nuts	ASTM A194 Gr.4	
9.10	Bonnet Gasket	Spiral Wound SS 316 with Grafoil	

10. Hydrostatic Test Pressure
 - a) Body : **157 kg/cm²(g)**
 - b) Seat : **114 kg/cm²(g)**
11. Test Pressure with Air : **5.6 - 7.0 kg/cm²(g)**
12. Painting Specifications:
 - i) Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.
 - ii) For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron
(Permissible thickness in each coat shall be within 80 to 120 micron).

Notes:

1. Valve specification sheet shall be read in conjunction with technical notes for Gate and Globe valves.
2. Valve shall be designed for intrinsically fire safe. Min. Body & Bonnet Thickness as per BS 1873 .
3. Testing shall be as per BS EN 12266-1,approved QAP,this specification and other relevant standards.
4. Bidder shall clearly write all/ any deviation against each part/ material of valve in the space provided for .
Wherever bidder agrees with MECON's data sheet, bidder shall clearly indicate "agreed".
5. Charpy 'V' notch test on each heat of base material shall be conducted as per relevant material code.
6. Hardness test shall be carried out as per relevant material code.
7. Stem packing shall be renewable with valve open on stream .
8. Painting procedure of the valves shall be as per Manufacturer's Standard.
9. Material Test Certificates and Hydro Test Reports shall be furnished prior to dispatch.

REV. NO.	DATE	ZONE	DESCRIPTIONS		BY	APPRD	REFERENCES		DRG. NO.
SECTION PROCESS & PIPING					CLIENT :			MECON LIMITED	
	NAME	DATE	CHKD	DATE					
DSGN	PM	25.04.12	AKJ	25.04.12	PROJECT :				
DRWN									
APPROVED		O.P. JAIN		DATA SHEET FOR GLOBE VALVES (NB≥2")		SCALE :		REV	
						DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/GV/81		0	

**DATA SHEET FOR GLOBE VALVES
(NB≥2")**

DATA SHEET FOR GLOBE VALVES

1. Valve Manufacturer : _____
2. Size : _____ Rating : ANSI 800# Design Standard : ISO 15761 / BS:5352
3. Purchaser's Specification : Refer Technical notes for Gate & Globe Valves
4. Design Pressure : _____ Design Temperature : -29°C to + 65°C
5. Corrosion Allowance : 1.5mm Service : _____
6. End Connections : Flanged both ends as per ASME B 16.5 ☐
 Butt Weld both ends as A-16.25 ☐
 Flanged one end butt weld other end ☐
 Socket weld both ends as per ASME B16.11 ☒ with 100mm pup pieces of A106 Gr. B Sch160
7. Flanges (where applicable) : a) RF ☐ FF ☐ RTJ ☐
 b) Serrated ☐ Smooth (125 to 200 AARH) ☐
8. Connecting Pipe Specification : N. A.
9. Valve Material Specification :

	Part	Material	Material Offered (Equivalent or Superior)
9.1	Body	ASTM A 105	
9.2	Bonnet (Bolted)	ASTM A 105	
9.3	Stem (Rising)	13% Cr. Steel (No Casting)	
9.4	Disc(Loose Plug/Ball Type)	SS 316 + Stellite	
9.5	Body Seat Ring	SS 316 + Stellite	
9.6	Stem Packing (Renewable with valve open on stream)	Corrosion inhibited die formed flexible graphite with braided anti extrusion rings	
9.7	Hand Wheel (Rising)	Malleable Iron/ Cast Steel/ Fab. Steel	
9.8	Bonnet Bolts	A 193 Gr. B7	
9.9	Bonnet Nuts	A194 Gr. 2H	
9.10	Bonnet Gasket	Spiral Wound SS 316 + Grafoil	

10. Hydrostatic Test Pressure
 a) Body : 210 kg/cm²(g)
 b) Seat : 155 kg/cm²(g)
11. Pneumatic Test Pressure with Air : 5.6-7 kg/cm² (g).
12. Painting Specifications:
 i) Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.
 ii) For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron).

Notes:

- Valve specification sheet shall be read in conjunction with technical notes for Gate and Globe valves.
- Valve shall be designed for intrinsically fire safe, Dimensions including thickness as per ISO 15761 .
- Testing shall be as per BS EN 12266-1, approved QAP, this specification and other relevant standards.
- Bidder shall clearly write all/ any deviation against each part/ material of valve in the space provided for . Wherever bidder agrees with MECON's data sheet, bidder shall clearly indicate "agreed".
- Charpy 'V' notch test on each heat of base material shall be conducted for all pressure containing parts such as body, end flange, welding ends as well as the bolting material as per ASTM A370. The test shall be conducted at 0°C. The minimum average absorbed energy per set of three specimen shall be 27 J with an individual minimum per specimen of 22 J.
- Hardness test shall be carried out on each heat of base material for all pressure containing parts of the valve. A full thickness cross section shall be taken for this purpose and the maximum hardness shall not exceed 248 HV10 based on minimum four measurements representing the entire thickness.
- Stem packing shall be renewable with valve open on stream .
- Painting procedure of the valves shall be as per Manufacturer's Standard.
- Material Test Certificates and Hydro Test Reports shall be furnished prior to dispatch.

REV. NO.	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.																								
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="5">SECTION PROCESS & PIPING</th> <th>CLIENT :</th> </tr> <tr> <th>NAME</th> <th>DATE</th> <th>CHKD</th> <th>DATE</th> <th></th> <th></th> </tr> <tr> <td>DSGN</td> <td>PM</td> <td>25.04.12</td> <td>AKJ</td> <td>25.04.12</td> <td>PROJECT :</td> </tr> <tr> <td>DRWN</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>						SECTION PROCESS & PIPING					CLIENT :	NAME	DATE	CHKD	DATE			DSGN	PM	25.04.12	AKJ	25.04.12	PROJECT :	DRWN						 MECON LIMITED	
SECTION PROCESS & PIPING					CLIENT :																										
NAME	DATE	CHKD	DATE																												
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DRWN																															
APPROVED O. P. JAIN DATA SHEET FOR GLOBE VALVES (NB<2")						SCALE : _____ DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/GV/82 REV 0																									

DATA SHEET FOR GLOBE VALVES

1. Valve Manufacturer : _____
2. Size : _____ Rating : ANSI **800#** Design Standard : **ISO 15761 / BS:5352**
3. Purchaser's Specification : **Refer Technical notes for Gate & Globe Valves**
4. Design Pressure : _____ Design Temperature : **-45°C to + 65°C**
5. Corrosion Allowance : **1.5mm** Service : _____
6. End Connections : Flanged both ends as per ASME B 16.5 ☐
 Butt Weld both ends as A-16.25 ☐
 Flanged one end butt weld other end ☐
 Socket weld both ends as per ASME B16.11 ☒ with 100mm pup pieces of A106 Gr. B Sch160
7. Flanges (where applicable) : a) RF ☐ FF ☐ RTJ ☐
 b) Serrated ☐ Smooth (125 to 200 AARH) ☐
8. Connecting Pipe Specification : **N. A.**
9. Valve Material Specification :

	Part	Material	Material Offered (Equivalent or Superior)
9.1	Body	ASTM A350 Gr. LF2	
9.2	Bonnet (Bolted)	ASTM A350 Gr. LF2	
9.3	Stem (Rising)	SS316 (No Casting) /ASTM A350 Gr. LF2	
9.4	Disc(Loose Plug/Ball Type)	SS316 /ASTM A350 Gr. LF2 + Stellite	
9.5	Body Seat Ring	SS316/ASTM A350 Gr. LF2 + Stellite	
9.6	Stem Packing (Renewable with valve open on stream)	Corrosion inhibited die formed flexible graphite with braided anti extrusion rings	
9.7	Hand Wheel (Rising)	Malleable Iron/ Cast Steel/ Fab. Steel	
9.8	Bonnet Bolts	ASTM A320 Gr.L7	
9.9	Bonnet Nuts	ASTM A194 Gr.4	
9.10	Bonnet Gasket	Spiral Wound SS 316 + Grafoil	

10. Hydrostatic Test Pressure
 a) Body : **210 kg/cm²(g)**
 b) Seat : **155 kg/cm²(g)**
11. Pneumatic Test Pressure with Air : **5.6-7 kg/cm² (g).**
12. Painting Specifications:
 i) Surface preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.
 ii) For above ground installation-Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron).

Notes:

- Valve specification sheet shall be read in conjunction with technical notes for Gate and Globe valves.
- Valve shall be designed for intrinsically fire safe. Dimensions including thickness as per ISO 15761 .
- Testing shall be as per BS EN 12266-1, approved QAP, this specification and other relevant standards.
- Bidder shall clearly write all/ any deviation against each part/ material of valve in the space provided for . Wherever bidder agrees with MECON's data sheet, bidder shall clearly indicate "agreed".
- Charpy 'V' notch test on each heat of base material shall be conducted as per relevant material code.
- Hardness test shall be carried out on each heat of base material for all pressure containing parts of the valve as per relevant material code.
- Stem packing shall be renewable with valve open on stream .
- Painting procedure of the valves shall be as per Manufacturer's Standard.
- Material Test Certificates and Hydro Test Reports shall be furnished prior to dispatch.

REV. NO.	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.												
																			
SECTION PROCESS & PIPING					CLIENT :														
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DRWN																			
APPROVED					O. P. JAIN	DATA SHEET FOR GLOBE VALVES (NB<2")	SCALE : DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/GV/83												
							REV 0												

DATA SHEET FOR CARTRIDGE FILTER

1.0 PROJECT : 2.0 JOB NO. : 3.0 VENDOR : * 4.0 OPERATING CONDITIONS : 4.1 FILTER : CARTRIDGE 4.2 FLUID HANDLED : NATURAL GAS VAPOUR/RLNG GAS 4.3 MOLECULAR WEIGHT : ** 4.4 Cp/Cv : ** 4.5 INLET SIZE (NB) : Refer P&ID 4.6 OPER. PR., KG/CM²G : Refer P&ID 4.7 PARTICLE/ MESH SIZE, MICRON ≥ 3 MICRON 4.8 PR. DROP KG/CM², CLEAN/ DIRTY : 0.2/ 0.5 Max. (SEE NOTE-2) 4.9 CORROSION ALLOWANCE, MM : 3.0 For Carbon Steel Parts 5.0 MATERIAL OF CONSTRUCTION 5.1 SHELL : SA-515/SA-516 Gr. 60/70 5.2 HEAD : * 5.3 BOTTOM : SA515/ SA-516 Gr. 60/70, SA 234 Gr. WPB 5.4 NOZZLES : SA-106 GR. B 5.5 GASKET : SS-304/316 SPIRAL WOUND WITH GRAFOIL 5.6 OTHER INTERNALS : * 5.7 FILTER ELEMENT : FIBRE GLASS MEDIA TO SUIT GAS QUALITY. 6.0 DESIGN AND CONSTRUCTION 6.1 DESIGN CODE : ASME SEC-VIII DIV-1 (LATEST EDITION) 6.2 DESIGN PR., KG/CM²G : As per P&ID 6.3 NO. OF CARTRIDGE ELEMENT : (SEE NOTE-2) 6.4 MAKE (ELEMENT) : AS PER VENDOR LIST IN MECON T.S. 6.5 FIXING DETAILS : NUTS & BOLTS 6.6 NAME OF VESSEL MANUFACTURER : * 6.7 FLANGE RATING : 600# 6.8 FLANGE TYPE : WNRF 6.9 VENT SIZE : Refer P&ID, DRAIN SIZE : Refer P&ID, UC SIZE : NR 6.10 HEAD(TOP COVER) CONNECTION : FLANGE 6.11 QOC REQUIRED : NA 7.0 OVERALL DIMENSION & WEIGHT: 7.1 OVERALL LENGTH, MM : * 7.2 OVERALL HEIGHT, MM : * 7.3 EMPTY WEIGHT, KGS : * 7.4 HYDROTESTWEIGHT : * 8.0 ACCESSORIES 8.1 DAVIT : YES 8.2 LIFTING LUGS: YES 8.3 ANCHOR BOLTS& NUTS YES 8.4 BLIND FLANGE,GASKET,BOLTS&NUTS FOR VENTS&DRAINS : YES 8.5 LADDER&PLATFORM: --- 9.0 PAINTING : SUITABLE TO CORROSIVE INDUSTRIAL ENVIRONMENT REF. MECON T.S. 10.0 INSPECTION & TESTING : AS PER MECON T.S. * VENDOR TO SPECIFY/ CONFIRM ** GAS COMPOSITION & OTHER PROPERTIES WILL BE PROVIDED TO SUCCESSFUL BIDDER. NOTES :- 1) THE TOTAL INTERNAL CROSS SECTIONAL AREA OF MOUNTED CARTRIDGE SHALL NOT BE LESS THAN INLET NOZZLE AREA. 2) SUCCESSFUL BIDDER SHALL SUBMIT MECHANICAL DESIGN CALCULATION FOR FILTER & PROCESS CALCULATION (ALONG WITH DETAILED PRESSURE DROP CALCULATION) OF CARTRIDGE FILTER & CARTRIDGE ELEMENT (INCLUDING RELEVANT GRAPH, CATALOGUE ETC.) FOR MECON CLEARANCE. 3) BIDDER SHALL SUBMIT SAMPLE CALCULATIONS (FOR CATRIDGE ELEMENT SIZING & PRESSURE DROP ACROSS THE FILTER) ALONG WITH OFFER. 4)VENDOR TO SELECT/CONFIRM THE MATERIAL CONSIDERING "-29 °C TO 65 °C" TEMPERATURE . A CHARPY V-NOTCH TEST SHALL BE CONDUCTED ON 3 SAMPLE HAVING ENERGY VALUE OF 27 J AVERAGE AND MINIMUM 22 J AT 0°C. 5) FILTER ELEMENT MUST WITHSTAND A DIFFERENTIAL PRESSURE OF 1.0 KG/CM²(g) WITHOUT CRACKING AND FAILING. 6)MANDATORY SPARES SHALL BE AS PER RELEVANT CLAUSE SPECIFIED IN TENDER DOCUMENT. 7)FILTER ELEMENT SHALL BE OF SINGLE PIECE CONSTRUCTION WITH NO JOINTS IN THE ELEMENT. STACKING OF FILTER ELEMENT IS NOT ALLOWED. 8)ALL CS MATERIALS SHALL BE OF FULLY KILLED QUALITY. 9) FLANGE SHALL CONFIRM TO ASME B 16.5. 10)GASKETS SHALL CONFORM TO ASME B 16.20 11) FREQUENCY OF CLEANING SHALL BE MINIMUM 30 DAYS FOR FILTER ELEMENT DESIGN. 12) PWHT REQUIRED AS PER ASME SEC-VIII (DIV-I)	CLIENT : ITEM TAG NO. : CF- QUANTITY : As per P&ID TYPE : HORIZONTAL FLUID DENSITY(@ P&T) Kg/m³ : ** FLOW RATE (MMSCMD) : Refer P&ID FLUID VISC., CENTI-POISE : ** COMPRESSIBILITY FACTOR (Z) : ** OUTLET SIZE (NB) : Refer P&ID OPER. TEMP., °C : 0- 55 FILTRATION EFF. % : 98 DUST CONC : 0 - 0.2 mg/SM³ OF GAS CORROSIVE/ TOXIC COMPONENT : Tot sulphur incl. H2S (max.)-10 PPM(by wt) H2S content (max)- 5PPM (by wt.) SHELL FLANGE : SA - 105 HEAD FLANGE : SA -105 PERFORATED SHEET : NOZZLE FLANGES : SA - 105 FASTENER : SA-193 Gr. B7, SA-194 Gr. 2H SUPPORT : SA516Gr.60/ SA 283 Gr. C/ IS:2062 FITTING: SA 234 Gr. WPB DESIGN TEMP., °C : (-)29 to (+) 65 O.D. (MM) X LENGTH (MM) XTHICKNESS(MM): * FILTER PR. DROP, KG/CM² : * (SEE NOTE-2) DUST/DIRT HOLDING CAPACITY OF EACH CARTRIDGE ELEMENT: * TOTAL GROSS FILTERING AREA OF CARTRIDGE ELEMENTS: * FLANGE FINISH : * PSV SIZE : * DPT SIZE : * FLUSHING CONNECTION : * INLET FLANGE TO OUTLET FLANGE: * SHELL DIA, MM : * OPERATING WT., KGS : *

REV.	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.												
SECTION : OIL & GAS <table border="1"> <tr> <th>NAME</th> <th>DATE</th> <th>CHKD</th> <th>DATE</th> </tr> <tr> <td>DSGN</td> <td></td> <td></td> <td></td> </tr> <tr> <td>DRWN</td> <td></td> <td></td> <td></td> </tr> </table> CLIENT : PROJECT :  MECON LIMITED								NAME	DATE	CHKD	DATE	DSGN				DRWN			
NAME	DATE	CHKD	DATE																
DSGN																			
DRWN																			
CARTRIDGE FILTER						SCALE :	REV												
APPROVED						DATA SHEET NO.:	0												

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PRESSURE SAFETY VALVES/CREEP RELIEF VALVE										
UNITS : Flow > Liquid - m ³ /hr , Gas-Sm ³ /day, Steam - kg/hr. Pressure -> kg/cm ² g, Temperature-°C, Level/ Length-> mm										
General	01	Tag No.	PSV-				CRV-			
	02	Line No./ Size	As per P&ID				As per P&ID			
	03	Vessel Protected	Cartridge Filter				-			
	04	Quantity	As per P&ID				As per P&ID			
	05	Safety/ Relief	Safety Relief				Creep Relief			
	06	Vendor	⌘				⌘			
Valve	07	Type	Standard				Standard			
	08	Full Nozzle Full Lift Mod. Nozzle	Full Nozzle Full Lift				Full Nozzle Full Lift			
	09	Bonnet Type	Closed				Closed			
	10	Conv./ Bellows/ Pilot Operated	Conventional				Conventional			
	11	Inlet Conn. : Size & Rating	⌘				⌘			
	12	Inlet Conn. : Facing & Finish	RF, ⌘				RF, ⌘			
	13	Outlet Conn. : Size & Rating	⌘				⌘			
	14	Outlet Conn. : Facing & Finish	RF, ⌘				RF, ⌘			
	15	Cap Over Adj. Bolt :	Required				Required			
	16	Screwed / Bolted	Bolted				Bolted			
	17	Lifting Gear - Type	-				-			
	Material	18	Test Gag	Required				Required		
19		Body and Bonnet	ASTM A216 Gr. WCB				ASTM A216 Gr. WCB			
20		Nozzle and Disc	SS 316				SS 316			
21		Spring	SS 316				SS 316			
22		Bellows								
Options	23	Resilient Seat Seal								
Basis	24	Code	API 520, 521 & 526				API 520, 521 & 526 / As per Manufacturer's Standard			
	25	Basis of Selection	Vessel Under Ext. Fire Case				CREEP RELIEF (1% flow)			
Service Conditions	26	Fluid and State	Natural Gas Vapour				Natural Gas Vapour			
	27	Corrosive Constituent	Tot sulphur incl. H ₂ S (max)-10 PPM(by wt)				Tot sulphur incl. H ₂ S (max)-10 PPM(by wt)			
			H ₂ S content (max)- 5PPM (by wt.)				H ₂ S content (max)- 5PPM (by wt.)			
	28	Corr. Allowance	2 mm				2 mm			
	29	Required Flow Capacity	⌘				⌘			
	30	Mol. Wgt. S.G. at Rel. Temp.	⌘⌘		⌘⌘		⌘⌘		⌘⌘	
	31	Oper. Pressure, kg/cm ² g	As per P&ID				As per P&ID			
	32	Oper. Temp. °C Rel. Temp. °C	0-55		⌘		0-55		⌘	
	33	Valve Discharges to	Atm.				Atm.			
	34	Back Press. Const. Or Variable	Atm.		Constant		Atm.		Constant	
	35	Set Pressure, Kg/cm ² (g)	- (Note-7)				- (Note-7)			
	36	Cold Bench Test Pressure	⌘				⌘			
	37	% Over Pressure % Blow Down	20		⌘		10		⌘	
	38	Cp/Cv Compressibility Factor	⌘⌘		⌘⌘		⌘⌘		⌘⌘	
		39	Viscosity at Rel. Temp. (cP)	⌘⌘				⌘⌘		
40		Vessel Wall Temp., °C Surf. Area-m ²	593		⌘		-		-	
Orifice	41	Calculated Area-inch ²	⌘				⌘			
	42	Sel. Area-inch ² Orifice Design	⌘		⌘		⌘		⌘	
	43	No. of Valves Req'd. for capacity	⌘				⌘			
	44	Total Area-inch ²	⌘				⌘			
	45	Actual Flow Capacity, SCFM	-				-			
	46	Relief Load	⌘				⌘			
	47	Model No.	⌘				⌘			
	48	Radiography & Charpy Test	Req'd. (100%)				Req'd. (100%)			
	49	IBR Certification	Not Required				Not Required			
Notes: ⌘ VENDOR TO SPECIFY/ CONFIRM. ⌘⌘ GAS COMPOSITION & OTHER PROPERTIES WILL BE PROVIDED TO SUCCESSFUL BIDDER. 1. VENDOR SHALL FURNISH SIZING CALCULATIONS TO SUPPORT HIS VALVE SELECTION. 2. VALVES SHALL BE 100% RADIOGRAPHED. 3. VENDOR TO CONSIDER COEFFICIENT OF DISCHARGE AS PER ASME-SEC-VIII (Latest). 4. FOR SAFETY VALVE SIZING, FURNISH CERTIFIED CAPACITIES AS PER API-520. 5. DESIGNATION, NO. & RATING OF PSV's & CRV's SHALL BE DECIDED DURING DETAIL ENGINEERING. 6. PSV's & CRV's SHALL BE SUPPLIED WITH INLET AND OUTLET COMPANION FLANGE. 7. PSV's & CRV's SET PRESSURE SHALL BE FINALISED DURING DETAILED ENGINEERING.										
REV. NO.	DATE	ZONE	DESCRIPTIONS			BY		DRG. NO.		
SECTION : OIL & GAS						CLIENT :				
REVISIONS						PROJECT :				
DSGN	NAME	DATE	CHKD	DATE	 MECON LIMITED					
DRWN										
APPROVED						PSV/CRV		DATASHEET NO:		
								REV-0		
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DATA SHEET-SCRUBBER

1.0 PROJECT : 2.0 JOB NO. : 3.0 VENDOR : ⚡ 4.0 OPERATING CONDITIONS : 4.1 SCRUBBER 4.2 FLUID HANDLED : NATURAL GAS / RLNG 4.3 MOLECULAR WEIGHT : ** 4.4 INLET SIZE : Refer P&ID 4.5 OPER. PR. KG/CM²G : Refer P&ID 4.6 LIQUID & DUST PARTICLE/ MESH SIZE, MICRON ≥ 10 MICRON 4.7 PR. DROP KG/CM², CLEAN/ DIRTY : 0.05 / - 4.8 CORROSION ALLOWANCE, MM : 3.0 4.9 COMPRESSIBILITY FACTOR : ** 5.0 MATERIAL OF CONSTRUCTION 5.1 SHELL : SA-515/SA-516 Gr. 60/70/ SA 106 Gr. B 5.2 HEAD : SA 516 GR. 60 5.3 BOTTOM : SA 516 Gr. 60 5.4 NOZZLES : SA-106 GR. B 5.5 SUPPORT : IS:2062 5.6 GASKET : SS 304/316 SPIRAL WOUND WITH GRAFOIL 6.0 DESIGN AND CONSTRUCTION 6.1 DESIGN CODE : ASME SEC.VIII DIV-I 6.2 DESIGN PR. KG/CM²G : 92 6.3 INTERNALS : SS-304L 6.5 FIXING DETAIL : AS PER SUPPLIER 6.6 FLANGE RATING : 600# 6.7 FLANGE TYPE : WNRF 6.8 VENT SIZE : Refer P&ID DRAIN SIZE : Refer P&ID 6.9 LG CONNECTION : Refer P&ID 7.0 COVER : BOLTED WITH DAVIT CONNECTION 7.1 OVERALL DIMENSION ⚡ 7.2 OVERALL LENGTH, CM : ⚡ 7.3 OVERALL HEIGHT, CM : ⚡ 7.4 EMPTY WEIGHT, KGS : ⚡ 8.0 ACCESSORIES 8.1 DAVIT DETAIL : YES 9.0 PAINTING : SUITABLE TO CORROSIVE INDUSTRIAL ENVIRONMENT REF. MECON T.S. 10.0 INSPECTION & TESTING : AS PER Mecon T.S.	CLIENT : ITEM NO. : SC- QUANTITY : As per P&ID TYPE : VERTICAL, CYCLONE FLOW RATE STD., SCMD : Refer P&ID FLUID VISC, CENTI-POISE : ** OUTLET SIZE : Refer P&ID OPER. TEMP., °C : 0 - 55 FILTRATION EFF. % : 98 SCRUBBER PR. DROP, KG/CM² : 0.1 MAX. CORROSIVE/ TOXIC COMPONENT : Tot sulphur incl. H₂S (max.)-10 PPM(by wt) H₂S content (max)- 5PPM (by wt.) EXTENT OF RADIOGRAPHY - 100% SP. GRAVITY : ** SHELL FLANGE : NA HEAD FLANGE : NA PERFORATED SHEET : NA NOZZLE FLANGES : SA-105 INTERNAL : SS-304L FASTENER : SA-193 GR. B7, SA-194 GR. 2H DESIGN TEMP., °C : -29 TO 65 O.D. X LENGTH, : ⚡ FLANGE FINISH : SMOOTH FINISH (125 AARH) PSV SIZE : REF. ATTACHED DATA SHEET UC SIZE : Refer P&ID SHELL DIA, CM : ⚡ OPERATING WT., KGS : ⚡

⚡ VENDOR TO SPECIFY/ CONFIRM

** GAS COMPOSITION & OTHER PROPERTIES WILL BE PROVIDED TO SUCCESSFUL BIDDER.

REV. NO.	DATE	ZONE	DESCRIPTIONS	BY	APPRD
REVISIONS					
SECTION O&G (LDP)			CLIENT :		
	NAME	DATE	CHKD	DATE	
DSGN					 MECON LIMITED
DRWN					
APPROVED			SCRUBBER TAG NO. SC-		
			SCALE : DATA SHEET NO.:		
			REV 0		

DATASHEET OF PRESSURE GAUGE

Project :- *

Client :- *

Contractor :- *

FOA No. :- *

1	Type	Direct		Wetted parts material	---				
2	Mounting	Local		Element	---				
3	Dial size	150 mm		Lower body	---				
	Colour	White (Non rusting plastic with black engraving)		Non wetted parts	---				
4	Case material	DIE CAST ALUMINIUM / SS		Process connection	---				
5	Bezel ring	Screwed / Bayonet		Size	---				
6	Window material	Shatter proof glass		Rating	---				
7	Enclosure	Min. IP 55 / NEMA 4		Facing &Finish	---				
8	Pressure element	Bourdon tube		Capillary material	---				
9	Element material	SS 316		Capillary length	---				
10	Socket material	SS 316		Flushing & Filling	---				
11	Accuracy	± 1% FSD	16	Over range protection	130% of range				
12	Zero adjustment	Micrometer pointer (Internal)	17	Blow out protection	Required				
			18	Options					
13	Connections	½” NPT (M)		a)	Snubber				
	Conn. Location	Bottom		b)	Syphon				
14	Movement	SS 304		c)	Gauge saver				
15	Diaphragm seal	---		d)	Liquid filled casing				
	Type	---	19	2-valve, 3-way manifold	Required				
			20	Make & Model	*				
Tag No.		Range		Pressure		Design Temp.	Fluid	Location	Options
				Operating	Design				

Refer P&ID

NOTES:

- 1) ‘*’ Information to be supplied by the Vendor / Contractor.
- 2) Make of the PG shall be from approved vendor list of Mecon /Client.
- 3) Detailed technical catalogue for offered model to be submitted by vendor/contractor during approval.
- 4) Offered Model shall meet the tender requirement.

0	NB	VJ	RKS	INSTRUMENTATION DATASHEETS	 MECON LTD. DELHI DS No: MEC/STD./ Page 154 of 644
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DATASHEET OF TEMPERATURE GAUGE (with Thermowell)									
Project :- *									
Client :- *									
Contractor :- *									
FOA No. :- *									
GENERAL					FILLED SYSTEM				
1	Type	FILLED SYSTEM / BIMETALLIC			15	SAMA Class	V B		
2	Well	REQUIRED				Compensation	CASE		
3	Mounting	LOCAL			16	Bulb type	ADJUSTABLE UNION		
4	Dial size	150 mm				Bulb material	316SS		
5	Colour	WHITE (Non rusting plastic with black figs.)			17	Bulb union threaded to	½" NPT(M)		
6	Case material	DIE CAST ALUMINIUM / SS			18	Extension type	RIGID		
7	Window material	SHATTER PROOF GLASS			19	Bulb dia	8 mm (Min)		
8	Conn. Location	BOTTOM			20	Capillary material			
9	Accuracy	±1% FSD				Armour Flexible			
10	Enclosure	WEATHER PROOF TO IS2147				Armour material			
	Enclosure class	IP 55 / NEMA 4				Capillary length			
11	Zero adj. Screw	MICROMETER POINTER (Internal)			21	Overrange protection	130% OF RANGE		
BIMETAL					THERMOWELL				
12	Stem:				22	Material	SS 316		
	Type				23	Construction	DRILLED BAR STOCK		
	Material				24	Process connection	1 ½" FLANGED		
	Size				25	Gauge connection	½" NPT (F)		
13	Stem diameter				26	Thermowell as per drg	Drg enclosed		
14					27	Options a)	LIQUID FILLED		
					28	Make & Model	*		
Tag No.	Range	Temperature (°C)		Well Dimensions		Flange rating		Location	Remarks
		Operating	Design	U	T				
Refer P&ID									
Note: 1. '**' Information to be supplied by the Vendor / Contractor. 2. Make of the TG shall be from approved vendor list of Mecon /Client. 3. Wake frequency calculation of offered Thermowell to be submitted by the Vendor / Contractor during approval. 4. Detailed technical catalogue for offered model to be submitted by vendor/contractor during approval. 5. Offered Model shall meet the tender requirement.									

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DATASHEET OF PRESSURE TRANSMITTER						
Project :- *						
Client :- *						
Contractor :- *						
FOA No. :- *						
GENERAL				MEASURING UNIT		
1	Function	Transmit & Indicate	15	Service	Pressure	
2	Type	Electronic Smart μ P Based	16	Element	Diaphragm	
3	Case	Mfg. Std.	17	Body Material	Carbon Steel or better	
4	Mounting	Yoke	18	Element Material	SS 316L	
5	Enclosure	Weather proof to IS2147 Explosion proof to IS2148	19	Process Connections	$\frac{1}{2}$ " NPT(F)	
	Enclosure class	NEMA 4 & NEMA 7		Process Conn. Locn.	Mfg. Std.	
6	Elec. Area Class.	Zone-I, Gr.IIA & IIB, T3, CCOE certified	20	Over Range Protection	130% of Range	
7	Intrinsically safe & Flameproof	Required				
8	Air supply	N.A	21	Output Meter	Required (W.P. & Intr. Safe)	
9	Power supply	24 VDC	22	Mounting Accessories	Required for 2" Pipe Mounting – Material (SS 316)	
10	Cable entry	$\frac{1}{2}$ " NPT(F)	23	Zero elevn. & suppression	Required	
11	Accuracy	$\pm 0.025\%$ of SPAN	24	2-valve, 3-way manifold	Required	
12	Repeatability	$\pm 0.05\%$	25	Make & Model	*	
TRANSMITTER						
13	Output	4 – 20 mA DC, Two wire				
14	Trans. Power supply	0 - 24 V DC				
Tag No.	Operating Pressure	Design Press.	Design Temp.	Range	Fluid	Options
Refer P&ID						
NOTES:						
1. '*' Information to be supplied by the Vendor / Contractor.						
2. Make of the PT shall be from approved vendor list of Mecon /Client.						
3. CCOE Certificate for offered transmitter to be submitted by the Vendor / Contractor during approval.						
4. Detailed technical catalogue for offered model to be submitted by vendor/contractor during approval.						
5. Offered Model shall meet the tender requirement.						
6. Environmental Enclosure with locking arrangement shall be provided for metering transmitters.						

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DATASHEET OF RTD (with Thermowell)									
Project :- *									
Client :- *									
Contractor :- *									
FOA No. :- *									
GENERAL				13	Cable entry	½" NPT (F)			
1	Assembly as per drg.	Drg. enclosed		14	No. of entries	Single			
				15	Enclosure type	Weather proof to IP55, Ex-proof (CCOE certified)			
2	Type	RTD Class A		THERMOWELL					
ELEMENT									
3	No. of elements	Simplex		16	Material	SS 316			
4	Calibration	As per DIN 43760		17	Construction	Drilled bar stock			
5	Element material	Platinum (Pt 100)		18	Process connection	1 ½" Flanged			
6	Resistance at 0°C	100 ohms		19	Inst. connection	½" NPT (F)			
7	Leads	Standard		20	Thermowell as per drg	Drg. Enclosed			
8	Sheath								
		O.D.	8 mm	TRANSMITTER					
		Material	SS 316						
9	Nipple & Union Material	SS 316		21	Quantity				
				22	Input				
10	No. Of wires	4 Wire		23	Output				
HEAD				24	Power Supply				
11	Head Cover type	Screwed cap & SS chain		25	Mounting				
12	Material	Cast Aluminium		26	Enclosure class				
				27	SS Tag Plate	Required			
				28	Make & Model No.	*			
Tag No.	Range	Temperature		Well Dimensions		Flange		Fluid	
		Nor	Design	U	T	Material	Rating/Face/Finish		
Refer P&ID									
NOTES: 1. '*' Information to be supplied by the Vendor / Contractor. 2. Make of the RTD shall be from approved vendor list of Mecon /Client. 3. Detailed technical catalogue for offered model to be submitted by vendor/contractor during approval. 4. Wake frequency calculation of offered Thermowell to be submitted by the Vendor / Contractor during approval. 5. CCOE Certificate for offered RTD to be submitted by the Vendor / Contractor during approval. 6. Offered Model shall meet the tender requirement.									

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TEMPERATURE TRANSMITTERS						
Units:- Flow :Liquid-m3/hr, Gas-MMSCMD, Steam- kg/hr, Pressure-Kg/cm ² (G), Temperature- °C, Level/Length-mm						
1	FUNCTION	TRANSMIT ☐ INDICATE ☐ BLIND ☐	11	POWER SUPPLY 24 V DC		
2	TYPE	ELECTRONIC (SMART) ☐	12	CONDUIT CONN. 1/2" NP TF		
3	CASE	MFR STD.	13	LINEARISATION UPSCALE ☐ DOWNSCALE ☐		
4	MOUNTING	DIRECT ON RTD/TC ☐ YOKE ☐ OTHER	14	ACCURACY +/- 0.1% FSD		
5	ENCLOSURE	Dual Chamber ☐ EX. PROOF ☐ W. PROOF CLASS : IP - 65 INTRINSICALLY SAFE ☐	15	RFI / EMI REQD. ☐ PROTECTION		
			16	LOAD 600 OHMS DRIVING CAPABILITY 24 V DC		
6	AREA CLASSIFICATION	NEC, CLASS-1, DIVL.-1, GROUP C&D	17	MAKE *		
7	INPUT	FROM RTD	18	MODEL NO. *		
8	OUTPUT	4-20 mA	19	OPTIONS		
9	COLD JUNCTION COMPENSATION		a)	Output Meter WP & INTR SAFE		
			b)	Mounting For 2" Pipe Accessories		
10	BURN OUT PROTECTION		c)	SS Tag Plate		
TAG NO.	Temperature	RANGE		Temp.	SERVICE	OPTION
	Nor.	SPAN	SET	Design		
TT-**	**	*	*	**	RTD (4 wire)	a, b, c
NOTES: 1 *** As per P & ID 2 ** INFORMATION TO BE SUPPLIED BY VENDOR/ CONTRACTOR. 3 THE DIGITAL OUTPUT METER SHOULD INDICATE THE TEMPERATURE IN DEG. C. 4 ENVIRONMENTAL COVER TO BE PROVIDED FOR EACH TRANSMITTER (DRAWING ENCLOSED ELSEWHERE IN BID DOC.) & WITH LOCKING ARRANGEMENT FOR METERING TRANSMITTERS. 5 DUAL CHAMBER ENCLOSURE SHALL BE PROVIDED 6 MAKE OF TT SHALL BE AS PER VENDOR LIST ATTACHED WITH BID DOCUMENTS.						
1	DATA SHEET OF TEMPERATURE TRANSMITTERS				 MECON LTD. DELHI	
REV					DS No: MEC/ 05/E5/DS-TT	

DATASHEET OF DIFFERENTIAL PRESSURE GAUGE						
Project :- *						
Client :- *						
Contractor :- *						
FOA No. :- *						
Type				Direct		
Mounting				Local/ Surface		
Dial Size				150mm		
Colour				White with Black Numerals		
Case Material				SS 316		
Bezel Ring				Screwed		
Window Material				Shatterproof Glass		
Enclosure				Weatherproof to IP55		
Pressure Element				Diaphragm		
Element Material				SS 316		
Socket Material				SS 316		
Accuracy				± 1.5% of FSD or Better		
Zero Adjustment				Micrometer Pointer		
Connection				½" NPTF		
Connection Location				Side/ Bottom		
Movement				SS 304		
Over range protection				Maximum static pressure		
Blow out protection				Required		
5-way manifold				Required		
Make & Model				*		
Tag No.	Range	Operating Pressure	Design Pressure	Design Temperature	Fluid	Location
Refer P&ID						
NOTES: 1) ‘*’ Information to be supplied by the Vendor / Contractor. 2) Make of the DPG shall be from approved vendor list of Mecon /Client. 3) Detailed technical catalogue for offered model to be submitted by vendor/contractor during approval. 4) Differential Pressure Gauge shall be suitable for the maximum static pressure in both the legs. 5) Tapings (3/4" sw) for the DPG connections shall be provided on the inlet and the outlet nozzle of the gas filters. 6) Offered Model shall meet the tender requirement.						

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DIFFERENTIAL PRESSURE TRANSMITTERS WITH LOCAL DISPLAY									
Units:- Flow : Liquid-m ³ /hr Gas- MMSCMD Steam- kg/hr Pressure- Kg/cm ² (G) Temperature- °C Level/Length-mm									
GENERAL					MEASURING UNIT				
1	Function	Transmit & Indicate with Local Display			24	Service	Diff. Pressure		
2	Type	Electronic Smart μ P Based			25	Element	Diaphragm		
3	Case	Mfg. Std.			26	Body Material	Carbon Steel		
4	Mounting	Yoke			27	Element Material	SS 316L		
5	Enclosure	Weather proof to IS2147 Explosion proof to IS2148			28	Process Connections	$\frac{1}{2}$ " NPT(F)		
	Enclosure class	NEMA 4 & NEMA 7				Process Conn. Locn.	Bottom		
6	Elec. Area Class.	Zone-I, Gr.IIA & IIB, T3			29	Diaphragm Seal:-	Not Required		
7	Intrinsically safe & Flameproof	Required				Type	---		
8	Air supply	N.A				Wetted Parts Matl.	---		
9	Power supply	24 VDC				Other Material	---		
10	Cable entry	$\frac{1}{2}$ " NPT(F)				Process Conn.:-	---		
11	Accuracy	$\pm 0.075\%$ of SPAN				Size and Rating	---		
12	Self Diagnostics Facility	Required				Facing and Finish	---		
TRANSMITTER						Capillary Material:-	---		
13	Output	4 – 20 mA DC, Two wire				Armour Flexible	---		
14	Trans. Power supply	24 V DC				Armour Flexible Matl.	---		
CONTROLLER						Capillary length, mm	---		
15	Output					Flush / Filling Conn. with plug	---		
16	A/M switch				MISCELLANEOUS				
	No. of positions				30	Over Range Protection	130% of Range		
17	Set Point Adj.				31	Options			
18	Manual Regulator					a)	Intrinsically safe digital Output meter		
19	Mode					b)	5-way manifold-SS316 Body & Trim		
RECORDER						c)	Mounting accessories for 2" Pipe		
20	Chart					d)	Mounting – Material (SS 316)		
21	Chart Drive					e)	Local display in Kg/cm ² g		
22	Moving Parts Matl.				32	Load Driving Capability	SS Tag Plate		
23	Chart speed				33	Make & Model	Not less than 600 ohms		
							*		
Tag No.	Diff Range Kg/Cm ² g		Zero Elev. mm H ₂ O	Zero Supp. mm H ₂ O	Design Press.	Design Temp.	Control Action	Fluid	Options
DPT-**	Span	Set							
	*	0 - 2	*	*	**	**		**	a, b, c, d, e

NOTES:

- 1) ‘*’ – Information to be furnished by bidder.
- 2) ‘**’ As per P& ID
- 3) Make of DPT shall be as per vendor list attached with bid documents.
- 4) For installation refer MECON’s installation standards.
- 5) Environmental cover to be provided for each transmitter.
- 6) 5 -Way Manifold shall be provided.

1	DATASHEET OF DIFFERENTIAL PRESSURE TRANSMITTERS WITH LOCAL DISPLAY	 MECON LTD. DELHI
Rev.		

LIMIT SWITCHES		
UNIT : Flow-> Liquid-M ³ /hr Gas-MMSCMD steam-kg/hr Pressure-> kg/cm ² g Tempreature-> ⁰ C Level/Length-> mm		
S.No.	DESCRIPTION	TECHNICAL REQUIREMENT
1	TYPE	Snap Action Micro
2	Area class	IEC Zone-1, IIA, IIB, T3
3	Limit Switch & Enclosure	Weather Proof (IP65) and Flame proof (Exd)
4	Conduit	1/2" NPTF (NOTE -3)
5	Rating	1A @ 24 V DC
6	Form	SPDT
7	Quantity	One each for open & close status of SDV, valves across the USM (Quantity as per P& ID)
8	Model No.	BY VENDOR
9	Junction Box(Ex-Proof)	One no. per SDV be provided. Limit switches duly terminated with ½" NPT as conduit connection. All connection shall be provided with ex-proof cable gland.
NOTES : - Vendor to furnish model No. and decoding detailsof limit Switch accompanied with relevant catalogues (in English) literatures. - Hazardous Certificates with model No. shall be furnished along with offer - Flying leads are not acceptable. Cable shall be terminated upto JB		
1	DATA SHEET OF LIMIT SWITCHES	 MECON LTD. DELHI
Rev.		DS No: MEC/ 05/E5/DS- LS

SPECIAL INSTRUCTIONS TO THE VENDOR
(FOR FLOW COMPUTERS - FC)

The purpose of this specification is to define the requirements of 'Panel Mounted Flow Computers' part of the Metering Skid.

- 1) Vendor shall be responsible for selection of the correct model nos. of instruments to meet the purchaser's specifications. In case of model no. required to change at a later date to meet the Purchaser's Specifications, the same shall be done by the vendor without any price and delivery implications.
- 2) FC Vendor shall submit Make, Model No. with decoding details, Technical Literature and Catalogue of Flow Computer
- 3) The Flow computer along with all the accessories including Isolating IS barriers, a separate terminal strip for all SCADA signals to/from CLIENT's RTU shall be fully wired and mounted in Metering panel. (Under supplier scope).
- 4) **GSM Modem** shall be provided with each flow computer for remote data configuration, remote data uploading (previous 35 days data) and remote data monitoring.
- 5) The flow computers shall be microprocessor based, with data entry keypad and alphanumeric display with AGA firmware for natural gas flow measurement. Flow computer electronics shall be protected from industrial interferences and shall be shock and vibration proof.
- 6) Validation of Flow Computer (Flow Computation sheet comparing with standard software) confirming to latest AGA-9 (latest version) / AGA 5 / AGA-8 / GPA 2172 / GPA 2145 / AGA-7 to be submitted for all the flow Computers separately.
- 7) The flow computer shall have a facility for audit trail, web enabled and shall be compatible to calculate compressibility factor as per AGA-8 detailed method, provision for digital communication and pulse / frequency both.
- 8) The flow computer shall be certified for custody transfer applications by laboratory / institutes authorized by weights and measures authority of its country of origin such as NMI, PTB, Pigsar or other reputed International Standard laboratories such as Trans Canada Calibrations (TCC) Canada, Measurement Canada, Colorado Engineering Experiment Station Inc. (CEESI) USA., Calibration Certificates to be submitted for all the Flow Computers separately
- 9) The flow computers shall compute and display the instantaneous and totalized flow rate for each stream corrected for pressure and temperature variations. The flow computers receive data from the Gas chromatograph for calculation of compressibility factor as per AGA-8 detail method. The flow computers shall be linked to the CLIENT's RTU for providing the flow measurements of the individual stream runs and related process variables.
- 10) The flow computers shall have at least serial ports for communication purpose with RTU/SCADA, online GC and Printer, USB port / RS232 with adaptor for laptop connectivity (Port for Laptop connectivity to be provided in front side of the FC).
- 11) The power consumption of Flow Computer and other associated utilities of online system shall be considered for Backup calculation and finalization of Power requirement.
- 12) FC Vendor shall be provided all necessary assistance if required for Software Configuration, Flow Computation Checking & Serial Communication checking with RTU/SCADA, GC, & GSM modem etc.(RTU/SCADA are not in scope of vendor)
- 13) Vendor/ Supplier shall provide all necessary hardware, software, serial communication cables with connectors (for each connection 30 meter) etc. for FC connectivity to RTU/ SCADA, GC and USB port / RS232 with adaptor for Laptop. Other details required for interfacing of their Flow Computers with Purchaser's RTU/SCADA. In addition to this, the communication software shall be supplied in CD / DVD for testing the communication link.
- 14) **The Flow metering parameters shall be available for future SCADA through serial communication on MODBUS. All shall be configured and available on dedicated RS 485 port.**

1	SPECIAL INSTRUCTIONS TO THE VENDOR (FOR FLOW COMPUTERS - FC)	 MECON LTD. DELHI Page 132 of 644 Doc. No.: MEC/05/E5/FC-SIV
Rev.		

DATA SHEET OF PANEL MOUNTED FLOW COMPUTER

1. a) Type : Electronic microprocessor based, data entry key board, online user Configurable Flow Computer suitable for Orifice meter (flow computations as per AGA 3).
- b) Make : *
- c) Model No. : *
2. Inputs : a) 4-20 mA DC (2 Wire) superimposed with digital signal (HART Protocol) from Orifice Flow Meter Transmitter.
- b) 4-20 mA DC (2 Wire) superimposed with digital signal (HART Protocol) from 'SMART' Pressure Transmitters representing line pressure.
- c) 4-20 mA D.C. (2 wire) superimposed with digital signal (HART protocol) from 'SMART' Temperature Transmitter representing line temperature.
- d) RS 485/422 MODBUS spare.
- e) RS-485/422/232 MODBUS from Gas Chromatograph
- f) Additional 4 Nos. 4-20mA DC (2 Wire) superimposed with digital signal (HART Protocol) from 'SMART' Pressure Transmitters representing inlet line pressure, Temperature Transmitters representing inlet line temperature, Diff. Pressure Transmitters representing DP across filters in both streams (In case I/Os not available in flowcomputer then PLC shall be provided with each flowcomputer alongwith respective parameter indication on panel).
- g) I/Os from Water Dew point Analyzer & Hydrocarbon Dew point analyzer (In case I/Os not available in flowcomputer then PLC shall be provided with each flowcomputer alongwith respective parameter indication on panel).
- h) Other Standard Inputs available
3. Interfacing Capacity a) Flow computers shall be interfaced with Gas Chromatographs supplied by others for feeding online gas composition to flow computer through RS485/232 MODBUS serial link. Protocol Detail will be provided during detail engineering. Vendor shall be responsible for proper integration of their flow computer with gas chromatograph. Vendor shall provide all necessary hardware, software etc. in vendor's supplied systems and other details required for interfacing of their flow computers.

1	DATASHEET OF PANEL MOUNTED FLOW COMPUTER	 MECON LTD. DELHI
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b) Flow computers shall be interfaced with RTU for flow metering data as well as temperature and pressure, energy flow rate and total energy, corrected volumetric flow rate and total flow, yesterday's energy total and volume total, today's running volumetric total and energy total, volume and energy integrated at 6 a.m. etc. For RTU, vendor shall finally supply as per Hardware & Protocol Details provided during detail engineering.

4. Keyboard capability : The data entry keyboard shall have the provision to enter the following:

- a) Pressure and Temperature base factor
- b) Specific gravity and scaling factor
- c) Mole % or composition of the gas to be metered
- d) Report headings, frequency and timing of reports
- e) Selection of parameter to be displayed and on-demand printing of reports
- f) Calorific Value
- g) Flow, Pressure, temperature and density values and give compensated flow for any external conditions
- h) Gas compressibility
- i) The flow computer shall have provision to enter default values of all inputs (inclusive of gas chromatograph) low/high alarms for all inputs (inclusive of gas chromatograph) and shall be user configurable. The flow computer shall use the default values in case of any input goes beyond low/high limit.
- j) Other Standard features available

5. Outputs :

- a) 4 – 20 mA DC analog output for corrected volumetric flow rate, line pressure, line temperature, energy rate (4 Nos.)
- b) 4 – 20 mA DC analog output for corrected totalised volume and uncorrected totalised volume (in future).
- c) Contact Alarm outputs for unit malfunctioning, process alarm like low pressure etc. (3 Nos.) (In future).
- d) RS 485 serial output link for RTU / SCADA for all signals of this data sheet.
- e) USB port / RS232 with adaptor for laptop connectivity.
- f) RS-232 for Printer.
- g) RS-232 for GSM Modem.
- h) RS-485 / 232 spare.
- i) Other standard outputs available.

6. Isolation : Power supply shall be galvanically isolated. Analog I/Os and Digital I/Os shall be opto-isolated. (Active isolators, as required, shall be included by the vendor suitable for DIN rail mounting, inside vendor supplied control panel. 24VDC for powering the isolators shall be distributed by vendor inside their cabinet. Isolating relays shall be provided for potential free contact generation from switched inputs)

7. Computations :

- a) Volume Flow rate at standard, normal or operator specified base conditions (Sm³/ hr)
- b) Integrated corrected volume.

1	DATASHEET OF PANEL MOUNTED FLOW COMPUTER	 MECON LTD. DELHI
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- c) Energy flow rate and integrated energy.
- d) Linearisation of temperature input.
- e) Generation of Standard and user defined reports at printer. All reports shall be user configurable.
- f) Co-efficient of deviation from ideal gas law as per AGA-8 on the basis of specific gravity, temperature, pressure and mole % of N₂ and CO₂ and other compositions for flow computers. Flow computer shall have capability for both AGA-8 and AGA-Nx-19 with user selectable upon application requirement.
- g) Previous day's flow/energy (i.e. yesterday's 6.0 a.m. total volume/energy to today's 6.00 a.m. total volume/energy) & current running total for the day (i.e. volume totalizer / integrator value at 6.00 a.m. from first day) to be stored in a separate location (register) and these shall be user configurable.
- h) Today's accumulated flow/energy (running total since morning 6.00 a.m. to current time) and shall be user configurable.
- i) Generation of reports for totalized volume & energy at daily (6 a.m.) weekly, fortnightly & monthly intervals etc. shall be user configurable.
- j) All the above data shall also be made available by vendor in the serial links to RTU

8. Features :
- a) Built in online diagnostics to detect proper functioning.
 - b) Parameters and programmed constants to stored in EEPROM/non-volatile memory.
 - c) Super capacitor capable of storing data for three months without power.
 - d) A minimum memory to log 240 alarms and 240 events for 15 days.
 - e) Archival of data for up to 15 history points for 35 days.
 - f) Built-in Closed loop Controller (PID) functionality (If not built-in, separate Flow Controller having communication facility between Flow Computer and Flow Controller shall be provided with each Flow Computers including suitable mounting arrangements in the Metering Panel)

9. Database :
- a) Current value of each input and output.
 - b) Minimum and maximum values of selected variables for a period of two days.
 - c) Values of selected variables by minute for last 60 minutes and by hour for last 30 days.
 - d) Daily averages or accumulations of selectable variables for each contract day for up to 30 days.
 - e) Event log databases for last 240 parameter changes.
 - f) Alarm log database for minimum 15 days alarms set and cleared

10. Calculations standard :
- a) Volume flow rate & Total Flow: AGA Report 3(Latest)
 - b) Compressibility: AGA 8 (Latest)
 - c) Energy Rate & Integrated Energy: AGA 5 (Latest)

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11. Accuracy : Calculation accuracy shall be better than ± 0.05 % of full scale including linearity, hysteresis, repeatability and resolution. Accuracy for analog inputs to be ± 0.005 % of FSD at 23°C and Analog O/P accuracy to be ± 0.1 % at 23°C.
12. Scan Processing Time : a) The interval between computer readings of process variables shall not exceed 1 sec.
b) The interval between each cycle for computation of instantaneous flow rate and totalized flow shall be less than 1 sec.
c) Algorithm and rounding off error for computation shall be within ± 0.001 %
13. Security : Key lock shall be provided for prevention of unauthorized data entry. Two software security levels shall be provided. Multilevel software password protection shall be provided.
14. Display : Alphanumeric LCD with selectable decimal. Displaying all units, messages alarms etc in English. Flow computer shall have the capability of displaying any of the following parameters with Engg. Units.
- Uncompensated volumetric flow rate
 - Compensated volumetric flow rate
 - Totalised corrected flow,
 - Totalized uncorrected flow
 - Today's flow rate
 - Yesterdays flow rate
 - Density / Sp. Gravity
 - Pressure
 - Temperature
 - Energy Rate & Total Energy
 - Complete Gas Composition
 - Calorific value.
 - Data entry
 - Error codes
 - Selected parameter codes
 - Alarms (Process and Systems) including diagnostic message (i.e. Pressure out of range, Temp. out of range, Flow over range, Fault in measurement, Battery low etc.)
 - Other standard displays available
 - Audit Trail for Custody Transfer.
 - All the above data shall also be made available by vendor in the serial links to SCADA.
15. Units of display : a) Corrected flow rate: Std. Cubic meter/hr (SCMH)
b) Corrected totalized volume: Std. Cubic meter.
c) Pressure: Kg/cm²g
d) Temperature: °C
e) Energy: Kcal3
16. Power supply : 24 V DC with suitable Memory back up.

1	DATASHEET OF PANEL MOUNTED FLOW COMPUTER	 MECON LTD. DELHI
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17. Configuration setup : Configuration and monitoring of operation of flow computer shall be done through configuration software running on IBM compatible PC.
18. Ambient conditions : Temperature: 0 to 65 ° C.
Humidity: 5 to 95 % non-condensing.
Vibration: As per ISA S75-13-1989, sec 4.2 & 5.35
ECD susceptibility: Should meet IEC 801-2, level 3.
Base Pressure: 1.0332 Kg/cm²
Base Temperature: 15°C
19. Enclosure : General purpose
20. Mounting : Flush panel mounted.
21. Tag Nos. : FY-**
22. Quantity : **

GSM MODEM

- a) Suitable to communicate with CLIENT's SCADA / RTU.

Notes:

1. '*' Vendor to furnish.
2. '**' As per P&ID
3. Separate communication port shall be provided in the flow computer for laptop & printer connectivity.
4. Original licensed software for retrieving the stored data, programming the Flow Computer using Laptop, software based on Windows 2000/XP shall be offered.
5. 2 sets of Flow Computer documentation including product literature, software/hardware manual, operating manual, maintenance instructions, Modbus addressing etc. shall be supplied.
6. The offered Flow Computer shall meet the requirement for Custody Transfer as mentioned in API Chapter 21.1 for audit & trial. In this regard compliance certificate from competent authority and other relevant documents shall be submitted.
7. **GSM Modem** shall be provided with each flow computer for remote data configuration, remote data uploading (previous 35 days data) and remote data monitoring.
8. The Flow Computer shall be approved for Custody Transfer by NMI / PTB / renowned Lab.
9. Flow Computer Validation Software
Supplier to provide licensed Software in the name of Client for authenticating the algorithm written in the Flow Computer as per AGA-3.
10. Vendor shall confirm all the instruction given in "**SPECIAL INSTRUCTIONS TO THE VENDOR**" enclosed with these Data sheets.
11. The communication speed of RS485 (for SCADA) serial communication port for flow computer shall be configurable from 2400 to 19,200 bps.
12. The Modbus communication protocol and message structure details to be used on the RS485 serial communication port (for SCADA) for Flow Computer shall be supplied after placement of order. Vendor shall furnish all details like pin configuration and tag number

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- wise MODBUS address mapping list etc. for smooth interfacing of all communication links with RTU (SCADA in future).
13. Vendor/ Supplier shall provide all necessary hardware, software, serial communication cables with connectors etc. in vendor's supplied systems and other details required for interfacing of their Flow Computers with Purchaser's RTU (SCADA). In addition to this, the communication software shall be supplied in CD or floppy for testing the communication link.
 14. Vendor/ Supplier shall be fully responsible for proper integration of their supplied systems and also integration with purchaser's SCADA (RTU) systems at site and vendor shall provide all necessary assistance to purchaser's for establishing all the serial links with SCADA RTU fully functional & Operational.
 15. The Flow Computers Terminal shall have minimum one No. of RS-485 Communication Ports for SCADA as specified in Data sheet, one no. RS-485/232 communication port for GC (Gas Chromatograph), one USB or 232 with adaptor for Laptop, One no. RS-232 for Printer. The communication protocol shall be MODBUS, the detail will be furnished during details engineering, However it shall support reading & writing as follows:
 - a) For reading function, CODE-3 or CODE-4 is required.
 - b) For writing function, GC data into the flow computer function code to be 6 (Single) and 16 (Multiple) are required.
 - c) As most of CLIENT RTU is 16 Bit registers, two registers are used for accommodating one 32-bit floating point no. Hence the flow computer (irrespective of size of the register) should be configured as 16-bit registers so that no-error is encountered in writing.
 16. Make of FC shall be as per vendor list attached with bid documents.

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FIELD MOUNTED FLOW COMPUTER

1. Type : On line Solar Panel & Battery operated Microprocessor based electronic Flow Computer suitable for mounting in the field location in Hazardous area.
2. Function : The Flow Computer for measuring, monitoring Gas flow from single meters Run with a Gas meter. The FC measure actual gases volume, pressure and temperature and calculates compressibility factors of the gas and based on which calculates standard volume of gas. Computation of Gas Calorific values. The unit shall be complete in all respects to achieve this functionality.
3. Inputs & Outputs :
 - a) 4-20 mA DC (2 Wire) superimposed with digital signal (HART Protocol) from Orifice Flow Meter Transmitter.
 - b) Temperature signal from RTD (Pt-100 – 3/4 wires) thermal element with an accuracy of ± 0.15 % of measured value with thermowell. All interconnecting cable shall be screened and armoured. The cable and cabling accessories to be supplied by the vendor.
 - c) Pressure signal from built-in Pressure Sensor with an accuracy of ± 0.1 % of measured value and Range as per P&ID. Pressure sensors to be individually calibrated and characteristics stored within the flow computer.
 - d) Additional 4 Nos. 4-20mA DC (2 Wire) superimposed with digital signal (HART Protocol) from Diff. Pressure Transmitters representing DP across filters, inlet PT & inlet TT.
 - e) Other Standard inputs available.
4. Outputs port :
 - a) RS 232 Serial Port for PC/LAPTOP connectivity
 - b) RS 485 Serial Output port for SCADA facility.(Refer Note 15)
5. Output Measurement:
 - a) Corrected flow rate: Sm^3/hr .
 - b) Corrected Totalised volume : Sm^3
 - c) Pressure : $\text{Kg/cm}^2\text{g}$
 - d) Temperature : $^{\circ}\text{C}$
 - e) Alarm output for unit malfunctioning
 - g) Other Standard outputs available
6. Isolation : All Inputs, Outputs and power supply shall be Individually Isolated.

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7. Display : Alphanumeric large character LCD with selectable decimal, Displaying all units, messages, alarms etc shall be in English.
8. Units of display : User configurable parameters like
a) Corrected flow rate: Sm^3/hr .
b) Corrected Totalised volume : Sm^3
c) Pressure : $\text{Kg/cm}^2\text{g}$
d) Temperature : $^{\circ}\text{C}$
e) Energy (Kcal)
f) Yesterday's Flow (SCMD)
g) Non resettable total (SCM)
h) Days Total (SCMD)
i) $\text{Co}_2/\text{N}_2/\text{Sp.gravity}$ etc. etc.
9. Power supply : Solar Panel (SP) Charge System with 6/12 V DC Chargeable Gelcell Battery Backup for at least 15 non sunny days and mounting Hardware for Mounting in a Hazardous area. (Refer Note 7)
10. Configuration Setup : To be done in factory for all flow computer fully taking into account the process conditions, sensor & flowmeter's characteristics and calibrations for direct on site operations.
11. Calculations standard : a) Volume Flow calculations: AGA3 & ISO 5167 (Latest).
b) Compressibility : AGA 8 (Latest)/ GPA
Field selectable Detailed / Gross I / Gross II Methods.
12. Features : a) Built in diagnostics to detect proper functioning.
b) Data security through password/key-lock facility and volume conversion and configuration to be sealed.
c) Parameters and programmed constants shall be stored in EEPROM / non-volatile memory.
d) Facility for entry and accessing live and stored data through external Laptop/ PC.
e) Shall have to store at least 35 days data (on hourly basis) for flowing pressure, temperature and corrected flow with date and time stamping.
f) Shall have to store at least last 35 days cumulative corrected flow on daily basis

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g) The stored data above shall be retrievable by using Laptops. Suitable dedicated port shall be available on the flow computer for Laptops connection. Software required shall be supplied.

h) Shall have addressing facility for identification by its address, for multi-dropping on a single telecom channel

i) The Time Function should be real time with accuracy +/- 0.01% for watchdog timer and Year / Month / Day and hour / Minute / Second format.

j) Processor should be 32 bit CMOS Micro -processor and access should be password protected

k) Flow calculation shall be internal selectable through software

13. Hazardous area : Certified intrinsically safe for area classification IEC Class 1 Division 2, Groups C & D.
14. Site conditions : Temperature -20 – 65°C (Design), Hot, humid, tropical, saline environment. Vibration: Tested as per ISA 575-13-1989, Sec. 4.2 & 5.35, ECD susceptibility: Should meet IEC- 801-2, Level 3.
15. Enclosure : Weather Proof to IP 55 / NEMA 4 and Compatible for mounting in Hazardous area as mentioned above.
16. Mounting : Outdoor
17. Accuracy : 0.5 % or better (Bibber shall categorically indicate the system accuracy i.e. overall accuracy considering flowmeter, PT, RTD etc.)
18. Accessories :
a) 5 way Valve manifold –SS(½” NPTF) for process Connection.
b) Solar Panel to Flow Computer Connecting cable (Copper cable) Minimum 10 meters.
c) 2 “ pipe mounting brackets for Flow Computer (FC) and Solar Panel.
19. Make : *
20. Model No. : *
21. Quantity : As per P&ID.
22. Tag no. : FQI- xxxx (xxxx - As per P&Id)
* By Vendor (Vender must furnish decoding details & catalogue with model no.)

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22. GSM MODEM

- a) Suitable to communicate with Client's SCADA.
- b) **Suitable for mounting in the Hazardous area.**

Notes:

1. Original licensed software for retrieving the stored data, programming the flow computer using portable PC (Laptop), software based on Windows 2000/ XP shall be supplied in the form of CD's for each skid as per MR.
2. All the Hardwares and softwares to be supplied shall confirm the Engineering Units as mentioned in these specifications.
3. Flow computer documentation including product literature, software/hardware manual, operating manual, maintenance instructions, Certificates etc. shall be supplied as per vendor data requirement.
4. GSM Modem shall be provided in the flow computer for remote data configuration, remote data uploading (previous 35 days data) and remote data monitoring.
5. Following features shall be available in Field mounted flow computer:-
 - i) Energy measurement in functions and display.
 - ii) Memory allocations shall be as given below:-
 - a) 512 K x 16 flash memory with non volatile copy of program code.
 - b) Programmable peripheral chip with EEPROM contains boot ladder code.
 - c) 256 K of SRAM with copy of program code and data/exact logs.
 - d) Flash memory preservation shall be achieved by 10 year data unpowered retention.
 - e) SRAM memory preservation shall be battery backed by Lithium Cell when main power is lost.
- f) Bidder / Supplier shall submit the Battery sizing calculation, Details of battery & Solar Panel, Product Technical Literature along with offer. The Rating, make and other necessary details in support of selected model for Battery & Solar Panel shall also be submitted. The power consumption of Flow Computer, Modem, PT and other associated utilities of online system shall be considered for Backup calculation and finalisation of sizing of Battery.
6. The installation of flow computer, its batteries, solar panel shall be in safe area (appx 15 feet) or in separate canopy outside the main skid canopy with the necessary cables and accessories shall be done. This should be as per the IGE/TD/13 guidelines. The FC should be visible from outside.
7. Field Mounted Flow Computer shall store previous 35 days data on hourly basis and cumulative corrected flow on daily basis.

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8. Conduit connection of ½” NPTF with plugs shall be provided for output connection from Flow Computer.
9. Bidder/Supplier shall configure and update records in Flow Computer as per technical requirement and data sheet before Final Inspection call. The process parameter and the required measuring units are already specified in Data sheets/ Tender documents and it shall be made available in Flow computer. All the specified function and features shall be demonstrated during the Final inspection.
10. Bidder shall confirm all the instruction given in “SPECIAL INSTRUCTIONS TO THE VENDOR” enclosed with these Data sheets.
11. The communication speed of RS232 (for SCADA) serial communication port for flow computer shall be configurable from 2400 to 19,200 bps.
12. The Modbus communication protocol and message structure details to be used on the RS232 serial communication port (for SCADA) for Field mounted Flow Computer shall be supplied after placement of order shall furnish all details like pin configuration and tag number wise MODBUS address mapping list etc. for smooth interfacing of all communication links with RTU (SCADA in future).
13. Bidder/ Supplier shall provide all necessary hardware, software etc. in vendor’s supplied systems and other details required for interfacing of their Flow Computers with Purchaser’s RTU (SCADA). In addition to this, the communication software shall be supplied in CD for testing the communication link.
14. Bidder/ Supplier shall be fully responsible for proper integration of their supplied systems and also integration with purchaser’s SCADA (RTU) systems at site and vendor shall provide all necessary assistance to purchaser’s for establishing all the serial links with SCADA RTU fully functional & Operational.
15. The Flow Computers Terminal shall have minimum 1 Nos. of RS-485 Communication Ports for SCADA as specified in Data sheet, one no. RS-485/232 communication port for GC (Gas Chromatograph) OR for Laptop PC. The communication protocol shall be MODBUS and shall support reading & writing as follows:
 - a) For reading function, CODE-3 or CODE-4 is required.
 - b) For writing function, GC data into the flow computer function code to be 6 (Single) and 16 (Multiple) are required.
 - c) As most of CLIENT RTU is 16 Bit registers, two registers are used for accommodating one 32-bit floating point no. Hence the flow computer (irrespective of size of the register) should be configured as 16-bit registers so that no-error is encountered in writing.

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SPECIFICATIONS FOR LEL DETECTION SYSTEM

SERVICE : To detect the presence of Natural Gas in the various locations in Terminal area.

NO. OF DETECTORS / COMPOSITION : Refer Data Sheet enclosed for quantity requirements.

ALARMS : To be available in the respective Control Rooms.

RELAY CONTACT FOR EACH CHANNEL : Required

RELAY CONTACT FOR GROUPING : Required

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DATA SHEET

1) SENSOR:

TYPE	:	Poison resistant, infrared absorption type for combustible gas or vapours. (Non-selective)
CONSTRUCTION	:	Explosion proof, SS 316 body with stainless steel flame arrestors, dust cover, weather proof as per NEMA 4X or IP 65 (NOTE-1) . Sensor element shall be replaceable type / plug in type. Terminal box shall be provided for further cabling. Flying leads shall not be offered. Cable entry shall be ¾" NPT (F) (NOTE-2) .
ELECTRICAL AREA CLASSIFICATION	:	Zone –1, Gr. II A & II B, T3
RANGE	:	0 –100 % LEL
ACCURACY	:	± 1 % of gas reading @ ≤50% LEL, ± 5 % of gas reading @ > 50% to 100% LEL
MOUNTING ACCESSORIES	:	Vendor to indicate.

NOTE 1: Splash guard & weatherproof cap for protection against dust and rain shall be provided.

NOTE 2: The junction box shall be weatherproof to IP 55 and certified to Explosion proof.

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2) GAS MONITOR / CONTROLLER:

- TYPE : Solid state electronic, panel mounted plug in modular construction
- NO. OF CHANNELS: No of Channels shall be as per attached sheet with this specification. However, single loop integrity shall be maintained by one monitoring card per sensor. Single Channel Monitors shall be offered.
- POWER SUPPLY : 24 V DC Monitor / Controller shall supply power to sensor.
- RANGE AND METER CALIBRATION : Adjustable between 0-100 % LEL
- INDICATORS : Required 0 –100 % LEL.
- INDICATOR LIGHTS: (Separate for each channel) Power on by a confidence flash for every 2 seconds.
20 % LEL
40 % LEL
Malfunction (malfunction shall include short cut. line breaking, over range and earth fault.)
- OTHER FEATURES : a) Dual adjustable set points for gas level alarm.
b) SPDT latching type relay contacts shall be provided for following:
- i) 20 % LEL (each channel)
-alarm high (adjustable)
 - ii) 40 % LEL (each channel)
-alarm very high (adjustable)
 - iii) Malfunction (common)
 - iv) 20 % LEL (Common)
-alarm high (adjustable)
 - v) 40 % LEL (Common)
-alarm very high (adjustable)
 - vi) Two spare potential free outputs for future use.
- c) Relay contacts shall be suitably rated for the specified power requirements.
- d) Reset push button (common)
- e) Sensor calibration without alarm outputs shall be achieved by inhibit switch on relevant channel.

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MOUNTING : Monitors / Controllers shall be supplied mounted in 19” racks with screwed terminals at the back. However 19” racks shall be fully wired-up in ready to use condition. Dummy plates shall be provided on spare channel slots wherever required (20 % spare slot shall be provided wherever applicable).

CALIBRATION : Set of fully equipped calibration gas kit consisting of at least a cylinder / bottle of calibration gas for minimum 6 months use (of known mixture of air and gas) , a pressure regulator with gauge , flexible tube / hose , adapter cap (to fit sensing head) shall be supplied to enable online calibration of LEL detectors.

NOTE:

1. The Bidder shall indicate distance limitation if any between Sensor and Monitor.
2. RS – 485 port shall be provided in monitor / controller for RTU / SCADA.
3. All the Digital signals from monitor / controller shall be terminated upto RTU / SCADA TB.

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SPECIAL INSTRUCTIONS TO VENDOR FOR LEL DETECTION SYSTEM

- 1) Vendor to note that the offered instruments shall be suitable for the following ambient conditions :

Temperature Range : 48°C (Max.)
Humidity : 99% (Max.)
Rainfall : 1000mm (Max.)

- 2) Power Supply shall be from the respective control panel to each monitor rack at each terminal, Power distribution is in the Vendor's scope. If conversion to DC level is required, the system shall be based on dual redundant power packs.
- 3) Vendor shall furnish the statutory certificates of explosion proof for both LEL detector and the junction boxes along with offer.
- 4) Vendor to note that the pellister of the detector must be poison resistant to the normally known pollutants present in a hydrocarbon processing industry including sulphides, SO₂, chlorides, dust etc.
- 5) Mounting details of the LEL detectors shall be furnished.
- 6) Adjustable set points shall be provided at the monitors.
- 7) Calibration gas suitable for the calibration of LEL detectors shall be included in the offer.
- 8) Mute circuits with acknowledge and reset buttons shall be provided.
- 9) Detailed configuration diagram showing connection of monitor etc. along with detailed catalogues, manuals etc. shall be furnished along with offer.
- 10) Time period required between successive calibrations of the LEL detectors shall be furnished in the offer.
- 11) Commissioning Spares for all the items shall be included in the offer. The vendor shall furnish the detailed list of the commissioning spares in the offer

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LEL SYSTEM FOR EACH PANEL MOUNTED FLOW COMPUTER
METERING SKID

- 1) FLAMMABLE GAS DETECTORS.
- 2) EXPLOSION PROOF JUNCTION BOXES.
- 3) WEATHERPROOF CAP.

QUANTITY (Sensors) : 4 NOS.
 MONITORS / CONTROLLERS : 1 Set
 NO OF CHANNELS : 8 NOS. (With Common Indicating Meter)
 MONITORING CARDS : 4 NOS.
 CALIBRATION KIT : 1 Set.

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SPECIAL INSTRUCTIONS TO THE VENDOR

1. Scope

The Gas Chromatograph is a part of the metering skid and shall be supplied along with respective metering skids. The GC Vendor along with skid Vendor shall execute this part.

- a) Technical specification, Data sheets attached in the bid document, covers the minimum requirements for the complete design, engineering, material selection, manufacturing, supply, nameplate marking, inspection, testing, shipping, erection, testing and commissioning of On-Line Gas Chromatographs with all accessories for Metering Skid. Controller along with Zener Barriers/Isolators shall be fully wired and mounted in the same metering Panel to be installed in the Control Room. Printer with stand (if not an integral unit with GC) along with connecting cables, shall be loose supplied. The Sampling System, Gas Analyser, Calibration, and Carrier Gas Cylinders all will be on skid mounted in field and suitable for installation in hazardous area and specified weather condition. For detail scope of work refers Bill of Material (Indicative) mentioned elsewhere in this document.
- b) In the event of any conflict between technical specification, data sheets, related standards, codes etc. the Vendor should refer the matter to the purchaser clarification and only after obtaining the same should proceed with the manufacture of the items in question.
- c) Purchaser's data sheets indicate type, minimum sampling system requirements and material of construction for Gas Chromatograph and its sampling system. However, this does not absolve the Vendor of the responsibility for proper selection with respect to the following:
 - ii. Proper design of the sampling system and gas chromatograph to measure the component of interest to the stated accuracy.
 - iii. Selection of materials for all the parts of the gas chromatograph system so as to be compatible with the process stream and surrounding atmosphere as per purchaser's data sheets.
- d) Vendor shall note that the offered instruments shall be suitable for the following ambient conditions:

Temperature Range: 65 °C (MAX), 5 - 40 °C (operating)
Humidity : 100 % (max)

- e) Vendor shall be responsible for selection of the correct model no. of instruments to meet the specifications contained in the spec. In case of model no. required to be changed at later date, the same shall be done by the Vendor without any price or delivery implications.
- f) Offer shall be clear, unambiguous (with no alternatives) and complete with all data sheets, catalogues etc.
- g) Gas Chromatograph shall be connected to the Flow Computers (the scope of SKID Vendor). Hence suitable interface & integration with Flow Computer is under Vendor's scope.
- h) Separate Analyser Cabin, necessary Sample Handling System, 20D straight run shall be provided as per the ISO10715. Tubing from main pipeline to Analyser Cabin (approximate distance between Analyser Cabin and Sampling Point on the pipelines will be min. 50 mtr.), Bottles and Skid for mounting are under Vendor's scope.

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- e) Vendor shall provide certificate for all the tests indicated in FAT. In addition, Vendor shall provide the 'Manufacturer's certificate of Conformity' to purchaser's specifications as per clause 2.2. of DIN 50049.

2. Spare Parts:-

- a) **Consumable as a part of the offer.**
b) **Commissioning spares as a part of the offer.**

3. Special Tools and Tackles for Operation & Maintenance of GC. List must be furnished along with the offer. (if required)
4. All units of measurement for various items in Vendor's specification sheets shall be to the same standards as in purchaser's data sheets. All instruments shall be graduated in the same engineering units as indicated in purchaser's data sheets.
5. All the materials specifications for various parts in the Vendor's specification sheet shall be to the same standards as those in purchaser's data sheets e.g. ASTM, BS etc.
6. Vendor shall not offer any prototype instruments in his bid. All instruments offered should have been proven in refinery or petrochemical plants before bidding.

7. Drawings & Data

Vendor shall submit all the datasheets/drawings/documents as indicated below,

a) Along with the offer

Vendor's Offer shall include a detailed specification sheet for Gas Chromatograph system which shall contain the following information:-

- i. All the details regarding type, construction, materials, accessories etc. of the On-line Gas Chromatograph along with technical catalogue.
- ii. Detailed sketch showing various components of sampling and sample conditioning system.
- iii. Sample flow rates required achieving response time, the recommended length and size of the sampling tube between process tap and sampling system.
- iv. Any special cabling requirements including shielding and grounding requirements and maximum permissible distances of separation between the field and the control room mounted units etc.
- v. A Copy of the Certificate of intrinsic safety/ flameproof from statutory body like BSEEFA, FM, PTB, CMRI etc. as applicable.
- vi. Consumption figures of electrical power and other utilities for each gas chromatograph system.
- vii. Overall dimensions of major units dimension of the skid to be mounted in field.

b) After Placement of Order

Vendor shall submit certified drawings and specification sheets for Gas Chromatograph which shall include the following (* marked shall be submitted for approval)

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- i. * Bill of Material of the complete G.C system.
- ii. * G.A Drg. With overall Dimension of both Sampling unit & Panel.
- iii. Sampling interconnection details identifying each component with make and model number.
- iv. Detailed interconnection diagram for process, piping and tubing. (Hook up Diagram)
- v. Installation drawings.
- vi. Calibration curves as required for each Gas Chromatograph system.
- vii. Cabling details including shielding / grounding requirements.
- viii. Utility consumptions.
- ix. Technical Literatures, Installation & Commissioning Manuals for all supplied items.
- x. Quality Assurance Plan.
- xi. Software required for the systems.
- xii. Wiring Diagram of Panel.
- xiii. Cable Parameters (Capacitance, inductance, L/R ratio) for interconnection cable between field and the control room mounted units for intrinsically safe system.
- xiv. The details of the heat load, humidity particulate / chemical filtration etc. of the system.
- xv. Vendor shall provide certificate for the entire test indicated in FAT. In addition, vender shall provide the “manufacturer’s certificate of Conformity” to purchaser’s specifications as per clause 2.2 of DIN 50049.

8. Indicative Bill of Materials for On-Line Gas Chromatograph

Field Mounted Items:

- a) Analyser for Gas Chromatograph with Necessary Certificate (CENELEC, CE, NMI etc.), 230/110 VAC / 50 Hz, One steam / one Cal., Power and signal cables and all accessories.
- b) Sample probe (SS) (inlet ¾” outlet ¼” - or as recommended) with SS Relief valve and pressure gauge, Thredolet 3000 # material ASTM – A-105 (as per ANSI B 16.5) thread as per ANSI B 1.20.1, necessary assembly consisting of Ball valve, manometer and Relief Valve etc.
- c) Sample line (1/16” or 1/8” SS tubing in protective Hose.) minimum 30 mtr.
- d) Sample Conditioning Cabinet with all accessories, equipments, PRV, Flow meter, PG, filters, Moisture Trap etc. and fittings.
- e) Mounting Skid for of Analyser, sampling conditioning cabinet and the bottle stand with vent system of 3 mtr. An explosion proof Junction Box with Switches for signal & power supply along with necessary power & signal cables and glands.
- f) Bottle (duly filled for Calibration Gas, Carrier Gas) & Bottle Stand with Bottle pressure regulators, Automatic switchover system for Carrier Gas, Heating plate etc.
- g) All Cables, Glands, Terminals, Tubing, structural items, Panel accessories required for installation of the system is in vendor’s scope.
- h) Dedicated earthing terminal has to be provided on the skid.

Control Room Mounted Items:

- a) Programmable Control Unit with all inputs/outputs and serial / communication ports as mentioned in Technical Specification.

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- b) G.C controller inside metering Panel along with all accessories like Zener Barriers/Isolators, AC/DC Converter, Power Supply unit, etc, as required to be installed in metering Panel.
- c) All required Signal Cables (armored) / Fiber Optic Cables, Power Cables and RS 232 Communication Cable (min 10 -15 Mtr) for each computer and Cable Glands.
- d) Colour Desk Jet Printer with printer table including all the cables (If not the integral part of GC).
- e) The Flow computer and GC communication (on serial port) and further for SCADA if required in the scope of vendor.

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DATA SHEET OF ON-LINE GAS CHROMATOGRAPH

1. SERVICE CONDITIONS

- Tag Nos. : AE - **
- Quantity : **
- Gas Composition : Refer Bid Documents
- Gas Pressure (Operating) : **
- Gas pressure (Design) : **
- Gas Temp (Normal) : **
- Gas Temp. (Design) : **
- Moisture Content : Dry Gas
- Line Size / Rating / Sch. / Flow : **

Tag No.	Line Size	Rating	Sch.	Max. Flow (MMSCMD)	Remarks
AE -**	**	**	STD	**	

11. Power Supply : 230/110 V, 50 HZ

12. Instrument Air : Not Available

‘**’ As per P& ID

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DATA SHEET FOR LAPTOP (TYPICAL)

1. All components / peripherals of the Laptop should be from OEM only. Authorised distributors doing local integration are disqualified and rejected.
2. The system offered should be modular in design with reference to both hardware / software to enable future upgradation and expandability. Only latest proven commercial release of the hardware and software should be offered.
3. The Laptop shall be supplied with all necessary power, communication cables with connector of main supplier and suitable to the Indian standards.
4. Technical literatures / Manuals / user instructions.
5. The minimum Specification of the Laptop shall be as follow:
 1. CPU : Intel Dual Core, 2.0 Ghz integrated cache
 2. Memory : RAM 1 GB DDR2 (Min.)
 3. HDD : HDD 160 GB (Min.)
 4. DVD / CD RW COMBO DRIVE
 5. Monitor 15"/ 17" TFT screen
 6. Intel Graphics Media accelerator 900 with up to 128 MB Shared Video Memory
 7. Integrated wireless Blue tooth
 8. Multimedia
 9. 56 K modem
 10. OS : WIN XP Professional (Licensed)
 11. Original Licensed Antivirus Software & MS office
 12. Port required (Min.): 1 serial, RJ 11, 3 USB port, RJ 45 -10/100/1000T Gigabit NIC, 9 Pin D connector serial ports (one male & one female) and 15 pin serial connector.
 13. Laptop Bag with all accessories.
 14. Warranty : 1 year OEM standard
 15. Make : Compaq / Dell / IBM / HP

1	SPECIFICATION FOR LAPTOP	 MECON LTD. DELHI
Rev.		DS No: MEC/ 05/E5/Spec.- Laptop

Rev. : 0

Edition : 1

TECHNICAL SPECIFICATION FOR GAS POWERED VALVE ACTUATORS

SPECIFICATION NO.: MEC/ TS / 05 / E5 / 002A



**ELECTRICAL & INSTRUMENTATION
(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

03.01.2015			
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Date	Prepared By	Checked By	Approved By

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- PHILOSOPHY FOR AUTO-CLOSURE OF VALVES

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1.0 SCOPE

- 1.1 This specification, together with the applicable data sheet, covers the minimum requirements for the design, manufacture, inspection, testing and shipping of valve actuators complete with accessories for quarter turn ball/ plug valves.
- 1.2 This specification indicates the minimum supply requirements and does not relieve the vendor from his responsibilities concerning the design and the safe operation of the supplied equipment.
- 1.3 The valve manufacturer shall also be responsible for proper operation of the actuator that shall develop a torque or a thrust sufficient to conveniently open and close the valve always with in the limits established by the resistance of the mechanical elements of the valve itself.
- 1.4 Valve and actuator shall be supplied as a single assembly complete in all respect and ready for installation at site.

2.0 REFERENCE DOCUMENTS

Reference is made in this specification to the latest edition of the following codes, standards and specifications:

Codes and Standards

ASME B31.8	:	Gas Transmission and Distribution Piping Systems
ASME B16.5	:	Steel Pipe Flanges and Flanged Fittings
ASME Sec. VIII	:	Boiler and Pressure Vessels, Code.
ANSI B2.1	:	Pipe Threads, General Purpose
NEC	:	National Electric Code
IEC	:	International Electro-technical Commission
NEMA	:	National Electrical Manufacturers Association

In case of conflict between the requirements of this specification and above referred documents, the requirements of this specification shall govern.

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3.0 **ACTUATOR SIZING**

3.1 For sizing the actuator, valve manufacturer shall furnish to the actuator manufacturer the following information:

- a) The maximum break - away torque or thrust required at the valve stem with manual/ remote operation to open and close a valve at the shut off pressure in the line. The actuator shall be sized at pressure indicated in Table-2 of datasheet and meeting the safety factor of 1.25 as required by the valve operation at the shut-off pressure in the line.
- b) The temperature correction factor.
- c) The pressure correction factor.
- d) As a result of points (a) to (c) the minimum required torque or thrust output of the actuator.
- e) Maximum allowable torque or thrust output of the actuator depending on the type and size of valve.

3.2 The maximum time required to open and close a ball valve shall be as indicated in the data sheet.

3.3 Actuator manufacturer shall provide the complete model no. decoding for actuators, limit switches and solenoid valves.

3.4 Complete details of Gas/ Hydraulic circuit with complete sequencing of port from open to close and close to open position shall be furnished in the offer for review.

3.5 Manufacturer shall furnish the detailed calculation for actuator sizing after placement of order. The calculation so furnished by manufacturer shall satisfy the sizing criteria as per above clauses. Manufacturer shall agree to upgrade the actuators offered to meet the sizing criteria without any price and schedule impact.

4.0 **DESIGN FEATURES**

4.1 The actuators shall be powered by Natural Gas from the main pipeline. The gas powered actuator shall operate at pressure indicated in Table-2 of datasheet. A typical scheme for tapping the gas from mainline with pressure reduction is shown in Sketch-1. Actuator electrical/ hydraulic circuit shall be developed as per the Sketch-2 enclosed.

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4.2 Actuator shall be direct gas operated scotch yoke type with manual hydraulic override. The actuator shall be provided with a hydraulic pump for manual operation. If there is no gas pressure available to actuator it shall be possible to actuate Direct Pneumatic Actuator by means of Nitrogen bottles or similar pressure source. Actuator manufacturer shall furnish the capacity and set pressure of nitrogen bottle for at least two opening and two closing strokes of the actuator.

4.3 The actuator shall be suitable for gas operating conditions and ambient temperature as specified in data sheets. The presence of methanol in the gas shall not affect the service of the Actuator.

4.4 All materials in contact with natural gas shall be suitable for the gas composition attached with this specification.

4.5 The actuator and its accessories shall be suitable; for outdoor installation and have weatherproof enclosure as per NEMA 4 or equivalent.

All compartments and housing containing electrical devices such as switches, contactors, relay, fuses, terminal box etc. shall be explosion proof suitable for NEC Class 1 Div. 2 Gr. C & D, T3 or equivalent. The cable glands shall be 1" NPT thread. The unused cable entries must be plugged off with solid metal plugs.

Solenoid valves shall be of explosion proof design certified for NEC Class 1 Div. 2 Gr. C & D, T3 or equivalent with moulded continuous duty coils and stainless steel valve body.

4.6 All pressure containing parts shall be designed to ASME Section VIII.

4.7 a) The actuator shall be suitable for direct mounting to the valve without changing the standard top works of the valve and shall have the capability to be mounted or removed from the valve when the valve is in service. The actuator shall be flanged and bolted directly on the valve body or extension. The connection between actuator and the valve or between the operators, the outer casing of the extension and the valve shall be such that there is no movement between these connections when the valve is actuated by the actuator under any load.

b) Actuator shall be suitable for installation on a vertical stem unless otherwise specified in the data sheet.

4.8 Provision shall be made to prevent accidental pressure build up in the actuator.

4.9 The construction of the actuator and its controls shall be such that proper manual operation and maintenance can be carried out by skilled personnel without the risk of being injured by moving parts.

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- 4.10 A position indicator on the actuator shall show the valve in the open, closed or partially open positions.
- 4.11 Bearings shall be factory packed with grease and shall not require additional lubrication for the life of the actuator.
- 4.12 Unless specified otherwise in the data sheet, the actuator shall be equipped with limit valves, which immediately shut off the gas supply to actuator when the valve reaches one of its end positions.
- 4.13 Actuator shall be provided with pressure gauges for pneumatic and hydraulic systems. The pressure gauges for the hydraulic system shall be in circuit with the pressure relief system.
- 4.14 In selection of pressure regulator due consideration shall be given to the effect of cooling of gas at the regulator and its down stream section.
- 4.15 A high pressure dehydrating filter cartridge shall be provided to remove condensate, moisture, foreign particles and any corrosive contaminants from pipeline gas.
- 4.16 The sound level of the gas escaping into the atmosphere when the actuator is in operation shall not exceed 90 dBA, measured at a distance of 10 meters.
- 4.17 The actuator shall be operated by either of the following two methods:
- For the remote control, the actuator shall have a solenoid valve, limit switches, relays, etc. and shall be suitable for remote and local operation as per description in the attached Actuator Data Sheet(s). Electrical signal supplied is a momentary type with 1 sec duration signal, Actuator shall have a self retaining system of the above signal in its control circuit.
 - For the local-control the actuator shall be suitable for local operation with line gas feed lines or through nitrogen bottles. The devices and accessories, which do not require the electricity for their operation, shall be provided in the actuators as per this specification. The actuators shall have a hand pump in conjunction with the oil circuit to achieve local control with hydraulic shock functionality.
- 4.18 The actuators shall be provided with limit switches for open and close positions. The position of switches shall be adjustable near the valve open and close positions. The limit switches shall be wired up to terminal block and shall be numbered for proper identification. The limit switches shall have 2 sets of contacts for each open and close position. The contact rating shall be as specified in the data sheet. The power to solenoid valves shall be cut-off when the actuator has travelled to extreme positions (close and open).

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4.19 The limit switches shall be wired in the actuator control circuit by the vendor so as to cut off power to the actuator once the end positions of the valve are reached. This is required to de-energize the solenoid valves in the steady state condition and failure of electrical power will not affect the valve position.

4.20 The stroke of the Actuator shall be easily adjustable in steps of maximum 0.5° for Ball/ Plug Valves.

4.21 Speed control nozzles for adjusting the valve speed over a wide range shall be provided.

4.22 If remote control is required, a local/ remote switch shall be installed to prevent remote control during maintenance work. This switch shall be provided with a hole 12 mm in diameter for locking with pad lock in either position. This local/ remote switch shall be wired up to the junction box as per circuit diagram.

All control accessories, pneumatic and hydraulic, shall be mounted in an enclosure and shall be fully wired and tubed. The enclosure shall be weatherproof as per NEMA-4 or equivalent.

4.23 All bleed and vent connections wherever required shall be piped outside the actuator cabinet so as to prevent gas pocketing inside the actuator cabinet. The actuator shall be of an automatic self purging design such that any gas pocket in the actuator will be eliminated.

4.24 Vendor shall be responsible for integrating the potential free NO or NC contacts of Remote Telemetry Unit (RTU's) for open and close command in interlock circuit. These commands will be of momentary type with 1 sec duration.

4.25 All mounting accessories needed for installing the actuator, tanks etc. are in manufacturer's scope of supply.

4.26 The interconnecting cabling, interconnecting pipe work between the actuator and the valve, adapters, tubing, cable glands, junction box are in manufacturer's scope of supply.

4.27 The actuator shall be supplied totally self-contained, wired, tubed and mounted on ball valve. In case of a separate control box, wiring and tubing between control box and actuator is in the vendor's scope. Three meters of ¾" tubing set including all connectors between the actuator and the control box and three meters of interconnecting piping work upstream & downstream of the valve and the control box be provided. Owner shall provide 20mm (3/4") SW tapping on process main line for line gas tapping.

4.28 Threading connections shall be NPT as per ANSI B2.1 and flange connection as per ANSI B16.5. The tubing, fittings and valves shall be stainless steel with Swage Lock

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fittings or equivalent.

5.0 COATING

The actuator, including gear boxes and piping, shall be coated as described below :

- 5.1 Removal of all rust by means of emery cloth or wire brush.
- 5.2 Short blast as per Swedish Standard No. SIS 055900 latest edition SA 2.5 one layer Primer Epoxy – Polyamide DFT 75 microns intermediate layer Epoxy – Polyamide DFT 25 microns, final layer Epoxy – Polyamide DFT 75 microns. Total DFT 175 microns and colour RAL 5012 (light blue).

6.0 INSPECTION AND TESTS

- 6.1 Test at the Actuator Manufacturer's Shop
 - a) Electrical and mechanical operating tests.
 - b) Seal test of hydraulic circuits.
 - c) Check of required functions.
 - d) Check of operating time control.
 - e) Check of limiting device operation.
 - f) Check of actuator torque or thrust.
- 6.2 Test at the Valve Manufacturer's Shop
 - a) Test and check covered by point 6.1 after assembly with ball/ plug valve.
 - b) No load test (DP=0) or load (DP max) Operations with the minimum required feeding pressure (pressure indicated in Table-2 of datasheet).
 - c) Check of the limiting device operation.
 - d) Various tests on the valve according to provisions of specific documentation.
 - e) Testing shall conform to actual field operating conditions.
- 6.3 All actuators shall be visually inspected.
- 6.4 Dimensional check on actuators shall be carried out as per the Purchaser approved

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drawings.

- 6.5 Purchaser reserves the right to perform inspection as indicated above at Manufacturer's works prior to shipment. Manufacturer shall give reasonable access and facilities required for inspection to the Purchaser's Inspector.

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

7.0 NAME PLATE

Actuator shall have a SS name plate attached firmly to it at a visible place and reporting the following information :

- Instrument tag number as per Purchaser's data sheets.
- Manufacturer's model, trade mark, serial no etc.
- Max. allowable operating pressure or voltage.
- Area classification in which the equipment can be used.
- Actuator characteristics data.
- Inspection agency name or logo.

8.0 SHIPPING

- 8.1 All threaded and flanged opening shall be suitably protected to prevent entry of foreign material.

- 8.2 The actuator shall be supplied pre-assembled except piping/ tubing, actuator, actuator control unit, tanks and other accessories shall be packed separately.

- 8.3 Protective grease oil coating shall be applied on the surface to protect them from rusting.

- 8.4 Package shall be marked legibly with suitable marking ink the following :

- Order number
- Package number
- Manufacturer's name
- Model no. & Thrust
- Tag number
- Inspection agency name or logo

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9.0 DOCUMENTATION

9.1 At the time of vendor drawing approval the manufacturer shall submit the following documents in accordance with EN102043.1C.

- a) A detailed specification sheet for valve actuator providing all the details regarding type, materials of construction for various parts etc.
- b) Schematic diagrams showing the complete actuator control circuit.
- c) A detailed dimensional drawing.
- d) Installation drawing complete with valve assembly.
- e) Actuator sizing calculations including relation between required torque of valve and actuator output torque.
- f) Information asked for vide section 3.0 of this specification and actuator sizing as per Actuator Data Sheet.
- g) Drawing showing connections by Purchaser (piping, electrical etc.)
- h) Wiring diagram (actuator electrical circuitry) incorporating latching of momentary signals, remote/ local switch, limit switches.
- i) Junction box terminal block nos. for I/O signals.
- j) Parts list.
- k) Recommended spare parts with prices.
- l) Assembly details (Valve & Actuator).
- m) Clause wise list of deviations from this specification, if any.
- n) Information regarding the past experience on similar actuators including (a) Size (b) Numbers (c) Name of Installation (d) Owner (e) Name of Contact Person (f) Date of Installation.
- o) Technical Catalogue giving detailed Technical Specification. and other information for each type of actuator and its accessories covered in the bid.

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9.2 Within 30 days from the date of Purchase Order manufacturer shall submit copies of the following for Purchaser's review and approval.

- a) Documents and specifications as listed in clause 9.1 of this specification.
- b) Test certificates and certificates from statutory bodies.
- c) Manual for installation, erection instructions, maintenance and operation instructions.
- d) Complete assembly drawing of the ball valve matching with the actuator offered.

The approval of these drawings/ documents will not absolve vendor of the responsibility with respect to correct operation of the actuator. Manufacturer's quotation, catalogues, drawings, operating and maintenance manuals etc. shall be in English language.

10.0 SPARES AND ACCESSORIES

Vendor shall quote for two years operational spares, commissioning spares, and any special tools needed for maintenance work on the actuator and its accessories.

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DATASHEET FOR GAS POWERED ACTUATORS FOR BALL VALVES

1. Actuator Manufacturer : By vendor
2. Specification for Gas Powered Actuator : MEC/ TS / 05 / E5 / 002A
3. Actuator Type : On-Off
4. Tag No. : As per the Table-1
5. Line No. : As per the Table-1
6. Service : Natural Gas
7. Vendor to furnish, after sizing the actuator, the filled in torque table no-2
8. Actuator Shut-off Pressure : As per the Table-1
6. Process Conditions
 - Power Gas : Natural Gas
 - Gas Temperature : As per the Table-1
 - Line Gas Pressure : As per the Table-1
 - Molecular Weight : As per gas composition
 - Cp/Cv : As per gas composition
 - Compressibility Factor : As per gas composition
10. Power Gas Feed Connection from main line : 3/4" SW
11. Actuator remote operation (for open and close) : Required
12. Actuator Feed Gas :
 - a) Line gas
 - b) N₂ Bottles
13. Valve Position Limit Switch : Required (SPDT contact for open and SPDT contact for close position separately)

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14.	Local/ Remote selector switch and its status contact	:	Required (shall be wired up to junction box as per circuit diagram)
15.	Pneumatic limit valves and solenoid, pilot valves to shut-off gas supply to actuator when valve reaches one of its end positions	:	Required
16.	Self retaining system for retaining momentary open or close signals in the control circuit	:	Required
17.	Electrical conduit connection (cable entries to junction box for purchaser's cable)	:	1" NPT
18.	Operating voltage for a) Solenoid Valves b) Relays	:	24V D.C. $\pm$ 10%
19.	Contact rating for a) Limit Switches b) L/R Switch (Status)	:	2A at 24V D.C.
20.	Pad lock with L/R Switch	:	Required
21.	Enclosure for a) Actuator b) Electrical items like solenoid valves, junction boxes, relays, cable glands	:	Certified weatherproof as per IP-55 Certified weatherproof to IP55 & Explosion proof certified for Class 1 Div. 2 Gr. C & D T3
22.	Area Classification	:	NEC (Class 1, Div. 2, Gr. C & D, T3)/equiv
23.	Material of construction for all tubing, valves, piping and fittings etc.	:	SS 316
24.	Make & Model No. of Actuator	:	By vendor
25.	Accessories Required	:	Required as per Specification
26.	Manual/ Hydraulic Override	:	Required as per Specification
27.	Time required for full opening/ Closing of the ball valve	:	2–3 sec. per inch. Nominal valve port Dia.

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TABLE-1

ITEM : GAS POWERED BALL VALVE ACTUATORS

S. No.	Size	Class	Type of Valve	Line No.	Gas Temp (°C)		Line Gas Pressure (kg/cm ² g)		Delta P Shut Off (kg/cm ² g)	Remarks
					Inlet	Max	Nor.	Max		

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TABLE-2

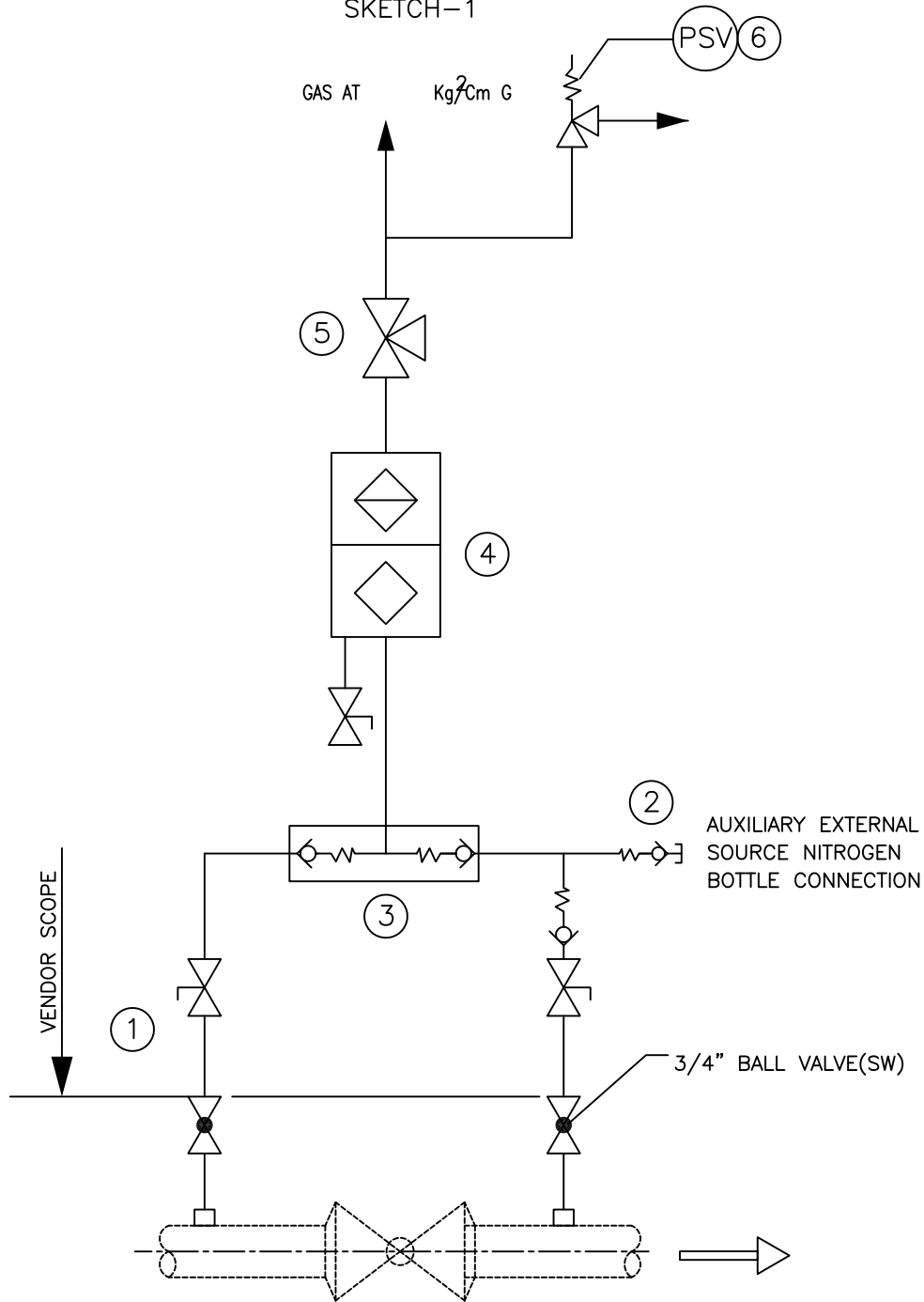
ITEM : GAS POWERED BALL VALVE ACTUATORS

Sl. No.	MR Item No., Valve Size & rating, Qty.	Data from Ball Valve Vendor for (@ Max. Diff. Press.)			Ball Valve Torque Figure with a safety Factor of 1.25		Actuator Generated Torque at regulated pressure (Note-1,3)		Model Selected
		Break Torque (Nm)	Running Torque (Nm)	Max Allowable Valve Stem Torque (Nm)	Break Torque (Nm)	Running Torque (Nm)	Break Torque (Nm)	Running Torque (Nm)	

NOTE :

1. THESE FIGURES SHALL BE USED AS BASIS FOR TESTING THE ACTUATOR PERFORMANCE DURING FACTORY TESTING. THE ACTUATOR ACCEPTANCE WOULD BE CARRIED OUT AFTER VERIFYING SUCCESSFUL TESTING COMPLETE BALL VALVE WITH ACTUATOR ASSEMBLY.
2. ALL TORQUE FIGURES MUST BE IN Nm.
3. Opening / Closing time shall be achieved at max. Design Differential pressure across the valve & actuator regulated pressure max. 24 kg/cm2(g) (approx.). However, the actuator shall open/close the valve at actuator regulated pressure of 10 kg/cm2(g) at 10 kg/cm2(g) Differential pressure across the valve and without timing restriction.

SKETCH-1



NOTES:-

1. THIS SCHEME SHOWS OUTLINE OF POWER GAS FEEDING SYSTEM.
2. VENDOR SHALL DEVELOP AND SUPPLY THE SUITABLE SYSTEM IN ACCORDANCE WITH THE SPECIFICATION.

1. STOP VALVE (3/4" NPT)
2. CHECK VALVE
3. HIGH PRESSURE SHUTTLE VALVE
4. FILTER SEPARATOR & GAS DEHYDRATOR
5. SELF ACTUATED PRESSURE REGULATOR
6. SAFETY RELIEF VALVE

REV NO	DATE	ZONE	DESCRIPTIONS		BY	APPRD			
REVISIONS						REFERENCES		DRG. NO.	
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SECTION		ELECT.(INST.) NEW DELHI					मेकॉन लिमिटेड		
	NAME	SIG.	DATE						
DSGN.									
DRWN									
CHKD. & VERIFIED				SPECIFICATION FOR GAS/ INSTRUMENT AIR POWERED VALVE ACTUATORS		SCALE : N.T.S			REV 0
APPROVED						DRG.NO. MEC/05/26/SD/002			
							MECON LIMITED		

5					4					3					2					1														
VENDOR TO DEVELOP ACTUATOR ELECTRICAL/HYDRAULIC CIRCUIT AS PER SKETCH BELOW AND PROVIDE JUNCTION BOX HOUSING TERMINAL BLOCKS FOR CUSTOMER CABLE TERMINATION																																		
G					F					E					D					C					B					A				
SKETCH-2										ACTUATOR ELECTRICAL/HYDRAULIC CIRCUIT TO BE DEVELOPED BY ACTUATOR/BALL VALVE SUPPLIER WHICH SHALL INCLUDE RELAYS, LIMIT SWITCHES, SOLENOID VALVES, LOCAL/REMOTE SWITCH, HYDRAULIC SHOCK ABSORBER WITH PUMP UNIT CONTROL AND MANUAL OPERATOR ETC. ALL CABRING THROUGH GLANDS BY SUPPLIER MULTICORE CABLE ENTRY (1" NPT) POWER SUPPLY OPEN COMMAND R/L SWITCH STATUS VALVE CLOSED STATUS VALVE OPEN STATUS VALVE OPEN COMMAND : POSITIVE PULSE(POTENTIAL FREE) FOR 1 SEC. VALVE CLOSED COMMAND : I NEGATIVE PULSE (POTENTIAL FREE) FOR 1. SEC. FOR ESD VALVES II OTHERWISE POSITIVE PULSE FOR OTHER VALVES																								
CONTACT STATUS :										1. CONTACT TO CLOSE ON VALVE OPEN FOR OPEN LIMIT SWITCH. 2. CONTACT TO CLOSE ON VALVE CLOSE FOR CLOSE LIMIT SWITCH. 3. L/R SWITCH CONTACT TO CLOSE WHEN VALVE IS ON REMOTE.																								
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REVISIONS										REFERENCES										DRG. NO.														
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1. **Application :**

Water Dew Point measurement in Natural Gas at pipeline conditions, Dry as well as associate /wet Natural gas custody transfer application.

2. **Sampling System:**

Extractive through retractable sample collection probes.

3. **Sample Pressure:** Refer P&ID.

4. **Sample Temperature:** Refer P&ID.

5. **Ambient Conditions**

Temp Range : 0 °C to 55 °C, Humidity 100% (Max)

Online Analyser system shall be suitable for the ambient conditions and shall guarantee that the performance of the online Analyser shall not deteriorate up to the specific ambient conditions.

6. **Accuracy & Repeatability** 1 Deg. C or better

7. **Range of Measurement:** Refer P&ID / Gas Composition.

8. **Unit of Measurement / Output:-**

'Water Dew Point' in Deg. C at line operating conditions.

9. **Resolution :** 0.1 °C or better

10. **Calibration Traceability**

Calibrations traceable to National Institute of Standards and Technology (NIST)/NPL/ Any Metrological Institute

11. **Analyser Measurement Response Time :** Less than 5 Minutes

12. **Initial warm up time :** Less than 20 min

13. **Analyser Shed:**

The analyzer shall be installed with suitable canopy, to avoid direct exposure to sunlight. Environment protection class is defined at point no 22.

14. **Type of Sensor:**

The sensing mechanism of the WDP analyzer to be '**Tunable Diode LASER Absorption Spectroscopy**' type.

15. **Cycle Time:**

In Seconds (to be specified by the bidder depending of the stability period in seconds in both way transitions from 'small to high' gas samples & from 'high to small' gas samples of their analyzer).

16. **Number of Streams:**

One stream.

17. **Pipeline Sizes:** Refer P&ID.

18. **Sample Collection Probe:**

0	DATASHEET OF ONLINE WATER DEW POINT ANALYZER SYSTEM	 MECON LTD. DELHI
Rev.		DS No: MEC/ 05/E5/DS-WDP

Retractable sample collection probes.

19. Sample Handling System:

- The sampling handling system shall be designed to move the sample from the process to the online Analyser in the shortest possible time.
- Sampling system shall include block valves on all process sampling lines.
- The sample handling system shall be designed in such a way so as to take care of both type of gas i.e. associate/wet as well as dry natural gas.
- Sample shall be returned to the atmosphere at a safe height.
- Sample system shall have selective filtrated passage of the concerned sample to avoid ingress of oil/dust in the sample.
- NG may contain traces of H₂S, Glycol & other corrosive impurities; supplied system should be designed accordingly.

20. Pressure Regulator & Sample conditioning:

Suitable pressure regulating device & sample conditioning device should be supplied. Pressure Regulator, Filter-Separator etc., necessary tubing from pressure regulator up to the analyzer, heating arrangement, if any, all are required to be supplied by the bidder. Regulator shall have over pressure protection system.

21. Instrument Air Supply:

No instrument air supply is available at site hence the vendor has to design accordingly without instrumentation air.

22. Enclosure & Area Classification:

The Analyser & all accessories to be field mountable type with IP66 protection and the electrical appliances to be certified for use safely in, Class-1, Division-1, and Group C&D area. Enclosure should be designed considering, no availability of instrument air supply at the site. The external cabinets to be made of SS 316.

23. Input Power Supply:

230 V 50 Hz

24. Local Indication:

Programmable "through-the-glass", local indication of 'Water Dew Point' in degree C shall be available & viewable from the outside of the field cabinet without opening any cabinet etc. Water Dew point conversion methods : ISO 18453 / ASTM D1142 or equivalent using live input for pipeline pressures / Temp.

25. Analog & Digital Outputs:

4 – 20 mA analog outputs for Water Dew point shall be available. One Ethernet and minimum two 'RS 232 / 485 MODBUS RTU' serial outputs shall also be made available simultaneously for both the outputs through each port. Minimum 2 Digital Output Relays for Hi/Lo Alarm and General Fault.

26. Analog & Digital Signal JB:

Analog & digital signals from the analyzer shall be terminated in separate JBs provided on the self- standing skid.

27. Sample Composition (normal range):

The average composition of natural gas is provided elsewhere in the tender. Composition of Natural gas may vary, system should be designed to perform in varying natural gas compositions.

28. Venting:

If required should be at least 3 meter above from the nearest working platform with proper support. All necessary piping tubing to be done by the bidder.

29. Memory & Data storage :

The online Analyser system supplied shall store the data for minimum one month period with a provision of downloading the data on as and when required basis. Vendor shall furnish the maximum capacity of the online Analyser to store the data in the offer.

0	DATASHEET OF ONLINE WATER DEW POINT ANALYZER SYSTEM	 MECON LTD. DELHI
Rev.		DS No: MEC/ 05/E5/DS-WDP

The system configuration & application program shall be stored on a non-volatile memory. Battery backup shall be provided in case memory is volatile. The design shall ensure that the application program and data tables remain unaffected in case of power fluctuation or failure. Clock time shall be protected with battery.

30. Communication Features

Analog & Digital Output: 4-20 mA analog output for Water Dew point shall be available. Programmable alarm relays with Potential Free output and hermetically sealed.

Minimum 02 nos. of isolated serial port, One RS 232 /485 serial communication port for connecting CLIENT's SCADA/ RTU / flow computer (MODBUS RTU protocol) output & One RS 232 /485 isolated serial communication port for connecting the configurator / Laptop. The protocol shall be MODBUS RTU or ASCII and the same shall be user selectable. The serial ports should be user configurable for 232 and 485. One TCP/IP Ethernet port configurable for programming, Mod bus Data communication, Printing. current process value, Day's average, max value and alarm value (set point to be configure in system) shall be communicated from analyser. The analyser should be configurable for data trending and registering the values up to 30 days. The data shall be downloaded to portable device like laptop having window software version 8 or higher.

Note: Complete details and documentation with respect to protocol details with message structure, frame structures, synchronizing / timing signals, memory register locations for data addressability and interface software driver details shall be furnished in order to successfully implement a serial link with the RTU. Any converter, repeater in the scope of vendor. Facility for remote monitoring of analyzer Through TCP/IP.

31. Diagnostic & validation features:

- The online Analyser shall have auto diagnosis feature and shall display error/ warn messages about the status of every parameter and eventful malfunctioning.
- Online automatic diagnostics for periodic self-checking of system integrity & alarming.
- Vendor must specify the frequency (if required) of factory validation / calibration of the supplied system
- Provision in Analyser for Auto calibration / validation & Auto Zero checking at site by user.
- Event Logging / Audit log with Data tamper protection.

32. Reporting Features

- Generation of Analysis Report (scheduled or on- demand) and Automatic Generation of 24 hrs Average maximum, minimum Reports.
- Generation of alarms, diagnostic report
- The reports & alarm log etc. shall be stored in user configurable modbus address for connectivity

33. Program Features

The programming shall be user friendly. Field modifications of data tables and Analyser application shall be possible under password protection. Recent version of interface software compatible for windows-7 & 8 Environment with license.

0	DATASHEET OF ONLINE WATER DEW POINT ANALYZER SYSTEM	 MECON LTD. DELHI
Rev.		DS No: MEC/ 05/E5/DS-WDP

1. **Application :**

Hydrocarbon Dew Point measurement in Natural Gas at pipeline conditions, Dry as well as associate /wet Natural gas custody transfer application.

2. **Sampling System:**

Extractive through retractable sample collection probes.

3. **Sample Pressure:** Refer P&ID.

4. **Sample Temperature:** Refer P&ID.

5. **Ambient Conditions**

Temp Range : 0 °C to 55 °C, Humidity 100% (Max)

Online Analyser system shall be suitable for the ambient conditions and shall guarantee that the performance of the online Analyser shall not deteriorate up to the specific ambient conditions.

6. **Accuracy & Repeatability** 0.5 Deg. C or better

7. **Range of Measurement:** Refer P&ID / Gas Composition.

8. **Unit of Measurement / Output:-**

'Hydrocarbon Dew Point' in Deg. C at line operating conditions.

9. **Resolution :** 0.1 °C or better

10. **Calibration Traceability**

Calibrations traceable to National Institute of Standards and Technology (NIST)/NPL/ Any Metrological Institute

11. **Analyser Measurement Response Time :** Less than 5 Minutes

12. **Initial warm up time :** Less than 20 min

13. **Analyser Shed:**

The analyzer shall be installed with suitable canopy, to avoid direct exposure to sunlight. Environment protection class is defined at point no 22.

14. **Type of Sensor:**

The sensing mechanism of the analyzer to be '**Tunable Diode LASER Absorption Spectroscopy**' type.

15. **Cycle Time:**

In Seconds (to be specified by the bidder depending of the stability period in seconds in both way transitions from 'small to high' gas samples & from 'high to small' gas samples of their analyzer).

16. **Number of Streams:**

One stream.

17. **Pipeline Sizes:** Refer P&ID.

18. **Sample Collection Probe:**

0	DATASHEET OF ONLINE HYDROCARBON DEW POINT ANALYZER SYSTEM	 MECON LTD. DELHI
Rev.		DS No: MEC/ 05/E5/DS-HDP

Retractable sample collection probes.

19. **Sample Handling System:**

- The sampling handling system shall be designed to move the sample from the process to the online Analyser in the shortest possible time.
- Sampling system shall include block valves on all process sampling lines.
- The sample handling system shall be designed in such a way so as to take care of both type of gas i.e. associate/wet as well as dry natural gas.
- Sample shall be returned to the atmosphere at a safe height.
- Sample system shall have selective filtrated passage of the concerned sample to avoid ingress of oil/dust in the sample.
- NG may contain traces of H₂S, Glycol & other corrosive impurities; supplied system should be designed accordingly.

20. **Pressure Regulator & Sample conditioning:**

Suitable pressure regulating device & sample conditioning device should be supplied. Pressure Regulator, Filter-Separator etc., necessary tubing from pressure regulator up to the analyzer, heating arrangement, if any, all are required to be supplied by the bidder. Regulator shall have over pressure protection system.

21. **Instrument Air Supply:**

No instrument air supply is available at site hence the vendor has to design accordingly without instrumentation air.

22. **Enclosure & Area Classification:**

The Analyser & all accessories to be field mountable type with IP66 protection and the electrical appliances to be certified for use safely in, Class-1, Division-1, and Group C&D area. Enclosure should be designed considering, no availability of instrument air supply at the site. The external cabinets to be made of SS 316.

23. **Input Power Supply:**

230 V 50 Hz

24. **Local Indication:**

Programmable "through-the-glass", local indication of 'Hydrocarbon Dew Point' in degree C shall be available & viewable from the outside of the field cabinet without opening any cabinet etc. Hydrocarbon Dew point conversion methods : ISO 18453 / ASTM D1142 or equivalent using live input for pipeline pressures / Temp.

25. **Analog & Digital Outputs:**

4 – 20 mA analog outputs for Hydrocarbon Dew point shall be available. One Ethernet and minimum two 'RS 232 / 485 MODBUS RTU' serial outputs shall also be made available simultaneously for both the outputs through each port. Minimum 2 Digital Output Relays for Hi/Lo Alarm and General Fault.

26. **Analog & Digital Signal JB:**

Analog & digital signals from the analyzer shall be terminated in separate JBs provided on the self- standing skid.

27. **Sample Composition (normal range):**

The average composition of natural gas is provided elsewhere in the tender. Composition of Natural gas may vary, system should be designed to perform in varying natural gas compositions.

28. **Venting:**

If required should be at least 3 meter above from the nearest working platform with proper support. All necessary piping tubing to be done by the bidder.

29. **Memory & Data storage :**

The online Analyser system supplied shall store the data for minimum one month period with a provision of downloading the data on as and when required basis. Vendor shall furnish the maximum capacity of the online Analyser to store the data in the offer.

0	DATASHEET OF ONLINE HYDROCARBON DEW POINT ANALYZER SYSTEM	 MECON LTD. DELHI
Rev.		DS No: MEC/ 05/E5/DS-HDP

The system configuration & application program shall be stored on a non-volatile memory. Battery backup shall be provided in case memory is volatile. The design shall ensure that the application program and data tables remain unaffected in case of power fluctuation or failure. Clock time shall be protected with battery.

30. Communication Features

Analog & Digital Output: 4-20 mA analog output for Hydrocarbon Dew point shall be available. Programmable alarm relays with Potential Free output and hermetically sealed.

Minimum 02 nos. of isolated serial port, One RS 232 /485 serial communication port for connecting CLIENT's SCADA/ RTU / flow computer (MODBUS RTU protocol) output & One RS 232 /485 isolated serial communication port for connecting the configurator / Laptop. The protocol shall be MODBUS RTU or ASCII and the same shall be user selectable. The serial ports should be user configurable for 232 and 485. One TCP/IP Ethernet port configurable for programming, Mod bus Data communication, Printing. current process value, Day's average, max value and alarm value (set point to be configure in system) shall be communicated from analyser. The analyser should be configurable for data trending and registering the values up to 30 days. The data shall be downloaded to portable device like laptop having window software version 8 or higher.

Note: Complete details and documentation with respect to protocol details with message structure, frame structures, synchronizing / timing signals, memory register locations for data addressability and interface software driver details shall be furnished in order to successfully implement a serial link with the RTU. Any converter, repeater in the scope of vendor. Facility for remote monitoring of analyzer Through TCP/IP.

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- The online Analyser shall have auto diagnosis feature and shall display error/ warn messages about the status of every parameter and eventful malfunctioning.
- Online automatic diagnostics for periodic self-checking of system integrity & alarming.
- Vendor must specify the frequency (if required) of factory validation / calibration of the supplied system
- Provision in Analyser for Auto calibration / validation & Auto Zero checking at site by user.
- Event Logging / Audit log with Data tamper protection.

32. Reporting Features

- Generation of Analysis Report (scheduled or on- demand) and Automatic Generation of 24 hrs Average maximum, minimum Reports.
- Generation of alarms, diagnostic report
- The reports & alarm log etc. shall be stored in user configurable modbus address for connectivity

33. Program Features

The programming shall be user friendly. Field modifications of data tables and Analyser application shall be possible under password protection. Recent version of interface software compatible for windows-7 & 8 Environment with license.

0	DATASHEET OF ONLINE HYDROCARBON DEW POINT ANALYZER SYSTEM	 MECON LTD. DELHI
Rev.		DS No: MEC/ 05/E5/DS-HDP

ANNEXURE - II

GAS COMPOSITION PARAMETERS

C1: 80% and above

C2 heavier: it is less than or equal to 18%

CO₂: 0.5 to 2% Mole

N₂: 0.5 to 2% Mole

Specific Gravity: 0.57 to 0.65

ANNEXURE - III

DRAWINGS

SYMBOLS

	PD METER
	TURBINE METER
	INSULATION JOINT (IJ)
	FLOW TEE (FWT)
	FIELD MOUNTED INSTRUMENT
	CONTROL PANEL MOUNTED INSTRUMENT
	ULTRASONIC METER
	SCADA INDICATOR, CONTROLLER OR OTHER DEVICES WITH OPERATOR ACCESS TO ADJUSTMENT.

ABBREVIATIONS

AE	ANALYZER SENSOR (GAS CHROMATOGRAPH)
AI	ANALYZER INDICATOR
AT	ANALYZER TRANSMITTER
FY	FLOW COMPUTER
FQI	FLOW TOTALIZER & INDICATOR
LG	LEVEL GAUGE
ZSH/ZSL	LIMIT SWITCHES (OPEN/CLOSE)
TI/TG	TEMPERATURE INDICATOR/ GAUGE
TE	TEMPERATURE ELEMENT
TW	THERMOWELL
DPI/DPG	DIFF. PRESSURE INDICATOR/ GAUGE
DPT	DIFF. PRESSURE TRANSMITTER
PI/PG	PRESSURE INDICATOR/ GAUGE
PT	PRESSURE TRANSMITTER
FC/FO	FAILURE TO CLOSE/OPEN
LO	LOCK OPEN
FIC/PIC	FLOW/PRESS. INDICATING CONTROLLER
	INTERLOCK
XRL	LOCAL/REMOTE INDICATION
XSL	LOCAL/REMOTE SWITCH
HSH	HAND SWITCH HIGH
HSL	HAND SWITCH LOW
FT	FLOW TRANSMITTER
FE	FLOW ELEMENT
Q.O.E.C.	QUICK OPENING END CLOSURE
WDP	WATER DEW POINT
HDP	HYDROCARBON DEW POINT

ABBREVIATIONS

TT	TEMP TRANSMITTER
FR	FLOW RECORDER
PIR	PRESSURE IND.RECORDER
TIR	TEMP. IND. RECORDER
PSH	PRESSURE SWITCH HIGH
PSL	PRESSURE SWITCH LOW
LSH	LEVEL SWITCH HIGH
LSL	LEVEL SWITCH LOW
LAH	LEVEL ALARM HIGH
LAL	LEVEL ALARM LOW
D	CONDENSATE DRAIN
A1A/B1A	150#/300# RATING
C1A/D1A	400#/600# RATING
LX/PX	PNEUMATIC/ ELECTRIC SIGNAL TRANSMITTER
FB	FULL BORE
SP	SAMPLER
NG	NATURAL GAS
V	VENT
AS	AUTO SAMPLER
CP	CORROSION PROBE
CC	CORROSION COUPON
AV	ACTUATED VALVE
SDV	SHUT DOWN VALVE
LV	LEVEL CONTROL VALVE
PV/PCV	PRESSURE CONTROL VALVE
FCV	FLOW CONTROL VALVE

- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- (P-NATURAL GAS)
- LINE SIZE (NOMINAL)

REV.NO	DATE	ZONE	DESCRIPTION	BY	VERIFIED
			REVISION		

		SECTION	OIL & GAS	NORTH EAST GAS GRID (PHASE-1 & 2 P/L SECTION)		
		LOCATION	DELHI			
		DESIGNED				
		DRAWN	SUNIL	LEGEND / DRAWING SYMBOLS		
	REFERENCES	DRG.NO.	CHECKED AND VERIFIED			
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			SIG	SCALE : NTS	SHEET	REV
			DATE	DRG. NO. ME/2017/OS/28/01/000/6601 18.05.2017	1 OF 2	0



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GRID LIMITED**

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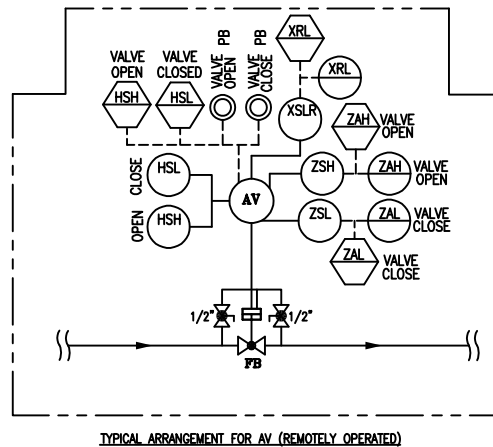
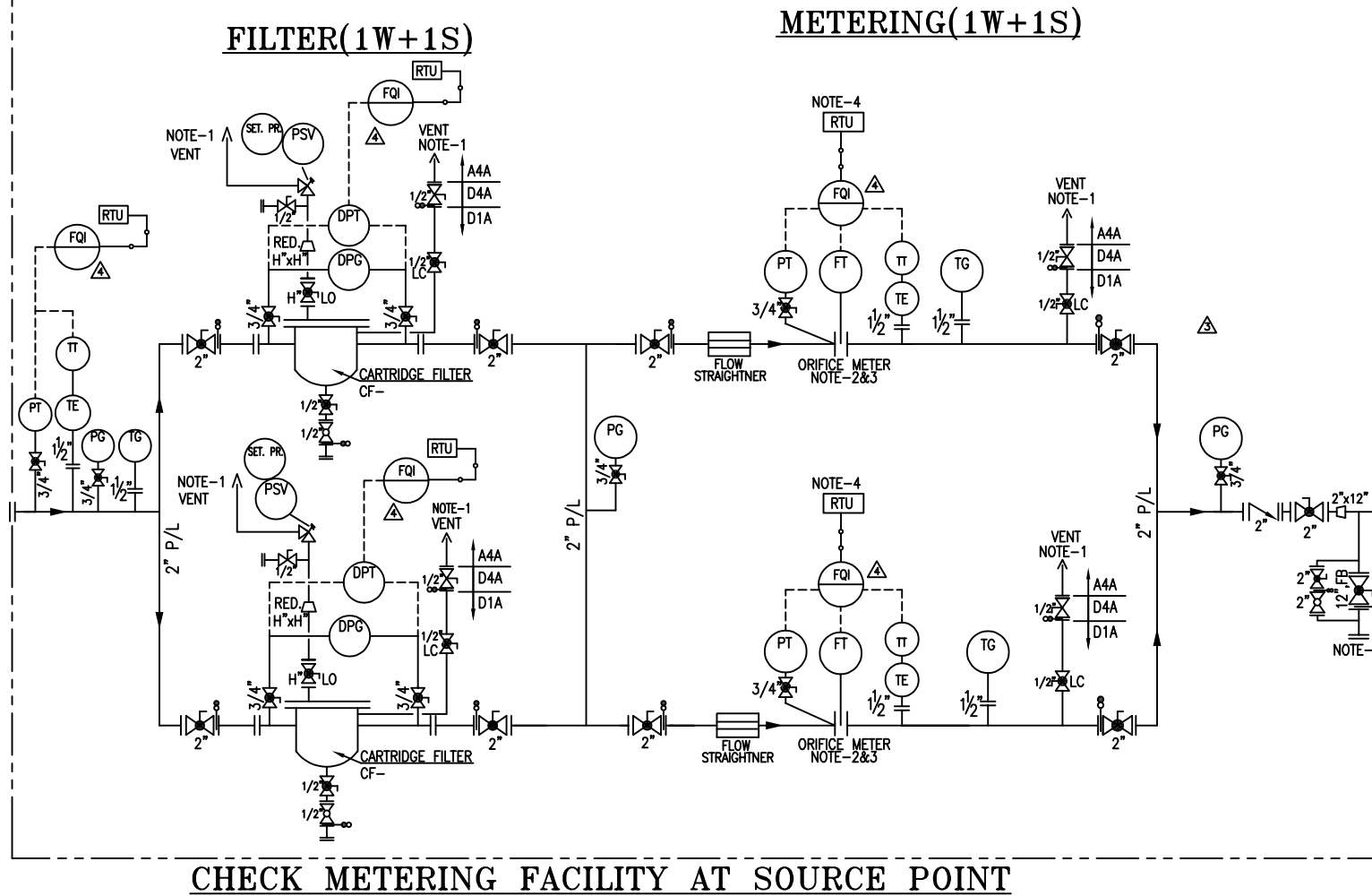
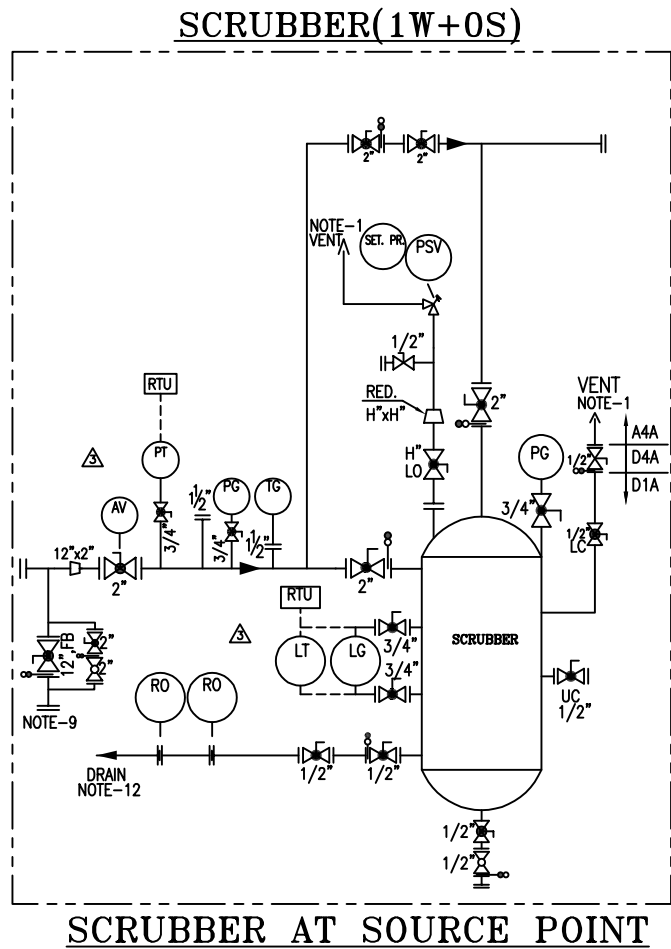
MECON LIMITED

**NORTH EAST GAS GRID
(PHASE-1 & 2 P/L SECTION)**

LEGEND / DRAWING SYMBOLS

SCALE : NTS	
DRG. NO. MEC/25VC100/28/M/000/0001	

SHEET	REV
1 OF 2	0



PROCESS DATA

LOCATION	FLOW (SCMD)	OPERATING PRESSURE Kg/Cm ² (g)	TEMPERATURE(DESIGN)	TEMPERATURE(WORKING)	DESIGN PRESSURE	DESIGN CLASS	QUANTITY (SCRUBBER)(NOS.)	QUANTITY (SKID)(NOS.)	REMARKS
ONGC KSAB WHI SOURCE JORHAT	20000	27-50	-29° TO 65°C	0° TO 55°C	92 Kg/Cm2(g)	600#	1	1	

NOTES:

- ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
- METERING SHALL BE DONE BY ORIFICE METER (SINGLE CHAMBER) WITH FIELD MOUNTED FLOW COMPUTER. INSTALLATION SHALL BE AS PER AGA3 LATEST EDITION. HOWEVER THERE SHALL BE TWO STREAMS OF METERING (1W+1S) FOR CHECK METERING.
- ENVIRONMENTAL ENCLOSURE REQUIRED FOR METERING INSTRUMENTS. INSULATION OF ORIFICE METER, METER RUN & IMPLUSE LINES OF METERING INSTRUMENT TO BE PROVIDED.
- PROVISION SHALL BE KEPT TO HOOK UP METERING PR. & TEMP., FLOW PARAMETERS WITH SCADA.
- INLET & OUTLET OF SKID SHALL BE PROVIDED WITH COMPANION FLANGES.
- ALL BALL VALVES SHALL BE FULL BORE ONLY.
- SIZE, RATING & SET PRESSURE OF PSV's TO BE DECIDED DURING DETAILED ENGINEERING.
- SKID SHALL BE SYMMETRIC ACROSS CENTRE LINE.
- FUTURE PROVISION FOR CAPACITY AUGMENTATION HAS BEEN PROVIDED. HOWEVER M/s IGGL HAS TO CONFIRM.
- EACH VENT LINE SHALL BE COMBINATION OF A BALL VALVE AND A PLUG VALVE/GLOBE VALVE.
- NOTE DELETED.
- NOTE DELETED.
- NOTE DELETED.
- NOTE DELETED.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UP TO 1/2" SW END.
- PLUG VALVE BW END/UP TO 1/2" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.



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REV	INST.	CONCURRED BY
SEC		

REV.NO	DATE	ZONE	DESCRIPTION	BY	VERIFIED
06.12.24			AS PER CLIENT'S REQUIREMENT	UMAR	AKB
10.10.24			AS PER CLIENT'S REQUIREMENT	UMAR	AKB
19.02.24			AS PER CLIENT'S COMMENTS	UMAR	AKB
04.01.24			GENERAL REVISION	UMAR	AKB

REFERENCES	DRG.NO.
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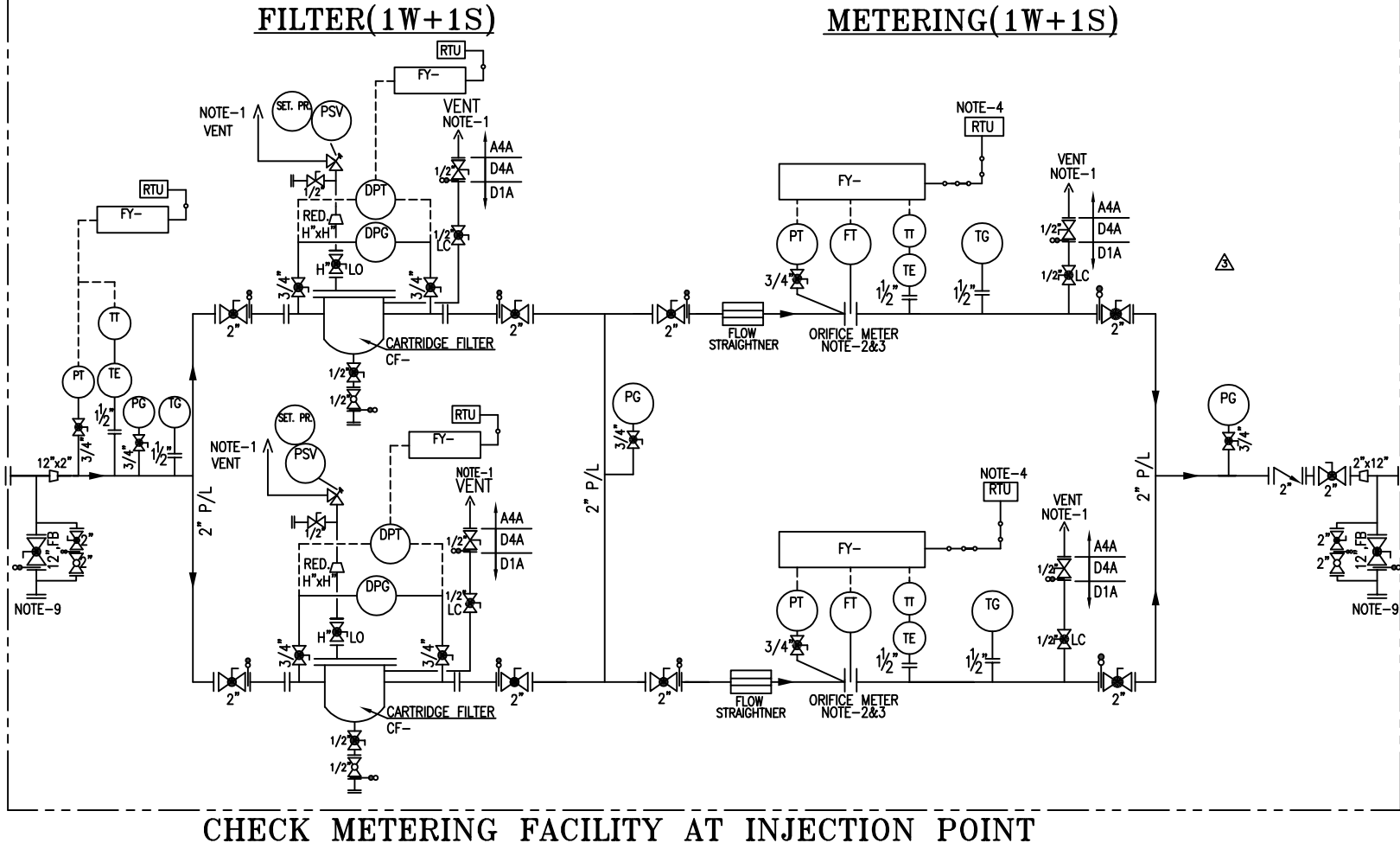
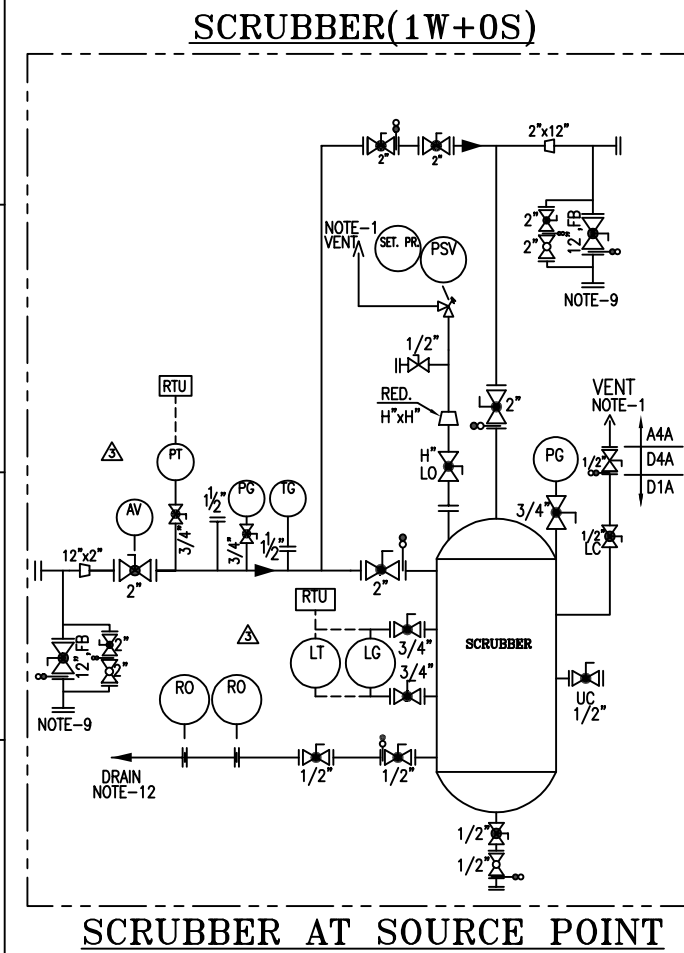
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LOCATION	DELHI
DESIGNED	UMAR
DRAWN	UMAR
CHECKED AND VERIFIED	A.K.BHARTI
APPROVED	SIG (S.GUPTA)
DATE	06.12.24

NORTH EAST GAS GRID (PHASE-1 & 2 P/L SECTION)

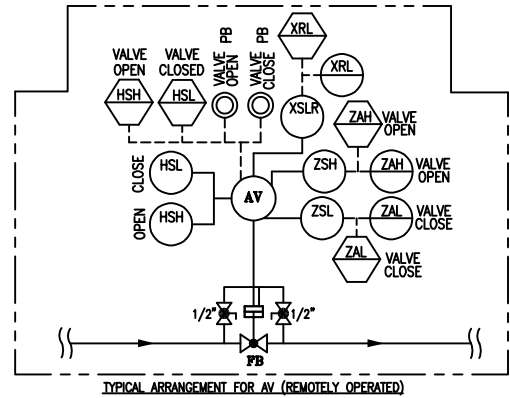
P & ID FOR CHECK METERING FACILITY (TYPE-1)

SCALE : NTS
DRG. NO. MEC/23VC/05/28/M/001/FEEDER-1001

REV 4



- NOTES:**
- ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
 - METERING SHALL BE DONE BY ORIFICE METER (SINGLE CHAMBER) WITH CONTROL PANEL MOUNTED FLOW COMPUTER. INSTALLATION SHALL BE AS PER AGA3 LATEST EDITION. HOWEVER THERE SHALL BE TWO STREAMS OF METERING (1W+1S) FOR CHECK METERING.
 - ENVIRONMENTAL ENCLOSURE REQUIRED FOR METERING INSTRUMENTS. INSULATION OF ORIFICE METER, METER RUN & IMPLUSE LINES OF METERING INSTRUMENT TO BE PROVIDED.
 - PROVISION SHALL BE KEPT TO HOOK UP METERING PR. & TEMP., FLOW PARAMETERS WITH SCADA.
 - INLET & OUTLET OF SKID SHALL BE PROVIDED WITH COMPANION FLANGES.
 - ALL BALL VALVES SHALL BE FULL BORE ONLY.
 - SIZE, RATING & SET PRESSURE OF PSV's TO BE DECIDED DURING DETAILED ENGINEERING.
 - SKID SHALL BE SYMMETRIC ACROSS CENTRE LINE.
 - FUTURE PROVISION FOR CAPACITY AUGMENTATION HAS BEEN PROVIDED. HOWEVER M/s IGGL HAS TO CONFIRM.
 - EACH VENT LINE SHALL BE COMBINATION OF A BALL VALVE AND A PLUG VALVE/GLOBE VALVE.
 - NOTE DELETED.
 - NOTE DELETED.
 - FLOW OF 52000 SCMD CONSIDERED FOR BABEJIA INJECTION POINT IS THE COMBINED FLOW OF ONGC BABEJIA & ONGC JANTAPATHAR.
 - SOLAR PANEL SYSTEM TO BE INSTALLED AT SOURCE POINT & CONTROL ROOM ALONG WITH PANEL MOUNTED FLOW COMPUTER TO BE INSTALLED AT INJECTION POINT.
 - NOTE DELETED.



PROCESS DATA

LOCATION	FLOW (SCMD)	OPERATING PRESSURE Kg/Cm ² (g)	TEMPERATURE(DESIGN)	TEMPERATURE(WORKING)	DESIGN PRESSURE	DESIGN CLASS	QUANTITY (SCRUBBER)(NOS.)	QUANTITY (SKID)(NOS.)	REMARKS
ONGC SUAB WHI SOURCE JORHAT	25000	27-50	-29° TO 65°C	0° TO 55°C	92 Kg/Cm ² (g)	600#	1	1	
ONGC JANTAPATHAR SOURCE	22000	27-50	-29° TO 65°C	0° TO 55°C	92 Kg/Cm ² (g)	600#	1	0	
ONGC BABEJIA WHI SOURCE JORHAT	52000 NOTE-13	27-50	-29° TO 65°C	0° TO 55°C	92 Kg/Cm ² (g)	600#	1	1	SCRUBBER FOR ONGC BABEJIA SOURCE POINT TO BE DESIGNED AT 30000 SCMD ONLY

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UP TO 1/2" SW END.
- PLUG VALVE BW END/UP TO 1/2" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.



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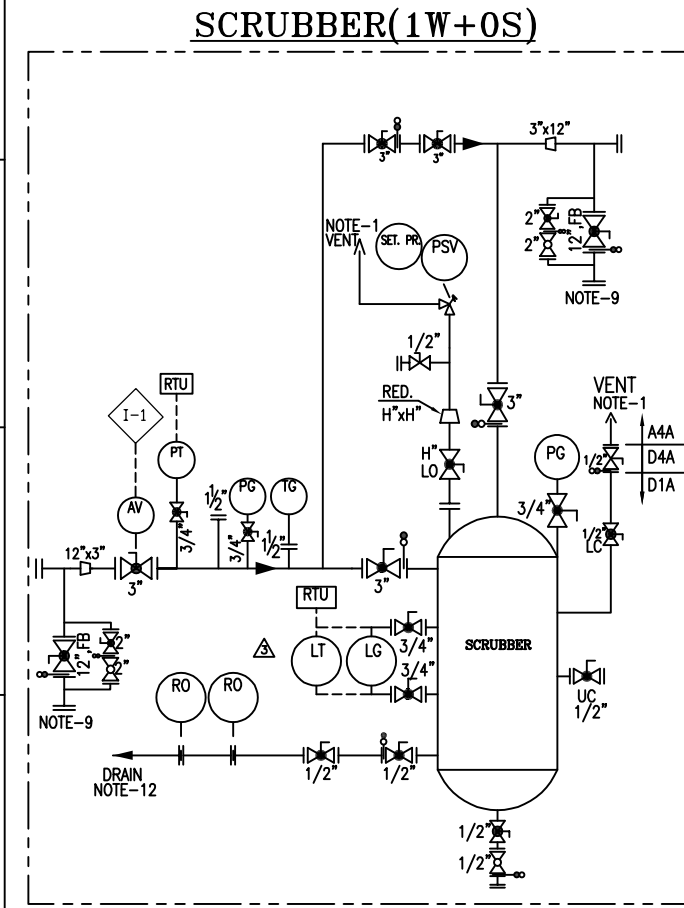


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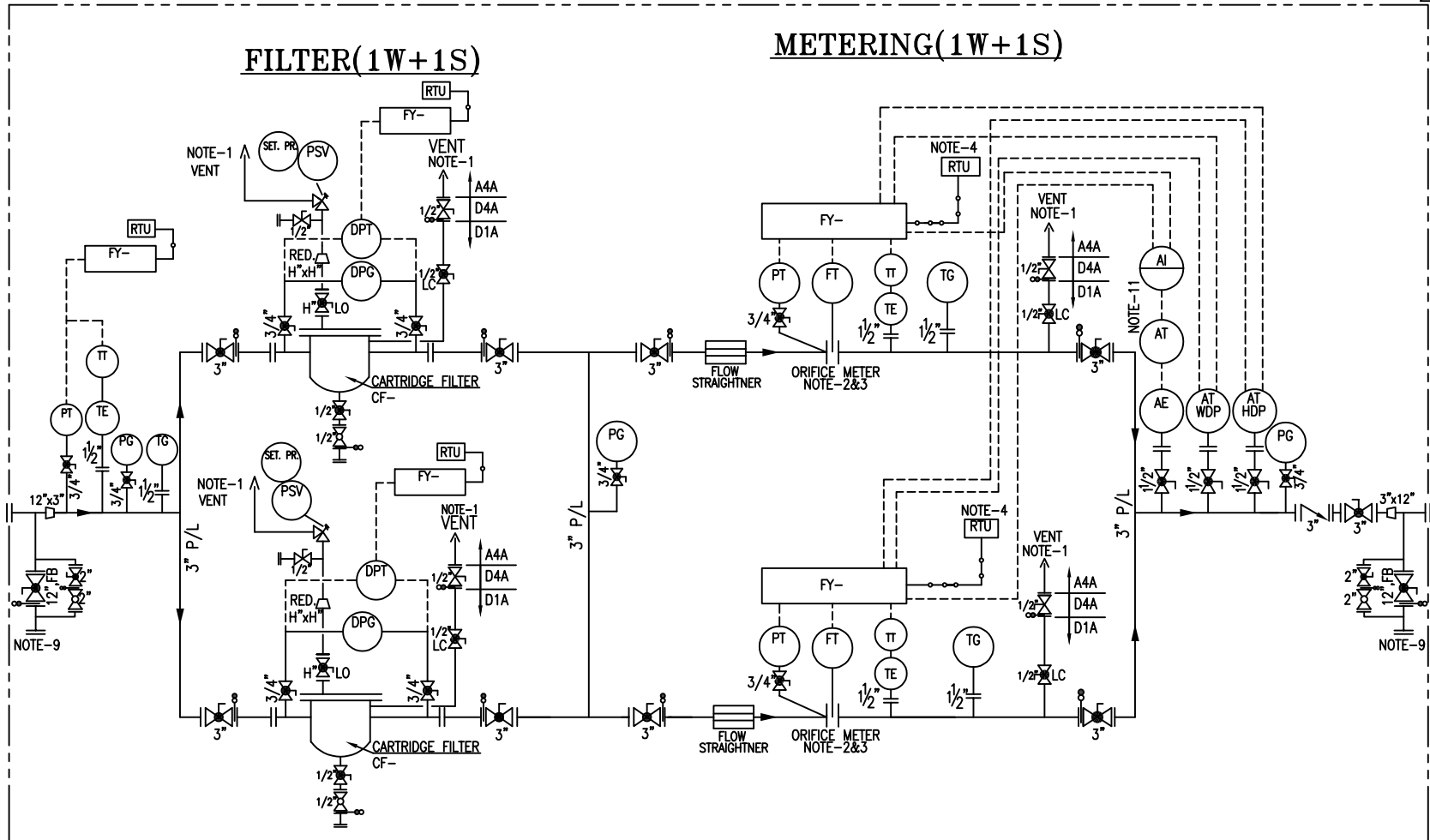
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2			19.02.24		AS PER CLIENT'S COMMENTS	UMAR	AKB												
3			04.01.24		GENERAL REVISION	UMAR	AKB												
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NORTH EAST GAS GRID (PHASE-1 & 2 P/L SECTION)
P & ID FOR CHECK METERING FACILITY (TYPE-II)
SCALE : NTS
Page 185 of 644
REV 3

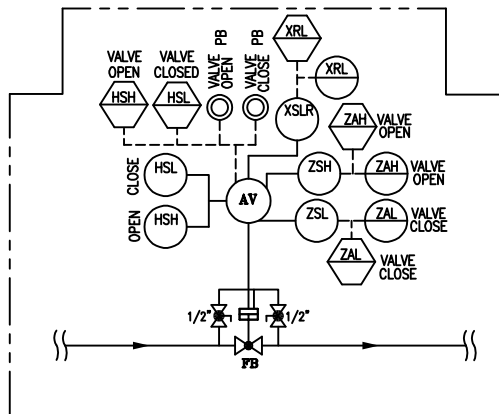


SCRUBBER AT SOURCE POINT



CHECK METERING FACILITY AT INJECTION POINT

INTERLOCK DETAILS		
INTERLOCK NO.	ACTUATED BY	CAUSE/RESULT
I-1	WATER AND HYDROCARBON DEW POINT ANALYZERS	OPEN & CLOSE AV BASED ON PREDETERMINED DEW POINT OF WATER/HYDROCARBON



TYPICAL ARRANGEMENT FOR AV (REMOTELY OPERATED)

PROCESS DATA

LOCATION	FLOW (SCMD)	OPERATING PRESSURE Kg/Cm ² (G)	TEMPERATURE(DESIGN)	TEMPERATURE(WORKING)	DESIGN PRESSURE	DESIGN CLASS	QUANTITY (SCRUBBER)(NOS.)	QUANTITY (SKID)(NOS.)	REMARKS
ONGC KORAGHAT WHI SOURCE JORHAT	110000 NOTE-13	27-50	-29° TO 65°C	0° TO 55°C	92 Kg/Cm ² (g)	600#	1	1	

- NOTES:
- ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
 - METERING SHALL BE DONE BY ORIFICE METER (SINGLE CHAMBER) WITH CONTROL PANEL MOUNTED FLOW COMPUTER. INSTALLATION SHALL BE AS PER AGA3 LATEST EDITION. HOWEVER THERE SHALL BE TWO STREAMS OF METERING (1W+1S) FOR CHECK METERING.
 - ENVIRONMENTAL ENCLOSURE REQUIRED FOR METERING INSTRUMENTS. INSULATION OF ORIFICE METER, METER RUN & IMPLUSE LINES OF METERING INSTRUMENT TO BE PROVIDED.
 - PROVISION SHALL BE KEPT TO HOOK UP METERING PR. & TEMP., FLOW PARAMETERS WITH SCADA.
 - INLET & OUTLET OF SKID SHALL BE PROVIDED WITH COMPANION FLANGES.
 - ALL BALL VALVES SHALL BE FULL BORE ONLY.
 - SIZE, RATING & SET PRESSURE OF PSV's TO BE DECIDED DURING DETAILED ENGINEERING.
 - SKID SHALL BE SYMMETRIC ACROSS CENTRE LINE.
 - FUTURE PROVISION FOR CAPACITY AUGMENTATION HAS BEEN PROVIDED. HOWEVER M/s IGGL HAS TO CONFIRM.
 - EACH VENT LINE SHALL BE COMBINATION OF A BALL VALVE AND A PLUG VALVE/GLOBE VALVE.
 - 20D UPSTREAM SHALL BE MAINTAINED FOR GC SAMPLE POINT. APART FROM GC, NECESSARY ANALYZER (WATER DEW POINT & HYDROCARBON DEW POINT) ALSO TO BE INSTALLED.
 - NOTE DELETED.
 - FLOW OF 110000 SCMD CONSIDERED FOR KORAGHAT INJECTION POINT IS THE COMBINED FLOW OF ONGC KORAGHAT & ONGC NAMBAR.
 - SOLAR PANEL SYSTEM TO BE INSTALLED AT SOURCE POINT & CONTROL ROOM ALONG WITH PANEL MOUNTED FLOW COMPUTER TO BE INSTALLED AT INJECTION POINT.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UP TO 1/2" SW END.
- PLUG VALVE BW END/UP TO 1/2" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.



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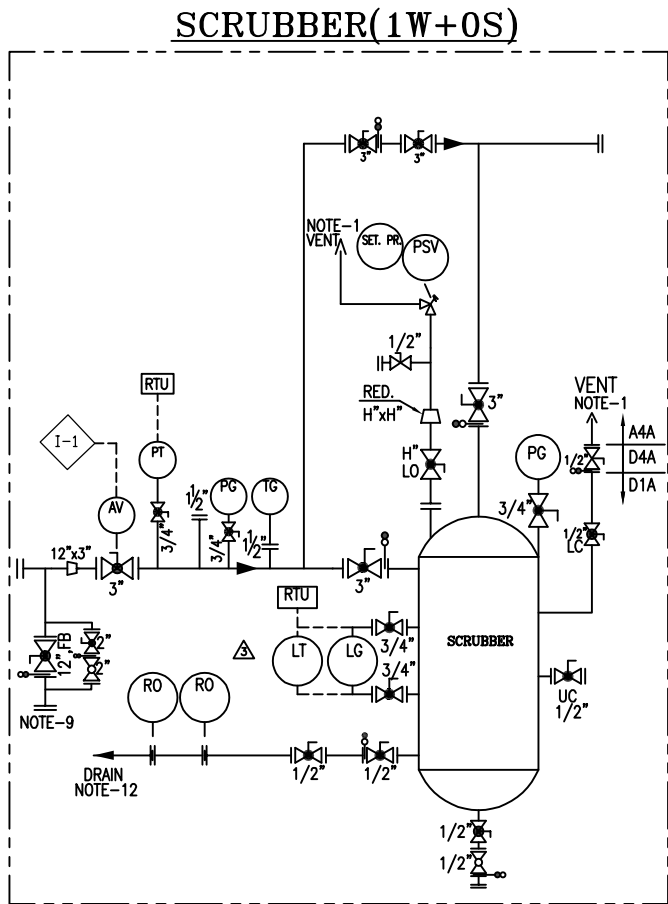
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SEC		

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2	19.02.24		AS PER CLIENT'S COMMENTS	UMAR	AKB
3	04.01.24		GENERAL REVISION	UMAR	AKB

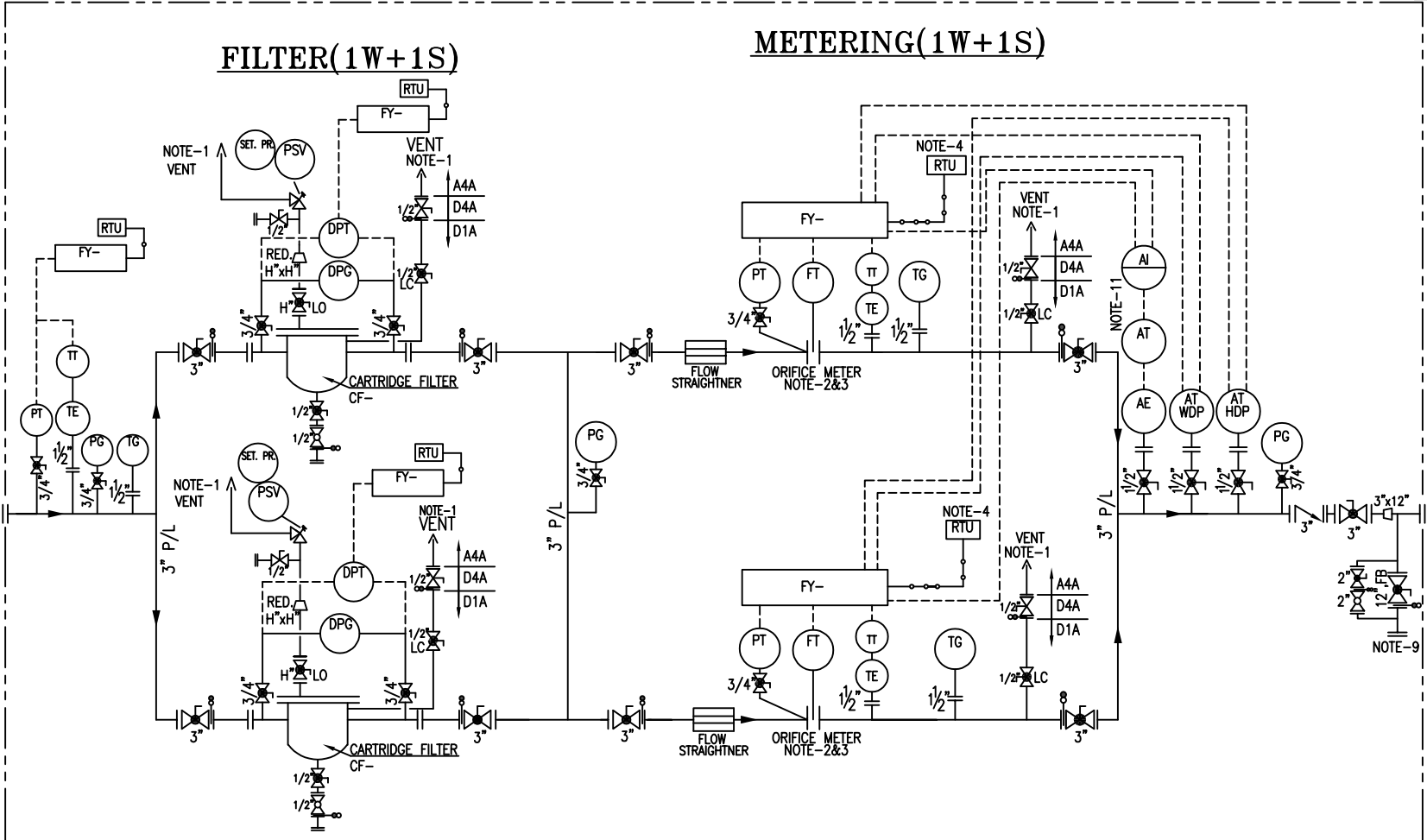
REFERENCES	DRG.NO.
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SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	UMAR
DRAWN	UMAR
CHECKED AND VERIFIED	A.K.BHARTI
SIG	(S.GUPTA)
DATE	10.10.24

NORTH EAST GAS GRID (PHASE-1 & 2 P/L SECTION)	
P & ID FOR CHECK METERING FACILITY (TYPE-III)	
SCALE : NTS	REV
DRG. NO. MEC/23VC/05/28/M/001/FEEDER-1003	3

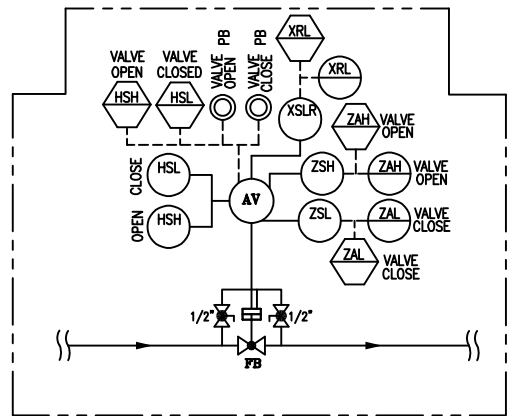


SCRUBBER AT SOURCE POINT



CHECK METERING FACILITY AT SOURCE POINT

INTERLOCK DETAILS		
INTERLOCK NO.	ACTUATED BY	CAUSE/RESULT
I-1	WATER AND HYDROCARBON DEW POINT ANALYZERS	OPEN & CLOSE AV BASED ON PREDETERMINED DEW POINT OF WATER/HYDROCARBON



TYPICAL ARRANGEMENT FOR AV (REMOTELY OPERATED)

PROCESS DATA

LOCATION	FLOW (SCMD)	OPERATING PRESSURE Kg/Cm ² (g)	TEMPERATURE(DESIGN)	TEMPERATURE(WORKING)	DESIGN PRESSURE	DESIGN CLASS	QUANTITY (SCRUBBER)(NOS.)	QUANTITY (SKID)(NOS.)	REMARKS
ONGC TULAMURA	100000	27-50	-29° TO 65°C	0° TO 55°C	92 Kg/Cm2(g)	600#	1	1	

- NOTES:
- ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
 - METERING SHALL BE DONE BY ORIFICE METER (SINGLE CHAMBER) WITH CONTROL PANEL MOUNTED FLOW COMPUTER. INSTALLATION SHALL BE AS PER AGA3 LATEST EDITION. HOWEVER THERE SHALL BE TWO STREAMS OF METERING (1W+1S) FOR CHECK METERING.
 - ENVIRONMENTAL ENCLOSURE REQUIRED FOR METERING INSTRUMENTS. INSULATION OF ORIFICE METER, METER RUN & IMPLUSE LINES OF METERING INSTRUMENT TO BE PROVIDED.
 - PROVISION SHALL BE KEPT TO HOOK UP METERING PR. & TEMP., FLOW PARAMETERS WITH SCADA.
 - INLET & OUTLET OF SKID SHALL BE PROVIDED WITH COMPANION FLANGES.
 - ALL BALL VALVES SHALL BE FULL BORE ONLY.
 - SIZE, RATING & SET PRESSURE OF PSV's TO BE DECIDED DURING DETAILED ENGINEERING.
 - SKID SHALL BE SYMMETRIC ACROSS CENTRE LINE.
 - FUTURE PROVISION FOR CAPACITY AUGMENTATION HAS BEEN PROVIDED. HOWEVER M/s IGGL HAS TO CONFIRM.
 - EACH VENT LINE SHALL BE COMBINATION OF A BALL VALVE AND A PLUG VALVE/GLOBE VALVE.
 - 20D UPSTREAM SHALL BE MAINTAINED FOR GC SAMPLE POINT. APART FROM GC, NECESSARY ANALYZER (WATER DEW POINT & HYDROCARBON DEW POINT) ALSO TO BE INSTALLED.
 - NOTE DELETED.
 - CONTROL ROOM ALONG WITH PANEL MOUNTED FLOW COMPUTER TO BE INSTALLED AT SOURCE POINT.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UP TO 1/2" SW END.
- PLUG VALVE BW END/UP TO 1/2" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.



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REV	INST.	CONCURRED BY
SEC		

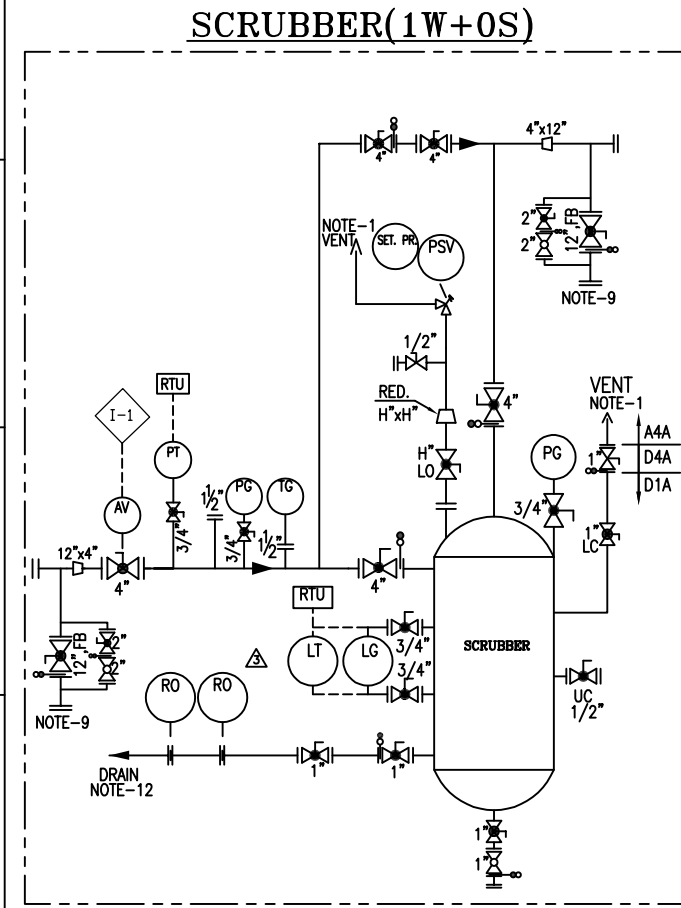
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2	19.02.24		AS PER CLIENT'S COMMENTS	UMAR	AKB
3	04.01.24		GENERAL REVISION	UMAR	AKB

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
1	10.10.24		AS PER CLIENT'S REQUIREMENT	UMAR	AKB
2	19.02.24		AS PER CLIENT'S COMMENTS	UMAR	AKB
3	04.01.24		GENERAL REVISION	UMAR	AKB

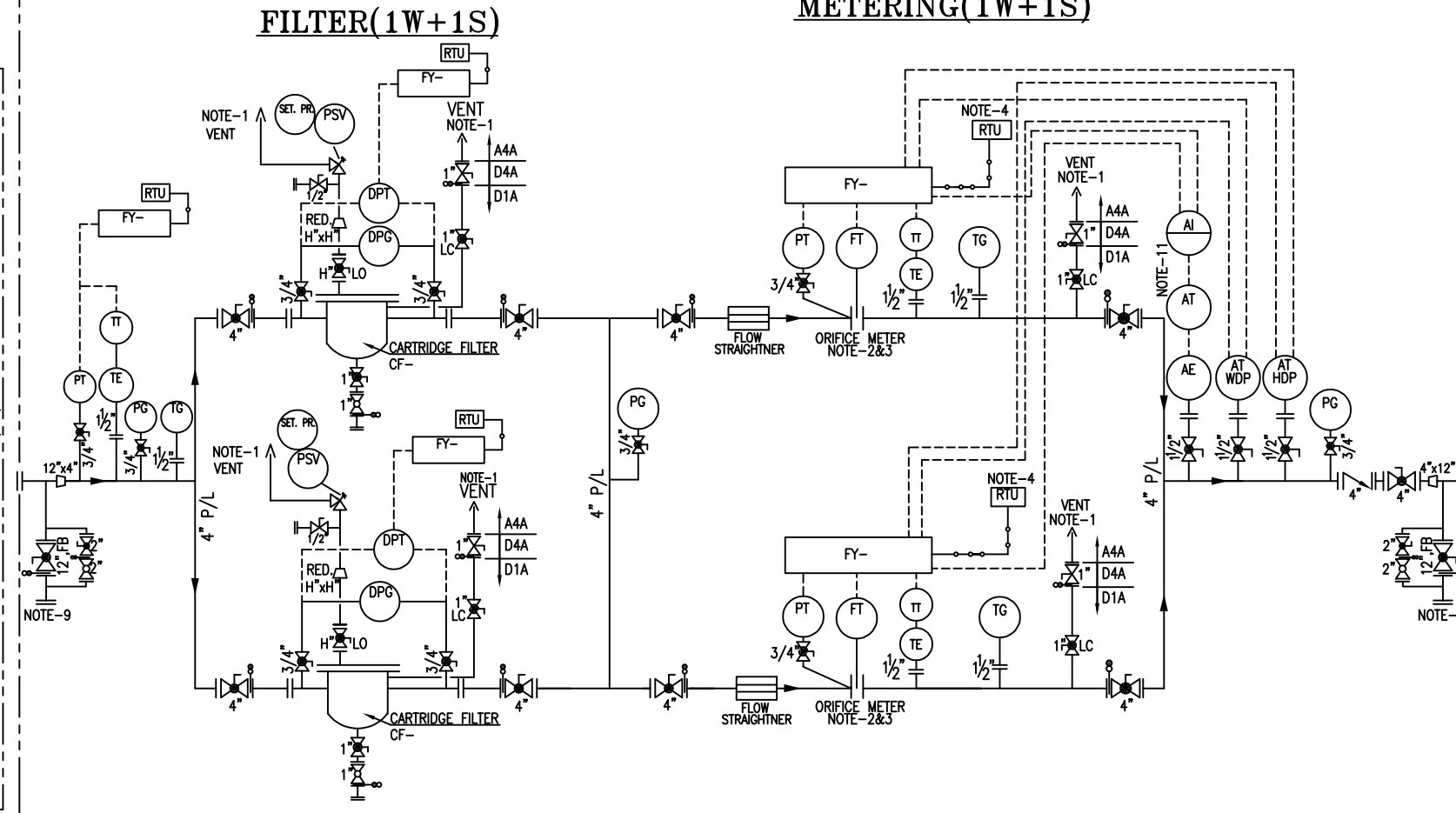
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1	10.10.24		AS PER CLIENT'S REQUIREMENT	UMAR	AKB
2	19.02.24		AS PER CLIENT'S COMMENTS	UMAR	AKB
3	04.01.24		GENERAL REVISION	UMAR	AKB

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	UMAR
DRAWN	UMAR
CHECKED AND VERIFIED	A.K.BHARTI
SIG	(S.GUPTA)
DATE	10.10.24

NORTH EAST GAS GRID (PHASE-1 & 2 P/L SECTION)	
P & ID FOR CHECK METERING FACILITY (TYPE-IV)	
SCALE : NTS	REV
DRG. NO. MEC/23VC/05/28/M/001/FEEDER-1004	3

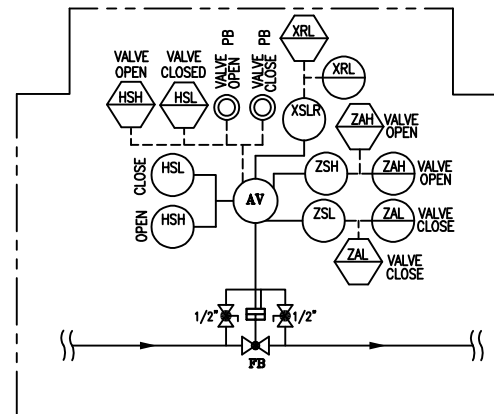


SCRUBBER AT SOURCE POINT



CHECK METERING FACILITY AT INJECTION POINT (RT PANISAGAR)

INTERLOCK DETAILS		
INTERLOCK NO.	ACTUATED BY	CAUSE/RESULT
I-1	WATER AND HYDROCARBON DEW POINT ANALYZERS	OPEN & CLOSE AV BASED ON PREDETERMINED DEW POINT OF WATER/HYDROCARBON



TYPICAL ARRANGEMENT FOR AV (REMOTELY OPERATED)

NOTES:

- ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
- METERING SHALL BE DONE BY ORIFICE METER (SINGLE CHAMBER) WITH CONTROL PANEL MOUNTED FLOW COMPUTER. INSTALLATION SHALL BE AS PER AGA3 LATEST EDITION. HOWEVER THERE SHALL BE TWO STREAMS OF METERING (1W+1S) FOR CHECK METERING.
- ENVIRONMENTAL ENCLOSURE REQUIRED FOR METERING INSTRUMENTS. INSULATION OF ORIFICE METER, METER RUN & IMPLUSE LINES OF METERING INSTRUMENT TO BE PROVIDED.
- PROVISION SHALL BE KEPT TO HOOK UP METERING PR. & TEMP., FLOW PARAMETERS WITH SCADA.
- INLET & OUTLET OF SKID SHALL BE PROVIDED WITH COMPANION FLANGES.
- ALL BALL VALVES SHALL BE FULL BORE ONLY.
- SIZE, RATING & SET PRESSURE OF PSV's TO BE DECIDED DURING DETAILED ENGINEERING.
- SKID SHALL BE SYMMETRIC ACROSS CENTRE LINE.
- FUTURE PROVISION FOR CAPACITY AUGMENTATION HAS BEEN PROVIDED. HOWEVER M/s IGGL HAS TO CONFIRM.
- EACH VENT LINE SHALL BE COMBINATION OF A BALL VALVE AND A PLUG VALVE/GLOBE VALVE.
- 20D UPSTREAM SHALL BE MAINTAINED FOR GC SAMPLE POINT. APART FROM GC, NECESSARY ANALYZER (WATER DEW POINT & HYDROCARBON DEW POINT) ALSO TO BE INSTALLED.
- NOTE DELETED.
- SOLAR PANEL SYSTEM TO BE INSTALLED AT SOURCE POINT & CONTROL ROOM ALONG WITH PANEL MOUNTED FLOW COMPUTER TO BE INSTALLED AT INJECTION POINT.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UP TO 1/2" SW END.
- PLUG VALVE BW END/UP TO 1/2" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

PROCESS DATA

LOCATION	FLOW (SCMD)	OPERATING PRESSURE Kg/Cm ² (g)	TEMPERATURE(DESIGN)	TEMPERATURE(WORKING)	DESIGN PRESSURE	DESIGN CLASS	QUANTITY (SCRUBBER)(NOS.)	QUANTITY (SKID)(NOS.)	REMARKS
ONGC KHUBAL FIELD	300000	27-50	-29° TO 65°C	0° TO 55°C	92 Kg/Cm ² (g)	600#	1	1	



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REV	INST.	CONCURRED BY
SEC		

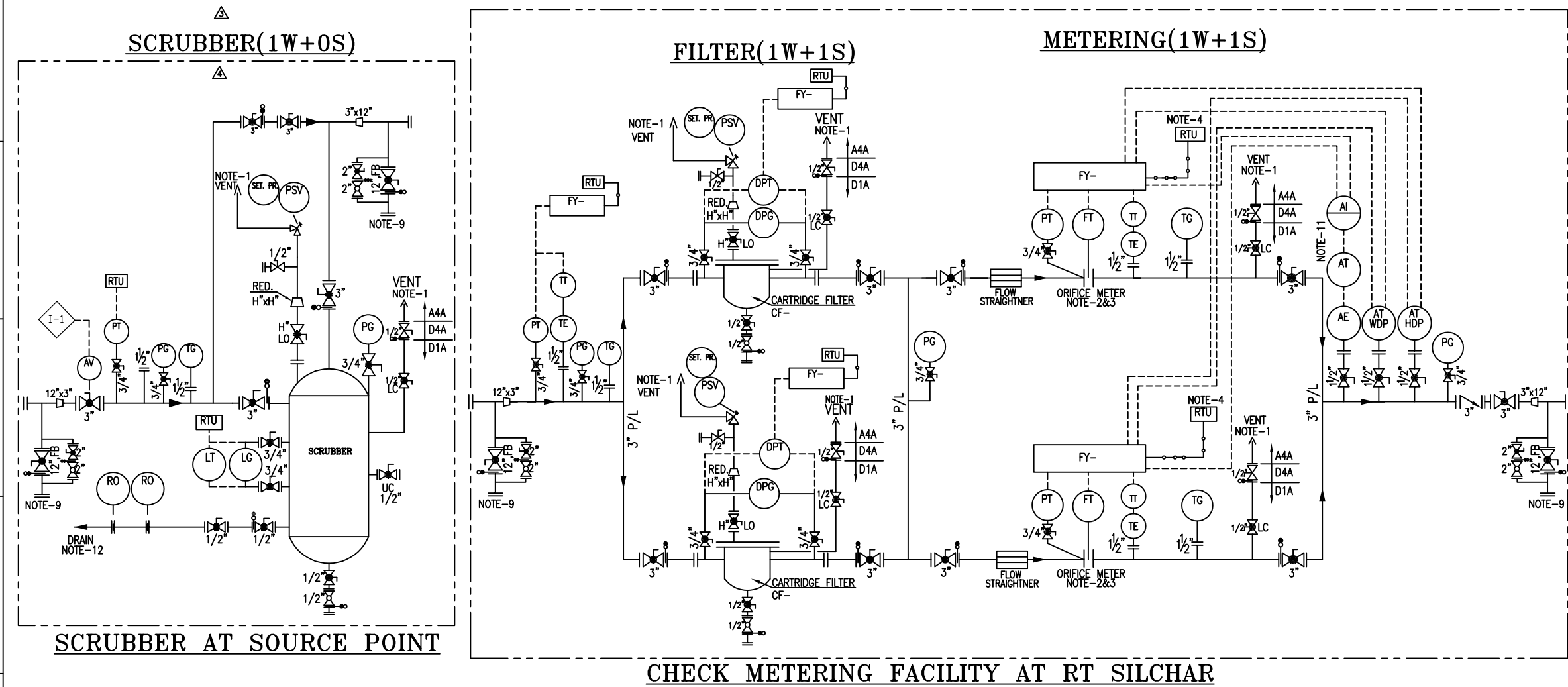
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19.02.24			AS PER CLIENT'S COMMENTS	UMAR	AKB
04.01.24			GENERAL REVISION	UMAR	AKB

REV.NO	DATE	ZONE	DESCRIPTION	BY	VERIFIED
10.10.24			AS PER CLIENT'S REQUIREMENT	UMAR	AKB
19.02.24			AS PER CLIENT'S COMMENTS	UMAR	AKB
04.01.24			GENERAL REVISION	UMAR	AKB

REV.NO	DATE	ZONE	DESCRIPTION	BY	VERIFIED
10.10.24			AS PER CLIENT'S REQUIREMENT	UMAR	AKB
19.02.24			AS PER CLIENT'S COMMENTS	UMAR	AKB
04.01.24			GENERAL REVISION	UMAR	AKB

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	UMAR
DRAWN	UMAR
CHECKED AND VERIFIED	A.K.BHARTI
SIG	(S.GUPTA)
DATE	10.10.24

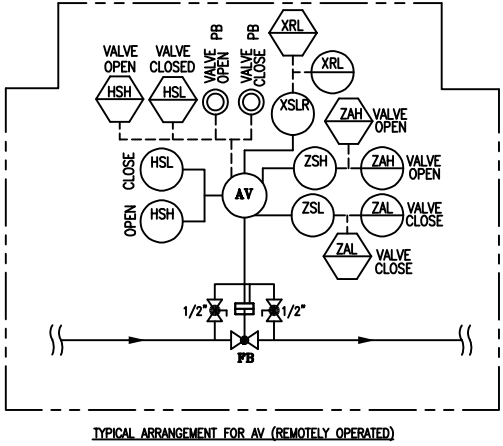
NORTH EAST GAS GRID (PHASE-1 & 2 P/L SECTION)		
P & ID FOR CHECK METERING FACILITY (TYPE-V)		
SCALE : NTS	Page 188 of 644	REV 3



INTERLOCK DETAILS		
INTERLOCK NO.	ACTUATED BY	CAUSE/RESULT
I-1	WATER AND HYDROCARBON DEW POINT ANALYZERS	OPEN & CLOSE AV BASED ON PREDETERMINED DEW POINT OF WATER/HYDROCARBON

PROCESS DATA

LOCATION	FLOW (SCMD)	OPERATING PRESSURE Kg/Cm ² (g)	TEMPERATURE(DESIGN)	TEMPERATURE(WORKING)	DESIGN PRESSURE	DESIGN CLASS	QUANTITY (SCRUBBER)(NOS.)	QUANTITY (SKID)(NOS.)	REMARKS
RT SILCHAR	120000	27-50	-29° TO 65°C	0° TO 55°C	92 Kg/Cm2(g)	600#	0	1	
△ BANASKHANDI GCS	△ 120000	27-50	-29° TO 65°C	0° TO 55°C	92 Kg/Cm2(g)	600#	1	0	



- NOTES:
- ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
 - METERING SHALL BE DONE BY ORIFICE METER (SINGLE CHAMBER) WITH CONTROL PANEL MOUNTED FLOW COMPUTER. INSTALLATION SHALL BE AS PER AGA3 LATEST EDITION. HOWEVER THERE SHALL BE TWO STREAMS OF METERING (1W+1S) FOR CHECK METERING.
 - ENVIRONMENTAL ENCLOSURE REQUIRED FOR METERING INSTRUMENTS. INSULATION OF ORIFICE METER, METER RUN & IMPLUSE LINES OF METERING INSTRUMENT TO BE PROVIDED.
 - PROVISION SHALL BE KEPT TO HOOK UP METERING PR. & TEMP., FLOW PARAMETERS WITH SCADA.
 - INLET & OUTLET OF SKID SHALL BE PROVIDED WITH COMPANION FLANGES.
 - ALL BALL VALVES SHALL BE FULL BORE ONLY.
 - SIZE, RATING & SET PRESSURE OF PSV's TO BE DECIDED DURING DETAILED ENGINEERING.
 - SKID SHALL BE SYMMETRIC ACROSS CENTRE LINE.
 - FUTURE PROVISION FOR CAPACITY AUGMENTATION HAS BEEN PROVIDED. HOWEVER M/s IGGL HAS TO CONFIRM.
 - EACH VENT LINE SHALL BE COMBINATION OF A BALL VALVE AND A PLUG VALVE/GLOBE VALVE.
 - 20D UPSTREAM SHALL BE MAINTAINED FOR GC SAMPLE POINT. APART FROM GC, NECESSARY ANALYZER (WATER DEW POINT & HYDROCARBON DEW POINT) ALSO TO BE INSTALLED.
 - NOTE DELETED.
 - NOTE DELETED.
 - SOLAR PANEL SYSTEM TO BE INSTALLED AT SOURCE POINT & CONTROL ROOM ALONG WITH PANEL MOUNTED FLOW COMPUTER TO BE INSTALLED AT INJECTION POINT.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UP TO 1/2" SW END.
- PLUG VALVE BW END/UP TO 1/2" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.



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REV	INST.	CONCURRED BY
SEC		

REV.NO	DATE	ZONE	DESCRIPTION	BY	VERIFIED
△ 08.01.25			SCRUBBER FOR EPS BANAKHANDI DELETED	UMAR	AKB
△ 10.10.24			AS PER CLIENT'S REQUIREMENT	UMAR	AKB
△ 19.02.24			AS PER CLIENT'S COMMENTS	UMAR	AKB
△ 04.01.24			GENERAL REVISION	UMAR	AKB

REFERENCES	DRG.NO.
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SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	UMAR
DRAWN	UMAR
CHECKED AND VERIFIED	A.K.BHARTI
SIG	(S.GUPTA)
DATE	08.01.25

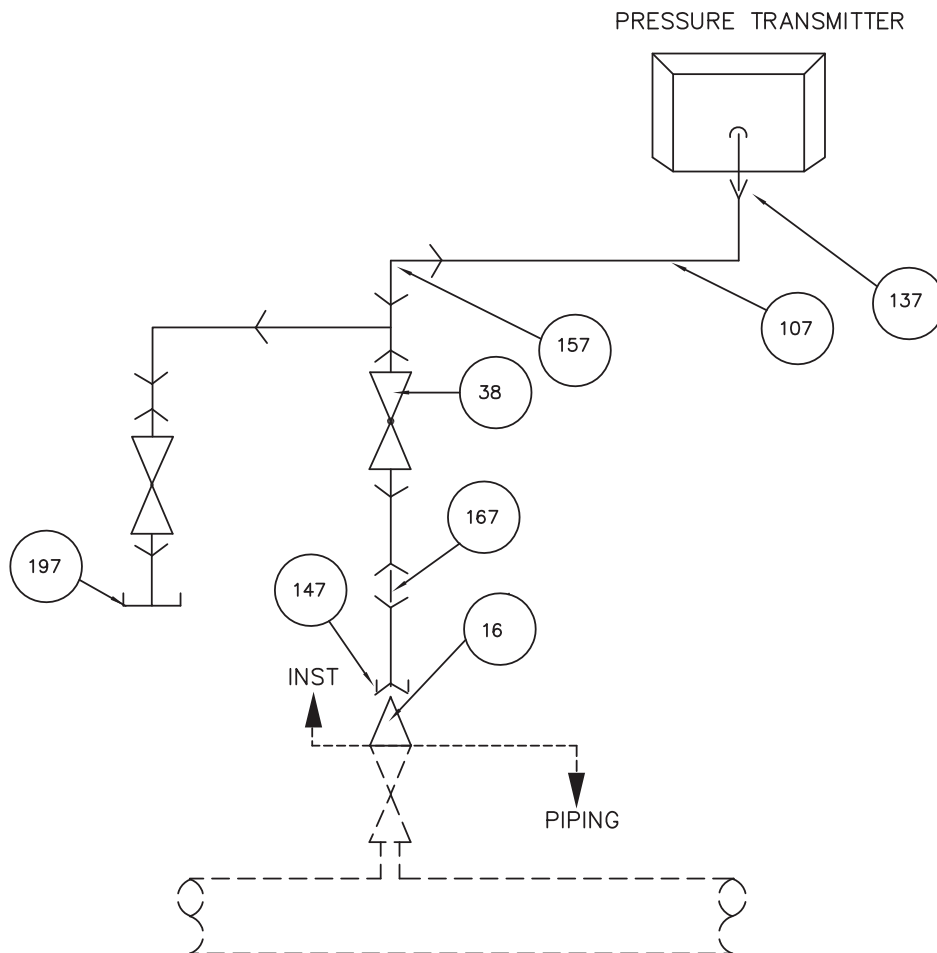
NORTH EAST GAS GRID (PHASE-1 & 2 P/L SECTION)	
P & ID FOR CHECK METERING FACILITY (TYPE-VI)	
SCALE : NTS	REV
DRG. NO. MEC/23VC/05/28/M/001/FEEDER-1006	4

ANNEXURE - IV

INSTALLATION DRAWING

LIST OF STANDARD DRAWINGS

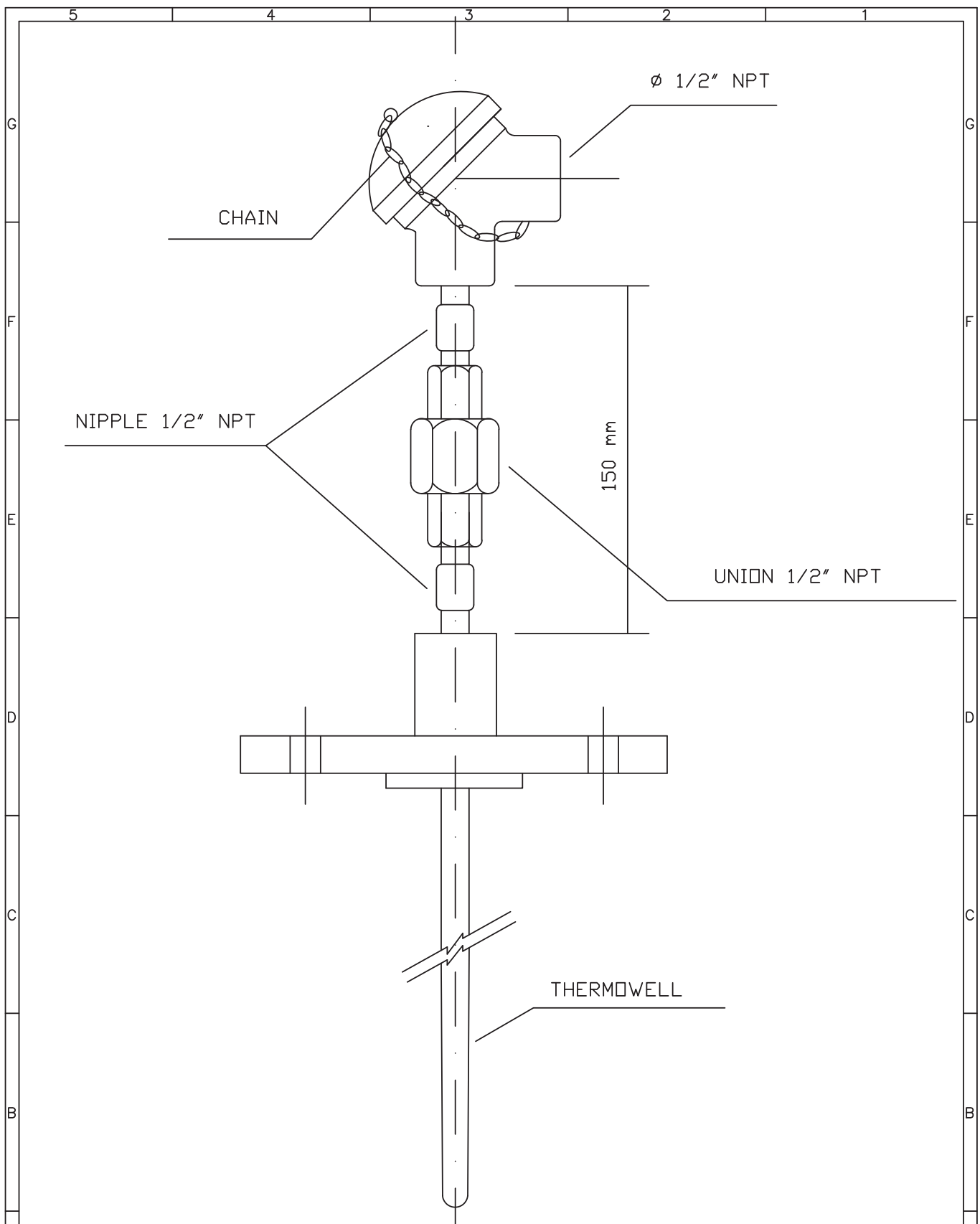
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1	MEC/05/E5/SD/PT/001	INSTALLATION DIAGRAM FOR PRESSURE TRANSMITTER.	0
2	MEC/05/E5/SD/RTD/002	MOUNTING DETAILS FOR RTD ON THERMOWELLS.	0
3	MEC/05/E5/SD/DPG/003	INSTALLATION DIAGRAM FOR DIFERENTIAL PRESSURE GAUGE.	0
4	MEC/05/E5/SD/PG/004	INSTALLATION DIAGRAM FOR PRESSURE GUAGE.	0
5	MEC/05/E5/SD/TG-RTD/005	INSTALLATION DIAGRAM FOR TEMPERATURE GUAGE & RTD.	0
6	MEC/05/E5/SD/RTD-TW/006	MOUNTING DETAILS FOR THERMOWELLS (RTD).	0
7	MEC/05/E5/SD/TG-TW/007	MOUNTING DETAILS FOR THERMOWELLS (T G).	0
8	MEC/05/E5/SD/JB/009	SUPPORT DETAILS FOR JUNCTION BOXES.	0
9	MEC/05/E5/SD/CY/011	FABRICATED CANOPY FOR INSTRUMENTS.	0



LIST OF MATERIAL

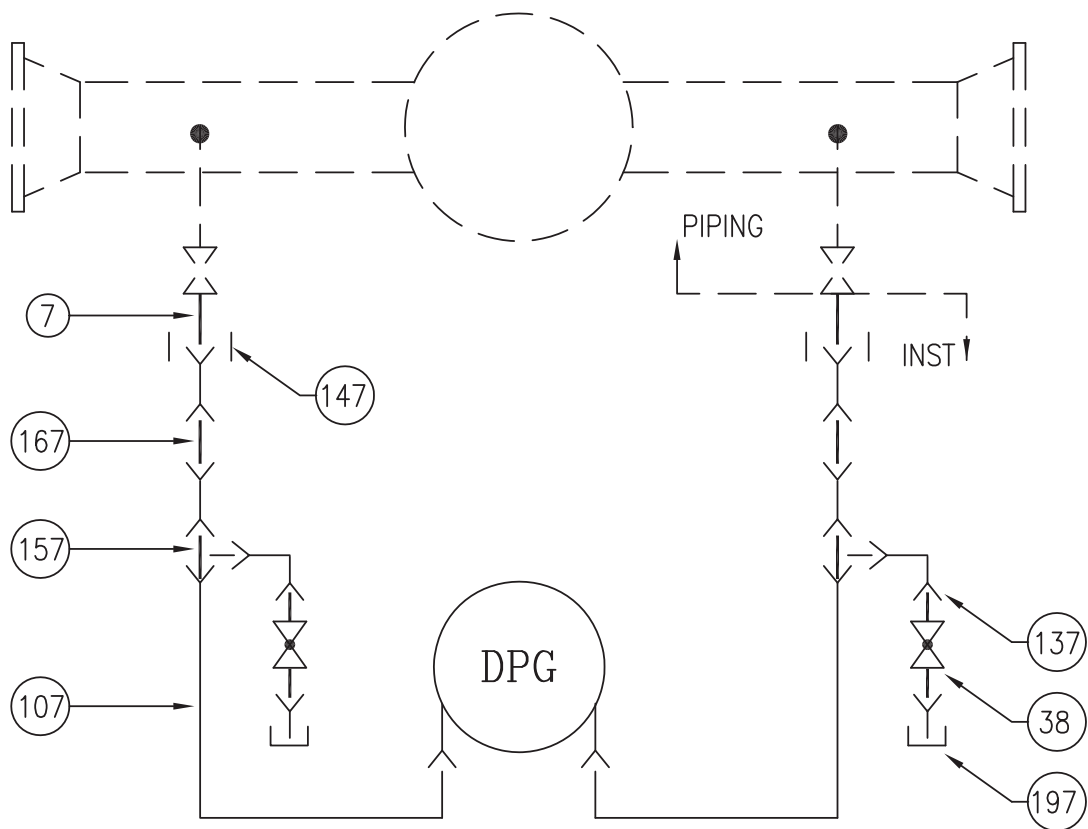
ITEM NO	DESCRIPTION	SIZE	QUANTITY (NOS.)	MATERIAL
16	SWAGE NIPPLE PLXTH	3/4"x1/2"	1	S.S
137	MALE CONNECTOR	1/2"TH 1/2"OD	5	S.S
147	FEMALE CONNECTOR	1/2"TH 1/2"OD	1	S.S
38	BALL VALVE SCRD	1/2"	2	S.S
157	UNION TEE SCRD	1/2"OD	1	S.S
107	TUBE	1/2"OD	A/R	S.S
167	TUBE UNION	1/2"OD	1	S.S
197	PLUG SCRD	1/2"OD	1	S.S

REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.
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SECTION : ELECTRICAL/INSTN.				MECON LIMITED			
DSGN	R.K.S	DATE	CHKD	DATE	MECON LIMITED		
DRWN	IRFAN				MECON LIMITED		
APPROVED	D.G.M			SCALE : NTS			REV 0
				DRG.NO. MEC/05/E5/SD/PT/001			



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SECTION	INSTRUMENTATION			INSTALLATION DIAGRAM	 मेकॉन लिमिटेड MECON LIMITED	REV
	NAME	SIG.	DATE			
DSGN.	R.K.S			MOUNTING DETAILS FOR RTD ON THERMOWELLS	SCALE : 1:50 DRG.NO.:MEC/05/E5/SD/RTD/002	0
DRWN	IRFAN					
CHKD. & VERIFIED	P.S					
APPROVED	D.G.M					



LIST OF MATERIAL

ITEM NO.	DESCRIPTION	SIZE	QUANTITY (NOS.)	MATERIAL
197	PLUG SCRD	1/2"	2	S.S
157	UNION TEE SCRD	1/2" OD	2	S.S
167	TUBE UNION	1/2" OD	2	S.S
38	BALL VALVE SCRD	1/2"	2	S.S
137	MALE CONNECTOR	1/2" TH X 1/2" OD	6	S.S
107	TUBE	1/2"	A/R	S.S
7	NIPPLE PLXTH	1/2"	2	S.S
147	FEMALE CONNECTOR	1/2" TH X 1/2" OD	2	S.S

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SECTION	INSTRUMENTATION		
	NAME	SIG.	DATE
DSGN.	RKS.		
DRWN	IRFAN		
CHKD. & VERIFIED	P.S.		
APPROVED	D.G.M.		

INSTALLATION DIAGRAM FOR DIFFERENTIAL PRESSURE GAUGE



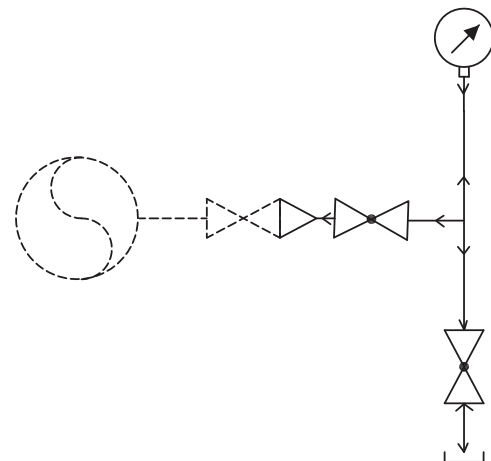
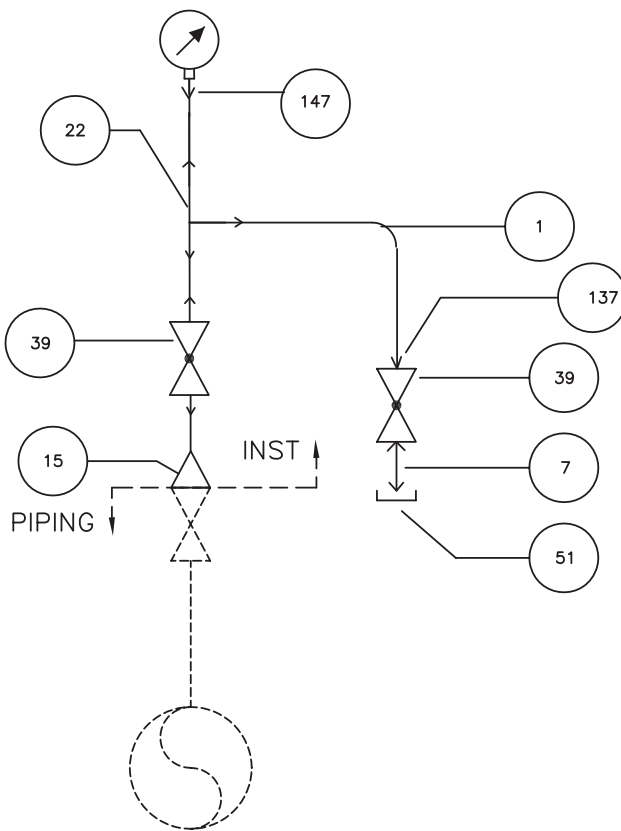
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MECON LIMITED

SCALE : 1:50

DRG.NO.MEC/05/E5/SD/DPG/003

REV
0



LIST OF MATERIALS

QUANTITY (NOS.)	ITEM NO.	DESCRIPTION	SIZE	MATERIAL
A/R	1	TUBE	1/2"	S.S
2	7	NIPPLE PL X TH	1/2"	S.S
3	147	FEMALE CONNECTOR	1/2"THx1/2"OD	S.S
1	22	EQUAL TEE	1/2"	S.S
2	39	BALL VALVE SCRD	1/2"	S.S
1	51	PLUG	1/2"	SS
1	15	SWAGE NIPPLE PLXTH	3/4" X 1/2"	SS
2	137	MALE CONNECTOR	1/2"THx1/2" OD	S.S

REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.
REVISIONS							
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SECTION : ELECTRICAL/INSTN.							
DSGN	R.K.S	DATE	CHKD	P.S			
DRWN	IRFAN						
APPROVED	D.G.M						

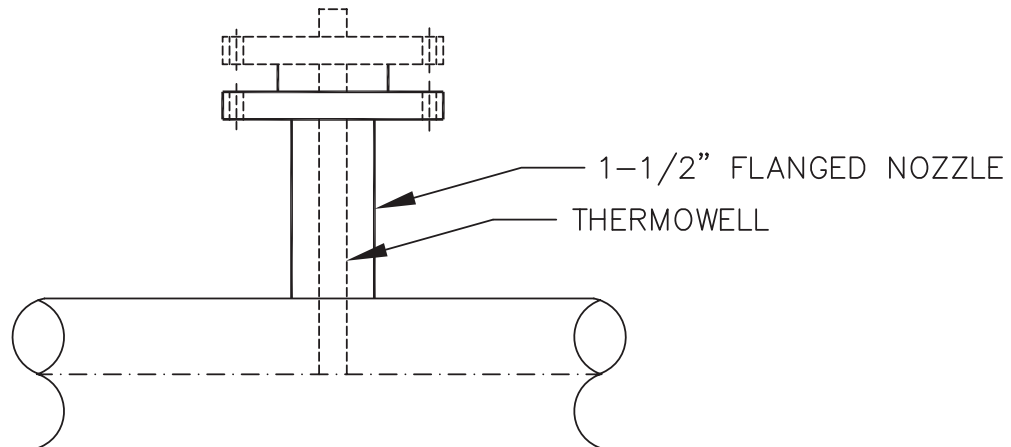


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SCALE : NTS

DRG.NO. MEC/05/E5/SD/PG/004

REV
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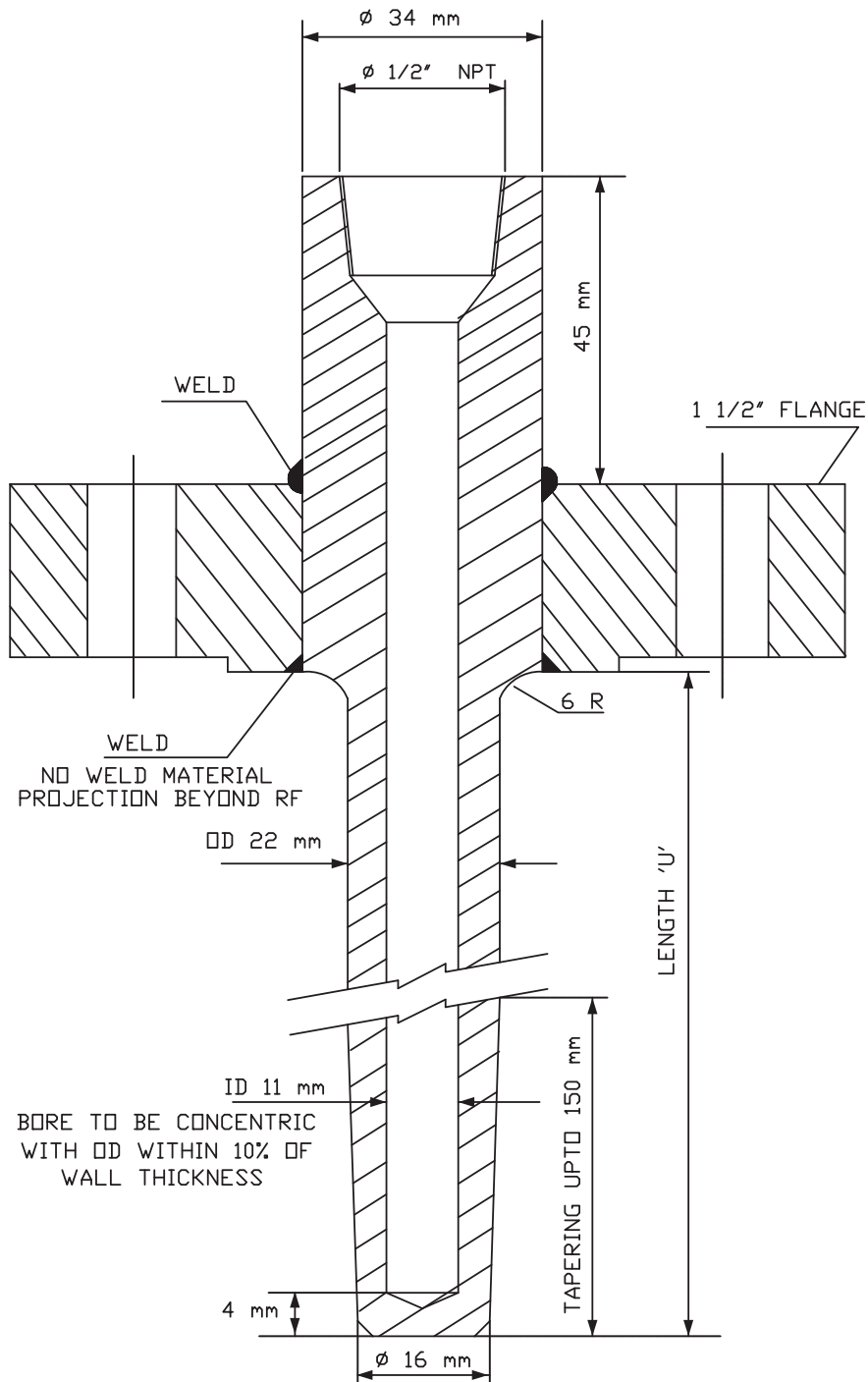


----- - INSTRUMENTATION SCOPE
 _____ - PIPING SCOPE

NOTES:

- 1) PIPING SCOPE INCLUDES SUPPLY & INSTALLATION OF 1-1/2" SOCK-O-LET 1-1/2" NOZZLE, 1-1/2" FLANGE ALONG WITH GASKET, STUD & NUTS.
- 2) INSTRUMENTATION SCOPE INCLUDES SUPPLY OF FLANGED THERMOWELL ALONG WITH THE INSTRUMENT.

REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.		
			REVISIONS						
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SECTION : ELECTRICAL/INSTN.			INSTALLATION DIAGRAM FOR TEMPERATURE GAUGE & RTD		 मेकन लिमिटेड MECON LIMITED		SCALE : DRG.NO. MEC/05/E5/SD/TG-RTD/005		
DSGN	R.K.S	DATE						CHKD	DATE
DRWN	IRFAN								
APPROVED		D.G.M							
REV 0									



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SECTION	INSTRUMENTATION			INSTALLATION DIAGRAM
	NAME	SIG.	DATE	
DSGN.	R.K.S			MOUNTING DETAILS FOR THERMOWELLS (RTD)
DRWN	IRFAN.			
CHKD. & VERIFIED	P.S			
APPROVED	D.G.M			



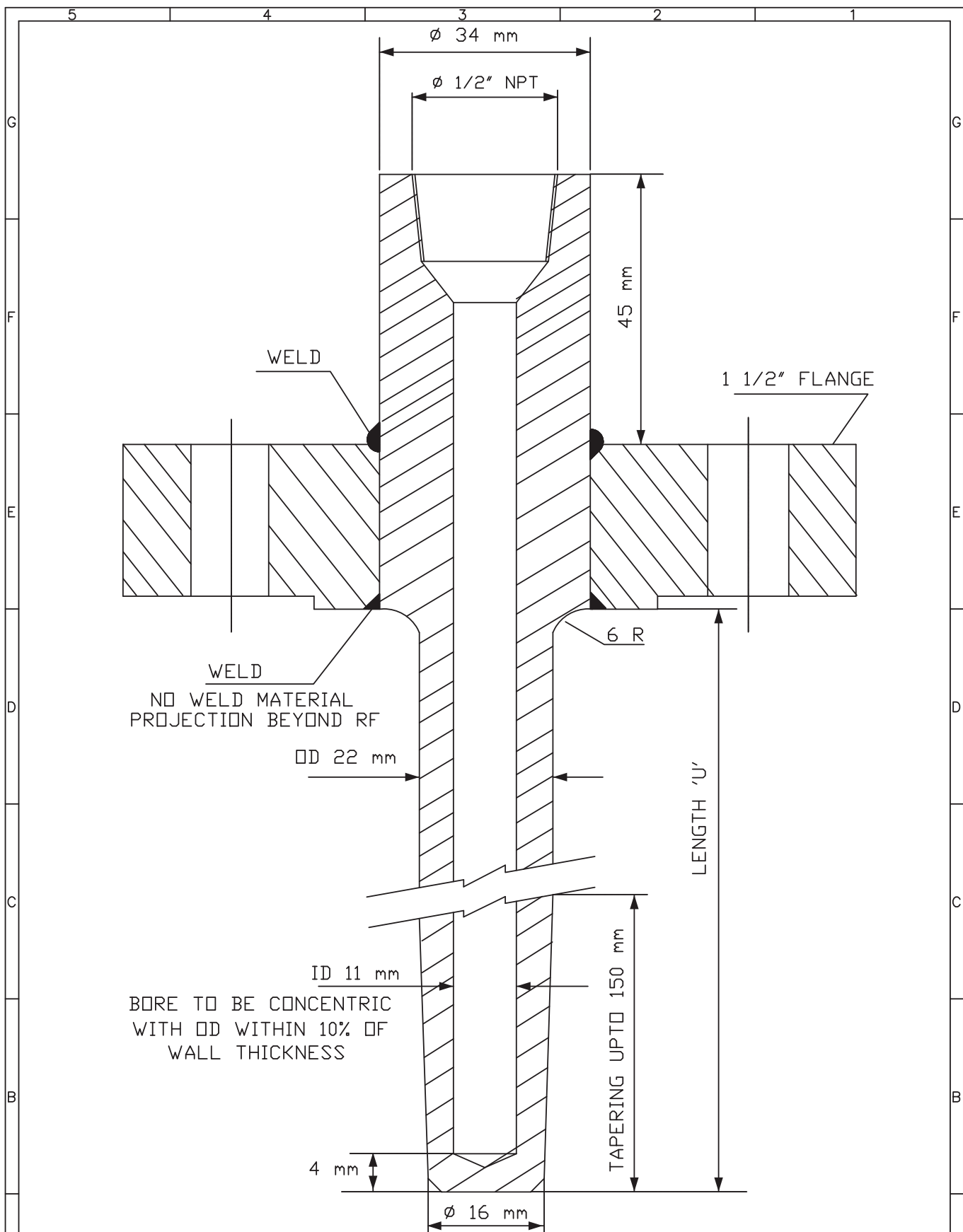
मेकॉन लिमिटेड

MECON LIMITED

SCALE : 1:50

DRG.NO.: MEC/05/E5/SD/RTD-TW/006

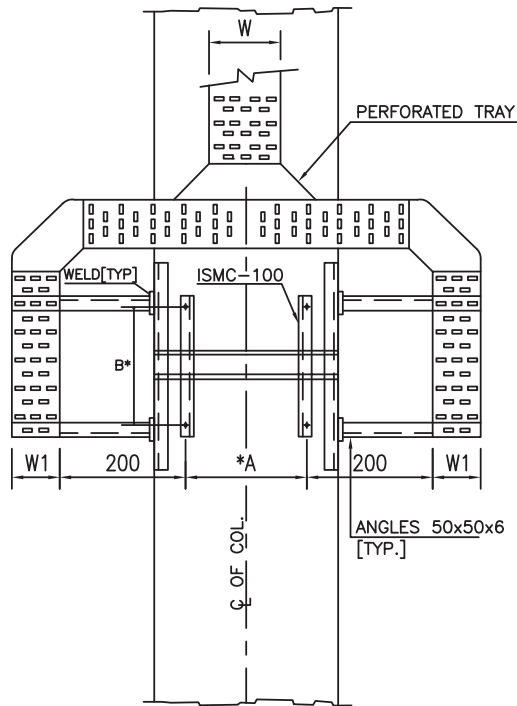
REV
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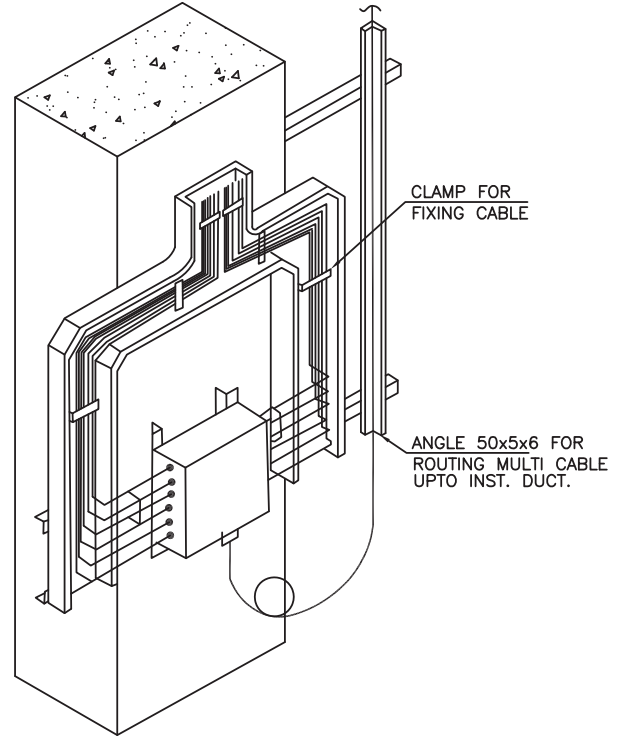
THIS DRAWING IS PROPERTY OF MECON AND IS ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	INSTRUMENTATION			INSTALLATION DIAGRAM	 मेकॉन लिमिटेड MECON LIMITED	REV
	NAME	SIG.	DATE			
DSGN.	RKS.			MOUNTING DETAILS FOR THERMOWELLS (TG)	SCALE : 1:50 DRG.NO.: MEC/05/E5/SD/TG-TW/007	0
DRWN	IRFAN.					
CHKD. & VERIFIED	PS					
APPROVED	D.G.M					

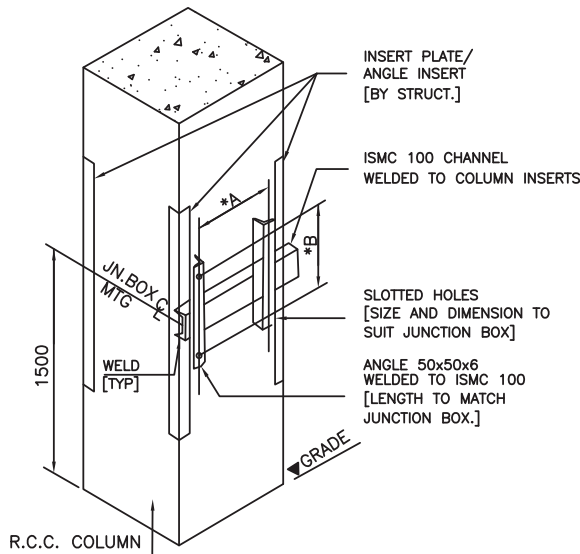
TRAY ARRANGEMENT FOR JUNCTION BOXES



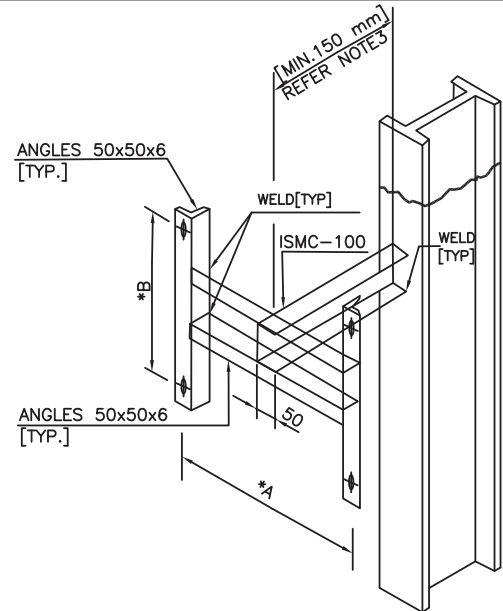
CABLE ROUTING FOR JUNCTION BOXES



JN. BOX MOUNTING FRAME [R.C.C. COLUMN]



JN. BOX MOUNTING FRAME [STEEL COLUMN]



* DIMENSIONS 'A AND B' TO SUIT JUNCTION BOX.

NOTES:

1. ALL DIMENSIONS ARE IN mm.
2. CLAMP MULTICABLE ON ANGLE WITH 25mm WIDE PVC COVERED ALLUMINIUM STRIP.
3. ADD 50mm WHERE-EVER FIRE INSULATION IS PROVIDED.

TRAY WIDTH

JN. BOX	W	W1
12 PAIR	300	150
8 TRIAD	300	150
8 PAIR	150	100
6 TRIAD	150	100

REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.
REVISIONS							
SECTION: INSTRUMENTATION							
DSGN	R.K.S	DATE	CHKD	DATE	 मेकॉन लिमिटेड MECON LIMITED		
DRWN	SUNIL						
APPROVED				D.G.M			
SUPPORT DETAILS FOR JUNCTION BOXES						SCALE : N.T.S. (SH. 1 OF 1) DRG.NO MEC/05/E5/SD/	REV 0

SCALE : N.T.S.

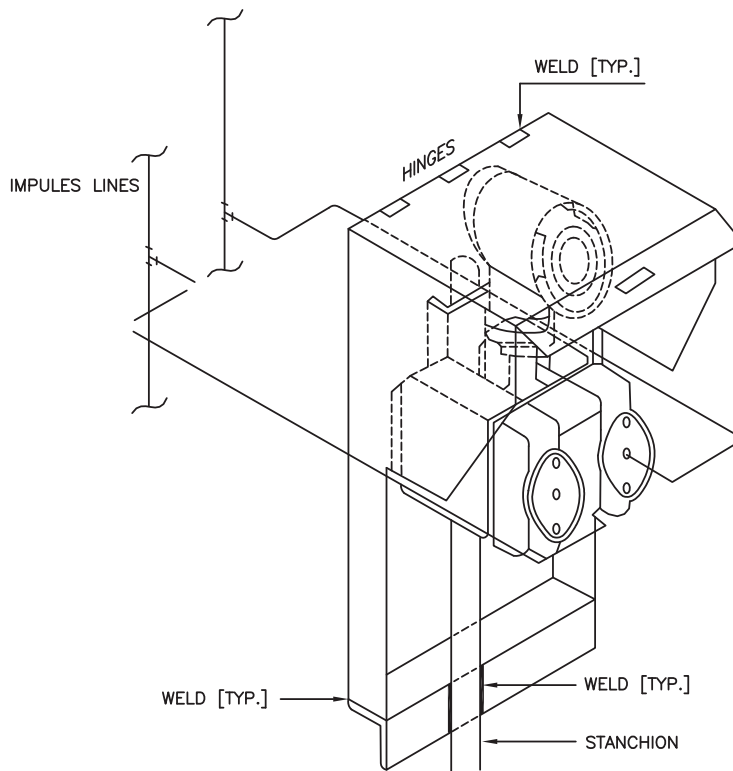
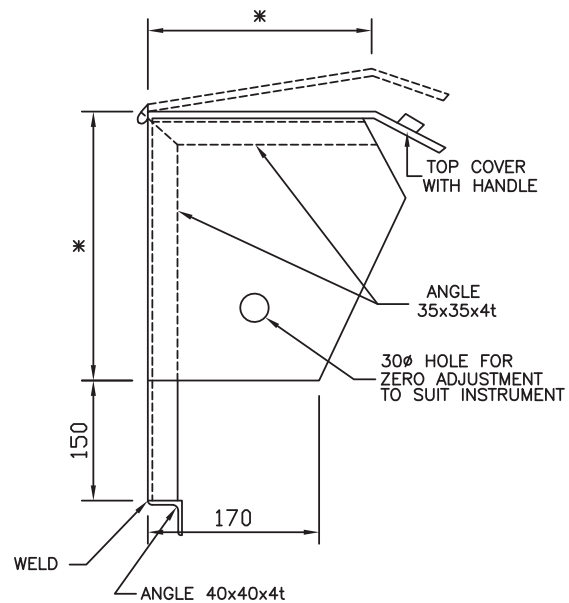
(SH. 1 OF 1)

REV

DRG.NO MEC/05/E5/SD/

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0

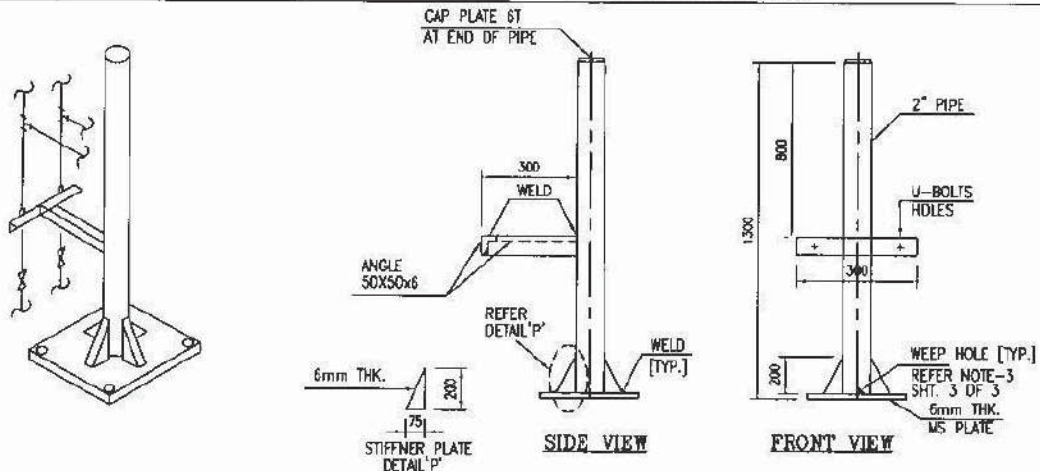


1. ALL DIMENSIONS ARE IN mm.
2. *-TO SUIT INSTRUMENT DIMENSIONS.
3. HINGES SHALL BE OF STAINLESS STEEL.
4. A MINIMUM OF TWO COATS PAINTING SHALL BE CARRIED OUT AFTER A MINIMUM OF ONE COAT OF RED OXIDE ZINC CHROMATE PRIMER. THE COLOUR OF THE PAINT SHALL BE AS PER IS-5.

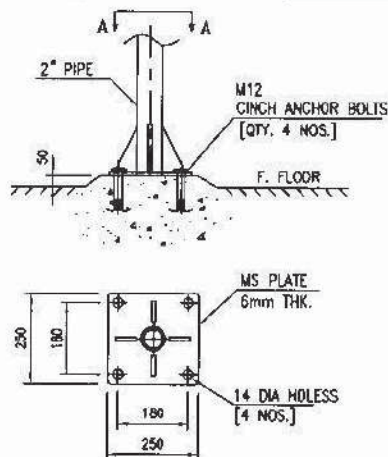
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TYPE 11

SINGLE INSTRUMENT SUPPORT - GENERAL ARRANGEMENT

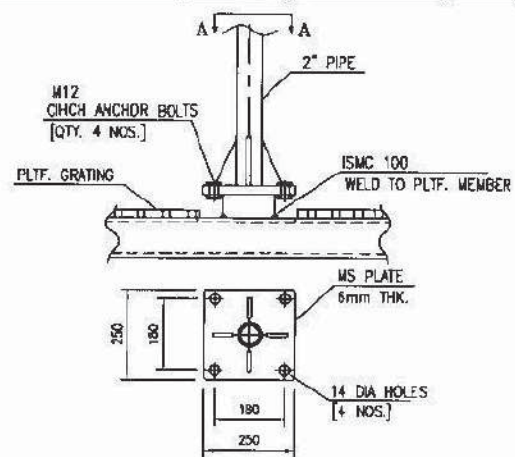


TYPE 11-1



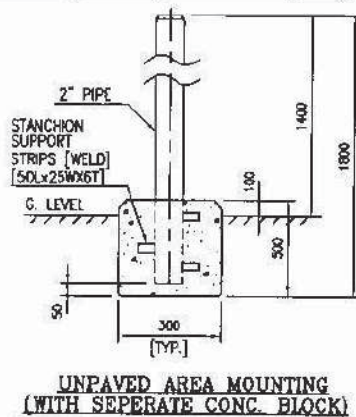
VIEW A-A
PAVED AREA MOUNTING

TYPE 11-2



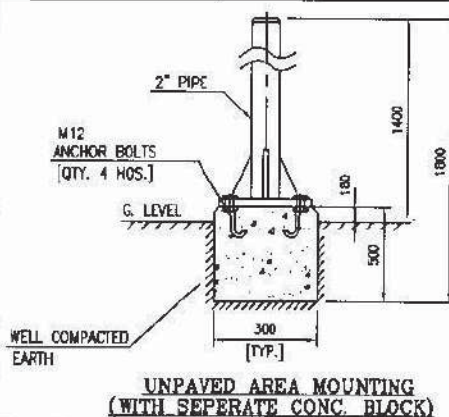
VIEW A-A
PLATFORM MOUNTING

TYPE 11-3



UNPAVED AREA MOUNTING
(WITH SEPERATE CONC. BLOCK)

TYPE 11-4



UNPAVED AREA MOUNTING
(WITH SEPERATE CONC. BLOCK)

REV NO.	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.
SECTION: INSTRUMENTATION							
NAME	DATE	CHKD	DATE				
DSGN	R.K.S	P.S					
DRWN	SUNIL						
APPROVED	D.G.M						

INSTRUMENT SUPPORT

SINGLE INSTRUMENT



मेकॉन लिमिटेड

MECON LIMITED

SCALE : N.T.S.

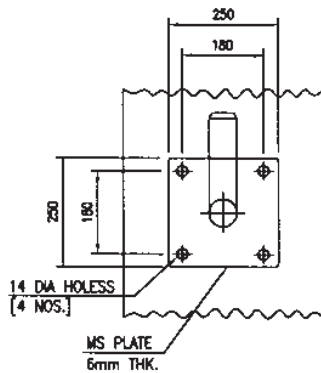
(SH. 1 OF 3)

REV

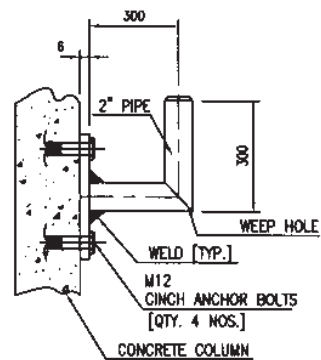
DRG.NO MEC/05/E5/SD/IS/010 A

D

CDNCRETE COLUMN MOUNTING

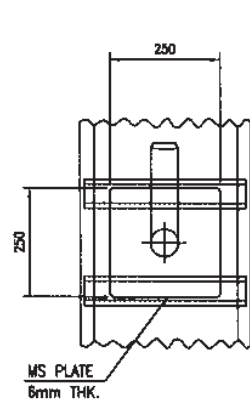


FRONT VIEW

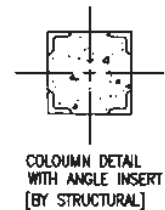
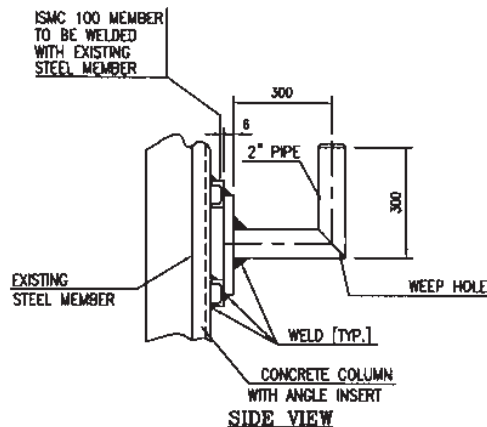


SIDE VIEW

CONCRETE COLUMN [WITH ANGLE INSERT] MOUNTING

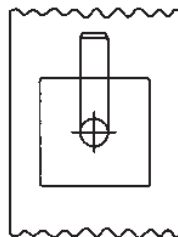


FRONT VIEW

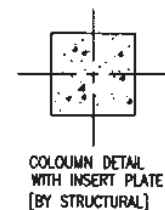
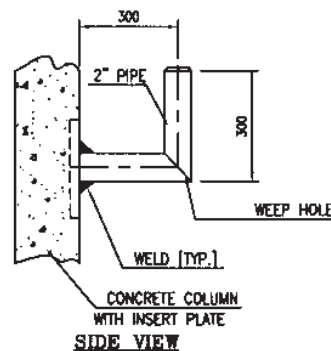


COLOUMN DETAIL
WITH ANGLE INSERT
[BY STRUCTURAL]

CONCRETE COLUMN [WITH INSERT PLATE] MOUNTING

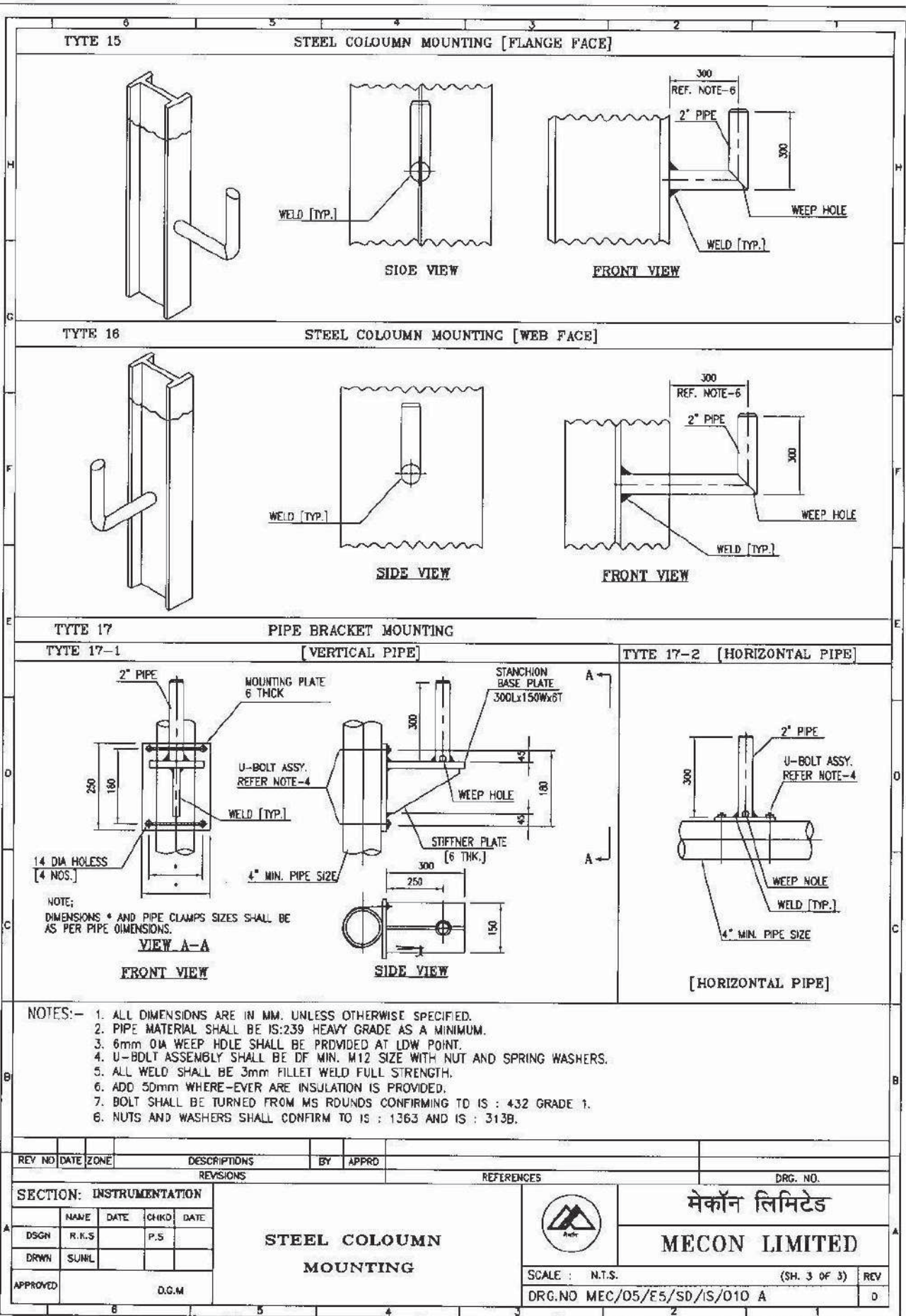


FRONT VIEW



COLOUMN DETAIL
WITH INSERT PLATE
[BY STRUCTURAL]

REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRO		
REVISIONS						REFERENCES	
SECTION N: INSTRUMENTATION						DRG. NO.	
	NAME	DATE	CHKD	DATE		मेकॉन लिमिटेड	
DSGN	R.K.S		P.S			MECON LIMITED	
DRWN	SUNIL						
APPROVED	D.G.M						
CONCRETE COLOUMN MOUNTING					SCALE : N.T.S. (SH. 2 OF 3) REV		
					DRG.NO MEC/D5/E5/SD/IS/D1D A 0		



TWO INSTRUMENT SUPPORT - GENERAL ARRANGEMENT



FRONT VIEW

TYPE 21-1

TYTE 21-2



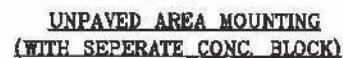
PAVED AREA MOUNTING



PLATFORM MOUNTING

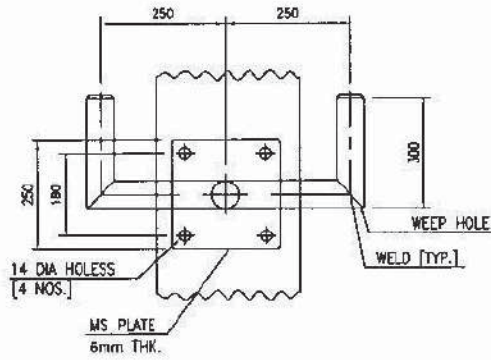
TYPE 21-3

TYTE 21-4

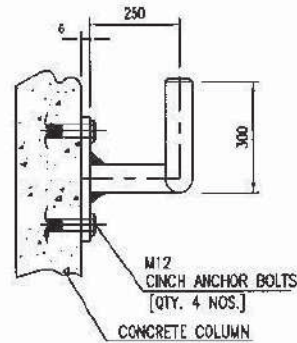
Page 204 of 644

TYPE 22

CONCRETE COLOUMN MOUNTING



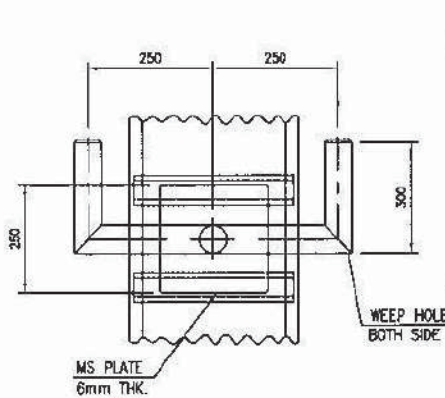
FRONT VIEW



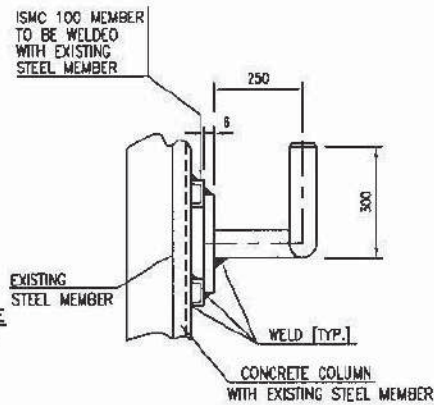
SIDE VIEW

TYPE 23

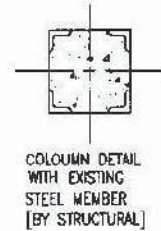
CONCRETE COLOUMN [WITH ANGLE INSERT] MOUNTING



FRONT VIEW



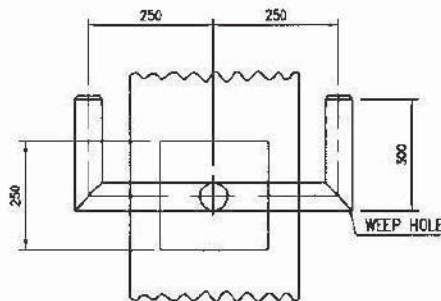
SIDE VIEW



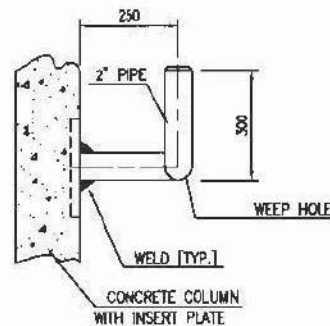
COLOUMN DETAIL WITH EXISTING STEEL MEMBER [BY STRUCTURAL]

TYPE 24

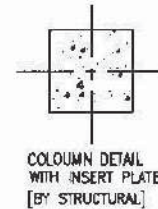
CONCRETE [WITH INSERT PLATE] MOUNTING



FRONT VIEW

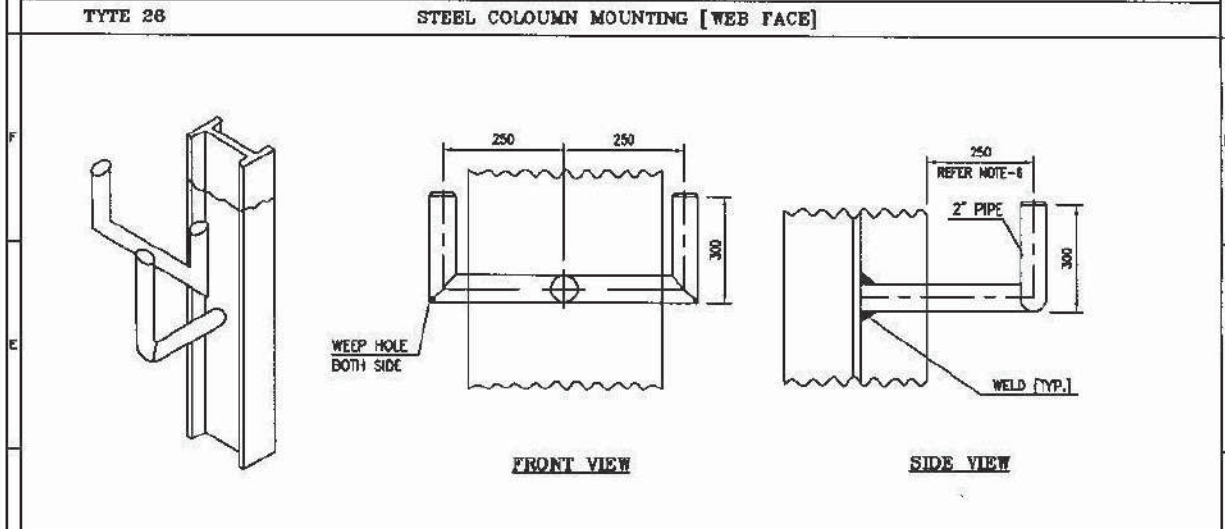
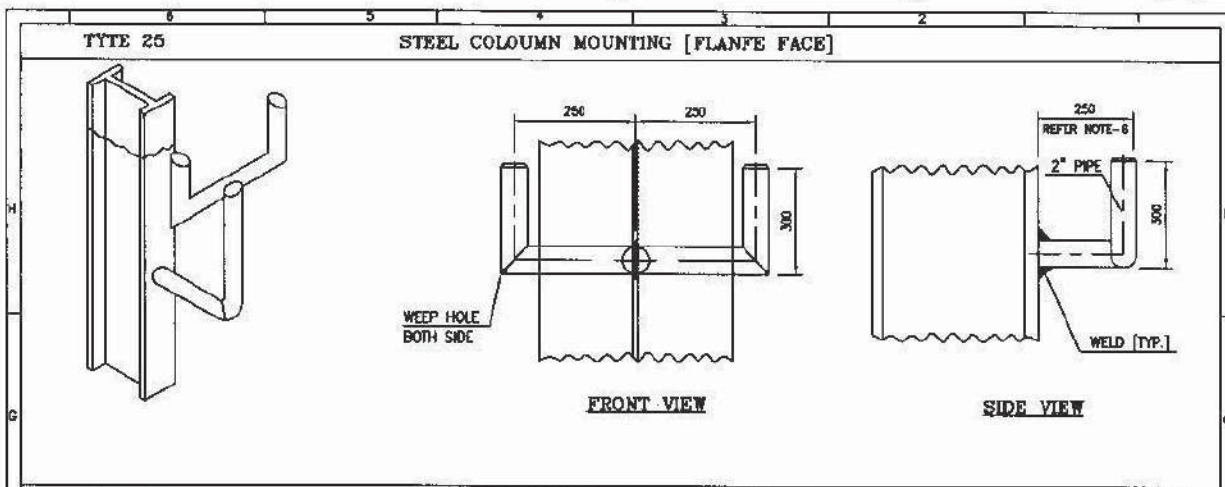


SIDE VIEW



COLOUMN DETAIL WITH INSERT PLATE [BY STRUCTURAL]

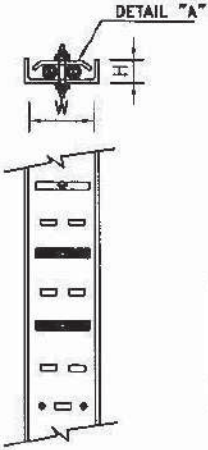
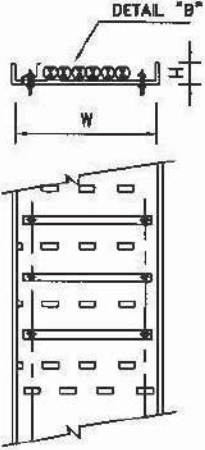
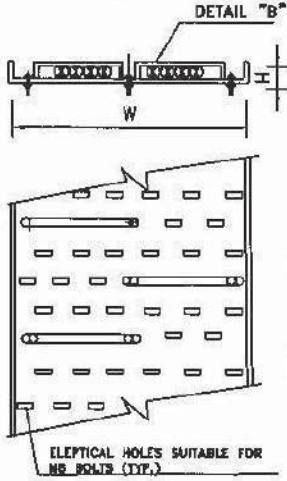
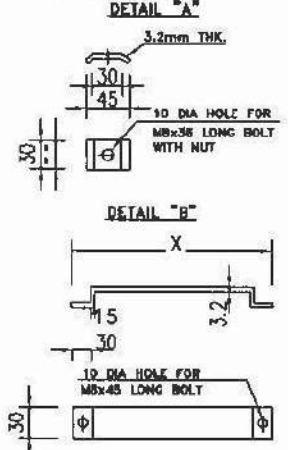
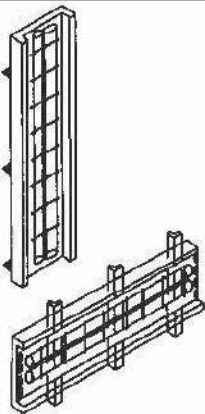
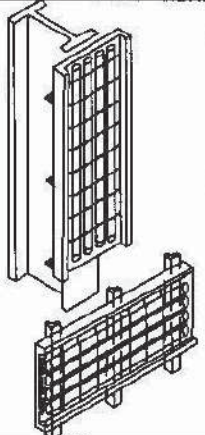
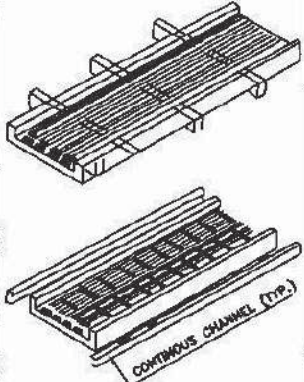
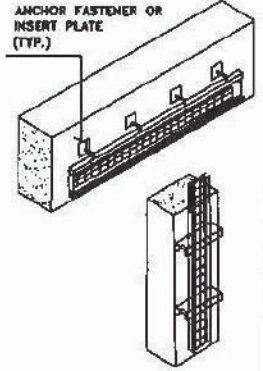
REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.
			REVISIONS				
SECTION: INSTRUMENTATION							
NAME	DATE	CHKD	DATE				
DSGN	R.K.S	P.S.					
DRWN	SUNIL						
APPROVED	D.G.M.						
CONCRETE COLOUMN MOUNTING				 मेकॉन लिमिटेड MECON LIMITED			
				SCALE : N.T.S.		(SH. 2 OF 3)	
				ORG.NO: MEC/05/E5/SD/IS/010 B		REV 0	



- NOTES:-**
1. ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE SPECIFIED.
 2. PIPE MATERIAL SHALL BE IS:1239 HEAVY GRADE AS A MINIMUM.
 3. 6mm DIA WEEP HOLE SHALL BE PROVIDED AT LOW POINT.
 4. U-BOLT ASSEMBLY SHALL BE OF MIN. M12 SIZE WITH NUT AND SPRING WASHERS.
 5. ALL WELD SHALL BE 3mm FILLET WELD FULL STRENGTH.
 6. ADD 50mm WHERE-EVER ARE INSULATION IS PROVIDED.
 7. BOLT SHALL BE TURNED FROM MS ROUNDS CONFIRMING TO IS : 432 GRADE 1.
 8. NUTS AND WASHERS SHALL CONFIRM TO IS : 1363 AND IS : 3138.

REV. NO.	DATE	ZONE	DESCRIPTIONS	BY	APPRD.	REFERENCES	DRG. NO.
SECTION: INSTRUMENTATION							
DSGN	R.K.S		CHKD	P.S.			
DRWN	SUNIL						
APPROVED	D.G.M.						

STEEL COLOUMN MOUNTING						मेकॉन लिमिटेड MECON LIMITED	
				SCALE : N.T.S.		(SH. 3 OF 3)	
				DRG.NO: MEC/05/E5/SD/IS/010 B		REV 0	

CABLE CLAMPING ON PERFORATED TRAYS																																										
SINGLE CLAMPING FOR TWO CABLES		SINGLE CLAMPING FOR MULTIPLE CABLES		DUAL CLAMPING FOR MULTIPLE CABLES		CABLE CLAMPS DETAIL																																				
																																										
PERFORATED TRAY-SUPPORTING DETAILS																																										
TRAY ROUTING EDGEWISE HOR./ VER RUNS		TRAY ROUTING EDGEWISE IN HOR./ VER RUNS		TRAY ROUTING WIDTHWISE IN HORIZONTAL RUNS		TRAY ROUTING CONCRETE BEAM/COLUMN IN HOR./VER. PLANE																																				
																																										
NOTES: 1. ALL DIMENSIONS ARE IN mm. 2. PERFORATED TRAY SHALL BE SUPPORTED AT EVERY 1000mm (TYP.) INTERVAL FOR HORIZONTAL AS WELL AS VERTICAL RUNS USING MINIMUM ANGLE SIZE AS 40x40x5 DR CONTINUOUS CHANNEL SUPPORT MC50. 3. CLAMPING OF CABLES ON PERFORATED TRAYS SHALL BE AT EVERY 500 mm ON VERTICAL RUNS AND EVERY 1000mm ON HORIZONTAL RUNS. 4. PERFORATED TRAYS SHALL BE SUPPLIED WITH CLAMPS, BOLTS/NUTS AND WASHER OF GALVANISED MILD STEEL. 5. GALVANISING SHALL BE AS PER 475B(55um/460g/m2) 6. THE PERFORATED TRAY THICKNESS SHALL BE 2mm.						CAPACITY OF PERFORATED TRAYS <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">TRAY WIDTH (W)</th> <th rowspan="2">FLANGE HEIGHT (H)</th> <th colspan="3">NO. OF CABLES</th> </tr> <tr> <th>1 PAIR/ 1 TRIAD</th> <th>6 PAIR/ 6 TRIAD</th> <th>12 PAIR/ 6 TRIAD</th> </tr> </thead> <tbody> <tr> <td>60</td> <td>20</td> <td>2</td> <td>1</td> <td>1</td> </tr> <tr> <td>100</td> <td>30</td> <td>4</td> <td>2</td> <td>1</td> </tr> <tr> <td>150</td> <td>30</td> <td>8</td> <td>4</td> <td>3</td> </tr> <tr> <td>200</td> <td>30</td> <td>10</td> <td>8</td> <td>4</td> </tr> <tr> <td>300</td> <td>30</td> <td>15</td> <td>8</td> <td>8</td> </tr> </tbody> </table>				TRAY WIDTH (W)	FLANGE HEIGHT (H)	NO. OF CABLES			1 PAIR/ 1 TRIAD	6 PAIR/ 6 TRIAD	12 PAIR/ 6 TRIAD	60	20	2	1	1	100	30	4	2	1	150	30	8	4	3	200	30	10	8	4	300	30	15	8	8
TRAY WIDTH (W)	FLANGE HEIGHT (H)	NO. OF CABLES																																								
		1 PAIR/ 1 TRIAD	6 PAIR/ 6 TRIAD	12 PAIR/ 6 TRIAD																																						
60	20	2	1	1																																						
100	30	4	2	1																																						
150	30	8	4	3																																						
200	30	10	8	4																																						
300	30	15	8	8																																						
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>REV NO</td> <td>DATE</td> <td>ZONE</td> <td>DESCRIPTIONS</td> <td>BY</td> <td>APPRO</td> <td>REFERENCES</td> <td>DRG. NO.</td> </tr> <tr> <td colspan="8" style="text-align: center;">REVISIONS</td> </tr> </table>										REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRO	REFERENCES	DRG. NO.	REVISIONS																								
REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRO	REFERENCES	DRG. NO.																																			
REVISIONS																																										
SECTION: INSTRUMENTATION <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td>NAME</td> <td>DATE</td> <td>CHKD</td> <td>DATE</td> </tr> <tr> <td>DSGN R.K.S</td> <td></td> <td>P.S</td> <td></td> </tr> <tr> <td>DRWN SUMI</td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="4">APPROVED</td> </tr> </table>						NAME	DATE	CHKD	DATE	DSGN R.K.S		P.S		DRWN SUMI				APPROVED				PERFORATED TRAY SUPPORTS & CABLES CLAMPING DETAILS				मेकॉन लिमिटेड MECON LIMITED																
NAME	DATE	CHKD	DATE																																							
DSGN R.K.S		P.S																																								
DRWN SUMI																																										
APPROVED																																										
						SCALE : N.T.S. (SH. 1 OF 1)		REV 0																																		
						DRG.NO MEC/D5/E5/SD/CB-LY/D12																																				

ANNEXURE – V

**LIST OF VENDORS FOR BOUGHT-
OUT ITEMS**

INSTRUMENTATION

I) PRESSURE REGULATOR AND SLAM SHUT VALVE

- 1) M/s Pietro Fiorentini S.P.A. (Italy)
- 2) M/s Emerson Process Management (Singapore)
- 3) M/s RMG-Regel Messtechnik (Germany)
- 4) M/s Nirmal Industrial Controls (India)
- 5) M/s Gortter Controls (Netherlands)
- 6) M/s Dresser

II) PID CONTROLLER

- 1) M/s ABB
- 2) M/s EUROTHERN
- 3) M/s TATA HONEYWELL
- 4) M/s MASIBUS

III) ORIFICE FITTINGS (METER RUN, FLOW CONDITIONER & ORIFICE PLATE, ORIFICE ASSLY)

- 1) M/s Emerson Process Management (Daniel), USA
- 2) M/s Canalta Controls, Canada
- 3) M/s FMC, USA
- 4) M/s Pietro Fiorentini, Italy

IVA) PANEL MOUNTED FLOW COMPUTERS

- 1) M/s Barton Instruments System Ltd.
- 2) M/s Daniel Measurement and Controls
- 3) M/s Instromet International, Belgium
- 4) M/s RMG Messtechnik GmbH
- 5) M/s Omni Flow Computers Inc.

IVB) FIELD MOUNTED FLOW COMPUTER

- 1) M/s Barton Instruments System LLC
- 2) M/s Daniel Measurement and Controls
- 3) M/s Bristol Babcock

V) GAS CHROMATOGRAPH

- 1) ABB Ltd , India
- 2) Daniel Measurement & Control Asia Pacific, India
- 3) Instromet International, NV
- 4) RMG Regal+Messtechnik GmbH

VI) L.E. L DETECTION SYSTEM

- 1) Crowcon Detection Instruments Ltd
- 2) Detection Instruments (I) Pvt Ltd
- 3) Detector Electronics Corporation
- 4) MSA – Mines safety appliances.
- 5) Oldham France S.A.
- 6) Honeywell

VII) CONTROL AND SIGNAL CABLES

- 1) M/s ASSOCIATED CABLES
- 2) M/s ASSOCIATED FLEXIBLES
- 3) M/s DELTON Cables Ltd, India
- 4) M/s BROOK
- 5) M/s KEI Industries Ltd INDIA
- 6) M/s Suyog Electricals Ltd, India
- 7) M/s Thermo Cables Ltd
- 8) M/s Udey Pyrocables Pvt Ltd, India
- 9) M/s T C Communication Ltd.

VIII) ZENER BARRIERS/ISOLATORS

- 1) M/s MTL
- 2) M/s P & F

IX) RTDs

- 1) M/s General Instruments Ltd., Mumbai
- 2) M/s Nagman Sensors (Pvt.) Ltd.
- 3) M/s Pyro Electric, Goa

X) PRESSURE, TEMPERATURE & DIFF. PRESSURE TRANSMITTER

- 1) M/s Fisher Rosemount (Emerson)
- 2) M/s Yokogawa
- 3) M/s Fuji
- 4) M/s Honeywell

XI) PRESSURE GAUGES, TEMPERATURE GAUGES & DIFFERENTIAL PRESSURE GAUGE

- 1) M/s AN Instruments Pvt. Ltd., New Delhi
- 2) M/s General Instruments Ltd., Mumbai
- 3) M/s WIKA

XII)A SS TUBE

- 1) Sandvik, Sweden

- 2) Choksy Tube Co Ltd.
- 3) Heavy Metals & Tubes Ltd.
- 4) Nuclear Fuel Complex, India
- 5) Scorodite
- 6) Ratnamani Metal & Tubes Ltd
- 7) Jindal Saw

XII)B SS TUBE FITTINGS

- 1) M/s Swagelok (USA)
- 2) M/s Parker (USA)
- 3) M/s Excelsior
- 4) M/s Reliance
- 5) M/s Multimetal
- 6) M/s Comfit
- 7) M/s Aura Inc
- 8) M/s Arya Crafts
- 9) M/s Swastic

XII)C SS VALVES & MANIFOLDS

- 1) M/s Swagelok (USA)
- 2) M/s Parker (USA)
- 3) M/s Excelsior
- 4) M/s Comfit
- 5) M/s Aura Inc
- 6) M/s Arya Crafts
- 7) M/s Swastic

XIII) JUNCTION BOXES AND CABLES GLANDS

- 1) M/s EX-PROTECTA
- 2) M/s FLAMEPROOF CONTROL GEARS
- 3) M/s BALIGA
- 4) M/s FLEXPLO ELECTRICALS

XIV) PUSH BUTTONS/LAMPS:

- 1) L&T
- 2) SIEMENS

XV) MCB'S:

- 1) HAVELL'S
- 2) INDO ASIAN
- 3) MDS

XVI) RELAYS:

- 1) OEN
- 2) JYOTI

XVII) POWER SUPPLY UNIT:

- 1) ELNOVA
- 2) APLAB

XVIII) CONTROL ROOM EQUIPMENT CONTROL PANEL & ACCESSORIES

- 1) M/s Keltron Controls Ltd., Kerala
- 2) M/s RITTAL
- 3) M/s Pyrotech
- 4) M/s Positronics Pvt. Ltd.
- 5) M/s ABB Instruments Ltd., New Delhi
- 6) M/s Emerson Process Management (I) Pvt. Ltd.
- 7) M/s Rockwell Automation (I) Ltd., Ghaziabad
- 8) M/s Siemens Ltd.
- 9) M/s Tata Honeywell Ltd.

XIX) PRINTERS

1. Compaq
2. Dell
3. IBM
4. HP
5. EPSON

XX) ACTUATOR

1. Rotork
2. Schuck
3. Biffi
4. Ledeen

MECHANICAL

i) PIPE CARBON STEEL TO INDIAN STANDARDS

1. A.S.T. PIPES PVT. LTD. (AST GROUP)
2. ADVANCE STEEL TUBE LTD.
3. APL APOLLO TUBES LTD. (ER. BIHAR TUBES LTD.)
4. ASIAN MILLS PVT. LTD.
5. ASRANI TUBES LIMITED
6. DADU PIPES (P) LTD.
7. ESSAR STEEL LIMITED(ER HAZIRA PIPES MILL)
8. GAURANG PRODUCTS PVT LTD. (AST GROUP)
9. GOODLUCK STEEL TUBES LTD.
10. HI-TECH PIPES LIMITED
11. INDUS TUBE LIMITED
12. JINDAL INDUSTRIES LTD
13. JINDAL PIPES LTD.
14. JINDAL SAW LTD (KOSI WORKS)
15. JOTINDRA STEEL & TUBE LTD
16. LALIT PIPES AND PIPES LTD.

17. MAHARASHTRA SEAMLESS LTD.
18. MAN INDUSTRIES (INDIA) LTD. – PITHAMPUR
19. MAN INDUSTRIES (INDIA) LTD. ANJAR
20. MUKAT TANKS & VESSELS LTD.
21. NEZONE TUBES LIMITED
22. NORTH EASTERN TUBES LIMITED
23. PRATIBHA INDUSTRIES LIMITED
24. PRATIBHA PIPES & STRUCTURAL LTD.
25. PSL LTD (CHENNAI)
26. PSL LTD (V1, V2 & NC)
27. RAMA STEEL TUBES LTD.
28. RATNAMANI METALS AND TUBES LTD.
29. RAVINDRA TUBES LIMITED
30. SAMSHI PIPE INDUSTRIES LIMITED
31. SURYA ROSHNI LTD.
32. SWASTIK PIPES LTD.
33. UTKARSH TUBES & PIPES LTD. (FORMLY BMW)
34. WELSPUN CORP. LIMITED (DAHEJ)
35. ZENITH BIRLA (INDIA) LIMITED

ii) PIPE & TUBULARS TO A.P.I. STANDARDS

1. ARCELORMITTAL TUBULAR PRODUCTS ROMAN SA, ROMANIA
2. BHEL (TRICHY), INDIA
3. DALMINE SPA (ENQUIRY TO TENARIS), UAE
4. EEWKOREA CO. LTD (GERMANY), KOREA
5. EEW KOREA CO. LTD. (KOREA), KOREA
6. EISENBAU KRAMER GMBH, GERMANY
7. HYUNDAI RB CO. LTD. SOUTH KOREA
8. ILVA LAMIERE E TUBI SRL (ENQ TO ILVA SPA, ITALY)
9. INOX TECH. SPA, ITALY
10. ISMT LTD. AHMEDNGR, INDIA
11. ISMT LTD. BARAMATI, INDIA
12. JINDAL PIPES LTD., INDIA
13. JINDAL SAW LTD. (KOSI WORKS), INDIA
14. JINDAL SAW LTD. (NASHIK WORKS), INDIA
15. LALIT PIPES AND PIPES LTD. INDIA
16. MAHARASHTRA SEAMLESS LTD., INDIA
17. MAN INDUSTRIES (I) LTD. (PITHAMPUR), INDIA
18. MUKAT TANKS & VESSELS LTD., INDIA
19. PRATIBHA INDUSTRIES LIMITED, INDIA
20. RATNAMANI METALS AND TUBES LTD., INDIA
21. SIDERCA S.A.I.C (ENQUIRY TOTENARIS), UAE
22. SUMITOMO METAL IND. LTD., INDIA
23. SURYA ROSHNI LTD., INDIA
24. SWASTIK PIPES LTD, INDIA
25. TATA STEEL UK LIMITED (FORMERLY C702)
26. TUBOS DE ACERO DE MEXICO SA (ENQ. TENARIS), UAE
27. TUBOS REUNIDOS SA SPAIN
28. UMRAN STEEL PIPE INC (TURKEY), TURKEY
29. VALCOVNY TRUB CHOMUTOV, CZECH REPUBLIC
30. VALLOUREC AND MANNESMANN TUBES, FRANCE
31. WELSPUN CORP LIMITED (DAHEJ), INDIA

iii) PIPE/TUBE CS (SEAMLESS) TO ASTM STDS

1. ARCELORMITTAL TUBULAR PRODUCTS ROMAN SA, ROMANIA
2. BHEL (TRICHY), INDIA
3. CHANGSHU SEAMLESS STEEL TUBE CO. LTD., CHINA
4. DALMINE SPA (ENQUIRY TO TENARIS), UAE
5. HEAVY METALS & TUBES LIMITED (MEHSANA), INDIA

6. ISMT LTD. AHMEDNGR, INDIA
7. ISMT LTD. BARAMATI INDIA
8. JFE STEEL CORPORATION, UAE
9. JINDAL SDAW LTD (NASHIK WORKS) INDIA
10. KLT AUTOMOTIVE AND TUBULAR PRODUCTS LTD., INDIA
11. MAHALAXMI SEAMLESS LIMITED, INDIA
12. MAHARASHTRA SEAMLESS LTD, INDIA
13. PRODUCTS TUBULARES S.A.U, SPAIN
14. RATNADEEP METAL TUBES LTD., INDIA
15. STAINNEST TUBES PVT LTD., INDIA
16. SUMITOMO METAL IND. LTD., INDIA
17. TUBOS REUNIDOS SA SPAIN
18. VALCOVNY TRUB CHOMUTOV, CZECH REPUBLIC
19. VALLOUREC ANDMANNESMANN TUBES FRANCE
20. YANGZHOU CHENGDE STEEL PIPE CO. LTD DUBAI (UAE)

iv) PIPE CARBON STEEL (WELDED) TO ASTM STDS

1. EEW KOREA CO. LTD. (GERMANY), KOREA
2. EEW KOREA CO. LTD. (KOREA), KOREA
3. EISENBAU KRAMER GMBH, GERMANY
4. HYUNDAI RB CO. LTD., SOUTH KOREA
5. INOX TECH. SPA, ITALY
6. JINDAL SAW LTD (KOSI WORKS), INDIA
7. LALIT PIPES AND PIPES LTD., INDIA
8. MAN INDUSTRIES (I) LTD.(PITHAMPUR), INDIA
9. MAN INDUSTRIES (INDIA) LTD. ANJAR, INDIA
10. MUKAT TANKS & VESSELS LTD., INDIA
11. RATNAMANI METALS AND TUBES LTD., INDIA
12. SUMITOMO METAL INDIA LTD., INDIA
13. TATA STEEL UK LIMITED

v) Valve

a) Globe Valves

- 1) M/s Weir BDV Valves (Aunit of Weir India Pvt. Ltd.)
- 2) M/s Datre Corpn (Calcutta)
- 3) M/s KSB Pumps Ltd., Coimbatore, India
- 4) M/s L&T Audco
- 5) M/s Neco Schuber & Salzer Ltd. (New Delhi)
- 6) M/s Niton Valve India Pvt. Ltd., India
- 7) M/s Ornate Valves (Mumbai)
- 8) M/s Panchavati Valves & Flages (P) Ltd., India
- 9) AV Valves Ltd., India
- 10) BHEL (Trichy), India
- 11) Econo Valves Pvt Ltd, India
- 12) Fouress Engg (I) Ltd (Aurangabad), India
- 13) Leader Valves Ltd, India
- 14) Oswal Industries Ltd, India
- 15) Petrochemical Engineering Enterprises, India (Fouress Group)
- 16) Sakhi Engineers Pvt Ltd., India
- 17) Shalimar Valves Pvt Ltd., India
- 18) Steel Strong Valves India Pvt Ltd, India
- 19) Petro Valves Pvt. Limited, Ahmedabad
- 20) Fluid Line Valves Co. (P) Ltd., India
- 21) MICON Engineers (Hubli) (P) Ltd., India

b) Check Valves

1. M/s Advance Valves Pvt. Ltd., Noida
2. M/s Aksons & Mechanical Enterprises, Mumbai
3. M/s Larsen & Toubro Limited (M/s Audco India Limited, Chennai)
4. M/s AV Valves Ltd., India
5. M/s Weir BDV Valves (A unit of Weir India Pvt. Ltd.)
6. M/s BHEL, Trichy
7. M/s Datre Coroportion Limited, Calcutta
8. M/s Leader Valves Ltd., Jalandhar
9. M/s Neco schubert & Salzer Ltd., New Delhi
10. M/s Niton Valves Industries (P) Ltd., Mumbai
11. M/s Precision Engg.Co., Mumbai
12. Econo Valves Pvt Ltd, India
13. Fouress Engg (I) Ltd (Aurangabad)
14. KSB Pumps Ltd (Coimbatore), India
15. NSSL Ltd. (Neco Schubert & SalzerLtd)
16. Oswal Industries Ltd, India
17. Panchvati Valves & Flanges Pvt Ltd, India
18. Petrochemical Engineering Enterprises, India (Fouress Group)
19. Sakhi Engineers Pvt Ltd
20. Shalimar Valves Pvt Ltd
21. Steel Strong Valves India Pvt Ltd, India
- 22) Fluid Line Valves Co. (P) Ltd., India
22. MICON Engineers (Hubli) (P) Ltd., India

c) **Plug Valves**

- 1) M/s Breda Energia Sesto Industria Spa, Italy
- 2) M/s Fisher Sanmar Ltd., Chennai
- 3) M/s Larsen & Toubro Ltd., (Audco) New Delhi
- 4) M/s Nordstrom Valves, USA
- 5) M/s Serck Audco Valves, UK
- 6) M/s Sumitomo Corporation India Pvt. Ltd., New Delhi
- 7) M/s Z Corporation, Korea
- 8) M/s Hawa Valves (India) Pvt. Ltd., Mumbai
- 9) M/s Steel Strong Valves India Pvt. Ltd., Navi Mumbai
- 10) M/s Econo Valves Pvt. Ltd., India (WSSL Ltd. Group Co.)
- 11) M/s Flow-Serve PTE (Mfr. SERCK), India
- 12) M/s Galli Cassina SPA, Italy

d) **Ball Valves**

1. M/s Hawa Valves (India) Pvt. Ltd, Navi Mumbai
2. M/s Larsen & Toubro (Audco), India
3. M/s Oswal Industries Ltd., India
4. M/s Virgo Engineers Ltd., Delhi
5. M/s Boteli Valve Group Co. Ltd., China
6. M/s Cameron Italy s.r.l., Italy
7. M/s Dafram S.P.A., Italy
8. M/s Fangyuan Valve Group Co. Ltd., China
9. M/s Franz Schuck GmbH, Germany
10. Kita Mura Valve Manufacturing Co.Ltd., India
11. Petrol Valve S.R. Italy
12. Piplviesse S.P.A. Italy
13. Tormene Gas Technology S.P.A. Valvetalia Group, Italy
14. Valbeot S.R.L. Italy
15. KMC Corporation, South Korea
16. MSA a.s. Czeek Republic
17. OMS Aleri, Italy

18. PCC Valves s.r.l. Italy
19. Perar s.p.a. (Engineering. To TRP srl), Italy
20. Italy s.r.l., Italy
21. MIR Valves, Malaysia

vi) Split Tee

- 1) M/s Ipsco, Canda
- 2) M/s TD Willamsons, USA

vii) Flanges

1. M/s Aditya Forge Ltd., Vadodara
2. M/s Amforge Industries Ltd., Mumbai
3. M/s CD Engineering Co., Ghaziabad
4. M/s Echjay Forgings Pvt. Ltd. (Bombay), Mumbai
5. M/s Echjay Industries Ltd., Rajkot
6. M/s Forge & Forge Pvt. Ltd., Rajkot
7. M/s Golden Iron & Steel Works, New Delhi
8. M/s JK Forgings, New Delhi
9. M/s Metal Forgings Pvt. Ltd., Mumbai
10. M/s Perfect Marketings Pvt. Ltd., New Delhi
11. M/s Sky Forge, Faridabad
12. M/s S&G, Faridabad
13. Chaudhry Hammer Works Ltd, India
14. JAV Forgings (P) Ltd, India
15. Kunj Forgings Pvt Ltd, India
16. MS Fittings Mgf. Co. Pvt. Ltd.
17. R.N. Gupta & Co. Ltd, India
18. R.P. Engineering Pvt Ltd, India
19. Sanghvi Forgings & Engineering Ltd
20. Shri Ganesh Forgings Ltd., India
21. Uma Shankar Khandelwal & Co., India
22. Sawan Engineers, Baroda
23. Stewarts & Lloyds of India Ltd., Kolkata
24. Engineering Services Enterprises
25. Abasi Engineersing Works, India
26. Anandmayee Forgings Pvt Ltd, India
27. CD Industries., India
28. Fivebros Forgings Vot Ltd., India
29. Good Luck Engineering Co., India
30. Korea Flange, South Korea
31. Lal Metal Forge Ltd, India
32. Melesi Officine
33. Amlrojie Melesi & C. srl. Italy
34. Nicola Galperti & Figlio S.P.A India
35. Paramount Forge, India
36. Pradeep Metal Limited, India
37. Punjab Steel Works (the), India
38. R.D.Forge, India
39. Shah Industrial & Comml. Corporation, India
40. Ulma Forja S. Coop.
41. Vivial Forge Pvt. Ltd., Vadodara

viii) Fittings

1. M/s Commercial Supplying Agency, Mumbai
2. M/s Dee Development Engineers Ltd.
3. M/s Eby Industries, Mumbai
4. M/s Flash Forge Pvt. Ltd., Vishakhapatnam

5. M/s Gujarat Infra Pipes Pvt. Ltd., Vadodara
6. M/s M.S. Fittings Mfg. Co. Pvt. Ltd., Kolkata
7. M/s Stewarts & Lloyds of India Ltd., Kolkata
8. M/s Teekay Tubes Pvt. Ltd., Mumbai
9. M/s Pipe Fit, Baroda
10. M/s Sky Forge, Faridabad
11. M/s S&G, Faridabad
12. M/s Sawan Engineers, Baroda
13. Eby Fasteners, India
14. R.N. Gupta & Co. Ltd, India
15. Exten Engg Pvt Ltd
16. Sivananda Pipe & Fittings Ltd
17. Chero Piping SPA, Italy
18. CSA Fittings, India
19. EBY Fasteners, India
20. Fittnox SRL, Italy
21. Keonsae High Pressure Co. Ltd., South Korea
22. Munro & Miller Fittings Ltd., U.K.
23. TK Corporation, South Korea
24. Tube Turn (India) Pvt Ltd., India
25. Topaz Piping Industries, India
26. Technoforge SPA, Italy
27. P.K. Tubes & Fittings Pvt. Ltd., India
28. Vivial Forge Pvt. Ltd., Vadodara

ix) Gaskets

1. IGP Engineers (P) Ltd., Madras
2. Madras Industrial Products, Madras
3. Dikson & Company, Bombay
4. Banco Products (P) Ltd., Vadodara
5. Goodrich Gaskets Pvt Ltd
6. Starflex Sealing India Pvt Ltd, India
7. Teekay Meta Flex Pvt Ltd
8. UNIKLINGER Ltd
9. HEM Engg. Corp.
10. Unique Industrial Packing Pvt. Ltd.

x) Fasteners

1. Nireka Engg. Co. (P) Ltd., Calcutta
2. Precision Taps & Dies, Bombay
3. AEP Company, Vithal Udyoug Nagar
4. Fix Fit Fasteners, Calcutta
5. Precision Engg. Industries, Baroda
6. Echjay Forgings Pvt. Ltd., Bombay
7. Capital Industries, Bombay
8. Boltmaster India Pvt Ltd, India
9. Deepak Fasteners Limited, India
10. Fasteners & Allied Products Pvt Ltd, India
11. Hardwin Fasteners Pvt Ltd, India
12. J.J. Industries, India
13. Multi Fasteners Pvt Ltd, India
14. Nexo Industries, India
15. Pacific Forging & Fasteners Pvt Ltd, India
16. Pioneer Nuts & Bolts Pvt Ltd, India
17. Precision Auto Engineers, India
18. President Engineering Works, India
19. Sandeep Engineering Works, India

20. Syndicate Engineering Industries, India
21. BEA SRL, Italy
22. Korea Parts & Fasteners (KPF), South Korea
23. Kundan Industries Ltd., India
24. Mega Engineering Pvt. Ltd., India
25. OME Metallurgica ERBESE S.R.L, Italy
26. Pankaj International, India
27. Udehra Fasters Ltd., India

xi) Welding Electrodes

1. For Mainline – Lincon make
2. For Terminal – For root pass - Lincon Make
For other passes – Lincon, D&H or equivalent make

PROCESS

I) CARTRIDGE FILTER

- 1) M/s Grand Prix Fab (Pvt.) Ltd. (New Delhi)
- 2) M/s Multitex Filtration Engineers Ltd. (New Delhi)
- 3) M/s Perry Equipment Corp. (USA)
- 4) M/s Siirtec NIGI SPA (Italy)
- 5) M/s Axsia Howmar Ltd. (UK)
- 6) M/s Faudi Filters Systems GmbH (Germany)
- 7) M/s Filtan Filter Anlagenbau GmbH (Germany)
- 8) M/s Plenty Filters (UK)
- 9) M/s Forain S.r.l. (Italy)
- 10) M/s Ravi Techno Systems (Mumbai)
- 11) M/s Gujarat Otofilt (Ahmedabad)
- 12) M/s Nirmal Industrial Controls (India)
- 13) M/s Flash Point
- 14) M/s Fil Sep Equipments Pvt. Ltd.

II) PRESSURE SAFETY VALVES

- 1) M/s Keystone Valves (India) Pvt. Ltd. (Baroda)
- 2) M/s Sevim Sarasin Valves India (P) Ltd
- 3) M/s Tyco Sanmar Ltd. (New Delhi)
- 4) M/s Parcol SPA, Italy
- 5) M/s Tai Milano SPA, Italy
- 6) M/s Emerson Process, Singapore
- 7) M/s Instrumentation Ltd., Palghat

III) KO DRUM

- 1) MULTITEX
- 2) GRAND PRIX

IV) FILTER SEPARATOR

- 1) MULTITEX
- 2) GRAND PRIX
- 3) FIL SEP
- 4) ULTRA FILTER

V) CONDENSATE TANK

- 1) MULTITEX
- 2) GRAND PRIX
- 3) NIRMAL INDUSTRIAL CONTROLS
- 4) MEENAKSHI ASSOCIATES
- 5) AERO ENGINEERS

VI) SCRUBBER

- 1) MULTITEX
- 2) GRAND PRIX

VII) CARTRIDGE ELEMENT MAKE

- 1) PECO
- 2) PALL
- 3) FILTERITE
- 4) VELCON
- 5) FACET
- 6) BURGESS MANNING

For porous metal cartridge

- 1) FUJI
- 2) PALL
- 3) PORAL
- 4) MOTT

VIII) QUICK OPENING CLOSURE MAKE

- 1) Peerless
- 2) Grinell
- 3) Peco,
- 4) Siirtec
- 5) Huber Yale
- 6) G.D. Engineering

Note-1

For procuring bought out items from vendors other than those listed above / for items not having vendor list, the same may be acceptable subject to the following :-

- a) The vendor/ supplier of bought out item(s) is a regular and reputed 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/MECON/OTHER PSU.
- c) Should have supplied at least 50% of required quantity or minimum 1 number whichever is higher of maximum size and rating of item(s) as required for intended services.

Successful bidder shall submit documentary evidences i.e. PO copies, Inspection Certificate etc. for the above at the time of drawing approval. Bidder may fulfill the above requirement using multiple PO in last seven years reckoned from bid due date. In case of ARC contracts, 50% qty. shall be determined based on quantity derived from FOA skid quantities specified in ARC FOA. Since Qtys are very large therefore Vendor can opt for Multiple makes in order to meet delivery schedule.

For MECHANICAL Items - category (v) VALVES, for makes of following Items , i.e., (b) CHECK VALVES , (c) PLUG VALVES and (d) BALLVALVES, valve manufacturer's valid API 6D certificate shall be submitted, even if his name appears in the above vendor list. Manufacturers of BALL / PLUG / CHECK valves, whose API 6D license is not found in active status during drawing approvals will not be accepted.

Note-2

The details of vendors indicated in this list are based on the information available with MECON; 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 party and also to expedite the material in time.

For MECHANICAL Items - category (v) VALVES, for makes of following Items , i.e., (b) CHECK VALVES , (c) PLUG VALVES and (d) BALLVALVES, valve manufacturer's valid API 6D certificate shall be submitted, even if his name appears in the above vendor list. Manufacturers of BALL / PLUG / CHECK valves, whose API 6D license is not found in active status during drawing approvals will not be accepted.

ANNEXURE - VI

QAPs

	CONTRACTOR		QUALITY ASSURANCE PLAN FOR STRUCTURAL AND MECHANICAL EQUIPMENT				PROJECT :																																																																																																																														
	ORDER NO. & DATE						PACKAGE NO.:																																																																																																																														
	SUB-CONTRACTOR						PACKAGE NAME : Ball Valve, Plug Valve, Check Valve, Globe Valve																																																																																																																														
	ORDER NO. & DATE																																																																																																																																				
INSTRUCTIONS FOR FILLING UP : 1. QAP shall be submitted for each of the equipment separately with break up 1. of assembly/sub-assembly & part/component or for group of equipment 2. having same specification. 2. Use numerical codes as indicated for extent of inspection & tests and submission of test certificates & documents. Additional codes & description 5. for extent of inspection & tests may be added as applicable for the plant 6. and equipment 3. Separate identification number with quantity for equipment shall be indicated wherever equipment having same specifications belonging 9. to different facilities are grouped together. 4. Weight in kilograms 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 style="width:100%; border-collapse: collapse;"> <tr> <th style="text-align: left;">Code</th> <th style="text-align: left;">Description</th> <th style="text-align: left;">Code</th> <th style="text-align: left;">Description</th> <th style="text-align: left;">Code</th> <th style="text-align: left;">Description</th> </tr> <tr> <td></td><td>Visual</td><td>18.</td><td>Amplitude Test</td><td>34.</td><td>Internal Inspection Report</td> </tr> <tr> <td></td><td>Dimensional</td><td>19.</td><td>Sponge Test</td><td></td><td>by Contractor</td> </tr> <tr> <td>3.</td><td>Fitment & Alignment</td><td>20.</td><td>Dust/ Water Ingress Test</td><td>35.</td><td>Hardness Test</td> </tr> <tr> <td>4.</td><td>Physical Test (Sample)</td><td>21.</td><td>Friction Factor Test</td><td>36.</td><td>Spark Test for Lining</td> </tr> <tr> <td></td><td>Chemical Test (Sample)</td><td>22.</td><td>Adhesion Test</td><td>37.</td><td>Calibration</td> </tr> <tr> <td></td><td>Ultrasonic Test</td><td>23.</td><td>Performance Test/Characteristic Curve</td><td>38.</td><td>Safety Device Test</td> </tr> <tr> <td>7.</td><td>Magnetic Particle Test (MPI)</td><td>24.</td><td>No Load/ Free Running Test</td><td>39.</td><td>Ease of Maintenance</td> </tr> <tr> <td>8.</td><td>Radiography Test</td><td>25.</td><td>Load/ Overload Test</td><td>40.</td><td>Fire Test (Type Test)</td> </tr> <tr> <td></td><td>Dye Penetration Test</td><td>26.</td><td>Measurement of Speeds</td><td>41.</td><td>Charpy V-Notch Test</td> </tr> <tr> <td>10.</td><td>Metallographic Exam.</td><td>27.</td><td>Accoustical Test</td><td>42.</td><td>Operational Torque Test</td> </tr> <tr> <td>11.</td><td>Welder's Qualification & Weld Procedure Test</td><td>28.</td><td>Geometrical Accuracy</td><td>43.</td><td>ENP (Electroless Nickel Plating) Execution</td> </tr> <tr> <td>12.</td><td>Approval of Test and Repair Procedure</td><td>29.</td><td>Repeatability and Positioning Accuracy</td><td>44.</td><td>Painting</td> </tr> <tr> <td>13.</td><td>Heat Treatment</td><td>30.</td><td>Proving Test</td><td>45.</td><td>Anti-Static Test</td> </tr> <tr> <td>14.</td><td>Pressure Test</td><td>31.</td><td>Surface Preparation</td><td>46.</td><td>Hydrostatic Double Block & Bleed Test</td> </tr> <tr> <td>15.</td><td>Leakage Test</td><td>32.</td><td>Manufacturer's Test Certificates bought-out items</td><td>47.</td><td>Functional Test</td> </tr> <tr> <td>16.</td><td>Balancing for</td><td>33.</td><td>IBR/ Other Statutory agencies compliance certificate</td><td>48.</td><td>Pneumatic Double Block & Bleed Test</td> </tr> <tr> <td>17.</td><td>Vibration Test</td><td></td><td></td><td>49.</td><td>Cyclic Test</td> </tr> <tr> <td></td><td></td><td></td><td></td><td>50.</td><td>STRIP TEST</td> </tr> </table>													Code	Description	Code	Description	Code	Description		Visual	18.	Amplitude Test	34.	Internal Inspection Report		Dimensional	19.	Sponge Test		by Contractor	3.	Fitment & Alignment	20.	Dust/ Water Ingress Test	35.	Hardness Test	4.	Physical Test (Sample)	21.	Friction Factor Test	36.	Spark Test for Lining		Chemical Test (Sample)	22.	Adhesion Test	37.	Calibration		Ultrasonic Test	23.	Performance Test/Characteristic Curve	38.	Safety Device Test	7.	Magnetic Particle Test (MPI)	24.	No Load/ Free Running Test	39.	Ease of Maintenance	8.	Radiography Test	25.	Load/ Overload Test	40.	Fire Test (Type Test)		Dye Penetration Test	26.	Measurement of Speeds	41.	Charpy V-Notch Test	10.	Metallographic Exam.	27.	Accoustical Test	42.	Operational Torque Test	11.	Welder's Qualification & Weld Procedure Test	28.	Geometrical Accuracy	43.	ENP (Electroless Nickel Plating) Execution	12.	Approval of Test and Repair Procedure	29.	Repeatability and Positioning Accuracy	44.	Painting	13.	Heat Treatment	30.	Proving Test	45.	Anti-Static Test	14.	Pressure Test	31.	Surface Preparation	46.	Hydrostatic Double Block & Bleed Test	15.	Leakage Test	32.	Manufacturer's Test Certificates bought-out items	47.	Functional Test	16.	Balancing for	33.	IBR/ Other Statutory agencies compliance certificate	48.	Pneumatic Double Block & Bleed Test	17.	Vibration Test			49.	Cyclic Test					50.	STRIP TEST
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ABBREVIATIONS USED : SV : SUB VENDOR MFR : MANUFACTURER TPI : DESIGNATED THIRD PARTY INSPECTION AGENCY H : HOLD R : REVIEW W : WITNESS							KEY TO SYMBOLS : * : TO BE FILLED BY VENDOR ** : TEST TO BE PERFORMED, IF APPLICABLE																																																																																																																														
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Sl. No.	Description (with equipment heading, place of use and brief specifications)	Identification No. (MR/SOR Item No.)	Quantity No./M	Unit Weight (Kg)	Manufacturer's Name and Address	Expected Schedule of Final Inspn.	Raw Material and In-Process Stage Inspection				Final Inspection/ Test by																																																																																																																										
							MFR/SV	TPIA	CONTR	MECON	MFR/SV	TPIA	CONTR	MECON																																																																																																																							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	14	15	16																																																																																																																				
1.0	Ball Valve, Plug Valve, Check Valve, Globe Valve		Refer (MR/SOR)	*	*	*	As per attached sheet 2 to 10																																																																																																																														
For CONTRACTOR For SUB-CONTRACTOR (Valve Manufacturer) QAP NO. MEC/WINO/05/28/M/001/QAP-002 SHEET 1 OF 10																REV 0																																																																																																																					

EQUIPMENT DETAILS					INSPECTION AND TESTS								Test Certificates & Documents to be submitted to MECON	Acceptance Criteria Standards/ IS/ BS/ ASME/ MECON TS / API /Normsand DOCUMENTS:	Inspection Codes & Sampling Plan				REMARKS
Sl. No.	Description (with equipment heading, place of use and brief specifications)	Identification No.	Quantity No./M	Unit Weight (Kg)	Raw Material and In-Process stage inspection				Final Inspection/ Test by						MFR/SV	TPIA	CONTR	MECON	
					MFR/SV	TPIA	CONTR	MECON	MFR/SV	TPIA	CONTR	MECON							
1	2	3	4	5	8	9	10	11	12	13	14	15	14	15	16A	16B	16C	16D	
1.01	Body	<u>Material</u> As per MR/SOR/ Alternate Material accepted by MECON			1,2	1,2	-	-	-	-	-	-	1. D1 2. Report	1. D1 2. MECON's TS & DS 3. Relevant Material Standard 4. Manufacturer's Specification	P	R	R	R	
					4	4	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's TS & D.S.	P	W	R	R	
					5	5	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	
					6 **	6 **	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-IV 2. MECON's T.S. & DS	P	W	R	R	Forgings, welds, wrought weld ends
					7 **	7 **	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-II 2. MECON's T.S. & DS	P	W	R	R	Wet MPI for 100% of internal surfaces of all castings & forgings & bevel surfaces (MPI/ DP)
					8 **	8 **	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-I 2. MECON's T.S.& DS	P	W	R	R	All castings as per clause 5.1.4 b) of T.S., all welds, weld ends of all cast
					9**	9**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-III 2. MECON's T.S.& DS	P	W	R	R	Bevel Surfaces (by MPI/ DP)
					13	13	-	-	-	-	-	-	Report/ Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S.& DS	P	R	R	R	
					35	35	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	
					41	41	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	

EQUIPMENT DETAILS					INSPECTION AND TESTS								Test Certificates & Documents to be submitted to MECON	Acceptance Criteria Standards/ IS/ BS/ ASME/ MECON TS / API /Normsand DOCUMENTS:	Inspection Codes & Sampling Plan				REMARKS
Sl. No.	Description (with equipment heading, place of use and brief specifications)	Identification No.	Quantity No./M	Unit Weight (Kg)	Raw Material and In-Process stage inspection				Final Inspection/ Test by						MFR/SV	TPIA	CONTR	MECON	
					MFR/SV	TPIA	CONTR	MECON	MFR/SV	TPIA	CONTR	MECON							
1	2	3	4	5	8	9	10	11	12	13	14	15	14	15	16A	16B	16C	16D	
1.02	Closure/ Body Adapter/ Tail Piece / Bonnet	Material Manufacturer to indicate (to be approved by MECON)			1,2	-	-	-	-	-	-	-	1. D1 2. Report	1. D1 2. MECON's TS & DS 3. Relevant Material Standard 4. Manufacturer's Specification	P	R	R	R	
					4	4	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's D.S.& TS	P	W	R	R	
					5	5	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	
					6**	6**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-IV 2. MECON's T.S. & DS	P	W	R	R	Forgings, welds, wrought weld ends
					7**	7**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-II 2. MECON's T.S. & DS	P	W	R	R	Wet MPI for 100% of internal surfaces of all castings & forgings & bevel surfaces (MPI/ DP)
					8**	8**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-I 2. MECON's T.S.& DS	P	W	R	R	All castings as per clause 5.1.4 b) of T.S., all welds, weld ends of all cast
					9**	9**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-III 2. MECON's T.S. & D.S.	P	W	R	R	Bevel Surfaces (by MPI/ DP)
					13	13	-	-	-	-	-	-	Report/ Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	R	R	R	
					35	35	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	
					41	41	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	

EQUIPMENT DETAILS					INSPECTION AND TESTS								Test Certificates & Documents to be submitted to MECON	Acceptance Criteria Standards/ IS/ BS/ ASME/ MECON TS / API /Normsand DOCUMENTS:	Inspection Codes & Sampling Plan				REMARKS
Sl. No.	Description (with equipment heading, place of use and brief specifications)	Identification No.	Quantity No./M	Unit Weight (Kg)	Raw Material and In-Process stage inspection				Final Inspection/ Test by						MFR/SV	TPIA	CONTR	MECON	
					MFR/SV	TPIA	CONTR	MECON	MFR/SV	TPIA	CONTR	MECON							
1	2	3	4	5	8	9	10	11	12	13	14	15	14	15	16A	16B	16C	16D	
1.03	Top Cover/Disc / Hinge Pin (For Check Valves)	<u>Material</u> Manufacturer to indicate (to be approved by MECON)			1,2	-	-	-	-	-	-	-	1. D1 2. Report	1. D1 2. MECON's TS & DS 3. Relevant Material Standard 4. Manufacturer's Specification	P	R	R	R	
					4	4	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's D.S. & T.S.	P	W	R	R	
					5	5	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	
					6 **	6 **	-	-	-	-	-	-	Test Report	1. ASME B16.34, Annex-E 2. MECON's T.S. & D.S.	P	W	R	R	Forgings, welds, wrought weld ends
					7 **	7 **	-	-	-	-	-	-	Test Report	1. ASME B16.34, Annex-C 2. MECON's T.S. & D.S.	P	W	R	R	Wet MPI for 100% of internal surfaces of all castings & forgings & bevel surfaces (MPI/ DP)
					8 **	8 **	-	-	-	-	-	-	Test Report	1. ASME B16.34 Annex-B 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	All castings as per clause 5.1.4 b) of T.S., all welds, weld ends of all cast
					9**	9**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-III 2. MECON's T.S. & D.S.	P	W	R	R	Bevel Surfaces (by MPI/ DP)
					13	13	-	-	-	-	-	-	Report/ Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	R	R	R	
					35	35	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	
					41	41	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	

EQUIPMENT DETAILS					INSPECTION AND TESTS								Test Certificates & Documents to be submitted to MECON	Acceptance Criteria Standards/ IS/ BS/ ASME/ MECON TS / API /Normsand DOCUMENTS:	Inspection Codes & Sampling Plan				REMARKS
Sl. No.	Description (with equipment heading, place of use and brief specifications)	Identification No.	Quantity No./M	Unit Weight (Kg)	Raw Material and In-Process stage inspection				Final Inspection/ Test by						MFR/SV	TPIA	CONTR	MECON	
					MFR/SV	TPIA	CONTR	MECON	MFR/SV	TPIA	CONTR	MECON							
1	2	3	4	5	8	9	10	11	12	13	14	15	14	15	16A	16B	16C	16D	
1.04	Trunnion (for Trunnion Mounted Valves)	<u>Material</u> Manufacturer to indicate (to be approved by MECON)			1,2	1,2	-	-	-	-	-	-	1. D1 2. Report	1. D1 2. MECON's TS & DS 3. Relevant Material Standard 4. Manufacturer's Specification	P	R	R	R	
					4	4	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's D.S. & T.S.	P	W	R	R	
					5	5	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	
					13	13	-	-	-	-	-	-	Report/ Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	R	R	R	
					35	35	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	
					41	41	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	
					43 **	43 **	-	-	-	-	-	-	1. Test Report 2. Material Test Certificates for composition, hardness, thickness & integrity	1. MECON's T.S. 2. MECON's D.S. 3. ASTM B733 Std. 4. Manufacturer's Specification	P	H	R	R	
1.05	Ball /Disc / Plug / Obturator	<u>Material</u> As per MR/ Alternate Material accepted by MECON			1,2	1,2	-	-	-	-	-	-	1. D1 2. Report	1. D1 2. MECON's TS & DS 3. Relevant Material Standard 4. Manufacturer's Specification	P	R	R	R	
					4	4	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's D.S. & T.S.	P	W	R	R	
					5	5	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	
					6**	6**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-IV 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	Forgings, welds, wrought weld ends
					7**	7**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-II 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	Wet MPI for 100% of internal surfaces of all castings & forgings & bevel

EQUIPMENT DETAILS					INSPECTION AND TESTS								Test Certificates & Documents to be submitted to MECON	Acceptance Criteria Standards/ IS/ BS/ ASME/ MECON TS / API /Normsand DOCUMENTS:	Inspection Codes & Sampling Plan				REMARKS
Sl. No.	Description (with equipment heading, place of use and brief specifications)	Identification No.	Quantity No./M	Unit Weight (Kg)	Raw Material and In-Process stage inspection				Final Inspection/ Test by						MFR/SV	TPIA	CONTR	MECON	
					MFR/SV	TPIA	CONTR	MECON	MFR/SV	TPIA	CONTR	MECON							
1	2	3	4	5	8	9	10	11	12	13	14	15	14	15	16A	16B	16C	16D	
					8**	8**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-I 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	All castings as per clause 5.1.4 b) of T.S., all welds, weld ends of all cast valves
					9**	9**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-III 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	Bevel Surfaces (by MPI/ DP)
					13	13	-	-	-	-	-	-	Report/ Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	R	R	R	
					35	35	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	
					41	41	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	
					43	43	-	-	-	-	-	-	1. Test Report 2. Material Test Certificates for composition, hardness, thickness & integrity	1. MECON's T.S. 2. MECON's D.S. 3. ASTM B733 Std. 4. Manufacturer's Specification	P	W	R	R	
1.06	Stem	Material As per MR/ Alternate Material accepted by MECON			1,2	1,2	-	-	-	-	-	-	1. D1 2. Report	1. D1 2. MECON's TS & DS 3. Relevant Material Standard 4. Manufacturer's Specification	P	R	R	R	
					4	4	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's D.S. & T.S.	P	W	R	R	
					5	5	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	
					6**	6**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-IV 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	Forgings, welds, wrought weld ends

EQUIPMENT DETAILS					INSPECTION AND TESTS								Test Certificates & Documents to be submitted to MECON	Acceptance Criteria Standards/ IS/ BS/ ASME/ MECON TS / API /Normsand DOCUMENTS:	Inspection Codes & Sampling Plan				REMARKS
Sl. No.	Description (with equipment heading, place of use and brief specifications)	Identification No.	Quantity No./M	Unit Weight (Kg)	Raw Material and In-Process stage inspection				Final Inspection/ Test by						MFR/SV	TPIA	CONTR	MECON	
					MFR/SV	TPIA	CONTR	MECON	MFR/SV	TPIA	CONTR	MECON							
1	2	3	4	5	8	9	10	11	12	13	14	15	14	15	16A	16B	16C	16D	
					7**	7**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-II 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	Wet MPI for 100% of internal surfaces of all castings & forgings & bevel
					8**	8**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-I 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	All castings as per clause 5.1.4 b) of T.S., all welds, weld ends of all cast
					9**	9**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-III 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	Bevel Surfaces (by MPI/ DP)
					13	13	-	-	-	-	-	-	Report/ Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S.& DS	P	R	R	R	
					35	35	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	
					41	41	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	
					43	43	-	-	-	-	-	-	1. Test Report 2. Material Test Certificates for composition, hardness, thickness & integrity	1. MECON's T.S. 2. MECON's D.S. 3. ASTM B733 Std. 4. Manufacturer's Specification	P	W	R	R	
1.07	Metal Seats / Retainer Ring (If provided)	Material As per MR/ Alternate Material accepted by MECON			1,2	1,2	-	-	-	-	-	-	1. D1 2. Report	1. D1 2. MECON's TS & DS 3. Relevant Material Standard 4. Manufacturer's Specification	P	R	R	R	
					4	4	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's D.S. & T.S.	P	W	R	R	
					5	5	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	

EQUIPMENT DETAILS					INSPECTION AND TESTS								Test Certificates & Documents to be submitted to MECON	Acceptance Criteria Standards/ IS/ BS/ ASME/ MECON TS / API /Normsand DOCUMENTS:	Inspection Codes & Sampling Plan				REMARKS
Sl. No.	Description (with equipment heading, place of use and brief specifications)	Identification No.	Quantity No./M	Unit Weight (Kg)	Raw Material and In-Process stage inspection				Final Inspection/ Test by						MFR/SV	TPIA	CONTR	MECON	
					MFR/SV	TPIA	CONTR	MECON	MFR/SV	TPIA	CONTR	MECON							
1	2	3	4	5	8	9	10	11	12	13	14	15	14	15	16A	16B	16C	16D	
					6**	6**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-IV 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	Forgings, welds, wrought weld ends
					7**	7**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-II 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	Wet MPI for 100% of internal surfaces of all castings & forgings & bevel surfaces (MPI/ DP)
					8**	8**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-I 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	All castings as per clause 5.1.4 b) of T.S., all welds, weld ends of all cast
					9**	9**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-III 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	Bevel Surfaces (by MPI/ DP)
					13	13	-	-	-	-	-	-	Report/ Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. & D.S.	P	R	R	R	
					35	35	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	
					41	41	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	
					43	43	-	-	-	-	-	-	1. Test Report 2. Material Test Certificates for composition, hardness, thickness & integrity	1. MECON's T.S. 2. MECON's D.S. 3. ASTM B733 Std. 4. Manufacturer's Specification	P	W	R	R	
1.08	Bolting Material (Studs & Nuts)	Material As per MR/ Alternate Material accepted			1,2	1,2	-	-	-	-	-	-	1. D1 2. Report	1. D1 2. MECON's T.S. & D.S. 3. Relevant Material Standard 4. Manufacturer's Specification	P	R	R	R	Alongwith thickness measurement for ENP Coating.
		by MECON			4	4	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's D.S. & T.S.	P	W	R	R	

EQUIPMENT DETAILS					INSPECTION AND TESTS								Test Certificates & Documents to be submitted to MECON	Acceptance Criteria Standards/ IS/ BS/ ASME/ MECON TS / API /Normsand DOCUMENTS:	Inspection Codes & Sampling Plan				REMARKS
Sl. No.	Description (with equipment heading, place of use and brief specifications)	Identification No.	Quantity No./M	Unit Weight (Kg)	Raw Material and In-Process stage inspection				Final Inspection/ Test by						MFR/SV	TPIA	CONTR	MECON	
					MFR/SV	TPIA	CONTR	MECON	MFR/SV	TPIA	CONTR	MECON							
1	2	3	4	5	8	9	10	11	12	13	14	15	14	15	16A	16B	16C	16D	
					5	5	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	H	R	R	
					6**	6**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-IV 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	Forgings, welds, wrought weld ends
					7**	7**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-II 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	Wet MPI for 100% of internal surfaces of all castings & forgings & bevel surfaces (MPI/ DP)
					8**	8**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-I 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	All castings as per clause 5.1.4 b) of T.S., all welds, weld ends of all cast valves
					9**	9**	-	-	-	-	-	-	Test Report	1. ASME B16.34, Appendix-III 2. MECON's T.S.	P	W	R	R	Bevel Surfaces (by MPI/ DP)
					13	13	-	-	-	-	-	-	Report/ Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. & D.S.	P	R	R	R	
					35	35	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	
					41	41	-	-	-	-	-	-	Material Test Certificates	1. Relevant Material Standard 2. MECON's T.S. 3. MECON's D.S.	P	W	R	R	
1.09	Assembled Valves				-	-	-	-	1,2	1,2	-	-	Report	1. D1 2. MECON's T.S.	P	W	W	W	
					-	-	-	-	3	3	-	-	Report		P	W	W	W	
					-	-	-	-	14	14	-	-	1. Report 2. Test Certificates	1. D1 2. MECON's T.S. 3. MECON's D.S. 4. Applicable Standard	P	W	W	W	
					-	-	-	-	15	15	-	-	1. Report 2. Test Certificates	1. D1 2. MECON's T.S. 3. MECON's D.S. 4. Applicable Standard	P	W	W	W	
							-	-	40	40	-	-	1. Report 2. Test Certificates	1. D1 2. MECON's T.S. 3. MECON's D.S. 4. Applicable Standard	P	R	R	R	

EQUIPMENT DETAILS					INSPECTION AND TESTS								Test Certificates & Documents to be submitted to MECON	Acceptance Criteria Standards/ IS/ BS/ ASME/ MECON TS / API /Normsand DOCUMENTS:	Inspection Codes & Sampling Plan				REMARKS		
Sl. No.	Description (with equipment heading, place of use and brief specifications)	Identification No.	Quantity No./M	Unit Weight (Kg)	Raw Material and In-Process stage inspection				Final Inspection/ Test by						MFR/SV	TPIA	CONTR	MECON			
					MFR/SV	TPIA	CONTR	MECON	MFR/SV	TPIA	CONTR	MECON									
1	2	3	4	5	8	9	10	11	12	13	14	15	14	15	16A	16B	16C	16D			
							-	-	42 **	42 **	-	-	1. Report 2. Test Certificates	1. D1 2. MECON's T.S. 3. MECON's D.S. 4. Applicable Standard	P	W	W	W	If Applicable		
					-	-	-	-	37	37	-	-	Certificates		-	R	R	R			
					-	-	-	-	44	44	-	-	1. Report 2. Test Certificates	1. D1 2. MECON's T.S. 3. MECON's D.S. 4. Applicable Standard	P	W	R	R			
					-	-	-	-	45 **	45 **	-	-	1. Report 2. Test Certificates	1. D1 2. MECON's T.S. 3. MECON's D.S. 4. Applicable Standard	P	W	W	W	If Applicable		
					-	-	-	-	46 **	46 **	-	-	1. Report 2. Test Certificates	1. D1 2. MECON's T.S. 3. MECON's D.S. 4. Applicable Standard	P	W	W	W	If Applicable		
					-	-	-	-	47	47	-	-	1. Report 2. Test Certificates	1. D1 2. MECON's T.S. 3. MECON's D.S. 4. Applicable Standard	P	W	W	W	Refer Note 3 of Table 2 of TS no. MEC/ TS / 05 / E5 / 002A		
					-	-	-	-	48 **	48 **	-	-	1. Report 2. Test Certificates	1. D1 2. MECON's T.S. 3. MECON's D.S. 4. Applicable Standard	P	W	W	W	If Applicable		
					-	-	-	-	49 **	49 **	-	-	1. Report 2. Test Certificates	1. D1 2. MECON's T.S. 3. MECON's D.S. 4. Applicable Standard	P	W	W	W	If Applicable		
					-	-	-	-	50	50	-	-	1. Final Report 2. Final Certificates	1. D1 2. MECON's T.S. 3. MECON's D.S. 4. Applicable Standard	P	W	W	W	One valve per size per rating		
1.10	Complete documentation check and compilation				-	-	-	-	-	-	-	-	1. Final Report 2. Final Certificates	1. D1 2. MECON's T.S. 3. MECON's D.S. 4. Applicable Standard	P	P / H / R	H	H			
1.11	Issue I.C. / I.R.N and give Dispatch clearance				-	-	-	-	-	-	-	-	1. Final Report 2. Final Certificates	1. D1 2. MECON's T.S. 3. MECON's D.S. 4. Applicable Standard	R	P	H	H			
1.12	Actuator Tests (If Applicable)				As per Actuator Quality Assurance Plan (to be submitted by vendor for approval)																
1) MAKE : As per Approved Make List in Tender Document or Approved PTR as per Tender conditions .																					
2) VENDOR shall establish approved WPS-PQR-WPQ for the weldings duly witnessed by TPIA (Applicable for fully welded body valves OR valves with welded pup pieces and size 2" and above only).																					
3) Vendor shall do RT for Body adapter to PUP piece welding and RT report shall be reviewed by MECON & TPIA (Applicable for valves with welded pup pieces and size 2" and above only)																					
4) Vendor shall do UT/RT for Bodt to Body adapter welding witnessed by TPIA (Applicable for fully welded body valves only)																					
For CONTRACTOR					For SUB-CONTRACTOR (Valve Manufacturer)					QAP NO.: MEC/WINO/05/28/M/001/QAP-002										REV 0	



MECON Limited
(A Govt. of India Enterprise)

**QUALITY ASSURANCE PLAN
FOR
FLANGES**

PROJECT:

ITEM: FLANGES

QAP NO.: MEC/WINO/05/21/M/001/S026/QAP/A

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**QUALITY ASSURANCE PLAN
FOR
FLANGES**



MECON Limited
(A Govt. of India Enterprise)

QUALITY ASSURANCE PLAN FOR FLANGES

PROJECT:

ITEM: FLANGES

QAP NO.: MEC/WINO/05/21/M/001/S026/QAP/A

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APPLICABLE CODES AND SPECIFICATIONS: MEC/TS/05/21/025, R-0 and MEC/TS/05/21/026, R-0 WITH AMENDMENTS									SCOPE OF INSPECTION		
S. NO.	STAGE	CHARACTERISTICS	CATEGORY	METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	RECORD	Vendor/ Sub Vendor	TPI	MECON
1.	Review of PO / Drg.	Review of PO Doc. / Drg.	Critical	Scrutiny / Verification	Each doc. of P.O.	Appl. Spec. / STD	-	-	P	R	R
2.	Raw Material	1. Manufacturing process of steel 2. Visual 3. Dimensional 4. Chemical Composition	Critical	Verification with M.T.C. Spectro Analysis	Each Heat Each Heat	Appl. Material Specification / STD	As per tender document / Material Specification / STD	Material Test Certificate and MI Register	P	R	R
3.	Forgings	1. Reduction Ratio 2. Temperature During Forging 3. Forging Dimensions	Critical	Measurement Optical Pyrometer Measurement	Minimum 1 per size	Standard Manufacturing Procedure	Std. Procedure As per Std. AMSE B16.5	Forging process record / internal Register	P	R	R
4.	Heat Treatment (as applicable)	Heat Treatment Cycle	Major	Verification of Heat Treatment Cycle	Each Heat / HT Lot	As per Tender Doc. / Material Specification / STD	As per Tender Doc. / Material Specification / MECON Std	T.P.M. Sheet, Heat Treatment Graph	P	R	R
5.	Mechanical Testing (as applicable)	1. Tensile Test (TS, YS, RA%, EL%) 2. Hardness 3. Charpy V-Notch Test	Major	Tensile Testing IMPACT Testing	One / HT / Lot / Group	As per Tender Doc. / Material Specification / STD	Std. Procedure As per Tender Doc. / Material Specification / MECON Std	Mechanical Test Report & T.C.	P	W	R



MECON Limited
(A Govt. of India Enterprise)

QUALITY ASSURANCE PLAN FOR FLANGES

PROJECT:

ITEM: FLANGES

QAP NO.: MEC/WINO/05/21/M/001/S026/QAP/A

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APPLICABLE CODES AND SPECIFICATIONS: MEC/TS/05/21/025, R-0 and MEC/TS/05/21/026, R-0 WITH AMENDMENTS									SCOPE OF INSPECTION		
S. NO.	STAGE	CHARACTERISTICS	CATEGORY	METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	RECORD	Vendor/ Sub Vendor	TPI	MECON
6	NDT	1. DP 2. UT 3. MPI	Major	DP Testing Ultrasonic Flaw Detector MPI Testing	100%	As per Tender Doc. / Material Specification / STD	As per Tender Doc. / Material Specification / MECON Std	Mechanical Test Report & T.C.	P	W	R
7.	Final Inspection	Visual & Dimensions	Major	Visual / Measurement	100%	As per Tender Doc. / Material Specification / STD	As per Tender Doc. / Material Specification / MECON Std	Dimension Report Format	P	W	W/R
8.	Making, Colour Coding, Rust Prevention & Packing	Making, Colour Coding, Rust prevention & Packing	Major	Visual	100%	As per Tender Doc. / Material Specification / STD	As per Tender Doc. / Material Specification / MECON Std	Packing List	P	W	W/R
10.	Certification & Release Notes	Inspection Release Note as per EN 10204 Type 3.2	Major	Verification of PO Spec. & QAP	100%	As per Tender Doc. / Material Specification / STD	As per Tender Doc. / Material Specification / MECON Std	Release Note	R	IR	IR
11.	Shipping	Verification of surface coating / type of packing	Major	-	-	As per Tender Doc. / Material Specification / STD	As per Tender Doc. / Material Specification / MECON Std	Shipping documents	P	R	R



MECON Limited
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QUALITY ASSURANCE PLAN FOR FLANGES

PROJECT:

ITEM: FLANGES

QAP NO.: MEC/WINO/05/21/M/001/S026/QAP/A

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APPLICABLE CODES AND SPECIFICATIONS: MEC/TS/05/21/025, R-0 and MEC/TS/05/21/026, R-0 WITH AMENDMENTS									SCOPE OF INSPECTION		
S. NO.	STAGE	CHARACTERISTICS	CATEGORY	METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	RECORD	Vendor/ Sub Vendor	TPI	MECON
Note: 1. MAKE: As per Approved Make List in Tender Document or Approved PTR as per Tender conditions. 2. All items shall be provided with EN 10204 Type 3.2 certificate. 3. All inspection related documents shall be reviewed (Sign & Stamp) by the contractor. Legends: H – Hold (Offer for Witness & obtain clearance), W – Witness, R – Review, A – Approval, I – Information, IR – Issue Release Note, C – Certify, X – Submit, PO – Purchase Order, PR – Purchase Requisition, SR – Stress Relieving, MPI – Magnetic Particle Inspection, DI-Dye Penetrant Test, UT – Ultrasonic examination, TS – Technical Specification, WPS – Welding Procedure Specification, PQR – Procedure Qualification Record, WQT – Welder Qualification Test. All the NDT / Leak Testing / Heat Treatment / Special manufacturing procedures have to be specially approved or only previously approved procedures have to be used. In case of conflict between purchase specification, contract documents and ITP more stringent conditions shall be applicable. The document describes generally the requirements pertaining to all types of Flanges. Requirements specific to the item are only applicable.											



MECON Limited
(A Govt. of India Enterprise)

**QUALITY ASSURANCE PLAN
FOR
FITTINGS**

PROJECT:

ITEM: PIPE FITTINGS

QAP NO.: MEC/WINO/05/21/M/001/S026/QAP/B

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**QUALITY ASSURANCE PLAN
FOR
FITTINGS**



MECON Limited
(A Govt. of India Enterprise)

QUALITY ASSURANCE PLAN FOR FITTINGS

PROJECT:

ITEM: PIPE FITTINGS

QAP NO.: MEC/WINO/05/21/M/001/S026/QAP/B

Page 2 of 4

APPLICABLE CODES AND SPECIFICATIONS: MEC/TS/05/21/025, R-0 and MEC/TS/05/21/026, R-0 WITH AMENDMENTS									SCOPE OF INSPECTION		
S. NO.	STAGE	COMPONENT	CHARACTERISTICS	METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	RECORD	Vendor/ Sub Vendor	TPI	MECON
1.	Material	FITTINGS	Fully killed steel	MTC	100%	PO & Std. Spec.	PO QAP & Std. Spec.	MTC	P	R	R
2.	Inspection	FITTINGS									
i)	Visual Inspection	FITTINGS	Visual Imp.	Visual Internal & External Surface	100%	PO & Std. Spec.	PO QAP & Std. Spec.	Inspection Report	P	W	R
ii)	NDT	FITTINGS	Soundness of Tee & Butt Welds	UT, RT & MPI	100%	PO & Std. Spec.	PO QAP & Std. Spec.	Inspection Report	P	W & Evaluation of RT Films	R
iii)	NDT	FITTINGS	Forgings	WET MPI	100%	PO & Std. Spec.	To comply with MSS-SP-53	Inspection Report	P	W	R
iv)	NDT	FITTINGS	End Laminations	UT for Distance of 25 mm on ends.	100%	PO & Std. Spec.	Any lamination than 6.35 mm not accepted	Inspection Report	P	W	R
v)	Testing Destructive	FITTINGS	Properties of Mech. / Chemical & Impact Test	Chemical by Spectro and other test as per ASTM A - 370	As per Heat / Lot	PO & Spec.	MSS-SP-75	IMP Lab Report	P	W	R



MECON Limited
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**QUALITY ASSURANCE PLAN
FOR
FITTINGS**

PROJECT:

ITEM: PIPE FITTINGS

QAP NO.: MEC/WINO/05/21/M/001/S026/QAP/B

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APPLICABLE CODES AND SPECIFICATIONS: MEC/TS/05/21/025, R-0 and MEC/TS/05/21/026, R-0 WITH AMENDMENTS									SCOPE OF INSPECTION		
S. NO.	STAGE	COMPONENT	CHARACTERISTICS	METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	RECORD	Vendor/ Sub Vendor	TPI	MECON
3.	Final Inspection	FITTINGS	Visual & Dimensional	-	As per lot	PO & Spec.	PO & Spec.	Inspection Report	P	W	W/R
4.	Marking	FITTINGS	Identification manufacturer's Name, nominal diameter end thickness malts & Tag No.	By painting	100%	PO & Spec.	-	-	P	W	W/R
5.	Certification & Release Notes	FITTINGS	Inspection Release Note as per EN 10204 Type 3.2	Verification of PO Spec. & QAP	100%	As per Tender Doc. / Material Specification / STD	As per Tender Doc. / Material Specification / MECON Std	Release Note	R	IR	IR
6.	Shipping	FITTINGS	Verification of surface coating / type of packing	-	-	As per Tender Doc. / Material Specification / STD	As per Tender Doc. / Material Specification / MECON Std	Shipping documents	P	R	R



MECON Limited
(A Govt. of India Enterprise)

QUALITY ASSURANCE PLAN FOR FITTINGS

PROJECT:

ITEM: PIPE FITTINGS

QAP NO.: MEC/WINO/05/21/M/001/S026/QAP/B

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APPLICABLE CODES AND SPECIFICATIONS: MEC/TS/05/21/025, R-0 and MEC/TS/05/21/026, R-0 WITH AMENDMENTS									SCOPE OF INSPECTION		
S. NO.	STAGE	COMPONENT	CHARACTERISTICS	METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	RECORD	Vendor/ Sub Vendor	TPI	MECON
Note: 1. MAKE: As per Approved Make List in Tender Document or Approved PTR as per Tender conditions. 2. All items shall be provided with EN 10204 Type 3.2 certificate. 3. All inspection related documents shall be reviewed (Sign & Stamp) by the Contractor. Legends: H – Hold (Offer for Witness & obtain clearance), W – Witness, R – Review, A – Approval, I – Information, IR – Issue Release Note, C – Certify, X – Submit, PO – Purchase Order, PR – Purchase Requisition, N-Normalizing, N&T – Normalizing & Tempering, SA – Solution annealing, N & SR – Normalizing & Stress relieving. All the NDT / Leak Testing / Heat Treatment / Special manufacturing procedures have to be specially approved or only previously approved procedures have to be used. In case of conflict between purchase specification, contract documents and ITP more stringent conditions shall be applicable. The document describes generally the requirements pertaining to all types of Fittings. Requirements specific to the item are only applicable.											



**INSPECTION AND TEST PLAN
FOR
ASSORTED PIPES**

**STANDARD SPECIFICATION NO.
MEC/TS/05/62/59A
Page 1 of 3**

**INSPECTION AND TEST PLAN
FOR
ASSORTED PIPES
(FOR METERING SKID)**

1	31.05.2024	ISSUED FOR IMPLEMENTATION	Sachin Kumar	Sachin Singhal	Anil Kumar
Rev. No.	Date	Purpose	Prepared	Checked by	Approved by

ITP No. : 05/21/012E/001



INSPECTION AND TEST PLAN FOR ASSORTED PIPES

STANDARD SPECIFICATION NO.
MEC/TS/05/62/59A

Page 2 of 3

SL.NO.	STAGE	COMPONENT	CHARACTERISTICS	METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	RECORD	SCOPE OF INSPECTION		
									Manufacturer	TPIA	Client/Mecon
1.0	Raw material inspection	Plate/Sheet/Strip	(i)Chemical Composition: CE	Testing	One sample per heat	Relevant Code & Technical Specification	As per code & Technical Specification	Mill test Certificate/report	H	R	R
			(ii)Mechanical properties YS,UTS,EL	Testing	One sample per heat	Relevant Code & Technical Specification	As per code & Technical Specification	Inspection report	H	R	R
2.0	Manufacturing, welding (HFW & SAW)	Pipe	Welding Speed, Current, Voltage, Frequency, Offset, Height of Flash & Trim	Record of Parameter	100% by Vendor	Relevant Code & Technical Specification	Approved WPS	Internal report	P	R	R
3.0	Product Testing										
3.1	Destructive Testing	Pipe	Mechanical Properties	Tensile, Flattening, Reverse Bend, Hardness, Impact & Macro	One sample per heat	Relevant Code & Technical Specification	As per code & Technical Specification	Lab Report	W	W	W
			Chemical Properties	Chemical Composition							
3.2	Non Destructive Testing	Pipe	Surface & Internal Inspection	UT/RT or as per code & specification	100% by Vendor	Relevant Code & Technical Specification	As per code & Technical Specification	Inspection Report/Internal Record	W	R	R



INSPECTION AND TEST PLAN FOR ASSORTED PIPES

STANDARD SPECIFICATION NO.
MEC/TS/05/62/59A

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SL.NO.	STAGE	COMPONENT	CHARACTERISTICS	METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	RECORD	SCOPE OF INSPECTION		
									Manufacturer	TPIA	Client/Mecon
3.3	Heat Treatment (As Applicable)	Pipe	Stress Relieving, Normalizing, Tempering, Solution Annealing etc.	Temperature Recording	Each Pipe	Relevant Code & Technical Specification	Relevant Code & Technical Specification	HT Chart	P	R	R
4.0	Hydrostatic test	Pipe	No leak	Visual	Each Pipe	Relevant Code & Technical Specification	As per code & Technical Specification	Inspection Report, Hydraulic Graph	W	W	RW
5.0	Final inspection	Pipe	Straightness, Outer Diameter (Pipe Body, Pipe Ends), Out of Roundness, Thickness, Length, Surface Lamination, Root Face, Bevel Angle	Visual, dimensional	100% by vendor	Relevant Code & Technical Specification	As per code & Technical Specification	Inspection Report	W	W	RW
6.0	Galvanizing (If Applicable)	Pipe	Integrity of Galvanized Coating	---	Each Pipe	Relevant Code & Technical Specification	As per code & Technical Specification	Inspection Report	P	R	R
Legends/Notes:											
W-witness, R-Review, RW- Minimum 10% witness and 100% Review ,											
NOTE: Hydrostatic test for the pipes can be allowed to be conducted along with the Skid assembly instead of hydrostatic testing at the pie manufacturer/supplier works. In that case, hydrostatic test of pipes shall be witnessed at the time of hydrotesting of metering skid assembly only.											

ITP No. : 05/21/012E/001

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	ORDER NO. & DATE			BID DOCUMENT NO. :	
	SUB-CONTRACTOR			ITEM NAME : PRESSURE SAFETY VALVE/CREEP RELIEF VALVE	
	ORDER NO. & DATE			SPEC. NO.: MEC/TS/05/62/056, REV-01	

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	PRESSURE SAFETY VALVE (PSV) /CREEP RELIEF VALVE (CRV)	-	-	-			1,2,3	P	1,2,4	W	-	1,2,3	P	1,2,3	W	1,2,3	R	1,2,3,4,5,8,14,15	D1,D3,D8,D10	47
							4,5	P	5,41	W	-	14,15	P	14,15	W	14,47	R	31,32,34,41,44,47	ASME SEC-VIII, DIV-1	100%
							8,41	P	8	R		31,32	P	44,47	W			MECON TS		
											44,47	P	31,32	R				APPROVED DS		

For MECON (Stamp & Signature)		For CONTRACTOR/ SUB-CONTRACTOR (Stamp & Signature)			
				QAP NO.	REV 0
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01	Pressure gauges / Temperature gauges / Diff. Pressure gauges	Refer P&ID, Tech. Spec. and Data Shts.	* Nos.	-	-	-	-	-	-	-	1,2,16,1, 8,21,22, 20	P	1,2,16,1, 8,21,22, 20	W	1,2,16,18, 21,22,20	R	1,2,16,18,20,21,22,D 5,D6	D3 & Tech. Spec., EN 837-1	10% Witness																																																																																																																																																																																																																																																																																																									
02	Pressure Transmitter / Diff. Pressure Transmitter / Temperature Transmitter	Refer P&ID, Tech. Spec. and Data Shts.	* Nos.	-	-	-	-	-	-	-	1,12(a), 23,28,16, 18,22,2, 9,30,20	P	1,12(a), 23,28,16, 6,18,22, 29,30	W	1,12(a),23, 28,16,18, 22,29,30,2 0	R	1,12(a),23,28,16,18,2 2,29,30,20,D5,D6	D3 & Tech. Spec.	10% Witness																																																																																																																																																																																																																																																																																																									
03	Resistance Temp. Detector with Thermowell	Refer P&ID, Tech. Spec. and Data Shts.	* Nos.	-	-	-	-	-	-	-	1,2,5,25, 16,32,18, 33,20,2 7,23	P	1,2, 25,16,3, 2,18,33, 27,23	W	1,2,5,25,1 6,32,18,33, 20,27,23	R	1,2,5,25,16,32,18,33, 20,27,23,D5,D6	D3 & Tech. Spec.	10% Witness																																																																																																																																																																																																																																																																																																									
04	Flow Computers	Refer P&ID, Tech. Spec. and Data Shts.	* No.	-	-	-	-	-	-	-	1,2,24,1 8,20	P	1,2,24,1 8	W	1,2,24,18, 20	R	1,2,24,20,18,D5,D6	D3 & Tech. Spec., AGA-3,5,7,8,9	100% Witness																																																																																																																																																																																																																																																																																																									

05	Orifice flow Meter	Refer P&ID, Tech. Spec. and Data Shts.	* No.	-	-	-	4,5,6,7,8,9,34,35,41	P	4,5,6,7,8,9,34,35,41	R	4,5,6,7,8,9,34,35,41	R	1,2,11(f),18,11(a),25,11(g),20,23	P	1,2,11(f),18,11(a),25,11(g),23	W	1,2,11(f),18,11(a),25,11(g),20,23	R	1,2,4,5,6,7,8,9,34,35,41,11(f),18,11(a),25,11(g),20,23,D5,D6	D3 & Tech. Spec., AGA-3	100% Witness
06	LEL Detection System	Refer P&ID, Tech. Spec. and Data Shts.	* Nos.	-	-	-	-	-	-	-	-	-	1,2,18,20,24,23	P	1,2,18,20,24,23	W	1,2,18,20,24,23	R	1,2,18,20,24,23,D5,D6	D3 & Tech. Spec.	10% Witness
07	Gas Chromatograph, Water Dew Point Analyzer, Hydrocarbon Dew Point Analyzer	Refer P&ID, Tech. Spec. and Data Shts.	* Nos.	-	-	-	-	-	-	-	-	-	1,2,12,13,20,24,23	P	1,2,12,13,20,24,23	W	1,2,12,13,20,24,23	R	1,2,12,13,20,24,23,D5,D6	D1,D2,D3,D4 & Tech. Spec.	100% Witness
08	Control Panel	Refer P&ID, Tech. Spec. and Data Shts.	* Nos.	-	-	-	-	-	-	-	-	-	1,2,3,10,11,11(a),12,13,24,20	P	1,2,3,10,11,11(a),12,13,20	W	1,2,3,10,11,11(a),12,13,24,20	R	1,2,3,10,11,11(a),12,13,24,20,D5,D6	D1,D2,D3,D4 & Tech. Spec.	100% Witness
09	Cables	Refer P&ID, Tech. Spec. and Data Shts.	* Nos.	-	-	-	-	-	-	-	-	-	1,2,4,5,10,11,12,13,11(j)	P	1,2,4,5,10,11,12,13,11(j)	W	1,2,4,5,10,11,12,13,11(j)	R	1,2,4,5,10,11,12,13,11(j),D5,D6	D3 & Tech. Spec., rel. IS / other std.	10% Witness

Note :-

1. This is Typical QAP. Bidder to prepare the QAP considering the tests / stds. (as applicable) & submit for review/approval. Review/Witness category & stage category will be finalized during approval.
2. Test Certificates of Barrier, SDC, SS tube, fittings, Manifolds, GSM Modem, Laptop, Printer, Junction Boxes, Cable Glands, solar panel, batteries, charge controller, canopies, cable tray, earthing wire, etc. shall be reviewed by TPL.

*Qty as per MR /PO and P& Id requirement.

P : Perform, W : Witness, R : Review

For MECON (Stamp & Signature)



for CONTRACTOR /SUB-CONTRACTOR
(Stamp & Signature)



QAP No.: MEC/05/E5/QAP - 030

R0

ANNEXURE - VII

FAT PROCEDURE/ FAT MANUAL

FAT PROCEDURE / FAT MANUAL
For
METERING SKIDS

**(This is Typical FAT Procedure. Bidder to prepare & submit the Factory
Acceptance Test Procedure for review / approval)**

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Pneumatic Leak Test
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1. PREFACE

Introduction:

This document defines procedure for Factory acceptance Test (FAT) to be carried out for Metering Skid(s). The purpose of carrying out FAT is to check functionality of the entire natural Gas Skid with respect to agreed technical documents.

NOTE: All the tests, inspection, checking, data-configuration etc shall be conducted as per FAT procedure by the vendor and the same shall be submitted to Mecon for review. The records / test reports/ calibration reports/ certificates, configuration sheet for flow computers and other relevant document should be prepared / obtained by the vendor and sent to Mecon for review.

Scope.

The FAT will confirm the compliance of ORIFICE based Metering Skid with the project specifications. The purpose of FAT is to check the performance of each component as well as entire skid. Upon completion of the test described in the following procedures, the system will be considered to be ready to be dispatched to the site. All the physical & functional tests are described in the remaining sections. When each functional test has been completed, the TPIA will indicate acceptance of the tests by signing the test certificates.

All the equipments / instruments/ items shall be installed (as far as possible) for demonstration during FAT. In case some of the items can not be erected/ installed during FAT, list of such item along with the reason for not installing the same shall be provided before start of FAT. FAT shall not be conducted before our approval of such list. In case difference in calculated values (calculated by different Instruments) is observed for any parameter, the list of such parameters along with values and suitable reason for such deviation to be submitted to us in advance for our review. In case deviation is observed in the parameter-values displayed by various components, the same shall be recorded and may result in to rejection of FAT.

All connectivity/ its simulation mentioned elsewhere in tender (like Laptop, Printers, SCADA/RTU, ORIFICE, FC, GSM Modem, GC, etc) shall be established and demonstrated during FAT. Non-compliance to any of these shall result in rejection of Metering skid

Reference Documents:

Design Documents of Skid

Document No.

- 1 P & ID for Skid Drawing No. -----
- 2 GA Drawing for Skid Drawing No. -----
- 3 Base frame and Foundation Drawing No. -----
- 4 Base frame Calculation Doc. No. -----
- 5 Quality assurance plan - Mechanical Items Doc. No. -----

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- 6 Quality assurance plan – Instrumentation Equipment Doc. No. -----
7 Material Test certificate, Radiography test report, Hydro-test certificate _____

Datasheet / Drawing of Equipments:

1. Upstream/ Downstream Flow straighteners – Drawing No. _____
2. Pressure Transmitter – Data Sheet No. _____
3. Differential Pressure Transmitter- Data Sheet No. _____
4. RTD with Temperature Transmitter– Data Sheet No. _____
5. Pressure Gauge – Data sheet No. _____
6. Temperature Gauge – Date sheet No. _____
7. Flow Computer – Data Sheet No. _____
8. Pressure safety Valve – Data Sheet No. _____
9. Control Panel – Data Sheet No. _____
10. Ball Valves ----- make - Drawing No. _____
11. Plug Valves - Drawing No. _____
12. Check Valves- Drawing No. _____
13. Cartridge Filter – Design data Doc. No. _____
14. Orifice Flow meter – Data sheet No. _____
15. Gas Chromatograph –Data sheet No. _____

Orientation of Witnesses:

All representatives shall be briefed on details/ description/ operating principles of the ORIFICE Metering Skid for this project before commencing the FAT.

Test Certificates:

Upon completion of the tests mentioned in this document, Test Certificates should be filled with the results and signed / stamped by all the parties.

Action List:

Any discrepancies noted during the functional tests shall be defined, recorded and summarized in the Action List Form. Once proper action has been taken on those points, this Action List shall be signed / stamped by Customer/ TPIA duly filled with the results.

2. VISUAL INSPECTION OF SKID.

2.1 Skid Review:

The Skid will be inspected for installation of all the components as per approved P & ID and approved G.A. Drawing. Dimensional Checking shall be done as per approved G.A. Drawing. Skid will also be inspected for correctness of installed Equipments/ instruments and approachability for maintenance. The Skid will be inspected for proper support with neoprene sheet / rubber pads / clamps for the major equipments/ Instruments and pipes / tubes.

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2.2 Test Certificate for Visual Inspection:

Upon completion of the visual inspection described in this section, the test certificate for Visual Inspection of skid should be dully filled and signed by both parties.

3. FACTORY ACCEPTANCE TEST:

3.1 Hydrostatic Test (if not performed earlier)

1. Complete skid shall be offered for hydrostatic test.
2. Non Corrosive water shall be used for hydro testing at ambient temperature.
3. During the hydro test, Flow meter & filter cartridges / elements shall not be installed with pipeline as internals will get damaged in contact with water.
4. All valves shall be kept at open position.
5. Either inlet or outlet pipe shall be closed with blind flange and the other side will be connected with water line (hose pipe) to fill up water in side the skid.
6. After filling water, the skid shall be pressurized to 1.5 times design pressure.
7. Maintain this pressure for six hours.
8. Pressure should not exceed hoop stress of the line pipe at any given moment of time.
9. No leakage is allowed through any joints and shell.
10. Record pressure and temperature reading at 30 minutes interval.

3.2 Pneumatic Test

1. After completion of hydro-test, drain out water from the skids.
2. Pass the air through the entire skid for some time to dry out the pipeline.
3. Assemble the Flow meter and impulse tubes in pipe line.
4. Keep all valves open and close either inlet or outlet side pipe with blind flange.
5. Pressurize the entire skid by nitrogen up to max. operating pressure and hold for one hour.
6. No leakage/ drop in pressure is allowed.
7. Check the leakage using soap water.

3.3 Functionality Test of Flow Computer

1. Configuration check, parameter settings/ checking etc shall be carried out as per approved Data Sheet/ FDS.
2. Volumetric flow rate, Mass flow rate by simulation of Flow meter signal using Function Generator/ any other equipment. Flow, Energy and Mass Totalizers, shall be also be checked.
3. Line Temperature and pressure, Diff. Pressure etc. shall be checked by inputting respective analog signals.
4. Interface data of flow computer with RTU – Measurement by Laptop.
5. Visual checking of instrumentation cable connection including cable gland, cable tag nos., JB mounting installation, cable dressing etc. as per approved drawing, wiring diagram.
6. Facility of entry of Atmospheric pressure and temperature by operator to be verified.
7. Various Units of measurement (Pressure, flow rate, heating value, energy etc.) shall be checked as per approved documents.
8. Simulation of Flow Computer output to SCADA by GSM Modem.
9. GC data input to Flow computer from SCADA via GSM modem.

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10. Proper entry of the Orifice flow meter error curve, K factors etc.
11. Checking of Audit Trail facility in the flow computer and its printing.
12. Modbus address details to be verified.
13. Availability and functioning of USB ports with connecting cables for communication of various devices/Instruments/ Equipments (like GC, ORIFICE, RTU/ SCADA, Printers, Laptop etc) with flow computers.(Functioning of standalone Software for flow calculation verification to be checked.)

3.4 Transmitter Test Procedure (Pressure, Differential Pressure, Temperature):

Provide power supply to the transmitter and check the local indication, in FC, RTU/SCADA TB & output during the pneumatic test. Calibration report (from approved Lab) and Hart functionality to be checked

3.5 Orifice Flow Meter :

The Orifice Flow meter has been manufactured by ----- and is calibrated at ----- using Natural Gas as per approved data sheet. The calibration Certificates shall be submitted for review during FAT. Insulation of metering system and Environmental enclosure for custody metering equipments shall be checked visually during FAT.

3.6 Control Panel :

1. Check the complete functional test as per loop diagram / Data sheet.
2. Hot stand by functionality of Power supply in control panel to be checked.
3. Visual Check: Wiring diagram and marking
4. Operation of Fan, Light and other items.
5. Check the painting quality, cable identification mark, tags, cable dressing,
6. Door alignment, locks and overall dimensions to be checked.
7. IS ground and panel ground shall be independent and to be checked.
8. Check the availability of spare items & space.

3.7 Gas Chromatograph:

1. GC controller/ display unit and interface unit Installation in control panel shall be checked as per approved data Sheet/ FDS.
2. Parameter settings/ software loading checking, default values etc shall be carried out for GC controller/ remote configurator as per approved data Sheet/ FDS.
3. Probes, Tools for insertion/ removal in pipe shall be also be checked.
4. Field Analyser unit with stand shall be also be checked as per Data sheet.
5. Calibration Gas cylinders, carrier gas cylinders, self acting pressure regulator for Cylinders (calibration gas/ carrier gas) shall be checked.
6. Report for composition of calibration gas shall comply to the specifications.
7. Shed for Analyser, Cable for remote configurator/ controller etc shall also be checked.
8. Communication between GC and Laptop shall also be checked and GC data simulation to be checked.
9. Simulation of GC data input to Flow computer, Metering supervisory system and RTU/ SCADA via GSM modem.

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10. Availability and functionality checking of communication with flow computers, Laptop, Metering supervisory system, RTU/ SCADA, Printer
11. GC Calibration shall be performed and chromatogram for 3 consecutive runs shall be recorded as base for future. Also heating value as displayed by GC and as calculated by FC shall be checked for exact matching and shall comply to GPA 2145 / 2172.
12. Modbus address details to be verified.

3.8 LEL Detection system:

1. Installation and Simulation of LEL monitor/ controller to be checked.
2. Installation & functioning of LEL Detectors to be checked.
3. LEL calibration gas cylinder, Regulator, portable LEL detectors etc. to be verified.
4. Verification of calibration report for Calibration mixture, CCOE certification for cylinders etc to be done.
5. Signals in RTU to be verified.
6. Modbus address details to be verified.

3.9 Solar Panel:

1. For each stream, check the functional test as per approved Document.
2. No. of Batteries as per approved Battery sizing Calculation to be checked
3. Output Voltage of each streams shall be recorded.
4. Visual Check: Support for Solar Panel, Battery enclosure/ mounting, Cable, identification

4.0 Spares:

List to be prepared as per P.O. terms/ tender documents for all the mandatory spares, commissioning spares, cables, and materials required for erection. All the spares shall be verified by TPIA during FAT test. All spares shall be identified with proper tags. Foundation bolt and mating flanges shall be checked during FAT.

5.0 Painting:

As per Std. Specification (Specification For Shop & Field Painting - MEC/S/05/21/07, Rev-0)

6.0 Documents Review:

After completion of all tests, Documents like material test certificates, Radiography test, Hydro-test, calibration/ test reports etc. for Ball valves/ Plug valves/ CRV/ NRV/ PSV/Filters, pipes, fittings, Tee/ elbow/ weld joints, shall be reviewed to check the compliance with the tender specifications and approved QAP for the equipments / instruments. All the documents shall be signed & stamped by TPI & bidder.

7.0 Annexure to FAT Manual:

Apart from FAT procedure, FAT Manual shall have Annexure which shall include the following:

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- a) List of all the loose items with details to be provided by vendor (like Mandatory Spares, commissioning spares, Consumables, Parts of metering skids, Parts of GC analyzer and shed, Parts of Control panel, mating flanges, Gaskets, materials required for installation of skid, Hand held communicators, portable LEL detector, Calibration gas, Printers with its accessories, laptop with its accessories, Connecting and power cable for laptop/ Printers/ peripherals, Earthing strips, Cable Trays, cable glands, plugs, blind flanges, lugs, ferrules, earthing Cables, Mounting Accessories, any other hardware required for establishing various connectivity mentioned elsewhere, Software etc.) to be enclosed as Annexure in the FAT Manual for our review/ approval. The items mentioned in the list (Annexure) shall be demonstrated during FAT.
- b) List of all the reports (like calibration reports for various Instruments, test reports for all the equipments, CCOE certificates etc.), with details like Report no., date, description etc shall also be prepared as Annexure of FAT manual. The same shall also be reviewed during FAT

Any discrepancy observed during FAT shall be recorded/ noted in the Action list. Issue of Inspection Release note/ Dispatch clearance shall be subject to compliance of all the FAT Check-list points/ Action list & submission of TPI release note for the complete skid.

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TEST CERTIFICATE

VISUAL INSEPCION

Project : -----

Client : -----

P.O. No : ----- **Dtd.** -----

Sr. No	POINT INSPECTED	RESULTS FOUND OK
1	Skid checked as per P & ID and GA Drawing	YES / NO
2.	Process parameter in Name Plate	YES / NO
3	Lifting hook	YES / NO
4	Copper jumper for all flanges	YES / NO
5	Earthing Connection at base frame	YES / NO
6	Insulation for Metering system	YES / NO
7	Instrumentation cable connection, cable dressing, cable tray covers and JB mounting installation etc. as per wiring diagram.	YES / NO
8	Identification Tags for cable and all Instruments	YES / NO
9	Painting colour of pipe line (golden Yellow)	YES / NO
10	Spares as per P.O. requirement	YES / NO
11	Foundation bolt and Matting flanges	YES / NO
12.	Support for all the equipments/ Instruments, Pipe, tubes, Trays	YES / NO
13.	Adequacy of O&M Platform and approachability	YES / NO
14.	Canopy to all transmitters	YES / NO
15.	Operating handles on all valves	YES / NO

Company Representative

TPIA

Client /Mecon Representative

Date:

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TEST CERTIFICATE

HYDROTEST OF SKID

Project : -----

Client : -----

P.O. No : ----- **Dtd.** -----

Test Pressure :

Test Media : Non Corrosive Water

Duration : 6 Hours

Sr. No.	TIME	Pressure
1		
2		
3		
4		
5		
6		
7		
8		

POINT INSPECTED

RESULT FOUND OK

a) Leak test at flange joints and other connections

YES / NO

Company Representative

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Client /Mecon Representative

Date:

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TEST CERTIFICATE

PNEUMATIC TEST OF SKID

Project : -----

Client : -----

P.O. No : ----- **Dtd.** -----

Test Pressure : Max. Operating Pressure

Test Media : Nitrogen Gas

Duration : 60 minutes

POINT INSPECTED

Leak test at flange joints and other connections

RESULT FOUND OK

YES / NO

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Date:

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TEST CERTIFICATE

DIMENSIONAL INSPECTION

Project : -----

Client : -----

P.O. No : ----- **Dtd.** -----

Sr. No	Parameters Requirement	Result Found
1.	Base Frame Dimension As per approved Foundation drawing	YES / NO
2.	Height of inlet pipe from base in mm _____	YES / NO
3.	Height of Outlet pipe from base in mm _____	YES / NO
4.	Upstream flow straightener Length in mm _____	YES / NO
5.	Down stream flow straightener Length in mm _____	YES / NO
6.	Location of Thermowell as per AGA 3	YES / NO
7.	Cable and trays from Metering system to control room ____meters	YES / NO
8.	Painting thickness of pipe line as per approved Specifications	YES / NO
9.	Dimension of Control Panel as per Approved Drawing	YES / NO

Company Representative

TPIA

Client /Mecon Representative

Date:

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FAT CHECK LIST

FIELD TARNSMITTERS

Project : -----

Client : -----

P.O. No : ----- **Dtd.** -----

SR. No.	ITEM DESCRIPTION	LOCAL, PANEL & RTU INDICATION CHECKED		REMARKS
1.	Inlet Pressure Transmitter	O Accepted	O Rejected	
2.	Inlet Temp. Transmitter	O Accepted	O Rejected	
3.	Diff Pressure Transmitter- Filter 1	O Accepted	O Rejected	
3.	Diff Pressure Transmitter- Filter 2	O Accepted	O Rejected	
4.	Metering Pressure Transmitter Stream1	O Accepted	O Rejected	
5.	Metering Pressure Transmitter Stream2	O Accepted	O Rejected	
6.	Metering Temperature Transmitter – Stream1	O Accepted	O Rejected	
7.	Metering Temperature Transmitter – Stream 2	O Accepted	O Rejected	
8.	Functioning of HART communication of transmitters	O Accepted	O Rejected	

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Client /Mecon Representative

Date:

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FAT CHECK LIST

FLOW COMPUTER

Project : -----

Client : -----

P.O. No : ----- **Dtd.** -----

Tag No.: Stream-1

Inspection / Simulation done for	CHECKED/ OBSERVED		REMARKS
Volumetric Flow rate (SCMH)	☐ Accepted	☐ Rejected	
Totaliser (SCM)	☐ Accepted	☐ Rejected	
Mass Flow rate (kg/ hr)	☐ Accepted	☐ Rejected	
Energy Flow rate (Kcal/ hr)	☐ Accepted	☐ Rejected	
Pipe Line Temperature °C	☐ Accepted	☐ Rejected	
Pipe Line Pressure Kg/Cm2g / Bar(g)	☐ Accepted	☐ Rejected	
Atmospheric pressure entry at site condition	☐ Accepted	☐ Rejected	
Base Pressure/ Base Temperature entry	☐ Accepted	☐ Rejected	
Configuration check, parameter settings	☐ Accepted	☐ Rejected	
PID controller Analog O/P check	☐ Accepted	☐ Rejected	
Functioning of PID loop for FCV by simulation	☐ Accepted	☐ Rejected	
Interface data of flow computer with RTU – Measurement by Laptop	☐ Accepted	☐ Rejected	
Various Units of measurement (Flow rate, heating value, energy)	☐ Accepted	☐ Rejected	
Flow computer o/p to SCADA	☐ Accepted	☐ Rejected	
GC data input to Flow computer from SCADA	☐ Accepted	☐ Rejected	
K factors for meter error curves	☐ Accepted	☐ Rejected	
Audit trail printout (to be attached)	☐ Accepted	☐ Rejected	
Software for flow calculation verification	☐ Accepted	☐ Rejected	

Company Representative

TPIA

Client /Mecon Representative

Date

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FAT CHECK LIST

FLOW COMPUTER

Project : -----

Client : -----

P.O. No : ----- **Dtd.** -----

Tag No.: Stream-2

Inspection / Simulation done for	CHECKED/ OBSERVED		REMARKS
Volumetric Flow rate (SCMH)	O Accepted	O Rejected	
Totaliser (SCM)	O Accepted	O Rejected	
Mass Flow rate (kg/ hr)	O Accepted	O Rejected	
Energy Flow rate (Kcal/ hr)	O Accepted	O Rejected	
Pipe Line Temperature °C	O Accepted	O Rejected	
Pipe Line Pressure Kg/Cm2g / Bar(g)	O Accepted	O Rejected	
Atmospheric pressure entry at site condition	O Accepted	O Rejected	
Base Pressure/ Base Temperature entry	O Accepted	O Rejected	
Configuration check, parameter settings	O Accepted	O Rejected	
PID controller Analog O/P check	O Accepted	O Rejected	
Functioning of PID loop for FCV by simulation	O Accepted	O Rejected	
Interface data of flow computer with RTU – Measurement by Laptop	O Accepted	O Rejected	
Various Units of measurement (Flow rate, heating value, energy)	O Accepted	O Rejected	
Flow computer o/p to SCADA by GSM modem.	O Accepted	O Rejected	
GC data input to Flow computer from SCADA by GSM modem.	O Accepted	O Rejected	
K factors for meter error curves	O Accepted	O Rejected	
Audit trail printout (to be attached)	O Accepted	O Rejected	
Software for flow calculation verification	O Accepted	O Rejected	

Company Representative

TPIA

Client /Mecon Representative

Date:

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TEST CERTIFICATE

CONTROL PANEL

Project : -----

Client : -----

P.O. No : ----- **Dtd.** -----

Type of Skid :

<u>POINT INSPECTED</u>		<u>OBSERVATION/ RESULT FOUND</u>
1)	Wiring connection as per approved wiring diagram	Yes / NO
2)	Functional Check as per data sheet	Yes/ NO
3)	Hot stand by functionality of Power supply, Modem	Yes/ NO
4)	Door alignment	Yes/ NO
5)	Dimensions / Drawings	Yes/ NO
6)	Painting	Yes/ NO
7)	Identification mark/ Tagging (Cable, Instruments)	Yes/ NO
8)	Cable Dressing, Plugging of spare holes	Yes/ NO
9)	Fan, Tube Light	Yes/ NO
10)	Adequacy of Installed spares for future use	Yes/ NO

Remarks (if any):

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TPIA

Client /Mecon Representative

Date:

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FAT CHECK LIST

ORIFICE FLOW METER

Project : -----

Client : -----

P.O. No : ----- **Dtd.** -----

Tag No.: Stream-1

Inspection / Simulation done for	CHECKED/ OBSERVED		REMARKS
Make/ Model/ for Flow meter	O Accepted	O Rejected	
Installation of Orifice Meter in skid	O Accepted	O Rejected	
Calibration report	O Accepted	O Rejected	

Tag No.: Stream- 2

Inspection / Simulation done for	CHECKED/ OBSERVED		REMARKS
Make/ Model/ for Flow meter	O Accepted	O Rejected	
Installation of Orifice Meter in skid	O Accepted	O Rejected	
Calibration report	O Accepted	O Rejected	

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Date:

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FAT CHECK LIST
GAS CHROMATOGRAPH

Project : -----

Client : -----

P.O. No : ----- **Dtd.** -----

Inspection / Simulation done for	CHECKED/ OBSERVED	REMARKS
MAKE/ Model of GC	O Accepted O Rejected	
GC controller/ remote configurator Installation in control panel	O Accepted O Rejected	
Parameter settings/ configuration/ application software loading, default values etc for GC controller/ remote configurator	O Accepted O Rejected	
Probes, Tools for insertion/ removal	O Accepted O Rejected	
Calibration Gas cylinders, carrier gas cylinders, self acting pressure regulator for Cylinders (calibration gas/ carrier gas) with stand, mounting arrangement	O Accepted O Rejected	
Field Analyser with Stand	O Accepted O Rejected	
Composition of calibration gases	O Accepted O Rejected	
Shed for Analyser, Cable for remote configurator/ controller, communication with various devices, instruments, equipments etc	O Accepted O Rejected	
Communication between GC and Laptop and GC data simulation	O Accepted O Rejected	
Simulation of GC data input to Flow computer, Metering supervisory system and RTU/ SCADA and via GSM modem	O Accepted O Rejected	
Functionality/ simulation of communication ports for communication with flow computers, Laptop, Metering supervisory system, RTU/ SCADA, Printers,	O Accepted O Rejected	
Interface of GC with RTU/ SCADA, Flow computers, LAPTOP, Printer, Metering supervisory system etc	O Accepted O Rejected	
Calibration methods, Various Units of measurement (heating value/ energy)	O Accepted O Rejected	
Communication with RTU/ SCADA	O Accepted O Rejected	
GC data input to Flow computer through SCADA	O Accepted O Rejected	
Calibration run for GC	O Accepted O Rejected	
Chromatogram for 3 consecutive runs	O Accepted O Rejected	

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TEST CERTIFICATE

SOLAR PANEL

Project : -----

Client : -----

P.O. No : ----- **Dtd.** -----

POINT INSPECTED

OBSERVATION/ RESULT FOUND

1) Functional check of Solar panel in stream-1	Yes / NO
2) Output Voltage _____ VDC in stream-1	Yes/ NO
3) No. of _____ (Ah) Batteries per stream _____	Yes/ NO
4) Functional check of Solar panel in stream-2	Yes / NO
5) Output Voltage _____ VDC in stream-2	Yes/ NO
6) Identification mark/ tagging	Yes/ NO
7) Adequacy of the Solar panel system mounting arrangement, fittings, requires cable and other hardware	Yes/ NO

Remarks (if any):

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ACTION LIST

Project : -----

Client : -----

P.O. No : ----- **Dtd.** -----

Type of Skid :

Sr. No.	Description	Action By
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		

Company Representative

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Date:

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FAT CHECK LIST
REVIEW OF DOCUMENTS

Project : -----

Client : -----

P.O. No : ----- **Dtd.** -----

SR. No.	DOCUMENTS REVIEWED	CHECKED	REMARKS
1.	Radiography Test for all items of skid (as per List prepared by vendor and attached as Annexure)	O Accepted O Rejected	
2.	Dye Penetration Test for all items of skid (as per List prepared by vendor and attached as Annexure)	O Accepted O Rejected	
3.	Test Certificate (for Filtration system, PSV, CRV, NRV, Flow profiler, Flow meter, Isolation Ball Valves, Plug valves, Flow computer, PT, DPT, PG, DPG, Thermo-well, RTD, LEL detection system, GC, Control panel, JB's, Pipe spools etc.)	O Accepted O Rejected	
3.	Hydro test for all items of skid (as per List prepared by vendor and attached as Annexure)	O Accepted O Rejected	
4.	Material test Report for all items of skid (as per List prepared by vendor and attached as Annexure)	O Accepted O Rejected	
5.	Certification as per 3.2 for all Pressure Equipments (as per List prepared by vendor and attached as Annexure)	O Accepted O Rejected	
6.,	Calibration Report for PT, DPT, TT, PSV, CRV, Flow Computer, GC, ORIFICE, LEL sensors, LEL detection system, Calibration Gas (for FC & LEL)	O Accepted O Rejected	
7.	Welding Procedure Specification, Welder qualification.	O Accepted O Rejected	
8.	Configuration Sheet for Flow computers, GC	O Accepted O Rejected	
9.	Compliance Certification for Painting of skid including all items (Filtration system, Valves, PSVs, CRVs etc) and control panel	O Accepted O Rejected	
10.	Material Correlation Chart & Welding Joints Correlation Chart	O Accepted O Rejected	

Company Representative

TPIA

Client /Mecon Representative

Date:

ANNEXURE - VIII

STANDARD SPECIFICATIONS

Standard Specifications

1.	Technical specification of Cartridge Filter	MEC/TS/05/62/017, Rev-1
2.	Specification of Assorted Pipe	MEC/TS/05/62/59A, Rev-0
3.	Technical Specification of Pressure Safety Valve	MEC/TS/05/62/056, Rev-1
4.	Specification for Seamless Fittings & Flanges up to 400 mm (16") NB	MEC/TS/05/21/025, Rev-0
5.	Specification for Gaskets, Nuts and Bolts	MEC/S/05/21/19, Rev-0
6.	Specification for Piping, Fabrication and Erection	MEC/S/05/21/06, Rev-0
7.	Specification for Vents, Drains and Wells, Pressure tapping	MEC/S/05/21/15, Rev-0
8.	Specification for Flushing and Testing	MEC/S/05/21/11, Rev-0
9.	Technical Specification for Ball Valve	MEC/TS/05/21/002, Rev-1
10.	Technical Specification for Plug Valve	MEC/TS/05/62/003, Rev-2
11.	Technical Specification for Check Valve	MEC/TS/05/62/004, Rev-2
12.	Specification For Shop & Field Painting	MEC/S/05/21/07, Rev-0
13.	Specification for Installation of Instruments	MEC/S/05/26/01, Rev-0
14.	Specification for Instrument Tubing	MEC/S/05/26/02, Rev-0
15.	Specification for Inlet, Outlet Sections and Flow Straightner	MEC/S/05/26/03, Rev-0
16.	Specification for Instrument Tube Fittings	MEC/S/05/26/04, Rev-0
17.	Specification for Instrument Valves and Manifolds	MEC/S/05/26/05, Rev-0
18.	Specification for Junction Boxes and Cable Glands	MEC/S/05/26/06, Rev-0
19.	Specification for Signal Cable	MEC/S/05/26/07, Rev-0
20.	General Technical Specification for Instrumentation	MEC/S/05/26/08, Rev-0
21.	Specification for Cabling	MEC/S/05/E5/21, Rev-0
22.	Specification for Earthing	MEC/S/05/26/23 A, Rev-0

TECHNICAL SPECIFICATION
FOR
CARTRIDGE FILTER & ACCESSORIES
(Dry Gas Filters)

SPECIFICATION NO. : MEC/TS/05/62/017, Rev-2



MECON LIMITED
DELHI - 110 092

C O N T E N T S

<u>Sl. No.</u>	<u>Description</u>	<u>Page No.</u>
1.0	GENERAL	2
2.0	SCOPE OF SUPPLY	2
3.0	SCOPE OF SERVICES	2
4.0	DESIGN	3
5.0	TECHNICAL REQUIREMENTS	4
6.0	INSPECTION AND TESTING	5
7.0	PROTECTION AND PAINTING	6
8.0	PACKAGING AND IDENTIFICATION	7
9.0	SPARE PARTS	8
10.0	INFORMATION/ DOCUMENTS/ DRAWINGS TO BE SUBMITTED WITH THE OFFER	8
11.0	INFORMATION/ DOCUMENTS/ DRAWINGS TO BE SUBMITTED BY SUCCESSFUL VENDOR	9
12.0	ORDER OF PRECEDENCE	10
REVISION	PREPARED BY	CHECKED BY
		APPROVED BY

1.0 **GENERAL**

1.1 This specification outlines the minimum requirements under which the manufacturer shall design, manufacture, test and supply Cartridge Filter for separating solid contaminants from the gas stream.

2.0 **SCOPE OF SUPPLY**

2.1 The vendor's scope of supply shall be Cartridge Filter alongwith accessories complete in all respects as per data sheet enclosed. The detailed scope of work is as follows :

The filters shall comprise of the following :

- Filter vessel alongwith necessary filtering cartridge.
- Necessary nozzles, companion flanges, blind flanges (with nuts, bolts, gaskets etc.) on the filter vessel as specified in the data sheets.
- Cartridge supporting arrangement inside the vessel.
- Quick opening closure for maintenance and filter element replacement.
- Instruments, viz. PSV as per Instrumentation inputs.
- Necessary supports for filter vessel.
- Cleats for platforms and ladders.
- Foundation bolts & base plate for embedding/ grouting into civil foundation.
- Documents clause 10, 11 & elsewhere in spec.
- Spare parts for two years normal operation.

3.0 **SCOPE OF SERVICES**

- Engineering, design and manufacturing.

- Procurement of raw materials etc. from sub-vendors.
- Preparation and submission of documentation for design approval by purchaser/consultant.
- Inspection and testing as per T.S.
- Surface preparation, protective coating and painting as per T.S.
- Packaging for transportation to site and supply.

4.0

DESIGN

4.1

Following codes & standards (latest edition) shall be followed for design, manufacture, testing etc. of the equipment.

ASME Sec-VIII Div-1	:	Boiler and Pressure Vessel Code
ASME Sec-IX	:	Welding and Brazing Qualifications
ASME Sec-II & ASTM	:	Material Specifications
ANSI B16.5	:	Pipe Flanges & Pipe Fittings
ANSI B16.1	:	Forged Steel Fittings Socket Welded & Threaded
ASME B16.47	:	Large Diameter Steel Flanges
ANSI B36.10	:	Welding & Seamless Wrought Steel Pipe.

4.2

For purpose of material selection national code of the country of origin shall also be acceptable provided the vendor specifically establishes, to the satisfaction of the purchaser, the equivalence or superiority of the proposed material with respect to those specified.

5.0 **TECHNICAL REQUIREMENTS**

- 5.1 The cartridge shall be from approved make.
- 5.2 Filter elements must withstand a pressure of $1.0 \text{ kg/cm}^2(\text{g})$ without breaking or failure.
- 5.3 At least 300mm space from bottom tangent line to be provided.
- 5.4 Filtering efficiency shall be as per enclosed data sheet.
- 5.5 Particle size shall be as indicated in the data sheets.
- 5.6 The end closure to be high pressure quick release type interlock to open only when vessel is completely depressurised.
- 5.7 Filter element should be suitable for specified mole% of CO_2 .
- 5.8 Core of filter element shall be of SS material.
- 5.9 A davit/ hinged arrangement shall be provided for the closure for convenient handling. The closure shall have perfect sealing arrangement to prevent leakage.
- 5.10 The equipment shall be of the type as mentioned in the data sheets and shall meet the duty requirements and performance parameters as mentioned therein.
- 5.11 Vendor shall submit calculations for sizing of the equipment together with all supporting documents/ catalogues/ nomographs etc. with the bid. The type, model and number of cartridge shall be selected based on allowable pressure drop and supplier's recommendation. The total internal cross sectional area of mounted cartridge shall not be less than inlet nozzle area for inlet size upto 150 NB. The calculation for the selected number of cartridge shall be furnished, alongwith the bid.

- 5.12 Suitable baffle plates shall be provided in the vessels for proper fluid flow distribution. Vessel diameter shall be minimum twice the diameter of inlet nozzle. All internal nuts and bolts shall be of stainless steel irrespective of material of construction of vessel.
- 5.13 All nozzles/ pipes on the vessel shall be of seamless construction. All nozzle less than or equal to 50 NB size shall be provided with 2 Nos., 6mm thick stiffeners at 90 degree to each other. All nozzles above 80 NB size, shall be provided with reinforcement pads.
- 5.14 All flanges shall be WNRF except DPT connection which is to be socket welded.
- 5.15 Dimensions of flanges including shell flanges, blind head cover flanges, nozzle flanges and blind flanges shall be as per ANSI B16.5. Larger flanges shall be as per ANSI B16.47.
- 5.16 Pressure parts joined by butt welds shall be with full penetration welds. Where both sides welding is not accessible, root run by tungsten inert gas process or backing strip, shall be used to ensure full penetration. Backing strip if used, shall be removed after welding.
- 5.17 Vessels shall be post weld heat treated, whenever it is required due to service requirement or due to code requirements. Vessels shall be post weld heat treated as a complete unit and no welding shall be permitted after the post weld heat treatment is completed.
- 5.18 For vessels in stainless steel construction, lower allowable stress values shall be considered as per ASME Code for their design.
- 5.19 Filter vessel shall be provided with lifting and earthing lugs. Fire proofing and insulation supports shall be provided if indicated in data sheet.

6.0 **INSPECTION AND TESTING**

- 6.1 Equipment shall be subjected to stage wise expediting, inspection and testing at vendor's/ sub-vendor's works by purchaser/ its authorised inspection agency. Vendor shall submit Quality Assurance (QA) procedures before commencement of fabrication. Approved QA procedures shall form the basis for equipment inspection.

- 6.2 Testing at vendor's works shall include but not limited to the following:
- Non destructive tests such as radiography, dye penetration tests.
 - Hydrostatic test at 150% of design pressure for the vessel.
 - Any other tests as per data sheets/ standards/ codes.
- 6.3 Any or all the tests, at purchaser's option, shall be witnessed by purchaser/ its authorised inspection agency. However, such inspection shall be regarded as check-up and in no way absolve the vendor of this responsibility.
- 6.4 Extent of radiography shall be 100%.

7.0 **PROTECTION AND PAINTING**

- 7.1 All exposed carbon steel parts to be painted shall be thoroughly cleaned from inside and outside to remove scale, rust, dirt and other foreign materials by wire brushing and sand blasting as applicable. Minimum acceptable standard in case of power tool cleaning shall be St. 3 and incase of blast cleaning shall be Sa 2½ as per Swedish Standard SIS 0055900.
- 7.2 Non-ferrous materials, austenitic stainless steels, plastic or plastic coated materials, insulated surfaces of equipment and pre-painted items shall not be painted.
- 7.3 Stainless steel surfaces both inside and outside shall be pickled and passivated.
- 7.4 Machined and bearing surfaces shall be protected with varnish or thick coat of grease.
- 7.5 Depending on the environment, following primer and finish coats shall be applied.

	<u>Environment</u>	<u>Description</u>		
i)	Normal Industrial	Surface Preparation	:	Sa 2½
		Primer	:	2 coats of Redoxide zinc chromate each 25 microns (min.) thick.

		Finish Coat	:	2 coats of synthetic enamel, each 25 microns (min.) thick.
ii)	Corrosive Industrial	Surface Preparation	:	Sa 2½
		Primer	:	2 coats of Epoxy zinc chromate each 35 microns (min.) thick.
		Finish Coat	:	2 coats of Epoxy high build paint each 100 microns (min.) thick.
iii)	Coastal and Marine	Surface Preparation	:	Sa 2½
		Primer	:	2 coats of high build Chlorinated Rubber zinc phosphate, each 50 microns (min.) thick.
		Finish	:	2 coats of chlorinated rubber paint, each 35 microns (min.) thick.
iv)	All Environment (temp. 80-400°C)	Surface Preparation	:	Sa 2½
		Finish	:	2 coats of heat resistant aluminium paint suitable for specified temp. each 20 µ thick. (All values refer to dry film thickness).
7.6	The colour of finish coat shall be intimated to vendor after placement of order.			
8.0	<u>PACKAGING AND IDENTIFICATION</u>			
8.1	All packaging shall be done in such a manner as to reduce the volume. The equipment shall be dismantled into major components suitable for shipment and shall be properly packed to provide adequate protection during shipment. All assemblies shall be properly match marked for site erection.			

8.2 Attachments, spares parts of the equipment and small items shall be packed separately in wooden-cases. Each item shall be appropriately tagged with identification of main equipment, its denomination and reference number of the respective assembly drawing.

8.3 Detailed packing list in water-proof envelope shall be inserted in the package together with equipment.

8.4 Each equipment shall have an identification plate giving salient equipment data, make, year of manufacture, equipment number, name of manufacturer etc.

9.0 **SPARE PARTS**

9.1 Vendor shall submit his recommended list of spare parts for two years with recommended quantities and operation of the equipment. Proper coding and referencing of spare parts shall be done so that later identification with appropriate equipment will be facilitated.

9.2 Recommended spares and their quantities should take into account related factors of equipment reliability, effect of equipment downtime upon production or safety, parts and availability of vendor's service facilities around proposed location of equipment.

9.3 Vendor shall also submit a list of recommended commissioning spares with quantities.

10.0 **INFORMATIONS/ DOCUMENTS/ DRAWINGS TO BE SUBMITTED WITH THE OFFER**

Contractor shall submit with the offer four copies each of the following:

10.1 Manufacturer's complete descriptive and illustrative catalogue/ literature.

10.2 The completion schedule activity wise.

10.3 In case of failure to submit the documents listed above, the offer may be rejected.

11.0	<u>INFORMATION/ DOCUMENTS/ DRAWINGS TO BE SUBMITTED BY SUCCESSFUL VENDOR</u> Successful vendor shall submit six copies unless noted otherwise, each of the following :
11.1	Inspection & test reports for all mandatory tests as per the applicable code. Test reports for any supplementary tests, in nicely bound volumes.
11.2	Material test certificates (physical) property, chemical composition, make, heat treatment report etc.) as applicable for items in nicely bound volumes.
11.3	Statutory test certificates, as applicable.
11.4	Filled in QAP for Owner's/ Consultants approval. These QAP's shall be submitted in four copies.
11.5	WPS & PQR, as required.
11.6	Within two(2) weeks of placement of order, the detailed fabrication drawings alongwith mechanical design calculations for Owner's/ Consultants approval. These drawings shall be submitted in four copies.
11.7	Detailed completion schedule activity wise, within one week of placement of order.
11.8	Weekly & fortnightly progress reports for all activities including procurement.
11.9	Purchase orders of bought out items soon after placement of order.
11.10	Manufacturer's drawings for bought out items, in 4 copies, for Owner's/ Consultant approval within 4 weeks.
11.11	Manufacturer related information for design of civil foundation & other matching items within 6 weeks of LOI.

11.12 All approved drawings/ documents as well as inspection and test reports for Owner's/ Consultants reference/ record in nicely category wise bound volumes separately.

Note: All drawings, instructions, catalogues, etc. shall be in English language and all dimensions shall be metric units.

12.0 **ORDER OF PRECEDENCE**

The following order of precedence shall govern in interpretation of various requirements and data :

- Data Sheets
- This Specification
- Codes & Standards
- Vendors Standards

TECHNICAL SPECIFICATION FOR SCRUBBER WITH ACCESSORIES

SPECIFICATION NO.: MEC/TS/05/62/019



MECON LIMITED
DELHI - 110 092

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PREPARED BY	CHECKED BY	APPROVED BY

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1.0 **GENERAL**

1.1 This specification outlines the minimum requirements under which the manufacturer shall design, manufacture, test and supply Scrubbers alongwith accessories including pressure safety valve, level gauges for separating entrained liquid & solid contaminants from the gas stream.

1.2 **Order of Precedence**

The following order of precedence shall govern in interpretation of various requirement and data.

- Data sheets.
- This specification.
- Codes & standards.
- Vendors standards.

2.0 **SCOPE OF SUPPLY**

2.1 The vendor's scope of supply shall be as per Data Sheet & Drawing enclosed. The detailed scope of supply is as follows :-

- Scrubbers complete in all respect.
- Companion flanges with bolting and gaskets for all nozzles.
- Cover flanges for manholes, handholes and inspection openings etc. with bolting and gaskets.
- Test blind flanges in addition to companion flanges.
- All internals complete with supports and fasteners.
- Tower davits.
- Manhole davits.
- All external welded attachments like platforms and ladder cleats, insulation supports if any and pipe support cleats etc.

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- Lifting lugs/ erection lugs.
- Template for skirt supports of equipment; template shall be supplied within 2 months from the date of Fax of Intent.
- Sight glasses and protector glasses.
- Cleats for earthing connections.
- Name plate with bracket.
- GA drawings for approval shall be submitted with in one month from FOI.
- Foundation/ Anchor/ Holding down bolts with nuts and washers. Shall be supplied within one month from FOI.
- Support stool.
- Lapping tool with transportation ring etc.
- Welding/ wire rods for weld seal gaskets.
- Special tools/ tackles.
- Attachment for painter's trolley.
- Documents as called in "Vendor Data Requirement Sheet".
- Spare parts for two years normal operation.
- Pressure Safety Valve and Level Gauge complete in all respect.

3.0

SCOPE OF SERVICES

- Engineering, design and manufacturing.
- Procurement of raw materials etc. from sub-vendors.
- Preparation and submission of documentation & GA drawings for design approval by purchaser/ consultant.
- QAP
- Inspection and testing as per T.S.

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- Surface preparation, protective coating and painting as per T.S.
- Packing for transportation to site and supply.

4.0 **DESIGN**

4.1 Complete design of equipment as per latest code of construction shall be the responsibility of the supplier. Strict compliance with the requirements of code/equipment specification, this specification and any other referred document shall be fully ensured.

4.2 Following codes & standards (latest edition) shall be followed for design, manufacture, testing etc. of the equipment.

ASME Sec-VIII Div-1 : Boiler and Pressure Vessel Code

ASME Sec-IX : Welding and Brazing Qualifications

ASME Sec-II & ASTM : Material Specifications

ANSI B16.5 : Pipe Flanges & Pipe Fittings

ANSI B16.11 : Forged Steel Fittings Socket Welded & Threaded

ASME B16.47 : Large Diameter Steel Flanges

ANSI B36.10 : Welding & Seamless Wrought Steel Pipe.

4.3 Detailed design calculations for adequacy of strength of all individual parts shall be made and submitted to Purchaser/ Consultant for comments and approval. After receipt of approval from Purchaser/ Consultant the design of equipment shall be considered as final. Any change/ comment, made on design calculations to satisfy the requirements of Code/enquiry documents, without any commercial implications, shall have to be incorporated. For high alloy steel parts/components designed as per ASME Sec VIII Div.I lower allowable stresses shall be adopted, unless otherwise specified. After the approval of various documents subsequent deviations shall be discouraged.

4.4 Any modification in design parameters as may be required by Purchaser/ Consultant after placement of order/ at any time shall have to be suitably incorporated. Commercial implications, if any, due to such changes shall be mutually discussed and settled.

4.5 Wind and seismic analysis shall be in accordance with IS: 875 and IS: 1893 unless otherwise stated in specifications.

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- Detailed vibration analysis for wind forces and seismic forces shall be submitted alongwith the design calculations. For the design consideration, wind forces shall be increased by 20% to cater for the effect of piping system, platforms and ladders etc.
- 4.6 Design of supports and anchor/foundation bolts shall be the responsibility of the supplier. The type, number, location and any other information if furnished in the specification sheets shall be strictly adhered to. However, adequacy of the same must be checked by the supplier. In no case diameter of anchor bolts for skirt support shall be less than M 24 and for other M 16.
- 4.7 Forces & moments coming on the nozzles shall be furnished after placement of order by Purchaser/ Consultant which shall be considered in the design by the supplier, without any commercial implication. Alternatively supplier shall indicate maximum permissible forces & moments for review and confirmation by Purchaser/ Consultant.
- 4.8 Unless otherwise specified, removable internal parts shall be designed in units as large as can be installed through the nearest/upper manhole or opening, Demisters, may however, be installed through the nearest lower manhole or opening.
- Trays, distributors, baffles and support beams shall be designed in such a way that deformation of the shell due to operating pressure and thermal expansion does not occur.
- Bolts and nuts for fixing internals shall be 18/8 SS and minimum size of bolt shall be M10.
- 4.9 Support for packing/internals shall be designed for the worst condition. In case of packing liquid hold-up of minimum 20% of packing volume shall be considered unless otherwise specified.
- 4.10 Unless otherwise specified minimum corrosion allowance for CS and low alloy steel shall be 1.5 mm or as specified in data sheet.
- 4.11 The lifting lugs shall be designed with a shock factor of 2.
- 5.0 **MATERIALS**
- 5.1 For purpose of material selection national code of the country of origin shall also be acceptable provided the vendor specifically establishes, to the satisfaction of the purchaser, the equivalence or superiority of the proposed material with respect to those specified.

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- 5.2 All materials, whatsoever, required to complete the supplies shall be procured by the supplier and all such materials shall be covered with due identifiable material test certificates.
- 5.3 Materials indicated in specification sheets are recommended for the required services conditions. Supplier, however, may use better or equivalent material with prior approval of Purchaser/ Consultant. Details of such materials must be indicated in the offer with proper reference.
- 5.4 Unless otherwise specified all C.S. material used for pressure parts shall be fully killed.
- 5.5 Unless otherwise specified copper or copper alloys shall not be used. Steel conditions with copper content upto 0.35% maximum are acceptable.
- 5.6 Materials for low temperature service shall be impact tested (Charpy) at the lowest design temperature in accordance with requirements of code/ specification.
- 5.7 For coarse grained and high tensile materials in carbon steel ($UTS > 45 \text{ kg/mm}^2$) and low alloy steel, guarantee impact strength shall be ensured at a temperature 15°C below envisaged hydraulic test temperature as precaution against brittle fracture during hydraulic test.
- 5.8 C.S. and low alloy steel exceeding thickness of 50mm shall be vacuum degassed except for plate ring flanges.
- 5.9 For AISI 316 and 316L material, ferrite content for plates, pipes and tubes shall be maximum 0.6% and for forging maximum 1%.
- 5.10 Intergranular corrosion test shall be carried out on all S.S. materials as per ASTM A 262 practice C if specified. The corrosion rate shall not exceed 0.6 mm/year.
- 5.11 All plate material over 50mm thickness shall be ultrasonically tested both on surfaces and edges as per ASTM A 435.
- 5.12 All forgings shall be ultrasonically tested as per ASTM A 388 for thickness greater than 100 mm with the criteria shown in ASME VIII Div. 2 para AM-203-2. In case any defect is found no repair by welding shall be allowed. ANSI flanges, for equipment designed as per ASME SCE VIII Div. I need not be ultrasonically tested.
- 5.13 For IS 2062 materials without mill test certificates check test, if called for by the inspector, shall be performed without any commercial implication.

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6.0 **TECHNICAL REQUIREMENTS**

- 6.1 The equipment shall be procured from a source possessing proven track record for trouble free and reliable operation.
- 6.2 At least 300mm space from bottom tangent line to be provided unless otherwise stated.
- 6.3 Scrubber efficiency shall be 98% minimum
- 6.4 Particle size shall be as indicated in the data sheets.
- 6.5 Internal should be suitable for specified mol% of CO₂ and gas composition, as given in data sheets.
- 6.6 Internal shall be of SS material.
- 6.7 The equipment shall be of the type as mentioned in the data sheets and shall meet the duty requirements and performance parameters as mentioned therein.
- 6.8 Vendor shall submit calculations for sizing of the equipment together with all supporting documents/ catalogues/ nomographs etc. with the bid. The type, model and number of cartridge/ cyclone shall be selected based on allowable pressure drop and supplier's recommendation. The total internal cross sectional area of cyclone shall not be less than inlet nozzle area for inlet size upto 150 NB. The calculation for the selected number of cyclone shall be furnished, alongwith the bid.
- 6.9 Suitable baffle plates shall be provided in the vessels for proper fluid flow distribution. Vessel diameter shall be minimum twice the diameter of inlet nozzle. All internal nuts and bolts shall be of stainless steel irrespective of material of construction of vessel.
- 6.10 All nozzles/ pipes on the vessel shall be of seamless construction. All nozzle less than or equal to 50 NB size shall be provided with 2 Nos., 6mm thick stiffeners at 90 degree to each other. All nozzles above 80 NB size, shall be provided with reinforcement pads.
- 6.11 All flanges shall be WNRF.
- 6.12 Dimensions of flanges including shell flanges, blind head cover flanges, nozzle flanges and blind flanges shall be as per ANSI B16.5. Larger flanges shall be as per ANSI B16.47.
- 6.13 Pressure parts joined by butt welds shall be with full penetration welds. Where both sides welding is not accessible, root run by tungsten inert gas process or backing strip, shall be used to ensure full penetration. Backing strip if used, shall be removed after welding.

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6.14 Vessels shall be post weld heat treated, whenever it is required due to service requirement or due to code requirements. Vessels shall be post weld heat treated as a complete unit and no welding shall be permitted after the post weld heat treatment is completed.

6.15 For vessels in stainless steel construction, lower allowable stress values shall be considered as per ASME Code for their design.

6.16 Vessel shall be provided with lifting and earthing lugs. Fire proofing and insulation supports shall be provided if indicated in data sheet.

7.0 **INSPECTION AND TESTING**

7.1 Equipment shall be subjected to stagewise expediting, inspection and testing at vendor's sub-vendor's works by purchaser/ its authorised inspection agency. Vendor shall submit Quality Assurance (QA) procedures before commencement of fabrication. Approved QA procedures shall form the basis for equipment inspection.

7.2 Testing at vendor's works shall include but not limited to the following:

- Non destructive tests such as radiography, dye penetration tests.
- Hydrostatic test at 150% of design pressure for the vessel.
- Any other tests as per data sheets/ standards/ codes.

7.3 All raw materials shall be inspected at source and test certificates to enable proper identification shall be submitted.

7.4 All equipment shall be inspected during various stages of manufacture starting from identification of raw materials to completion. The equipment shall be considered acceptable for despatch only after final certification for acceptance is issued by the inspector.

7.5 Bought out items or items sub-contracted to other sub-suppliers shall also be inspected at the sub-supplier's works.

7.6 Inspection by third party, if specified, shall be arranged by the supplier at free of cost. It shall be responsibility of the supplier to make available to the inspector all the new/revised drawings, calculations and other enquiry documents.

7.7 Inspection order on third party shall also include specific instructions for marking copies of all correspondence from inspecting authorities to purchaser/ consultant and reporting monthly progress of the order to purchaser/consultant Complete responsibility of getting approval of drawings/ calculations and documents from inspecting authority shall be that of the supplier.

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7.8 In case of site fabricated/ assembled equipment same inspection agency shall be responsible for inspection, testing at site.

7.9 In case of castable refractory, 3 Nos. slab of each size shall be cast at site before application and tested to meet the refractory specification in the presence of the inspector.

7.10 Unless otherwise stated gaskets used during testing shall be same as specified for operating conditions. After testing, gaskets used during testing shall be replaced by new gaskets.

7.11 The following NDT requirements are mandatory in addition to the requirements of code/ specifications.

a) **Ultrasonic Examinations**

- i) Butt weld in thickness $\geq 50\text{mm}$ as supplement to radiography.
- ii) Full penetration welds of nozzle attachments on equipments shell/head of thickness $\geq 50\text{mm}$ as substitute to radiography.

b) **Magnetic particle/ liquid penetrant examination**

- i) All edges of plates and openings in shell of C.S. having thickness over 50mm and low alloy steel/ S.S. having thickness over 25mm.
- ii) Root-run and final layer of all butt welds.
- iii) Fillet welds of 3½% nickel and S.S.
- iv) Each layer of weld deposit in case of S.S. overlay.
- v) Knuckle surface of dished ends/ toriconical Sections and pipe bends.
- vi) Skirt to head joint.
- vii) In case of heat treated equipment final examination as stated above for all weld surfaces shall be carried out after heat treatment.

c) **Radiography**

- i) Radiography when called for shall be applicable to all pressure welds i.e. longitudinal and circumferentials.

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- ii) When formed heads are made of welded plates/ petal construction all the weld seams prior to forming and after forming shall be fully radiographed.
- iii) All the weld T joints shall be radiographed.
- iv) Radiography examination of welds in Cr-Mo and Cr-Mo steel shall preferably be carried out after heat treatment. If radiography is carried out prior to heat treatment the welding and adjacent areas of base metal shall be examined by MP/DP examination after heat treatment.

7.14 All completed equipment shall be tested hydrostatically as per the requirements of specification/ codes in presence of the inspecting authority. Pneumatic test of completed equipment shall be carried out only when specially mentioned in the specification sheets. Water used for testing of S.S. equipment shall not have a chloride content exceeding 30 ppm, C.S. 30 ppm.

7.15 When required as per specifications/ code, strain gauge measurements shall be carried out on outside circumstance during hydraulic testing. The results shall be plotted both during pressurising and depressurising and procedure of such strain measurements shall have prior approval of consultant.

7.16 Any or all the tests, at purchaser's option, shall be witnessed by purchaser/ its authorised inspection agency. However, such inspection shall be regarded as check-up and in no way absolve the vendor of this responsibility.

8.0 **PROTECTION AND PAINTING**

8.1 All exposed carbon steel parts to be painted shall be thoroughly cleaned from inside and outside to remove scale, rust, dirt and other foreign materials by wire brushing and sand blasting as applicable. Minimum acceptable standard in case of power tool cleaning shall be St. 3 and in case of blast cleaning shall be Sa 2½ as per Swedish Standard SIS 0055900.

8.2 Non-ferrous materials, austenitic stainless steels, plastic or plastic coated materials, insulated surfaces of equipment and pre-painted items shall not be painted.

8.3 Stainless steel surfaces both inside and outside shall be pickled and passivated.

8.4 Machined and bearing surfaces shall be protected with varnish or thick coat of grease.

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8.5 Depending on the environment, following primer and finish coats shall be applied.

	<u>Environment</u>	<u>Description</u>	
i)	Normal Industrial	Surface Preparation	: Sa 2½
		Primer	: 2 coats of Redoxide zinc chromate each 25 microns (min.) thick.
		Finish Coat	: 2 coats of synthetic enamel, each 25 microns (min.) thick.
ii)	Corrosive Industrial	Surface Preparation	: Sa 2½
		Primer	: 2 coats of Epoxy zinc chromate each 35 microns (min.) thick.
		Finish Coat	: 2 coats of Epoxy high build paint each 100 microns (min.) thick.
iii)	Coastal and Marine	Surface Preparation	: Sa 2½
		Primer	: 2 coats of high build Chlorinated Rubber zinc phosphate, each 50 microns (min.) thick.
		Finish	: 2 coats of chlorinated rubber paint, each 35 microns (min.) thick.
iv)	All Environment (temp. 80-400°C)	Surface Preparation	: Sa 2½
		Finish	: 2 coats of heat resistant aluminium paint suitable for specified temp. each 20 µ thick. (All values refer to dry film thickness).

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8.6 The colour of finish coat shall be intimated to vendor after placement of order.

9.0 **PACKAGING AND IDENTIFICATION**

9.1 All packaging shall be done in such a manner as to reduce the volume. The equipment shall be dismantled into major components suitable for shipment and shall be properly packed to provide adequate protection during shipment. All assemblies shall be properly match marked for site erection.

9.2 Attachments, spares parts of the equipment and small items shall be packed separately in wooden-cases. Each item shall be appropriately tagged with identification of main equipment, its denomination and reference number of the respective assembly drawing.

9.3 Detailed packing list in water-proof envelope shall be inserted in the package together with equipment.

9.4 Each equipment shall have an identification plate giving salient equipment data, make, year of manufacture, equipment number, name of manufacturer etc.

10.0 **SPARE PARTS**

10.1 Vendor shall submit his recommended list of spare parts with recommended quantities and itemised prices for first two years of operation of the equipment. Proper coding and referencing of spare parts shall be done so that later identification with appropriate equipment will be facilitated.

10.2 Recommended spares and their quantities should take into account related factors of equipment reliability, effect of equipment downtime upon production or safety, cost of parts and availability of vendor's service facilities around proposed location of equipment.

10.3 Vendor shall also submit a list of recommended commissioning spares with quantities and the itemised prices.

11.0 **INFORMATIONS/ DOCUMENTS/ DRAWINGS TO BE SUBMITTED WITH THE OFFER**

Contractor shall submit with the offer four copies each of the following:

11.1 Enclosed data sheet duly filled in.

11.2 Manufacturer's complete descriptive and illustrative catalogue/ literature.

11.3 The completion schedule activity wise.

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11.4	Basic Design Calculation
11.5	In case of failure to submit the documents listed above, the offer may be rejected.
12.0	<u>INFORMATION/ DOCUMENTS/ DRAWINGS TO BE SUBMITTED BY SUCCESSFUL VENDOR</u>
	Successful Contractor shall submit six copies unless noted otherwise, each of the following :
12.1	Inspection & test reports for all mandatory tests as per the applicable code. Test reports for any supplementary tests, in nicely bound volumes.
12.2	Material test certificates (physical) property, chemical composition, make, heat treatment report etc.) as applicable for items in nicely bound volumes.
12.3	Statutory test certificates, as applicable.
12.4	Filled in QAP for Owner's/ Consultants approval. These QAP's shall be submitted in four copies with in 15 days from LOI.
12.5	WPS & PQR, as required.
12.6	Within two(2) weeks of placement of order, the detailed fabrication drawings alongwith design calculations for Owner's/ Consultants approval. These drawings shall be submitted in four copies.
12.7	Detailed completion schedule activity wise, (Bar Chart) within one week of placement of order.
12.8	Weekly & fortnightly progress reports for all activities including procurement.
12.9	Purchase orders of bought out items soon after placement of order.
12.10	Manufacturer's drawings for bought out items, in 4 copies, for Owner's/ Consultant approval within 4 weeks.
12.11	Manufacturer related information for design of civil foundation & other matching items within 6 weeks of LOI.
12.12	All approved drawings/ documents as well as inspection and test reports for Owner's/ Consultants reference/ record in nicely category wise bound volumes separately.
	<u>Note:</u> All drawings, instructions, catalogues, etc. shall be in English language and all dimensions shall be metric units.

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TECHNICAL SPECIFICATION
FOR
ASSORTED PIPES

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Prepared By :	Checked By :	Approved By :

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1.0 **GENERAL**

1.1 All pipes and their dimensions, tolerances, chemical composition, physical properties, heat treatment, hydrotest and other testing and marking requirements shall conform to the latest codes and standards specified in the Material Requisition (MR). Deviation(s), if any, shall be clearly highlighted in the offer.

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 & treatment report) shall also be furnished for the pipes supplied.

1.3 **Manufacturing Processes**

1.3.1 Steel made by Acid Bessemer Process shall not be acceptable.

1.3.2 All longitudinally welded pipes other than IS:3589 should employ automatic welding.

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

- 1.5
- a) Seamless and E.R.W. pipes shall not have any circumferential seam joint in a random length. However, in case of E.FS.W. pipe, in one random length one welded circumferential seam of same quality as longitudinal weld is permitted. This weld shall be at least 2.5 m from either end. The longitudinal seams of the two portions shall be staggered by 90°. Single random length in such cases shall be 5 to 7m.
 - b) Unless otherwise mentioned in the respective material code, E.FS.W. pipes < 36" shall not have more than one longitudinal seam joint and E.FS.W. pipes ≥ 36" shall not have more than two longitudinal seam joints.

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1.6 Pipe with screwed ends shall have NPT external taper pipe threads conforming to ASME/ ANSI B1.20.1 upto 1.5" NB & IS:554 for 2" to 6" NB.

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

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

1.8 Gavanished 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.

1.10 **I.G.C. Test for Stainless Steels**

1.10.1 For all austenitic stainless steel pipes, intergranular corrosion test shall have to be conducted as per following:

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

OR

ASTM 262 practice " E" with acceptance criteria of " No cracks as observed from 20X magnification" & "Microscopic structure to be observed from 250X magnification".

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 corresponding to the highest pipe

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thickness. When testing in is conducted as per Practice "E", photograph of microscopic structure shall be submitted for record.

- 1.11 All welded pipes indicated as 'CRYO' & 'LT' in MR shall be impact tested per requirement and 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 Pipes under 'NACE' category shall meet the requirements given in MR-01-75.
- 1.13 Specified heat treatment for carbon steel & 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 galvanised pipes to IS:1239, the minimum percentage of elongation shall be 20%.

2.0 **IBR PIPES**

2.1 **IBR Documentation**

- 2.1.1 Pipes under purview of IBR shall be accompanied with IBR certificate original in Form IIIA, 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.
- 2.1.2 For materials $1\frac{1}{4}\text{Cr}-\frac{1}{2}\text{Mo}$ (ASTM A335 Gr. P11/ A691 Gr. $1\frac{1}{4}\text{Cr}$) & $2\frac{1}{4}\text{Cr}-1\text{Mo}$ (ASTM A335 Gr.P22/ A691 Gr. $2\frac{1}{4}\text{Cr}$), from III-A approved by IBR shall include the tabulation of E_t , S_c & S_r values for the entire temperature range given below. E_t , S_c & S_r values shall be such that throughout the temperature range

$$\begin{array}{rcl} E_t / 1.5 & \geq & \\ S_r / 1.5 & \geq & S_a \\ S_c & \geq & \end{array}$$

where,

S_A : Allowable stress at the working metal temperature.
 E_t : Yield point (0.2% proof stress at the working metal temperature).

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- S_c : The average stress to produce elongation of 1% (creep) in 1,00,000 hrs at the working metal temperature.
- S_r : The average stress to produce rupture in 1,00,000 hrs. at the working metal temperature and in no case more than 1.33 times the lowest stress to produce rupture at this temperature.

S_A (psi)	Temperature (°F)											
Material	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
A 691 Gr. 1½ Cr	18900	18300	18000	17600	17300	16800	16300	15000	9900	6300	4200	2800
A335 Gr. P2/ A691 Gr. 2 ¼ Cr	17900	17900	17900	17900	17900	17800	14500	12800	10800	7800	5100	3200

Note: S_A values given above are as per ASME B31.3-1999. 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 regulation.

The chemical composition as indicated in this clause is not applicable for pipes other than IBR services.

3.0 **HYDROSTATIC TEST**

Refer Annexure – I.

4.0 **MARKING AND DESPATCH**

4.1 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", etc., shall also be marked.

4.2 Pipes under "IBR", "CRYO", & "NACE" shall be painted in red stripes, light purple brown stripes & canary yellow stripes, respectively, longitudinally throughout the length for easy identification.

4.3 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.

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- 4.4 Pipes shall be dry, clen and free from from moisture, dirt and loose foreign materials of any kind.
- 4.5 Pipes shall be protected from rust, corrosion and mechanical damage during transportation, shipment and storage.
- 4.6 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.
- 4.7 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 |
- 4.8 End protectors to be used on bevelled ends shall be securely and tightly attached with belt or wire.
- 4.9 Steel end protectors to be used on galvanised pipes shall be galvanised.

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ANNEXURE–I

3.0 HYDROSTATIC TEST

3.1 All pipes shall be hydrostatically tested.

3.2 The mill test pressure shall be as follows:

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

a) Carbon Steel

Material Standard	Test Pressure Standard
ASTM A 106 Gr. B	ASTM A 530
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 A 530
ASTM A 333 Gr. 3 & 6, E.R.W.	ASTM A 530

b) Seamless Alloy Steel

Material Standard	Test Pressure Standard
ASTM A335 GR.P1, P12, P11, P22, P5, P9	ASTM A 530
ASTM A268 TP 405, TP410	ASTM A530

c) Seamless Stainless Steel

Material Standard	Test Pressure Standard
ASTM A312 Gr.TP304, 304L, 304H, 316, 316L, 316H, 321, 347	ASTM A 530

d) Seamless Nickel Alloy

Material Standard	Test Pressure Standard
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

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e) Welded Nickel Alloy

Material Standard	Test Pressure Standard
ASTM B725 UNS No.2200, 4400	ASTM B725
ASTM B517 UNS No.6600	ASTM B517
ASTM B514 UNS No.8800	ASTM B514

3.2.2

Electric Fusion Welded

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

Material Standard	Test Pressure Standard
API 5L Gr.B ASTM A 671 Gr.CC65, 70 (Cl.32) ASTM A 672 Gr.C60, 65, 70 (Cl.12,22) ASTM A 671 Gr.CF60, 65, 66, 70 (Cl.32) ASTM A 691 Gr. ½ Cr, 1Cr, 1 ¼Cr, 2 ¼Cr, 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 TP304/ 304H/ 316/ 316H/ 321/ 347 welded

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

Size	Pipe Schedule: S10		Pipe Schedule : S40		Pipe Schedule : S80	
	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

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

Material Standard	Test Pressure Standard
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

3.2.3 Carbon Steel Pipes to IS Standards

Material Standard	Test Pressure Standard
IS :1239	IS :1239
IS :3589	IS :3589

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TECHNICAL SPECIFICATION
FOR
PRESSURE SAFETY VALVES

SPECIFICATION NO. : MEC/TS/05/62/056, Rev-1

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Revision No.	Date	Revised by	Checked by	Approved by
1		K.P. Singh	A.K. Johri	Niraj Gupta

PREPARED BY : K.P. SINGH	CHECKED BY : A.K. JOHRI	APPROVED BY : NIRAJ GUPTA

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1.0 **GENERAL**

1.1 **Scope**

1.1.1 This specification together with the attached data sheets covers the requirements for the design, materials, nameplate marking, testing and shipping of pressure safety valves.

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

ASME B 1.20.1	:	Pipe threads
ASME B 16.5	:	Pipe flanges and flanged fittings
ASME B 16.20	:	Ring joint gaskets and grooves for steel pipe flanges
ASME Sec.VIII	:	Boiler & pressure vessels codes for unfired pressure vessel
API RP 520 (Part-I & II)	:	Sizing, selection and installation of pressure relieving devices in refineries
API RP 521	:	Guide for pressure relieving and depressurising systems
API 526	:	Flanged steel safety-relief valves
API 527	:	Commercial seat tightness of refineries relief valve with metal to metal seats
DIN 50049	:	Document on material testing
IBR	:	Indian boiler regulations

1.1.3 In the event of any conflict between this specification, data sheets, related standards, codes etc, the Vendor should refer the matter to the Purchaser for clarifications and only after obtaining the same, should proceed with the manufacture of the items in question.

1.1.4 Purchaser's data sheets indicate the selected valve's relieving area, materials for the body, bonnet, disc, nozzle, spring, indicative inlet/outlet connection sizes, bellows etc. However, this does not relieve the Vendor of the responsibility for proper selection with respect to the following :

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	a) Sizing calculations and selection of valve with proper relieving area to meet the operating conditions indicated. b) Selection of materials for all parts of the valve suitable for the fluid and its conditions indicated.
1.1.5	All process-wetted parts, metallic and non-metallic, shall be suitable for the fluids and service specified by the Purchaser. The service gas composition shall be as given in Annexure-I.
1.2	Bids
1.2.1	Vendor's quotation shall include a detailed specification sheet for each pressure safety valve which shall provide all the details regarding type, construction materials, relieving area, relieving capacity, orifice letter designation, overpressure, blowdown, operating pressure, etc., and any other valve accessories.
1.2.2	All the units of measurement for various items in the Vendor's specification sheets shall be to the same standards as those in Purchaser's data sheets.
1.2.3	All the material specifications for various parts in the Vendor's specification sheets shall be to the same standards as those in Purchaser's data sheets.
1.2.4	Deleted.
1.2.5	Vendor shall enclose catalogues giving detailed technical specifications and other information for each type of pressure safety valve covered in the bid.
1.2.6	Vendor's quotation, catalogues, drawings, operating and maintenance manual, etc., shall be in English.
1.2.7	Vendor's quotation shall include detailed sizing calculation for each pressure safety valve. Published data for certified discharge coefficient and certified flow capacities and actual discharge area shall be furnished. Data used by Vendor without the above mentioned supported documentation shall, on prima-facie basis, be rejected.
1.2.8	All valves shall have been type tested for capacity as per ASME. A copy of the certificate shall be provided.
1.2.9	Vendor shall also quote separately for the following : a) Two years recommended operational spares for each pressure relief valve and its accessories. List of such spares without price shall be indicated along with technical bid and separately with price. b) Any specific tools needed for maintenance work.

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1.2.10 Vendor's quotation shall include general arrangement and sectional drawings showing all features and major parts with reference numbers and material specification.

IMPORTANT

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.

1.2.11 Vendor's quotation shall include Quality Assurance Plan (QAP) enclosed with this tender duly signed, stamped & accepted.

1.3 Drawings and Data

1.3.1 Detailed drawings, data, catalogues required from the Vendor are indicated by the Purchaser in this specification. The required number or reproduces and prints should be dispatched to the address mentioned, adhering to the time limits indicated.

1.3.2 Within two weeks of placement of order, Vendor shall submit six copies of certified drawings and specification sheets for each pressure safety valve for Purchaser's final approval. These documents shall specially include the following :

- a) Flange face to face dimension.
- b) Height of the complete valve assembly.
- c) Weight of the complete valve assembly.
- d) Cold bench set pressure for the valve to be tested at atmospheric temperature and back pressure.
- e) The cold test medium to be used for bench test in case it is different from air.
- f) Horizontal reaction force at center line of valve outlet.
- g) Relieving capacity of the valve under the same operating conditions.
- h) Over pressure and blowdown/ reclosing pressure for each valve.

1.3.3 Vendor shall provide test certificates for all the tests indicated in clause 5.0 of this specification. In addition Vendor shall provide the Manufacturer's certificate of conformity to Purchaser's specifications as per clause 2.2 of Din 50049.

1.3.4 Within 30 days from the approval date, Manufacturer shall submit to Purchaser one reproducible and six copies of the approved drawings, documents and specifications as listed in clause 1.3.2 above.

1.3.5 Prior to shipment, Manufacturer shall submit one reproducible and six copies of the following:

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- a) Test certificates for all the tests indicated in clause 5.0 of this specification.
- b) Manual for installation, erection, maintenance and operation instructions, including a list of recommended spares for the valves.

2.0 **VALVE SIZING**

2.1 Sizing shall be carried out using the formulae mentioned in the following standards, whenever the sizing code mentioned in the Purchaser's data sheets refers to them:

Sizing Code	Standard
API	API RP 520 Part-I
ASME	ASME boiler and pressure vessel code section VIII titled - Unfired pressure vessels
IBR	Indian Boiler Regulations Paragraph – 293

2.2 Discharge co-efficient of Vendor's pressure safety valves shall be minimum 0.975 as per API – 520. However, for valves covered under IBR, regulations of IBR shall govern.

2.3 For flanged pressure safety valves, the orifice letter designation and the corresponding relieving area indicated in the Purchaser's data sheet shall be as per API 526. For a valve of given inlet and outlet sizes and letter designation, relieving area of the valves offered by Vendor shall meet those in API-526, as a minimum.

2.4 The discharge capacity of selected pressure safety valves shall be calculated based on certified ASME capacity curves or by using ASME certified discharge coefficient and actual orifice area. Higher valve size shall be selected in case pressure relief valve discharge capacity is less than the required flow rate.

2.5 The definitions of various terminologies used in Purchaser's data sheets are as per paragraph 3.1 of API RP 520 Part-I.

3.0 **VALVE CONSTRUCTION**

3.1 **Body**

3.1.1 Unless otherwise mentioned end connection details shall be as below :-

- a) Threaded end connections shall be to NPT as per ASME B 1.20.1.
- b) Flanged end connections shall be as per ASME B 16.5.

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- c) Flanged face finish shall be serrated concentric to paragraphs 6.3.4.1, 6.3.4.2 and 6.3.4.3 of ASME B 16.5. The face finish as specified in data sheets, shall have serrations as follows.

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

3.1.2 For flanged valves, inlet and outlet sizes & ratings and center to flange face dimensions shall be in accordance with API-526. Dimensional tolerances shall be as mentioned therein.

3.1.3 Body drain with a plug shall be provided as a standard feature on every pressure safety valve.

3.2 **Trim**

3.2.1 The term 'trim' covers all the parts of the valves exposed to and in contact with the process fluid except for the body and bonnet assembly.

3.2.2 Valves shall in general be of the full nozzle full lift type, unless otherwise specified.

3.2.3 Wherever stelling of disc and nozzle has been specified, it stands for stelling of the seat joint and the entire disc contour, unless otherwise mentioned.

3.2.4 Resilient seat/ seal or 'O' rings wherever used shall be suitable for pressure and temperature conditions specified.

3.3 **Bonnet and Spring**

3.3.1 All valves shall be provided with a cap over the adjusting bolt.

3.3.2 Lifting lever shall be provided whenever the fluid to be relieved is steam or air.

3.3.3 Valve spring design shall permit an adjustment $\pm 5\%$ of the set pressure as a minimum.

3.3.4 Carbon Steel spring shall be cadmium/ nickel plated.

3.3.5 The allowable tolerances in set pressures are as below :

$\pm 0.14 \text{ kg/cm}^2(\text{g})$ for set pressures upto and including $5 \text{ kg/cm}^2(\text{g})$;
 $\pm 3\%$ for set pressure above $5 \text{ kg/cm}^2(\text{g})$.

3.3.6 Bonnet shall be of the enclosed type in general. Open type of bonnet may be used only for non-toxic fluids.

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3.4 **Pilot**

3.4.1 Wherever pilot operated valves are specified, pilot shall be non-flowing type and shall be designed fail safe.

3.4.2 All accessories like back flow preventer, pilot filter etc. required for proper operation of pilot operated valves as per indicated service conditions shall be included.

3.4.3 Wherever the body is part of flow path, body material shall be same as trim material, as a minimum.

4.0 **NAMEPLATE**

4.1 Each pressure safety valve shall have a S.S. nameplate attached firmly to it at a visible place, furnishing the following information:

- a) Tag number as per Purchaser's data sheets.
- b) Manufacturer's serial no. or model no.
- c) Manufacturer's name/ trade mark.
- d) Nominal flanged size in inches and rating in lbs. for both inlet and outlet.
- e) Orifice letter designation.
- f) Valve set pressure.
- g) Cold bench test set pressure.

Unit of the above pressures shall be marked in the same units as those followed in Purchaser's data sheets.

5.0 **INSPECTION & TESTING**

5.1 Unless otherwise specified, Purchaser reserves the right to test and inspect all the items at the Vendor's works.

5.1.1 Purchaser's Inspector shall perform inspection and witness test on all valves as indicated in the Quality Assurance Plan (QAP) attached with this specification.

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

- a) Material test certificate from the foundry (MIL certificate) for each valve body and bonnet castings, nozzle, disc etc.
- b) Certificate of radiography / x-ray for valve castings. 100% radiography shall be carried out for all valve castings with body rating of 600# and above. A minimum of two shots shall be taken for all curved portion of the body and bonnet.

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- c) Hydrostatic test reports for all valve bodies and functional test reports for all valves as per clause 5.3 and 5.4 of this specification.
- d) IBR certificate in Form III item 11 and shall be furnished for all safety valves in steam service in addition to Form III C. Form III C shall also be furnished for pressure relief valves in distribution network.

5.3 **Hydrostatic Test**

5.3.1 Each pressure safety valve body and nozzle shall undergo hydrostatic test as per outlet flange and inlet flange ANSI rating, respectively. However all the safety valves castings covered under IBR shall be tested as per IBR regulations. There shall not be any visible leakage during this test.

5.4 **Functional Tests**

5.4.1 Assembled valves shall be subjected to functional tests as below :

- a) Cold bench set pressure test

Pressure relief valve shall be tested for opening at specified set pressure and also for seat tightness.

- b) Seat Leakage test as per API

Whenever the specified set pressure is less than or equal to 70 kg/cm²g, the valve shall meet the seat tightness requirements specified in API RP-527. The maximum permissible leakage rates for conventional and balanced bellows valves against various sizes shall be as specified therein. Whenever the specified set pressure exceeds 70 kg/cm²g, the Vendor shall submit the leakage rates of valves for approval by the Purchaser.

Where bubble tightness has been specified, there shall be no leakage or bubbles of air at the specified percentage of set pressure.

- c) Valve lift test

5.5 **Witness Inspection**

All pressure safety valves shall be offered for pre-despatch inspection for following as a minimum :

- a) Physical dimensional checks and workmanship
- b) Hydrostatic test as per clause 5.3 of this specification.
- c) Functional test on representative samples.
- d) Review of all certificate and test reports as indicated in clause 5.2 of this specification.

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In the event of tests being not witnessed by Purchaser, the tests shall anyway be completed by the Vendor and documents for same submitted for scrutiny.

6.0 **SHIPPING**

- 6.1 Valves shall be supplied as a whole, complete with all the accessories like cap, lifting lever, test gag, etc.
- 6.2 All threaded and flanged opening shall be suitably protected to prevent entry of foreign material.

7.0 **GUARANTEE**

- 7.1 Manufacturer shall guarantee that the materials and machining of valves and fittings comply with the requirements in this specification and in the Purchase Order.
- 7.2 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.
- 7.3 If valve defect or malfunctioning cannot be eliminated, Manufacturer shall replace the valve without delay,
- 7.4 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.
- 7.5 All expenses shall be to Manufacturer's account.

8.0 **REJECTION**

- 8.1 Vendor shall make his offer in detail with respect to every item of the Purchaser's specifications. Any offer not conforming to this shall be summarily rejected.

**SPECIFICATION
FOR
SEAMLESS FITTINGS & FLANGES
[SIZE UPTO DN 400 mm (16") NB]**

SPECIFICATION NO.: MEC/TS/05/21/025



**(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

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9.0	DOCUMENTATION

PREPARED BY: (Shalini Singh)	CHECKED BY: (Sunil Kumar)	APPROVED BY: (A.K. Johri)	ISSUE DATE : Dec. 2008

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1.0 SCOPE

This specification covers the minimum requirements for the design, manufacture and supply of following carbon steel flanges and fittings of size upto DN 400 mm (16") to be installed in onshore pipeline systems handling non-sour hydrocarbons in liquid or gaseous phase including Liquefied Petroleum Gas (LPG) :

- Flanges such as welding neck flanges, blind flanges, spectacle blinds, spacers and blinds etc.
- Seamless fittings such as tees, elbows, reducers, caps, outlets etc.

2.0 REFERENCE DOCUMENTS

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

ASME B31.4	-	Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids
ASME B31.8	-	Gas Transmission and Distribution Piping Systems
ASME B16.5	-	Pipe Flanges and Flanged Fittings
ASME B16.9	-	Factory Made Wrought Steel Butt Welding Fittings
ASME B 16.11	-	Forged Steel Fittings, Socket Welding and Threaded
ASME B 16.48	-	Steel Line Blanks
ASME Sec VIII	-	Boiler and Pressure Vessel Code - Rules for Construction of Pressure Vessels
ASME Sec IX	-	Boiler and Pressure Vessel Code - Welding and Brazing Qualifications
ASTM A 370	-	Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
MSS-SP-25	-	Standard Marking System for Valves, Fittings, Flanges and Unions

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MSS-SP-97 - Forged Carbon Steel Branch Outlet Fittings - Socket Welding, Threaded and Butt welding Ends.

2.2 In case of conflict between the requirements of this specification and the requirements of above referred Codes and Standards, the requirements of this specification shall govern.

3.0 MANUFACTURER'S QUALIFICATION

Manufacturer who intends bidding for fittings must possess the records of a successful proof test, in accordance with the provisions of ASME B16.9 / MSS-SP-75 as applicable.

4.0 MATERIAL

4.1 The Carbon Steel used in the manufacture of flanges and fittings shall be fully killed. Material for flanges and fittings shall comply with the material standard indicated in the Purchase Requisition. In addition, the material shall also meet the requirements specified hereinafter.

4.2 Each heat of steel used for the manufacture of flanges and fittings shall have Carbon Equivalent (CE) not greater than 0.45 calculated from check analysis in accordance with the following formula:

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

Carbon contents on check analysis shall not exceed 0.22%.

4.3 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 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 analysed 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.

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4.4 For flanges and fittings specified to be used for Gas service or LPG service, Hardness test shall be carried out in accordance with ASTM A 370. Hardness testing shall cover at least 10% per item, per size, per heat, per manufacturing method. A full thickness cross section shall be taken for this purpose and the maximum hardness shall not exceed 248 HV₁₀.

4.5 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.

5.0 DESIGN AND MANUFACTURE

5.1 Flanges such as weld neck flanges and blind flanges shall conform to the requirements of ASME B16.5.

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

5.3 Fittings such as tees, elbows, reducers, etc. shall be seamless type and shall conform to ASME B16.9 for sizes DN 50 mm (2") to DN 400 mm (16") (both sizes included) and ASME B 16.11 for sizes below DN 50 mm (2").

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

5.5 Type, face and face finish of flanges shall be as specified in Purchase Requisition.

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

5.7 All butt weld ends shall be bevelled as per ASME B 16.5 / ASME B 16.9 / MSS-SP-97 as applicable.

5.8 Repair by welding on flanges and fittings is not permitted.

5.9 Stub-in or pipe to pipe connection shall not be used in the manufacture of tees. Tees shall be manufactured by forging or extrusion methods. The longitudinal weld seam shall be kept at 90° from the extrusion. Fittings shall not have any circumferential joint.

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6.0 INSPECTION AND TESTS

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

- a) All flanges and fittings shall be visually inspected. The internal and external surfaces of the flanges and fittings shall be free from any strikes, gauges and other detrimental defects.
- b) Dimensional checks shall be carried out on finished products as per ASME B16.5 for flanges, ASME B16.48 for spacers and blinds and ASME B16.9 / MSS-SP-97 as applicable for fittings and as per this specification.
- c) Chemical composition and mechanical properties shall be checked as per relevant material standards and this specification, for each heat of steel used.
- d) 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.

6.2 Purchaser's Inspector reserves the right to perform stage wise inspection and witness tests, as indicated in clause 6.1 of this specification at Manufacturer's Works prior to shipment. Manufacturer shall give reasonable notice' of time and shall provide, without charge, reasonable access and facilities required for inspection, to the Purchaser's Inspector.

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

7.0 TEST CERTIFICATES

Manufacturer shall furnish the following certificates:

- a) Test certificates relevant to the chemical analysis and mechanical properties of the materials used for manufacture of flanges and fittings as per relevant standards and this specification.
- b) Test Reports on non destructive testing.
- c) 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

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the specified minimum yield strength for the pipe with which the fitting is to be attached without impairment of serviceability.

8.0 PAINTING, MARKING AND SHIPMENT

- 8.1 After all inspection and tests required have been carried out; all external surfaces shall be thoroughly cleaned to remove grease, dust and rust and shall be applied with standard mill coating for protection against corrosion during transit and storage. The coating shall be easily removable in the field.
- 8.2 Ends of all fittings and weld neck flanges shall be suitably protected to avoid any damage during transit. Metallic or high impact plastic bevel protectors shall be provided for fittings and flanges. Flange face shall be suitably protected to avoid any damage during transit.
- 8.3 All flanges and fittings shall be marked as per applicable dimension / manufacturing standard.

9.0 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 / Material Requisition.

- 9.1 At the time of bidding, Manufacturer shall submit the following documents:
- Reference list of previous supplies of similar fittings of similar specification.
 - Clausewise list of deviations from this specification, if any.
 - Brief description of the manufacturing and quality control facilities at Manufacturer's works.
 - Manufacturer's qualification requirement as per clause 3.0 of this specification.
 - Quality Assurance Plan (QAP) enclosed with this tender duly signed, stamped and accepted.
- 9.2 Prior to shipment, the Manufacturer shall submit test certificates as listed in clause 7.0 of this specification.
- 9.3 All documents shall be in English Language only.

**SPECIFICATION
FOR
FLANGES AND WELDED FITTINGS
[SIZE DN 450 mm (18") AND ABOVE]**

SPECIFICATION NO.: MEC/TS/05/21/026



**(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

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9.0	DOCUMENTATION

PREPARED BY: (Shalini Singh)	CHECKED BY: (Sunil Kumar)	APPROVED BY: (A.K. Johri)	ISSUE DATE : Dec. 2008

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1.0 **SCOPE**

This specification covers the minimum requirements for the design, manufacture and supply of following items to be installed in pipeline system handling hydrocarbons in liquid or gaseous phase including Liquefied Petroleum Gas (LPG) :

- Carbon Steel Welded Fittings 450 mm (18") NB and above, such as tees, elbows, reducers, caps, outlets etc.
- Carbon Steel Flanges 450mm (18") NB and above, such as welding neck flanges, blind flanges, spectacle blind, spacers & blinds etc.

This specification does not cover the above mentioned items which are to be installed in pipeline system handling sour hydrocarbons (liquid/ gas) service as defined in NACE Standard MR-01-75.

2.0 **REFERENCE DOCUMENTS**

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

ASME B31.4	-	Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids
ASME B31.8	-	Gas Transmission and Distribution Piping Systems
ASME B16.5	-	Pipe Flanges and Flanged Fittings
ASME B16.9	-	Factory Made Wrought Steel Butt Welding Fittings
ASME B 16.11	-	Forged Steel Fittings, Socket Welding and Threaded
ASME B 16.48	-	Steel Line Blanks
ASME Sec VIII	-	Boiler and Pressure Vessel Code - Rules for Construction of Pressure Vessels
ASME Sec IX	-	Boiler and Pressure Vessel Code - Welding and Brazing Qualifications
ASTM A 370	-	Standard Test Methods and Definitions for Mechanical Testing of Steel Products.

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MSS-SP-44	-	Steel Pipeline Flanges 22" & 26" and above.
MSS-SP-25	-	Standard Marking System for Valves, Fittings, Flanges and Unions
MSS-SP-97	-	Forged Carbon Steel Branch Outlet Fittings - Socket Welding, Threaded and Butt welding Ends.

2.2 In case of conflict between the requirements of this specification and the requirements of above referred Codes and Standards, the requirements of this specification shall govern.

3.0 **MANUFACTURER'S QUALIFICATION**

The design of fittings shall be established by mathematical analysis contained in ASME Sec. VIII/ ASME B31.3. The design of fittings for which mathematical analysis is not available shall be established by proof testing. These records shall be submitted at the time of bidding, qualifying the complete range of fittings offered. Manufacturer who intends bidding for fittings must possess the records of a successful proof test in accordance with the provisions of ASME B16.9 and/ or MSS-SP-75. These records shall be submitted at the time of bidding, qualifying the complete range of fittings offered. Failure to submit such records at the time of bidding may become a cause of rejection of the offer.

4.0 **MATERIALS**

4.1 The steel used in the manufacture of fittings and flanges shall be fully killed carbon steel with a grain size of ASTM 7 or finer as defined in ASTM E112. This requirement shall not apply to quenched and tempered fittings. The basic material for fittings and flanges shall be as indicated in the Material Requisition. Additionally, the material shall also meet the requirements specified hereinafter.

4.2 Each heat of steel used for the manufacture of fittings and flanges shall have carbon equivalent (CE) not greater than 0.45 calculated from check analysis in accordance with the following formula:

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

4.3 Carbon contents on check analysis shall not exceed 0.22%.

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- 4.4 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 analysed as above, shall not be less than 22 Joules.

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

- 4.5 Hardness test shall be carried out as per ASTM A370 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. Hardness testing shall cover at least 10% per item, per size, per heat, per manufacturing method.

- 4.6 One transverse guided weld bend test shall be performed for each lot of welded fittings produced from the same heat in accordance with provisions of MSS-SP-75. The dimension "A" in guided bend test shall not exceed 4.0 times the nominal wall thickness and dimension "B" shall be equal to $A+2t+3.2\text{mm}$, where "t" is nominal wall thickness.

- 4.7 One transverse weld tensile test shall be conducted on each heat/ lot of welded fittings in accordance with the requirements of MSS-SP-75.

- 4.8 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.

5.0 **DESIGN AND MANUFACTURE**

- 5.1 Flanges such as weld neck flanges and blind flanges shall conform to the requirements of ASME B16.5 upto size DN 600mm (24") excluding DN 550mm (22"), MSS-SP-44 for sizes DN 550mm (22") and ASME B16.47 for sizes DN 650mm (26") and above.

- 5.2 Spectacle blind and Spacer & blind shall conform to the requirements of API 590 upto sizes DN 600mm (24"). For sizes above DN 650mm (26") and above, Spectacle blind and Spacer & blind shall conform to Manufacturer's standard.

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- 5.3 Type, face and face finish of flanges shall be as specified in Material Requisition.
- 5.4 Fittings such as tees, elbows and reducers shall be either welded or seamless type. All fittings shall comply with the requirements of MSS-SP-75. Fittings such as weldolets etc. shall be manufactured in accordance with MSS-SP-97.
- 5.5 Tees shall be manufactured by forging or extrusion method. Stub-in or pipe to pipe connection shall not be used in the manufacture of tees. The longitudinal weld seam shall be kept at 90° from the extrusion. Fittings shall not have any circumferential weld joint.
- 5.6 All butt weld ends shall be bevelled as per ASME B16.5/ MSS-SP-44/ ASME B16.47 as applicable for flanges and MSS-SP-75 / MSS-SP-97 as applicable for fittings.
- 5.7 Inside weld projection for welded fitting shall not exceed 1.6 mm. The reinforcement of inside weld seam shall be removed for a distance of 100mm from each end of welded fittings.
- 5.8 All welds shall be made by welders and welding procedures qualified in accordance with provisions of ASME Sec. IX. The procedure qualification shall include impact test for weld/ heat affected zone, hardness test and guided bend test and shall meet the requirements of Clauses 4.4, 4.5 and 4.6 of this specification, respectively.
- 5.9 Repair by welding on flanges and parent metal of fittings is not allowed. Repair of weld seam by welding shall be carried out by welders and welding procedures duly qualified as per ASME Section IX and API 1104 and records for each repair shall be maintained. Repair welding procedure qualification shall include all tests which are applicable for regular production welding procedure qualification.

6.0 **INSPECTION AND TESTS**

- 6.1 The Manufacturer shall perform all inspections and tests as per the requirement of this specification and the relevant codes, prior to shipment at his works. Such inspections and tests shall be, but not limited to, the following :
- 6.1.1 All fittings and flanges shall be visually inspected. The internal and external surfaces of the fittings shall be free from any strikes, gouges, burrs and other detrimental defects.
- 6.1.2 Dimensional checks shall be carried out on finished products as per ASME B16.5/ MSS-SP-44/ ASME B16.47 as applicable for flanges and ASME B16.9/ MSS-SP-75 /

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MSS-SP-97 as applicable for fittings and as per this specification. Fittings not covered in MSS-SP-75 shall be checked as per Manufacturer's standard.

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

6.1.4 The non-destructive inspection shall be carried out as given below :

- a) All butt and repair welds for welded fittings shall be examined 100% by radiography. Acceptance limits shall be as per API 1104.
- b) When elbows of size $\geq 18"$ NB are manufactured, the first elbow of each radius, diameter and wall thickness shall be ultrasonically checked for sufficient wall thickness in areas where a minimum wall thickness is to be expected. This shall be followed by random inspection of one out of every three elbows of the same radius, diameter and wall thickness.
- c) All finished wrought weld ends shall be 100% tested for lamination type defects by ultrasonic test. Any lamination larger than 6.35mm shall not be acceptable.
- d) Magnetic particle or liquid penetrant examination shall be performed on cold formed butt welding tees with extruded outlets, that are subjected to an extreme fiber elongation of greater than 5% shall be carried out as per the Supplementary Requirement SR3 of MSS-SP-75.
- e) Welds which cannot be inspected by radiographic methods shall be checked by ultrasonic or magnetic particle methods. Acceptance criteria shall be as per ASME Section VIII Appendix 12 and Appendix 6, respectively.

6.2 Purchaser's Inspector reserves the right to perform stagewise inspection and witness tests, as indicated in Clause 6.1 of this specification at Manufacturer's Works prior to shipment. Manufacturer shall give reasonable notice of time and shall provide, without charge, reasonable access and facilities required for inspection, to the Purchaser's Inspector. Inspection and tests performed/ witnessed by Purchaser's Inspector shall in no way relieve the Manufacturer's obligation to perform the required inspection and tests.

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7.0 **TEST CERTIFICATES**

Manufacturer shall furnish the following certificates :

- a) Test certificates relevant to the chemical and mechanical properties of the materials used for manufacture of flanges and fittings as per relevant standards and this specification.
- b) Test Reports on radiography, ultrasonic inspection and magnetic particle examination.
- c) Test reports of heat treatment carried out as per the specification.
- d) Welding procedures and welders' qualification reports.
- e) Test 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.

8.0 **PAINTING, MARKING AND SHIPMENT**

- 8.1 After all required inspection and tests have been carried out, all external surfaces shall be thoroughly cleaned to remove grease, dust & rust and shall be applied with standard mill coating for protection against corrosion during transit and storage. The coating shall be easily removable in the field. Manufacturer shall furnish the details of paint used at the time of bidding.
- 8.2 Ends of all fittings and weld neck flanges shall be suitably protected to avoid any damage during transit. Metallic or high impact plastic bevel protectors shall be provided for fittings and flanges. Flange face shall be suitably protected to avoid any damage during transit.
- 8.3 All fittings and flanges shall be marked as per applicable dimension / manufacturing standard.
- 8.4 Package shall be marked legibly with suitable marking ink to indicate the following :
 - a) Manufacturer's Name
 - b) Type of flange(s) and fittings(s)
 - c) Nominal diameter, thickness and material grade
 - d) Purchase order number and item serial number

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9.0 **DOCUMENTATION**

9.1 Manufacturer shall furnish at the time of bidding, the following documents:

- a) Reference list of similar supplies including all relevant details, viz. Project, Year, Client, Location, Size and Service.
- b) Record of successful qualification test of fittings in compliance with the requirement of this specification.
- c) Brief description of the manufacturing, heat treatment and quality control facilities of the Manufacturer's Works.
- d) Clause-wise list of deviations from this specification, if any.

9.2 Within three weeks of placement of order, Manufacturer shall submit four copies of method of manufacture, testing and quality control procedure for raw material and finished product for Purchaser's approval.

Once the approval has been given by Purchaser, any changes in design, material and method of manufacture shall be notified to the Purchaser, whose approval in writing of all changes shall be obtained before the flanges and fittings are manufactured.

9.3 Within four weeks from the approval date, Manufacturer shall submit six copies of all documents as listed in Clause 9.2 of this specification.

9.4 Prior to shipment, the Manufacturer shall submit six copies of the test certificates as listed in Clause 7.0 of this specification.

9.5 All documents shall be in English Language only.

SPECIFICATION FOR GASKETS, BOLTS & NUTS

SPECIFICATION NO.: MEC/S/05/21/19



**(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
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1.0	GASKETS
2.0	NUTS AND BOLTS

PREPARED BY: (Shalini Singh)	CHECKED BY: (Sunil Kumar)	APPROVED BY: (A.K. Johri)	ISSUE DATE : Jan. 2009

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TECHNICAL NOTES FOR GASKETS

- 1.0 All gaskets shall conform to the codes/standards and specifications given in the requisition. Vendor shall strictly comply with MR / PR stipulations and no deviations shall be permitted.
- 2.0 Process of manufacture, dimensions and tolerances not specified in requisition shall be in accordance with the requirements of the manufacturer's standards.
- 3.0 Test reports shall be supplied for all mandatory tests for gaskets as per the standards specified in the requisition.
- 4.0 Chemical composition and hardness of RTJ gaskets shall also be furnished in the form of test reports on samples.
- 5.0 For Spiral wound material following shall be furnished:
 - a. Manufacturer's test certificate for filler material and spiral material as per the relevant material specifications.
 - b. Manufacturer's test certificate for raw materials and tests for compressibility / seal-ability & recovery as per the relevant material specifications.
- 6.0 Full face gaskets shall have bolt holes punched out.
- 7.0 Filler material for spiral wound gaskets shall not have any colour or dye.
- 8.0 All spiral wound gaskets shall be supplied with Outer ring. Material of the outer ring shall be CS unless other wise specified in the MR.
- 9.0 For spiral wound gaskets, material of Inner Compression ring shall be same as Spiral Strip material. In addition to the requirements as per code and as specified in the MR, inner rings shall be provided for the following:
 - a. Sizes 26" and above.
 - b. Class 900 and above.
- 10.0 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. ½ Mo	130
Type 304, 316, 321, 347	140
Type 304L, 316L	120

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- 11.0 Face finish of metallic RTJ gaskets shall be 32 to 63 AARH.
- 12.0 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.
- 13.0 All items shall be inspected and approved by MECON Inspector or any other agency authorized by MECON.
- 14.0 Any additional requirements specified in the requisition, shall be fully complied with.
- 15.0 Non-metallic ring gaskets as per ASME B16.21 shall match flanges to ASME B16.5 upto 24" (except 22" size) and to ASME B16.47B above 24" unless specified otherwise. For 22" size, the matching flange standard shall be MSS-SP44 unless specified otherwise.
- 16.0 Spiral wound gasket as per ASME B16.20 shall match flanges to ASME B16.5 upto 24" (except 22" size) and to ASME B16.47B above 24" unless specifically mentioned otherwise. For 22" size, the matching flange standard shall be MSS-SP44 unless specified otherwise.
- 17.0 The following abbreviations have been used in the Material Requisition for Spiral Wound Gaskets :
- | | | |
|--------|---|---------------------------|
| (I) | : | Inner Ring |
| (O) | : | Outer Ring |
| CAF | : | Compressed Asbestos Fibre |
| GRAFIL | : | Grafoil Filler |

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TECHNICAL NOTES FOR BOLTS & NUTS

- 1.0 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 specification given in the requisition. The applicable identification symbol in accordance with the material specification shall be stamped on each bolt and nut. Vendor shall strictly comply with MR / PR stipulations and no deviations shall be permitted.
- 2.0 Test reports shall be supplied for all mandatory tests as per the relevant material specifications.
- 3.0 Material test certificate shall also be furnished. (Heat Analysis, Product Analysis and Mechanical Requirement)
- 4.0 Stress Rupture Test as detailed in ASTM A453 shall be carried out for all ASTM A453 bolting material irrespective of the temperature.
- 5.0 All bolting shall be as per ANSI B 18.2.1 for studs. M/c bolts and jackscrews and ANSI BI8.2.2 for nuts.
- 6.0 Threads shall be unified (UNC for 1" dia and BUN for > 1" dia) as per ANSI B.1.1 with class 2A fit for studs, M/c bolts and jackscrews and class 2B fit for nuts.
- 7.0 Stud bolts shall be threaded full length with two heavy hexagonal nuts. Length tolerance shall be in accordance with the requirement as per ANSI B 16.5.
- 8.0 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.
- 9.0 Heads of jackscrews and m/c bolts shall be heavy hexagonal type. Jackscrew end shall be rounded.
- 10.0 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.
- 11.0 All items shall be inspected and approved (stagewise) by MECON inspector or any other agency authorized by MECON.
- 12.0 The heat treatment for stud bolts & nuts shall be as per code unless mentioned otherwise.
- 13.0 All austenitic stainless steel bolts, nuts, screws shall be supplied in solution annealed condition unless specified otherwise in the material specification.
- 14.0 Any additional requirements specified in the requisition shall be fully complied with.

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- 15.0 Stud bolts, nuts & jackscrews shall be impact tested wherever specified in the material specification and also where the material specification is indicated as "CRYO". For" S.S. nuts and bolts minimum impact energy absorption shall be 27 Joules and test temperature shall be -196°C unless mentioned otherwise. For other materials impact energy and test shall be as per respective code.
- 16.0 Bolts / nuts of material of construction B7M / 2HM shall be 100% Hardness tested as per supplementary requirement S3 of ASTM A 193.
- 17.0 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.
- 18.0 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.

SPECIFICATION FOR PIPING FABRICATION AND ERECTION

SPECIFICATION NO.: MEC/S/05/21/06



**(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

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ANNEXURE-1 - WELDING SPECIFICATION

EXHIBIT-A -	ELECTRODE QUALIFICATIONS TEST RECORD
EXHIBIT-B -	STRESS RELIEF HEAT TREATMENT PROCEDURE SPECIFICATION
EXHIBIT-C -	STANDARD PROCEDURE SPECIFICATION NO.
EXHIBIT-D -	COUPON TEST RECORD
EXHIBIT-E -	WELDER'S IDENTIFICATION CARD
EXHIBIT-F -	RADIOGRAPHIC PROCEDURE FOR PIPE WELDING
EXHIBIT-G -	WELDING SPECIFICATION CHART

ANNEXURE-2 - DESTRUCTIVE TESTING OF WELDED JOINT - BUTT WELDS

ANNEXURE-3 - ULTRASONIC INSPECTION

ANNEXURE-4 - RADIOGRAPHY

PREPARED BY: (Shalini Singh)	CHECKED BY: (Sunil Kumar)	APPROVED BY: (A.K. Johri)	ISSUE DATE : Dec. 2008

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1.0 GENERAL

This specification covers general requirements of fabrication and erection of aboveground 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

Generally the scope of work of contractor shall include the following :

- 2.1 Transportation of required piping materials, pipe support 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 etc.
 - i. Online instruments like control valve, orifice flange, rotameter, safety valves etc.
- 2.2 Shop & field fabrication and erection of piping in accordance with documents listed under Cl. 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, turn buckles, supporting fixtures, bracket cantilevers, struts, teeposts including erection of spring supports and sway braces.
- 2.4 Fabrication
 - 2.4.1 Fabrication of piping specials like special radius bends, reducers, mitres etc.

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- 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.
- 2.5 Modifications like providing additional cleats, extension of stem of valve, locking arrangement of valves etc. as and when required.
- 2.6 Preparation of Isometrics, bill of materials, supporting details of all NON-IBR lines upto 2-1/2" within the unit battery limit and get subsequent approval from Engineer-in-Charge as and when called for.
- 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, 6-82-0002'.
- 2.12 Casting of concrete pedestals and fabrication & erection of small structures for pipe supports including supply of necessary materials.
- 2.13 Providing insert plates from concrete structures and repair of platform gratings around pipe openings.
- 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. MEC/S/05/21/11).

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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 MECON 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 licensor's standards and specifications.

3.1.4 Drawings, sketches and documents prepared by contractor duly approved by Engineer-in-Charge' (such as isometrics and offsite piping etc.)

3.1.5 Approved construction job procedures prepared by Contractor as stipulated in 2.16

3.1.6 MECON specifications/documents as below :

- a. Process and Instrument Diagram.
- b. Piping Materials Specification
- c. Piping support standards.
- d. Line list / Number
- e. Piping support index.
- f. Standard specification of NDT Requirement of Piping
- g. Welding specification charts for piping classes.
- h. Standard specification for Pressure Testing of Erected Piping System.
- i. Welding specification for fabrication of piping
- j. Any other MECON or OTHER specifications attached with Piping Material Specification or special condition of contract.
- k. Procedure for storage, preservation and positive identification of materials Contractors works / stores.

3.1.7 Following codes, standards and regulations

- a. ASME B 31.3 : Process Piping
- b. ASME Sec. VIII : Code for unfired pressure vessel.
- c. IBR Regulations

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- d. IS:823 : Code for procedure for Manual Metal Arc Welding of Mild Steel (for structural steel).
- e. NACE Std. : Code for Sour Services material requirements MR.

Note : All codes referred shall be latest edition.

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 / MECON's 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 AS., S.S., NACE, LTCS, 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.

4.2 Fabrication

- 4.2.1 All fabrication shall be carried out in accordance with piping general arrangement drawings, (prepared by CONTRACTOR and approved by COMPANY) including this specification and codes as specified in section 2.0.
- 4.2.2 CONTRACTOR shall be responsible for working to the exact dimensions as per the approved drawings. Dimensional tolerances to be adopted during implementation of fabrication work shall be as per attached sketch "TOLERANCES FOR FABRICATION".
- 4.2.3 Flange bolt holes shall generally straddle the established centre lines unless other orientation is required and as called out in approved drawings.
- 4.2.4 Threading shall be NPT to ANSI B 1.20.1. Threading shall preferably be done after bending, forging or heat treatment operation. However if it is not possible, precaution shall be taken to protect threading against deformation. Thread shall be clean cut with no burrs or stripping. Dies shall be new, sharp and properly designed for piping material. Ends shall be reamed to remove burrs.

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- 4.2.5 All threaded joints shall be aligned properly. The pipe entering unions shall be true to centrelines so as to avoid forcing of union coupling during make up. Damaged threads shall be cut from the end of run and the pipe shall be rethreaded.
- 4.2.6 Immediately before testing the piping, all threads of pipe and fittings shall be thoroughly cleared of cuttings, fuel oil or other foreign matter. The male threads shall be sealed with thread sealant and the piping made up sufficiently for the thread to seize. Sealant shall be teflon tape.
- 4.2.7 Seal welding of threaded connections when specified shall include the first block valve, cover all threads. The joint shall be cleaned of all cutting oil and other foreign material and made up dry to full thread engagement. Instrument threaded connections which are frequently subjected to testing and maintenance shall not be seal welded.
- 4.2.8 All threaded connections shall be protected from rusting by applying greases or oil when in operating condition.
- 4.2.9 When socket weld fittings or valves are used, pipe shall be spaced approximately 1/16" to avoid bottoming which could result in excessive weld stress.
- 4.2.10 Where the ends of the piping components being welded have an internal surface misalignment exceeding 1.6mm, the wall of the component extending internally shall be trimmed by machining so that the adjoining internal surface will approximately flush.

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.

4.3 Dimensional Tolerances

Dimensional tolerances for piping fabrication shall be as per MECON Standard Specification. 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 equipments, 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.

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4.4 IBR Piping

- 4.4.1 Contractor shall be supplied generally with all drawings for steam piping falling under the purview of Indian Boiler Regulations duly approved by Boiler Inspectorate. 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. . .
- 4.4.2 Approval of boiler inspector on the drawings prepared by the contractor shall be obtained by the contractor at his own cost.

4.5 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.

4.6 Butt Welded and Socket Welded Piping

End preparation, alignment and fit-up of pipe pieces to be welded, welding, pre-heat, post-heating and heat treatment shall be as described in the welding specification and NDT specification.

4.7 Screwed Piping

In general, Galvanized piping shall have threads as per IS:554 or ANSI B 2.1 NPT as required to match threads on fittings, valves etc. All other piping shall have threads as per ANSI B 2.1, 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 leakproof joint.

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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.

4.8 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 centerlines unless different orientation is shown in the drawing.

Wherever a spectacle blind is to be provided, drilling and tapping for the jack screws in the flange, shall be done before welding it to the pipe.

4.9 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.

4.10 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.

4.11 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.

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4.12 Mitre Bends and Fabricated Reducers

The specific application of welded mitre bends and fabrication reducers shall be governed by the Piping Material Specifications. Generally all 90 deg. mitres shall be 4-piece 3-weld type and 45 deg. mitres shall be 3-piece 2-weld type as per MECON Standard unless otherwise specified. 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.

4.13 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.

4.14 Galvanised Piping

Galvanised carbon steel piping shall be completely cold worked, so as not to damage galvanised surfaces. This piping involves only threaded joints and additional external threading on pipes may be required to be done as per requirement.

4.15 Jacketed Piping

The Jacketing shall be done in accordance with MECON 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 jumpover 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.

4.16 Shop Fabrication / Prefabrication

The purpose of shop fabrication or pre-fabrication is to minimise 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 a removable rust preventive. Care shall also be taken to avoid any physical damage to flange faces and threads.

4.17 Miscellaneous

- 4.17.1 Contractor shall fabricate miscellaneous elements like flash pot, seal pot, sample cooler, supporting elements like turn buckles, extension of spindles and interlocking arrangement of valves, operating platforms as required by Engineer-in-Charge.

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4.17.2 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.

4.17.3 Fabrication of pipes from plate

Pipes shall be fabricated at site as and when required as per the specifications attached 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 discolouring 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 / equipments 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.

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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:

- All Expansion joints / Bellows shall be installed in accordance with the specification and installation drawings, supplied to the Contractor.
- Upon receipt, the Contractor shall remove the Expansion Joints/ Bellows from the case(s) and check for any damage occurred during transit.
- 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.
- Each Expansion Joint / Bellow shall be blown free of dust / foreign matter with compressed air or cleaned with a piece of cloth.
- 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.
- An Expansion Joints / Bellow shall preferably be slinged from the end pipes / flanges or on the middle pipe.
- 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.
- 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.
- 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.
- The pipe ends / flanges shall be spaced at a distance specified in the drawings.
- 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.
- Butt-welding shall be carried out at each end of the expansion joint. For flanged Expansion Joint, the mating flanges shall be bolted.

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- 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.
- The Expansion Joint shall not have any lateral deflection. The Contractor shall maintain parallelism of restraining rings or bellows convolutions.
- Precautions
 - For carrying out welding, earthing lead shall not be attached with the Expansion Joint.
 - The Expansion bellow shall be protected from arc weld spot and welding spatter.
 - 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 equipments 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.

Temporary protective covers shall be retained on all flange connections of pumps, turbines, compressors and other similar equipments, until the piping is finally connected, so as to avoid any foreign material from entering these equipments.

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 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.

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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 pointing 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 restriction orifices, control valves, safety valves, relief valves, rotameters, orifice flange assembly, venturimeters, flowmeters etc. 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. 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 Equipments / Items

Installation of line mounted items like filters, strainers, steam traps, air traps, desuperheaters, 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 pipe supports will be shown in drawing for lines 2" NB. However, any extra supports desired by Engineer-in-Charge

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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.

Preset 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.

6.0 **WELDING**

Welding of pipelines shall be done as per applicable codes and **Annexure-1**

7.0 **ERECTION**

7.1 **Pre-fabrication and Field Assembly**

Extent of pre-fabrication shall be purely at the discretion of CONTRACTOR keeping in view the following :-

7.1.1 Field joint shall be decided by CONTRACTOR keeping in view the transportation of pre-fabricated pieces to site.

7.1.2 There can be some variations in the dimensions and level appearing in the arrangement drawings and those actually occurring at site due to minor variations in the location of equipments, structures, cut out etc. Adequate field joints shall be provided, permitting assembly and erection of pipe work without major modification.

7.2 **Supporting**

Location and design of pipe supports shown in approved drawings and support drawings shall be strictly followed.

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7.2.1 Supports shall be installed in such a way that they do not contribute to over stressing of a line.

7.2.2 Fabrication and erection of additional supporting elements and structural fixtures which in COMPANY's view are required for proper supporting of the system, shall be carried out by CONTRACTOR at no extra cost.

7.2.3 All temporary supports, elements required for alignment, erection and assembly shall be removed after completion of work.

7.3 **Equipment hook-up**

7.3.1 Prior to hook-up, the alignment and trueness of flange faces shall be checked to ensure that no undue stresses shall be induced in the system while hooking up.

8.0 **INSPECTION**

8.1

8.2 CONTRACTOR shall provide all facilities/ assistance to COMPANY for proper execution of their inspection without any extra charge.

8.3 All piping work shall be subjected to inspection by COMPANY at any time during fabrication. CONTRACTOR shall furnish to COMPANY detailed work programme sufficiently in advance, in order to enable COMPANY to arrange for inspection.

9.0 **PROTECTIVE COATING**

9.1 All above ground piping system shall be applied with protective coating in accordance with specification for shop & field painting.

9.2 All under ground portion of piping system shall be coated with three layer P.E. coating. CONTRACTOR shall prepared procedure for epoxy painting of buried pipeline for approval of COMPANY. Procedure shall include surface preparation, brand and type of coating to be adopted. Coating of pipes shall not commence without approval of coating procedure. Total dry film thickness to be achieved shall not be less than 300 microns. Compatible primer and finish coat as recommended by coating manufacturer shall only be applied. Coating integrity shall be checked by "Holiday detector" over full length of coated pipe work. Coating to be supplied by CONTRACTOR shall be suitable for design temperature.

9.3 Once the coating has been accepted by COMPANY, backfilling operation can be started. In order to protect coated pipe from damage, the excavated trench shall be examined for stone, rock and any other hard substance detrimental to coating. All such substances shall be removed before lowering the pipe in the trench. COMPANY may ask for a 100mm padding of clear sand under and above pipeline in rocky or otherwise hard soil area. No additional payment on account of padding shall however be admissible.

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10.0 **FLUSHING**

Completed piping systems shall be flushed by CONTRACTOR with fresh water, to clean the pipe of all dirt, debris, and foreign material. CONTRACTOR shall prepare a procedure for flushing of the system for approval of COMPANY. Flushing shall not be commenced without approval of flushing procedure.

- 10.1 CONTRACTOR shall perform all activities like dismantling and reinstalling of all strainers, in line instruments etc. before and after completion of flushing.
- 10.2 Flushing shall be considered as complete only after inspection and approval by COMPANY.
- 10.3 Disposal of muck and flushing media shall be arranged by CONTRACTOR as directed by COMPANY, in such a manner that it does not spoil the adjacent installation. CONTRACTOR shall obtain COMPANY approval regarding the place and method to be adopted for disposal of debris.
- 10.4 Record of flushing giving following details shall be submitted by CONTRACTOR to COMPANY for its approval and records :
 - a) Date of flushing
 - b) Identification of line : flushed-line number

11.0 **HYDROSTATIC TESTING**

- 11.1 Completed piping system as approved by COMPANY shall be hydrostatically tested in the presence of COMPANY. The general requirements of hydrostatic testing shall be in accordance with codes specified in section 2.0.
- 11.2 CONTRACTOR shall prepare hydrostatic test procedure based on specified codes. The hydrostatic test shall commence only after approval of procedure by COMPANY.
- 11.3 Piping system shall be hydrostatically tested to a pressure corresponding to 1.4 times the design pressure.
- 11.4 Fresh water shall be used as test media. CONTRACTOR shall locate the source of water supply and arrange for transportation of water to test site. CONTRACTOR shall arrange at his own cost the water analysis and confirm that water is suitable for testing. In case any corrosion inhibitor is to added, the same shall be done after approval of COMPANY.
- 11.5 Lines repaired subsequent to hydrostatic test shall be retested using the same procedure as originally adopted. However COMPANY may waive such retest in case of minor repairs by taking precautionary measures to ensure sound construction.

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- 11.6 All equipment and instruments used for hydrostatic test shall be approved by COMPANY before start of tests.
- 11.7 Pressure gauges shall be installed on line to measure test pressures. In case of longer lines two or more pressure gauges shall be installed as directed by COMPANY. One gauge shall be installed at the discharge of the pressurising pump. Pressure gauge used for hydrostatic testing shall be calibrated with dead weight tester in the presence of Engineer-in-charge. Range of pressure gauge shall generally be 1.5 times the test pressure.
- 11.8 Orifice plates and restriction orifices shall not be installed until hydrostatic testing is completed. Temporary gaskets shall be used during testing.
- 11.9 First block valve of pressure instruments shall be half open & plugged at the time of hydrostatic testing. Temperature connections shall be blanked off during testing.
- 11.10 All equipments, in line instruments, relief valves shall be disconnected from piping system by means of blinds during testing. Control valves shall be replaced by spool pieces during testing.
- 11.11 High point vents and low point drain required for testing in addition to those marked in the drawings shall be provided by CONTRACTOR at his own cost.
- 11.12 All welded and screwed joints shall be kept clean for detecting leaks during testing.
- 11.13 Test pressure shall be maintained long enough to facilitate complete inspection of the system. Minimum duration of test shall be 6 hours unless other wise specified. Pressurising equipment shall be isolated immediately after test pressure is attained.
- 11.14 After successful completion of hydrostatic testing, the piping system shall be dewatered. All lines shall be completely dried using compressed air. CONTRACTOR shall make his own arrangement for supply of compressed air. Drying of lines shall be considered complete on approval by COMPANY.
- 11.15 **Test Records**

The records in duplicate shall be prepared and submitted by CONTRACTOR as below :

- a) Date of test
- b) Identification of pipe tested - line number
- c) Test pressure
- d) Test results
- e) Signature of CONTRACTOR
- f) Approval signature by COMPANY.

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ANNEXURE-1

WELDING SPECIFICATION

1.0 GENERAL

This specification shall be followed for the fabrication of all types of welded joints of carbon steel above ground natural gas service piping systems.

The welded pipe joints shall include the following :

- a) All line pipe joints of the longitudinal and circumferential butt welded.
- b) Attachments of castings, forgings, flanges.
- c) Welded manifold headers and other sub-assemblies
- d) Welded branch connections with or without reinforcing pads.
- e) Joints in welded/ fabrication piping components.
- f) The attachments of smaller connections for vents drain drips and other instrument tapings.

Any approval granted by the Engineer-in-charge or owner's inspectors shall not relieve the contractor of his responsibilities & guarantees.

1.1 Applicable Codes & Standards

All welding work, equipments for welding, heat treatment, other auxiliary functions and the welding personnel shall be as per the requirements of the latest editions of the following approved standards and procedures :-

- i) Code for gas transmission and distribution piping systems. ANSI B31.8.
- ii) Code for petroleum refinery piping, ANSI B31.3.

In addition, the following codes/ specifications referred to in the relevant code of fabrication shall be followed for the welding/ brazing qualifications, consumable qualifications and non destructive test procedures.

- i) Standard for welding of pipelines and related facilities API-1104.
- ii) Material Specifications - Welding rods, electrodes and filler materials - ASME Sec. - IIC.
- iii) Code for non destructive examination ASME Sec-V.
- iv) Qualification standard for welding and brazing procedure and welders, brazers, welding and brazing operators - ASME Sec-I

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In the event of any difference due to the additional requirements mentioned in this specification, over and above those obligation as per codes, this specification shall be binding.

1.2

Base Material

- a) In general carbon steel is used in this plant. The details of material specifications are given in the welding Specification Chart.
- b) The contractor shall provide the Manufacturer's test certificates for every heat of the materials supplied by him.

1.3A

Filler Materials

- a) The Contractor shall provide all the necessary welding electrodes, filler materials, etc. required for the execution of the work.
- b) The welding electrodes/ 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.
- c) The electrode shall be suitable for the welding process recommended and base metal used. Unless otherwise specified physical properties of the welds produced by a electrode recommended for the welding of a particular base metal shall not be lower than the minimum values specified for the base metal 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 Engineer-in-charge.
- d) 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.
- e) 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.
- f) The Contractor shall submit batch test certificate from the electrode Manufacturers giving details of physical and chemical tests carried out by them, for each batch of electrodes to be used.
- g) 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 temperature recommended by the electrode Manufacture. Out-of-the oven time of electrodes before they are consumed shall not exceed the limits recommended by the electrodes manufacturer. The electrodes shall be handled with care to avoid any damage to flux covering.

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- h) 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.
- i) The electrodes, filler wires and flux used shall be free from rust, oil, greases, earth and other foreign matter which can affect the quality of welding.

1.3B

SHIELDING & PURGING GAS

- a) 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.
- b) Argon gas with a purity level of 99.995% shall be used for purging.
- c) When GTAW process alone or a combination of GTA Wand 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.
- d) 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.
- e) 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.
- f) Gas backing (purging) is not required for socket type of welded joints.
- g) 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.

1.4

Welding Consumables

The Contractor shall provide at this own expense all the welding consumables necessary for the execution of the job such as electrodes filler wires, oxygen, acetylene, etc. and these should bear the approval of the COMPANY.

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1.5 **Equipment & Accessories**

- 1.5.1 The Contractor should have the arrangement of sufficient number of welding and cutting equipments, auxiliaries and accessories of sufficient capacities so as to meet the target schedule.
- 1.5.2 All the equipment for performing the heat treatment, including transformers, thermocouples, flow meters, automatic temperature recorders with suitable calibration arrangement etc. shall be provided by the Contractor, at his own expense and these should bear the approval of the COMPANY.
- 1.5.3 Contractor shall make necessary arrangements at his own expense for providing the radiographic equipment, radiographic films, and all the equipment/ materials required for carrying out the dye penetrant/ magnetic particle test for satisfactory and timely completion of the job.
- 1.5.4 Redoing of any work necessitated by faulty equipments or operation used by the Contractor, will be done at his own expense.

1.6 **Welding Processes**

- 1.6.1 Welding of various materials under this specification shall be carried out using Shielded Metal Arc Welding (SMAW) Process with the approval of the Engineer-in-charge.
- 1.6.2 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.
- 1.6.3 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.
- 1.6.4 A combination of different welding processes or a could be employed for a particular joint only after duly qualifying the welding procedure as per the requirements of code of fabrication to be adopted and obtaining the approval of the Engineer-in-charge.

1.7 **End Preparation**

1.7.1 **End Preparation**

The edges to be welded shall be prepared to meet the joint design requirements by gas cutting, machining or grinding method. After gas cutting, oxides shall be removed by chipping or grinding.

1.7.2 **Cleaning**

- a) The ends to be welded shall be properly cleaned to remove paint, oil, greases, rust, oxides, sand, earth and other foreign matter. The ends shall be

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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.

1.8 **Alignment and Spacing**

- a) Prior to alignment, the contractor shall inspect the pipe ends inside and outside for damage, dents, laminations etc. Pipe for welding shall be set up correctly spaced. Temporary attachment of any kind shall not be welded. Every effort shall be made to reduce misalignment by the use of clamp and rotation of pipes to the best fit. For pipes of same nominal wall thickness, the off set should not exceed 1.6mm. Any branch connections sleeve shall be at least 150mm from any other weld. The welds for fitting shall be so located that top of the weld shall not come within 50mm of any other weld. The use of internal line up clamps is mandatory for diameters 10" and above. However, in case where it is impossible to use internal line up clamp, external line up clamp may be used.
- b) 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.

1.9 **Weather Conditions**

1.9.1 The parts being welded and the welding personnel should be protected from rain and strong winds. In the absence of such a protection no welding shall be carried out.

1.9.2 During field welding using GTAW process, particular care shall be exercised to prevent any air current affecting the welding process.

1.10 **Welding**

1.10.1 **Root Pass**

- a) Root pass shall be made with electrodes/ filler wires recommended in the welding specification chart. The preferable size of the electrode is 2.5mm diameter (12 SWG) but in no case greater than 3.25mm (10 SWG).
- b) Uphill welding shall be adopted for welding pipes weld fixed with its axis horizontal. Downward technique of welding shall not be used for welding of pipes in horizontal position, unless specifically permitted by Engineer-in-charge for a particular case.

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- c) The root pass of but joints should be executed properly so as to achieve full penetration with complete fusion of the root edges. Weld projection inside the pipe shall not exceed .4mm wherever not specified by the applicable code.
- d) Any deviations 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 continuous & uninterrupted during a pass.
- f) On completion of each run, craters, welding irregularities, slag etc., shall be removed by grinding and chiselling.
- g) While the welding is in progress care should be taken to avoid any kind of movement of components, to prevent occurrence of weld cracks.
- h) Fillet welds shall be made by shielded metal arc/ GTAW welding process irrespective of the thickness and class of piping.
- i) Peening shall not be used unless specified in the welding specification chart.

1.10.2 **Joint Completion**

- a) Joint shall be completed using the class of filler wires/ 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.
- b) Butt joints shall be completed with a cover layer that would effect good cover at the joint edge and a gradual notch free surface.
- d) Each weld joints should have a workman like finish.
- e) Weld identification mark shall be stamped clearly at each joint, just adjacent to the weld. Metal stamping shall not be used on the thin wall pipe. Suitable paint shall be used on thin wall pipes for identification.
- f) No painting shall be done until the weld joint has been hydrostatically tested.

1.10.3 **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

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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 E/ER-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.

1.11 **Heat Treatment**

1.11.1 **Preheating**

- a) Preheating requirements for the various materials shall be as per the welding specification chart attached. No welding shall be carried out without preheating the joint to 10°C (50°F) when the ambient temperature is below 10 degree.
- b) Preheating shall be performed using resistance or induction heating methods. Preheating by gas burners, utilising any acetylene or oxy-propane gas mixtures, with neutral flame may also be carried out when permitted by the Engineer-in-charge.
- c) Preheating shall extend uniformly to atleast three times the thickness of the joint, but not less than 50mm, 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.
- 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.

1.11.2 **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.

1.11.3 **Postweld Heat Treatment**

- 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 relevant specifications, applicable standards and the instructions of the Engineer-in-charge. In this regard procedure qualification to be done before carrying out

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PWHT in production welds.

- b) The heat treatment of welded joints shall be carried out as per the requirements laid down in ANSI B31.8 and welding specification chart.
- c) The contractor shall submit for the approval of the Engineer-in-charge, the details of the post weld heat treatment procedure, as per **Exhibit 'B'** attached, that the propose to adopt for each of the materials/ assembly/ part involved, well before carrying out actual heat treatment.
- d) Post weld heat treatment shall be done by using an electric resistance or induction heating equipment as decided by the Engineer-in-charge.
- 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 treated band over which specified post weld heat treatment is carried out, the temperature attained is atleast as that specified in the relevant applicable standards/ codes.
- f) 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 of the pipes should not be allowed to exceed 400°C.
- g) 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 the equally spaced location along the periphery of the pipe joint. The minimum number of thermocouples attached per joint shall be 1 upto 6" dia, 2 upto 10" dia and 3 upto 12" and above. However the Engineer-in-charge can increase the required minimum number of thermocouples to be attached if found necessary.
- h) Automatic temperature recorders which have been duly calibrated should be employed. The calibration chart of each recorder should be submitted to the Engineer-in-charge prior to starting the heat treatment operation and his approval should be obtained.
- i) Immediately on completion of the heat treatment, the post weld heat treatment charts/ records alongwith the hardness test results on the weld joints (whenever required as per the welding specification chart), shall be submitted to Engineer-in-charge for his approval.
- j) 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 should appear on the corresponding post weld heat treatment charts. The same identification numbers shall also be followed for identification for corresponding radiographic films. The chart containing the identification

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numbers and piping sketch shall be submitted to the Engineer-in-charge in suitable folders.

- k) The hardness of the heat affected zone as well as of the weld metal, after heat treatment, shall be measured using suitable hardness tester and shall not exceed the maximum hardness specified in the welding specification chart. The weld joint shall be subjected to re-heat treatment when hardness measured exceeds the specified limit, at the contractor's own expenses.
- l) The contractor shall arrange for the hardness testing and shall maintain the records of all joints tested. These records shall be checked by the plant Owner's inspector.

1.12 **Cleaning of the Weld Joints**

All weld joints shall be free from adherent weld spatter, slag, dirt or foreign matter. This can be achieved by brushing.

1.13 **Inspection & Testing**

1.13.1 **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 offer the Owner's inspector all means and facilities necessary for carrying out inspection.
- b) The owner is entitled to depute his own inspector to the shop or field where pre-fabrication 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 equipments and the welding performance.
 - ii. To supervise the welding procedure qualification.
 - iii. To supervise the welder performance qualifications.
- c) Contractor shall intimate sufficiently in advance the commencement of qualification tests welding works and acceptance tests, to enable the plant owner's inspector to be present to supervise them.

1.13.2 **Welding Procedure Qualifications**

- a) Welding Procedure Qualification shall be carried out in accordance with the relevant requirements of API 1104/ ASME Sec-IX 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.

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- 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 this own expense. A complete set of test results in format as per **Exhibit-D** (attached) shall be submitted to the COMPANY's inspector for approval immediately after completing the procedure qualification test and atleast 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 testers, dye penetrant examination, Charpy V-notch etc. shall be carried out on 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-2** and ASME Sec-IX.

1.13.3

Welder's Qualification

- a) Welders shall be qualified in accordance with the API 1104/ ASME IX and other applicable codes by the contractor at his expense. The butt weld test pieces of the qualification test shall meet the radiographic tests requirements as mentioned in 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 and obtain express approval, before commencement of the work. No welder shall be permitted to work without the possession of the identify card. 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 identify cards after it has been duly certified by the COMPANY. If a welder is found to perform a type of welding 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.

1.13.4

Visual Inspection

Inspection of all welds shall be carried out by COMPANY 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, under cuts, dimensions of the weld, surface porosity and other surface defects. Under-cutting adjacent to the completed weld shall not exceed the limits specified in the applicable standard/ code.

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1.13.5 Non-destructive Examination

The non destructive examination shall mainly consist of examination using x-ray radiography as detailed in **Annexure-4**.

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 per the requirements laid in subsequent paragraphs.

The CONTRACTOR shall make all the arrangements for the radiographic examination of work covered by this 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 requirements mentioned in the specification shall be arranged and executed by the CONTRACTOR through his own resources. In addition, for pipes with wall thickness 9.5mm and above, ultrasonic inspection is required in the following cases as per **Annexure-3** of this specification.

- On the first 100 welded joints corresponding to each automatic (GTAW/ GMAW) welding procedure used.
- When 20mm or more are cut from the pipe end as supplied, the ends shall be ultrasonically inspected for an additional length of 20mm to ensure no lamination exist.
- When welds are repaired.
- When in the opinion of COMPANY, ultrasonic inspection is required to confirm or clarify defects indicated by radiography.
- When automatic procedure is used at least 10cm on each weld shall be ultrasonically inspected at COMPANY's discretion.

In addition, ultrasonic inspection may be required for certain critical weldings of the pipeline (i.e. tie-ins, welding of valves, flanges) randomly selected at COMPANY's discretion. All fillet and groove welds other than that radiographed shall be subjected to dye penetrant/ MP inspection. The non destructive test system used for inspecting welds must be approved by the COMPANY.

Weld quality is judged on the basis of the acceptability criteria mentioned below :

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 paint marker.

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In addition to the API-1104 requirements, the welds containing cracks including crater cracks regardless of size of location are unacceptable.

- i. Any amount of inadequate penetration of the root bead as defined by API-1104 is unacceptable.
- ii. Any amount of incomplete fusion between the root and bevel as defined by API-1104 is unacceptable.
- iii. Unrepaired burn through areas are unacceptable.

Contractor shall appoint agency for carrying out the radiography works at site from the list of agency (ies) enclosed in the bid document.

- 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 penetrometer shall be used in establishing radiographic procedure / technique. The acceptance criteria shall be as per the relevant codes of Fabrication and over riding requirements if mentioned else where 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.
- 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.
- 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 else where in the contract) for some critical material require usage of X-Radiation, then Radiography shall be done using X-Rays only.
- The Contractor shall fulfill all the statutory and owner's safety requirements while handling X-ray and Gamma-ray equipments.

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- 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, inline 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.
- 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.
- 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.
- 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.
- 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.
- 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**.

1.13.6

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.

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1.13.7 **Magnetic Particle & Liquid Penetrant 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.

1.13.8 **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.

1.13.9 **Proof Tests**

Hydrostatic and pneumatic tests shall be performed as per the requirements laid down in the respective flushing & testing specification/ applicable codes to demonstrate the soundness of the welds. The tests shall be conducted only after fulfilling the requirements of visual examination, radiography etc. and after the entire work has been certified by the Owner's inspector, as fit for subjecting to such test.

1.14 **Repairs of Welds**

- a) Defects ascertained, through the inspection methods, which are beyond acceptable limits shall be removed from the joint completely by the process of chipping and grinding.
- b) When an entire joint is judged unacceptable, the welding shall be completely cut and the edges be suitably prepared as per required alignment tolerances. The 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) Where random radiography is specified, the test welds of each welder shall be completely radiographed. In the case of pipes of sizes 6" and below, the first two welds shall be completely radiographed.
- e) For each weld found unacceptable due to a welder's fault, two additional checks should be carried out on welds performed by the same welder. This operation is interactive and the procedure of radiographing two additional

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welds for each weld deemed unsatisfactory shall be continued till such time that the two consecutive welds of satisfactory quality are found for every defective weld.

The contractor shall carry out these additional radiographic testing.

To avoid the possibility of too many defective welds by a single welder remaining undetected for a long period of time, the Contractor shall promptly arrange for radiographic examination so that there is no accumulation of defective joints.

1.15 **Limitations on Repairs**

Only one attempt at repair of any region is permitted. Repairs are limited to a maximum 30% of the weld length. For internal or external repairs which open the weld root, only 20% of the weld length may be repaired. Repairs opening the root must only be carried out in the presence of COMPANY. The minimum length of a repaired area shall be 100mm as measured over the recapped length. Welds containing cracks shall be cut out and rebevelled to make a joint, COMPANY shall authorise all repairs.

1.16 **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.

1.17 **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.

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ELECTRODE QUALIFICATIONS TEST RECORD

A : Tested at (Site Name) Date :
 Test Period :

 Manufacturer's Name :
 Brand Name :
 Batch Number & size Tested :
 Classification & Code :
 Intended for Welding in positions :
 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 :
 Postweld Heat Treatment Details :
 Visual Examination :
 Radiographic Examination Results :

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Tensile Test Results :

Sl. No.	Identification Number	U.T.S.	Yield Point	Elongation	Remarks

C : Impact Test Results

Test Temperature : Notch in :

Type of Specimens (Impd, Charpy) : Size of Specimens :

Specimen No.	Impact Value	Average
1.		
2.		
3.		
4.		
5.		

D : Chemical Analysis Result

Electrode size used :

Batch No.

%C	%S	%P	%Si	%Mn	%Cr	%Ni	%Mo

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E : Fillet Weld Test Results

Welding Positions :
 Base Materials :
 Size of electrode used :
 Visual Inspection Results : 1)
 2)
 3)
 Micro Test Results
 Fracture Test Results :
 Remarks :

F : Other Test Results

i) Transverse Tensile Test :
 In Combination with :
 Base Material used :
 Position of Welding :
 Preheat Temperature :
 Postweld Heat Treatment :
 Radiography :

Identification No.	U.T.S.	Fracture in	Remarks

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2. **Guide Bend Test**

Position	ID No.	Root, Face or Side Bend	Remarks
	1		
	2		
	3		
	4		
	5		

3. **Any other tests**

Conclusions

Approved By :

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STRESS RELIEF HEAT TREATMENT PROCEDURE SPECIFICATION

Name of the Heat - Treatment :

Name of the Project : Specification

Reference No.

1. General Details

Name of the Equipment :

Name of the Assembly/ Part :

Assembly/ Part Drawing No. :

Material :

2. Furnace Details

Type of Heating : Gas/ Oil/ Elec. Res./ Induction (Tick Mark)

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 :

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4. Other Details, if any :
5. The following documents are to be furnished :
along with these specification :
 - i) Material Test Certificates
 - ii) Assembly/ Part Details

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STANDARD PROCEDURE SPECIFICATION NO.

for Welding of Pipe and Fittings

- Process & type (Details of special machines).
- Material (Pipes to which the procedure applied, grade of steel, type of pipe, Reference Specification).
- Diameter and wall thickness (Series of dia and thickness to which procedure is applicable)
- Joint Design
- Filler Metal and Number of Beads
- Electrical or Flame Characteristics
- Position
- Direction of Weldings (Uphill, Downhill, Mixed)
- Number of Welders
- Time Lapse between passes
- Type of Line-up Clamp
- Removal of Line-up Clamp (Minimum percentage of welding carried out before removal of clamps)
- Cleaning
- Preheat, Stress Relief
- Shielding Flux
- Speed of Travel
- Sketches and Tabulations (to be attached)
- Wire Speed (rate of wire speed and variation range)
- Minimum No. of passes which must be completed before discontinuing weld.

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- Minimum No. of welders required for the first pass and second pass :

Tested : Welder

Approved : Welding Supt.

Accepted : Chief Engineer

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EXHIBIT-D

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COUPON TEST RECORD

Location
Date State Roll Weld Fixed position
weld welder Mark
..... Welding Time Time of day
..... M. Temperature F. Weather Condition
..... Wing break used Voltage
..... Amperage Type of welding machine
..... Size Filler Metal
..... Size of reinforcement
..... Pipe kind and Grade
..... Wall thickness
..... Dia O.D.

1 2 3 4 5 6 7

Bead No. Size of electrode
..... No. of electrode
.....

1 2 3 4 5 6 7

Coupon Stenciled Original
Dimension of Plate Original area of plate
(inch²) Maximum Load
..... Tensile S/ in. plate area
..... Fracture Location
.....

Procedure	Qualifying Test	Qualified
Welder	Line Test	Disqualified

Max. tensile strength min. tensile strength

Avg. tensile strength Remarks on tensile strength

1.
2.
3.
4.

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Remarks on Bend Tests

1.
2.
3.
4.

Remarks on Nick Tests

1.
2.
3.
4.

Other Tests

(Use back for additional remarks)

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EXHIBIT-E

WELDER's IDENTIFICATION CARD

Name :
 Identification :
 Date of Testing :
 Valid Unit :
 Approval of Welding :
 Welding Position :
 Material :
 Diameter :
 Wall Thickness :
 Type of Welding Consumable :

Approved By :

Employer's Signature
with Seal

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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, gamma ray)
8. Type of equipment (external/ internal)
9. Intensifying screens and material
10. Filter type and placement mask, diaphragm lead screen etc. adjacent to radiation sources or specimen.
11. Geometric relationship (source local spot size, max and min source strength, object to film distance, radiation angle with respect to weld and film).
12. Limit of film coverage
13. Film type and make
14. Exposure Time
15. Processing (time temperature for development stop bath or rinse, fixation, washing, drying etc.)
16. Density
17. Sensitivity
18. Type of penetrameter

Approval of the COMPANY

Signature of CONTRACTOR
 with seal

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WELDING SPECIFICATION CHART

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Class :

Material Specification :

Pipes : API 5L Gr. X 60, API 5L Gr. B API 5L Gr. X 42
Fittings : A 105, A234 Gr. WPB. MSS-SP-75, Gr. WPHY42, MSS-S
Flanges : A 105, MSS-SP-44 Gr. F42, MSS-SP as Gr. WPH 60
Other : _____ 44 Gr. F6C

Base Metal of NCL :

Welding Processes : Groove Joints : Butt

Root Pass SMAW Filler Pass SMAW Root Pass SMAW Filler Pass SMAW Filler Joints/ Socket Joints : SMAW

Welding Materials : Groove Joints : Butt

Root Pass E6010G/ E7010G Filler Pass F7010G/ E8010G/ E8818G
Root Pass E7010/ E7018G/ E8018G Filler Pass F7016/ E7018G/ E80118G

Filler Joints/ Socket Joints : E7016/ E7018/ E7018G/ E8018G

Backing Page _____ Consumable :

Gases : Purging _____ Shielding

Gas Composition : Purging _____ Shielding

Preheating : 10 min for all welds, 100°C Post heating

Post weld heat treatment :

Holding temp. : 595-650 C Holding Time : 1 Hr. per inch thk
Rate of heating : 200 C/hr max. Min holding time : 1 hr.
Method of cooling : Controlled Rate of cooling : 200°C/hr max.

Mechanical property requirements :

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Charpy `V' notch impact test valve :

Normal : 22 J
 Average : 27 J
 At temperature : 0 °C
 Hardness : 300 HV10 (for weld & HAZ)

Code of fabrication : ANSI B31.8; API 1104 and welding specifications.

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TECHNICAL NOTES

- Welding, heat treatment and non destructive testing shall be carried out in accordance with the requirement of ANSI B31.8/ API-1104 and additional requirement specified in the specification. In case of conflict between code and specification more stringent conditions shall be applicable.
- No welding shall be carried out without preheating the joint to 10°C (50 °F) when the ambient temperature is below 10°C (50 °F).
- Preheat shall be applied while welding the following material as detailed below :

API 5L Gr. B	:	Thickness upto	100 °F min.
		and inclusive of 12mm	
A 105	:		
MSS-SP-44 Gr. F60	:	Thickness beyond	200 °F
A 234 Gr. WPB	:	12 mm	
MSS-SP-75-WPHY60	:		
- For fillet welds complete welding may be carried out using the electrodes recommended for filler passes.
- All weldments & HAZ shall meet the hardness requirements of 300 HV10 during procedure qualification. If the hardness exceeds 300 HV10 the joints shall be heat treated at temp. 1100-1250 °F for one hour. The heating and cooling rates shall be decided during procedure qualification subject to a maximum of 200 °C/Hr. Hardness testing shall be carried out by Vickers hardness tester during welding procedure qualification test only. No hardness test is required for production welds.
- The electrodes used shall meet the following additional requirement :

<u>Specification</u>	<u>UTS (Min.) (As welded)</u>	<u>Impact (As welded)</u>
E7018-G	52.7 kg/mm ²	20 ft. lb. at 0°C
E7018-I	52.7 kg/mm ²	-
E6010	-	-
E6018	-	20 ft. lb. at 0°C
- All the weldments & HAZ shall meet the impact test requirement of 20 ft. lb at 0°C.

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ANNEXURE-2

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 be performed till a period of at least 24 hours has expired.

Weld specimens, for pipe diameter greater than or equal to 12.3/4" shall be taken from the positions indicated in Fig. 1 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 no. of tests to be carried out is given in Table-I of this specification.

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

Table-I

TYPE AND NUMBER OF TEST SPECIMENS FOR PROCEDURE QUALIFICATION TEST

Pipe Size, Out-side diameter Inches	Number of Specimens									
	Tensile API	Tensile ISO	Nick Break	Root Bend	Face Bend	Side Bend	Macro	Hard- ness	Impact	Total
Wall Thickness > 1/2 inch (12.7mm) and under										
Under 2 3/8	0	0	2	2	0	0	0	0	0	4
2 3/8 to 4 1/2 incl.	0	0	2	2	0	0	0	0	0	4
Over 4 1/2 less than 12 3/4	2	0	2	2	2	0	2	2	12	24
12 3/4 and over	2	2	4	4	4	0	2	2	24	44
Wall Thickness > 1/2 inch (12.7mm)										
4 1/2 and smaller	0	2	0	0	0	2	0	0	0	4
Over 4 1/2 less than 12 3/4	2	0	2	2	2	0	2	2	12	24
12 3/4 and over	2	2	4	0	0	8	2	2	24	44

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1.2 **Tensile Strength**

Specimens for pipe diameter over 12 3/4" shall be taken from the position indicated in Fig. 1 of this specification. Two API type specimen shall be taken for pipe diameter greater than or equal to 12 3/4".

1.3 **Nick-Break Test**

1.3.1 **Preparation**

Specimens 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 authorisation 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 macrosection has to be at least three times the width of the weld. The section is to be prepared by grinding or polishing and etching to clearly reveal the weld metal and heat effected zone.

1.4.2 **Method**

Specimens shall be carefully examined under the microscope with a magnification of at least 25 times. The COMPANY may ask for a macrograph with 5 times 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 macrosection is to be used for hardness testing using the Vickers method with 100 N (10 kg) load. Indentations are to be made along traverses each approximately 1mm below the surface at both side of the weld.

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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 0.5mm 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 indentation are to be made in the adjacent region as well as on the opposite side of the macrosection along the specified traverses.

1.5.2 **Method**

The test shall be carried out in accordance with Recommendation ISO R81, Vickers hardness, using laboratory type machine controlled as per-recommendation of ISO R 146 and using a diamond pyramid penetrator set at 2.37 rad. (136) with a load of 100 N (10 kg).

1.5.3 **Requirements**

Hardness value shall not exceed 300 H V10 . In case of a single reading slightly (+10 HV) higher than the specified limit, further indentations should be made to check if the high value was an isolated case.

All the hardness values obtained from the heat effected zone shall not exceed 100 HV with respect to the average hardness of the values obtained for the base metal.

If these additional tests mentioned above give a hardness within the specification limit, the slightly higher value may be accepted.

1.6 **Charpy-V-notch Impact Test**

1.6.1 Specimens shall be taken from the position indicated in Fig. 1 of this specification. The test specimens will be prepared in accordance with ISO R 148. Charpy V-notch specimens shall have dimensions as given in Fig. 3 of the specification.

Three test specimens shall be taken from each sample and they shall be cut and worked so that their length is transversal and perpendicular to the weld bead with the notch position as shown in Fig. 4 of this specification. The notch shall be perpendicular to the roller surface. The test specimens width shall depend upon the pipe wall nominal thickness as following :

Nominal wall thickness in mm	Test Specimens width in mm
> 12	12
> 9.5 and ≤ 12	7.5

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 ≥ 7 and ≤ 9.5

5

 < 7

2.5

1.6.2 Test Method

The test shall be carried out as indicated in ISO R 148 "Beam Impact Test V-notch.

Test pieces shall be immersed in a thermostatic bath and maintained at the test temperature for at least 15 minutes. They shall then be placed in the testing machine and broken within 5 seconds of their removal from the batch.

1.6.3 Requirements

The impact energy shall be greater or equal to :-

Test Specimens in mm	Average of Three specimens Joule (min) (Note-2)	Minimum Single Value Joules (Note 1)
10	27	22
7.5	21.5	17.5
5	18.5	15.0
2.5	10.0	8.0

Note:

- 1) Only one value is permitted to be lower than average upto the value specified.

1.7 Bend Test Requirements

The bend test specimens shall be made and tested as per the requirements of API-1104 sixteenth edition - May, 1983 except that the dimensions of Jig for guided bend test fig. 5 para 2.6 API-1104 shall be modified as follows :

Radius of the plunger	$\phi A'$	$= 2 t$
Radius of the die	$\phi B'$	$= 3 t + 1.6\text{mm}$
Width of the die	$\phi C'$	$= 50.8$

The acceptance criteria shall however be as per para 2.643 and 2.653 of API-1104 sixteenth edition - May, 1983.

Note t = Thickness of Specimen (nominal)

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ANNEXURE-3

1.0 **ULTRASONIC INSPECTION**

In addition to the radiographic inspection ultrasonic inspection is required as per conditions mentioned in **Annexure-1** 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 **Equipment and Operators**

The CONTRACTOR who carries out the ultrasonic inspection shall have sufficient qualified personnel, equipment and instrument at his disposal to be able to effect the tests without hindering or delaying the pipeline assembly operations.

- Calibrate the equipment;
- Perform an operational test under production conditions;
- Interpret the screen picture;
- Evaluate the size and location of reflectors
- 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.

The CONTRACTOR appointed to carry out UT inspection shall supply 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 be state, as an indication only but not limited to the following information :

- Type of U.T. equipment used
- Type and dimensions of transducers
- Frequency range
- Details for calibration
- Coupling medium
- Inspection technique
- Record details
- Reference to the welding procedure where it is intended to adopt the specification.
- Temperature range of the joints to be inspected.

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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, when there are typical defects the test intends to detect.

1.4 **Test Procedure**

Circumferential weld shall be inspected from both sides using angled. 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 50mm wide on both sides of the weld with steel - wire brushes and anyhow the cleaned strip must be atleast wide enough to allow full 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 :

- Ultrasonic equipment and coupling medium
- Sample sections for calibration of instruments.
- Equipment for cleaning of surface to be examined.
- Rulers 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 which is considered unsuitable. The decision of the COMPANY is final. The CONTRACTOR appointed to carry out ultrasonic inspection 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 instrument and equipment necessary for carrying out ultrasonic inspection on site shall satisfy the requirements laid down by the public board of institutions which regulate "safety at work".

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1.5 **Ultrasonic Instruments**

The ultrasonic instruments :

- Shall be each pulse 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 various amplification, with steps of 1 or 2 dB over a range of a least 60 dB.
- The regulation control shall be accurate to within 1 dB and this accuracy shall be certified by the instrument manufacturer.
- 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 stabilising device with a tolerance of 2 volts.

1.6 **Probes**

The probes used shall have dimensions, frequencies, and a refraction angle suited to the type of steel, the diameter 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 points, shall be checked using a V_1 and V_2 sample block, IIW type or the calibration block ASTM E-428.

For the calibration of runs and the regulation of detection sensitivity during the test, a calibration piece be used. This piece shall be taken from the production material, and will be at least 150mm long (measured in the direction of the axis), and at least 50mm wide (measured in the direction of the circumference), (see Fig. 4 of this specification).

In the middle of the inside and the outside surface of the calibration piece a groove shall be made. The groove will have a rectangular cross-section, a flat bottom and the following dimensions :-

- Depth : 1 +/- 0.1mm
- Breadth (measured parallel to the 150mm side) : 1 +/- 0.1mm
- Length (measured parallel to the 50mm side) not less than 30mm.

In addition, the calibration piece shall have a hole, 2mm in diameter, passing through its thickness and positioned so that during calibration the echoes returning from the two grooves do not interfere with those returning from the hole.

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1.6 Calibration

For a precise check of the sound paths necessary for a full inspection of the weld joint, the probe shall be moved (half skip and full skip distance) until internal and external notches on the test piece are detected (see Fig. 5 of this specification).

The relevant defect limits the path lengths on the time base. The calibration of reference sensitivity is obtained by utilising the through drilled test hole in the thickness of the reference block to draw the distance amplitude correction curve relevant to the test probe.

Calibration shall be carried out according to the following procedure : place its internal vertex until the maximum height of echo is displayed on the screen; this echo is adjusted to 80% of full screen height by means of the sensitivity adjuster set in dB. Without varying the amplification, the probe placed at full skip distance from the hole is moved to detect the external vertex the hole until the maximum height of echo is obtained. The straight line connecting the peaks of the two echoes obtained by the above procedure, represents the 100% reference level, while the one connecting the two points at half height of the same echoes represents "50% reference level".

The two straight lines shall be marked on the screen with a pen. Calibration shall be repeated each time tests are re-started at intervals not longer than 30 minutes during normal operations; each time the conditions fixed in advance are altered. This calibration is applicable provided that the crystal of the probe is 8 x 9mm size. Should this size of the crystal be different, the value of the sensitivity obtained from the calibration by a crystal of a different size shall be brought to the value of sensitivity obtained from the calibration by a 8 x 9mm crystal. The sensitivities of the two different size probes shall be compared through the echoes obtained on the notch of the test piece with the probe position at half skip of the distance.

1.9 Regulation of Amplification during Production Testing

The amplification during production testing shall be obtained by adding 2-6 dB (according to the surface condition of the pipe and its cleanness) to the reference amplification.

1.10 Qualification of Ultrasonic Testing Operators

Before the inspection begins or during the same inspection, the COMPANY may require a qualification test for the ultrasonic equipment operators.

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 respond is obtained paying attention all the time to the probetube coupling.

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If, under these conditions, the height of the defer echo is equal to or greater than that of the reference echo, the defect shall be evaluated. 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 defects. Returns which 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, it recommended. Defect location is effected by measuring the projection distance between the probe output and the reflecting surface.

The operators carrying out the tests shall have besides the probing instrument, tools for cleaning the pipe surface (files, brushes, etc.) as well as the coupling liquid or paste appropriate for the temperature of the section to be examined.

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ANNEXURE-4

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 edition) :

- i) API 1104, Standard for welding pipelines and related facilities.
- ii) ANSI B31.8, code for Gas Transmission and Distribution Piping Systems.
- iii) ANSI B31.4, Code for Liquid Petroleum Transportation Piping System.
- iv) ASTM E94, Recommended practice for Radiographic Testing.
- v) ASTM, E 142, Standard Method for Controlling Quality of Radiographic Testing.
- vi) The American Society for non-destructive Testing. Recommended Practice No. SNT-TC-1A 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 COMPANY 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 in all exposures.

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- 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 2.0 and 3.5 through out 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, and the outline and holes of the penetrometer are clearly discernible.
- 3.5 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 alongwith the joint identification number shall be duly entered in a register and signed by the CONTRACTOR and submitted to the COMPANY for approval.
- 3.6 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 in Table 4 of API 1104. 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 to film distance used is a minimum of 12 inches.
- 3.7 Three copies of each acceptable radiographic procedure (as outlined in Specification no. MEC/S/05/62/02) 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 authorised representative to be used as a standard for the quality of production radiographs during the job. The other two sets shall be retained by COMPANY for its permanent record.
- 3.8 Three copies of the exposure charts relating to material thickness, kilo voltage, source to film distance and exposure time shall also be made available to aCOMPANY by the CONTRACTOR.
- 3.9 The CONTRACTOR shall, on a daily basis, record for each radiograph (1) radiography 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 to a particular butt weld and welder on piping drawing and pipeline alignment drawing.

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3.10 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.

3.11 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.

3.12 The CONTRACTOR, if found necessary, may modify the procedure of radiographic examination suiting the local conditions prevailing. This shall, however, be subject to the approval of the COMPANY.

3.13 COMPANY shall have free access to all the CONTRACTOR's work facilities in the field.

3.14 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 may be allowed, at the discretion of the COMPANY, in case of inaccessible joints.

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 rad. (360°).

If it is impossible to place the radiation source inside the pipe, the weld will be inspected with the source on the outside. An overlap of at least 40mm at the ends of each film shall be required to ensure that the first and last location increment numbers are common to successive films and to establish that no part of a weld has been omitted.

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-6.

6.0 **PENETRAMETERS**

6.1 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 1027. 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,

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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. 6 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 radiographs.

The COMPANY may authorise use of types of IQI other than those planned, provided that they conform with recognised standards and only if the CONTRACTOR is able to demonstrate that the minimum sensitivity level required is obtained. For this demonstration, a test shall be carried out comparing the IQI specified and the CONTRACTOR's to show up the identification number and other details of the proposed IQI, which must be visible in the test radiograph.

7.0 **FILM IDENTIFICATION MARKERS**

All films shall be clearly identified by lead numbers, letters, and/ or markers. The image of the markers shall appear on the films, without interfering with the interpretation. These markers positions shall also be marked on the part to be radiographed and shall be maintained during radiography.

8.0 **PROTECTION AND CARE OF FILM**

8.1 All unexposed films shall protected and stored properly as per the requirements of API 1104 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 area 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 which contain, according to the CONTRACTOR's interpretation, unacceptable defects.

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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 according 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 Oaecuer 0-1 acquity 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 radiographers shall be presented in suitable folders for preservation alongwith necessary documentation.

11.2 All radiographs shall become property of the COMPANY.

12.0 **EQUIPMENT AND ACCESSORIES**

12.1 CONTRACTOR shall make necessary arrangement at his own expense, for providing the radiographic equipment, radiographic films and 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 with 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 can be suitably controlled to allow viewing film densities upto 4.0 without damaging the film.

13.0 **RADIATION PROTECTION**

13.1 CONTRACTOR shall be responsible for the protection and personal monitoring of every man with or near radiation sources.

13.2 The protection and monitoring shall comply with local regulations.

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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**

14.1 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 FOR SAFETY REGULATIONS**

15.1 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 INDUSTRIAL INJURIES**

16.1 CONTRACTOR shall maintain first aid facilities for its employees and those of its 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**

17.1 Notwithstanding the above there is nothing in these clauses to exempt the CONTRACTOR from the operation of any other act or rules in force.

SPECIFICATION FOR VENTS, DRAINS AND WELLS

SPECIFICATION NO.: MEC/S/05/21/15



**(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

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	OIL & GAS SBU, DELHI		
TITLE	VENTS, DRAINS AND WELLS	DOCUMENT NO. MEC/S/05/21/15	Page 1 of 1
			REVISION : 0
			EDITION : 1

C O N T E N T S

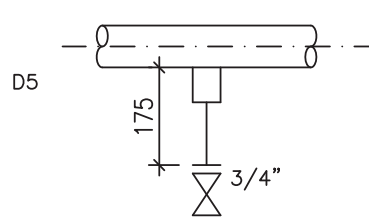
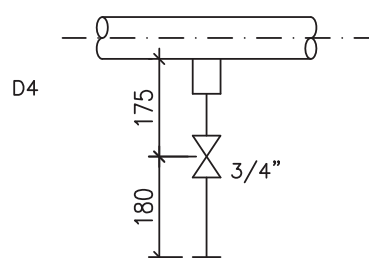
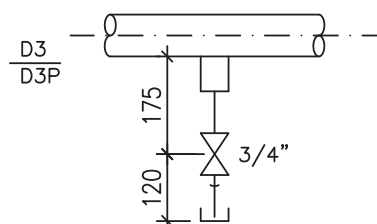
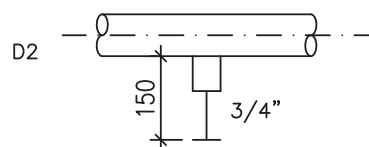
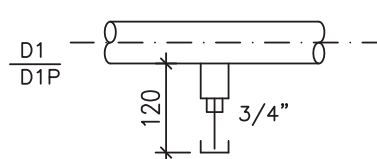
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1.	Vent & Drain for Line 2" & above	MEC/SD/05/21/15/01
2.	Wells Installation 1½ Dia Taps	MEC/SD/05/21/15/02 (Sheet 1 of 2)
3.	Wells Installation 1½ Dia Taps	MEC/SD/05/21/15/02 (Sheet 2 of 2)
4.	Vent & Drain for lines 1½" & below	MEC/SD/05/21/15/03
5.	Pressure Tapping	MEC/SD/05/21/15/05

PREPARED BY: (Binita Brahma)	CHECKED BY: (Sunil Kumar)	APPROVED BY: (A.K. Johri)	ISSUE DATE : Feb. 2009

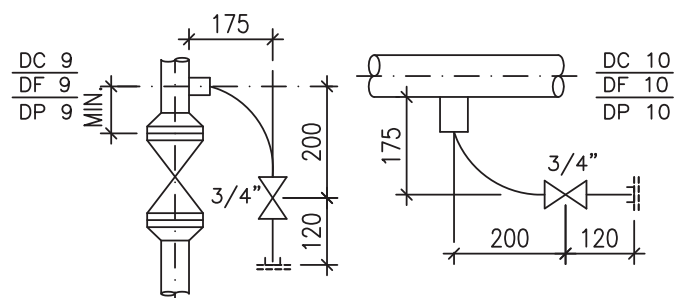
MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	VENTS, DRAINS AND WELLS	DOCUMENT NO. MEC/S/05/21/15	Page 1 of 1
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AMENDMENT STATUS

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)



1. DIMENSIONS ARE VALID FOR 75mm (MAX.) THICKNESS INSULATION FOR HIGHER INSULATION THICKNESS INCREASE DIMENSIONS AS REQUIRED.
2. VENTS & DRAINS SHALL BE PROVIDED WITH GATE, GLOBE OR PLUG VALVE WITH HALF COUPLING OR STUB IN WITH CAP OR FLANGE, BLIND FLANGE, AS PER PIPING SPECIFICATIONS.
3. VENTS/DRAINS CAN BE PROVIDED ON FLAT SIDE OF ECCENTRIC REDUCERS ON SIZES 4" & ABOVE.
4. LEGEND V=VENT, D=DRAIN, C=CAP, F=FLANGE, P=PLUG
5. PLUGGED END OF VALVE OR FITTING SHALL BE THREADED.





1. ELBOW MIN. 4" Ø OR LARGER
2. VERTICAL LINE 4" Ø OR LARGER
3. HORIZONTAL LINE 4" Ø OR LARGER
4. VERTICAL LINE DIA LESS THAN 4"
5. HORIZONTAL LINE DIA LESS THAN 4"

1. BOLTS, NUTS AND GASCKETS BY PIPING.
2. MIN. CLEARANCE FOR REMOVAL L+550
3. L1 DIMENSIONS ARE CALCULATED FOR WN, RF FLG. ONLY.
4. IN CASE ANY DEVIATION IS REQUIRED FOR INSTALATION TAPS FROM THIS STD. INST. DEPTT. TO BE CONSULTED.

WELLS INSTALLATION
1 1/2" DIA TAPS

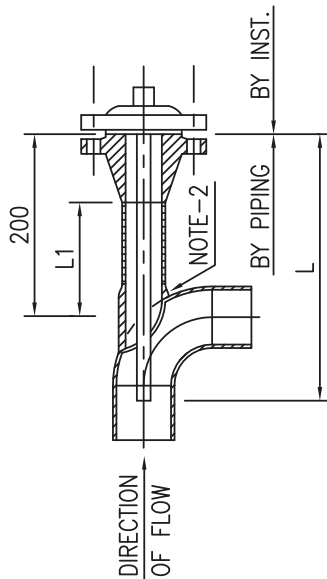
MECON LIMITED

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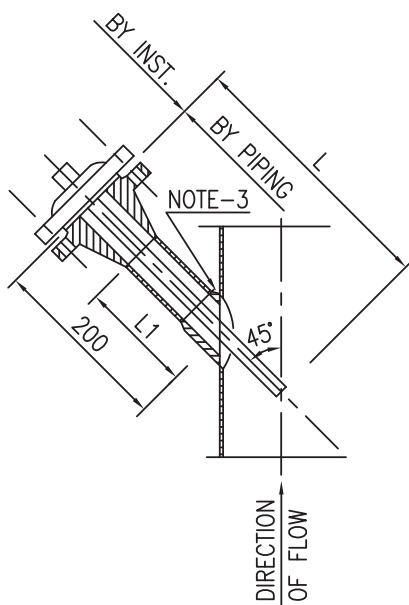
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DRG.NO MEC/SD/05/21/15/02 (SH. 1 OF 2)

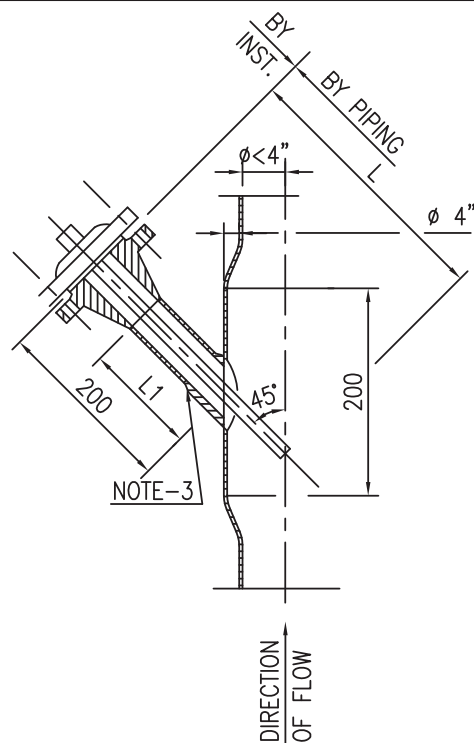
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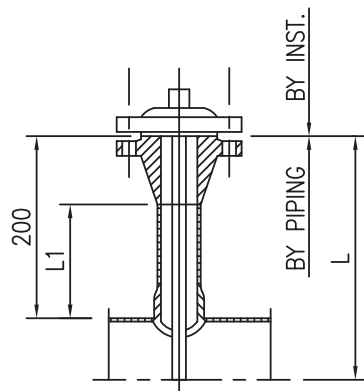
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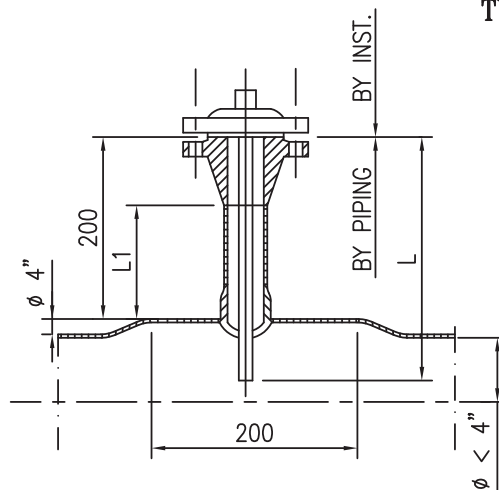
TYPE TW-7



TYPE TW-9



TYPE TW-8



TYPE TW-10

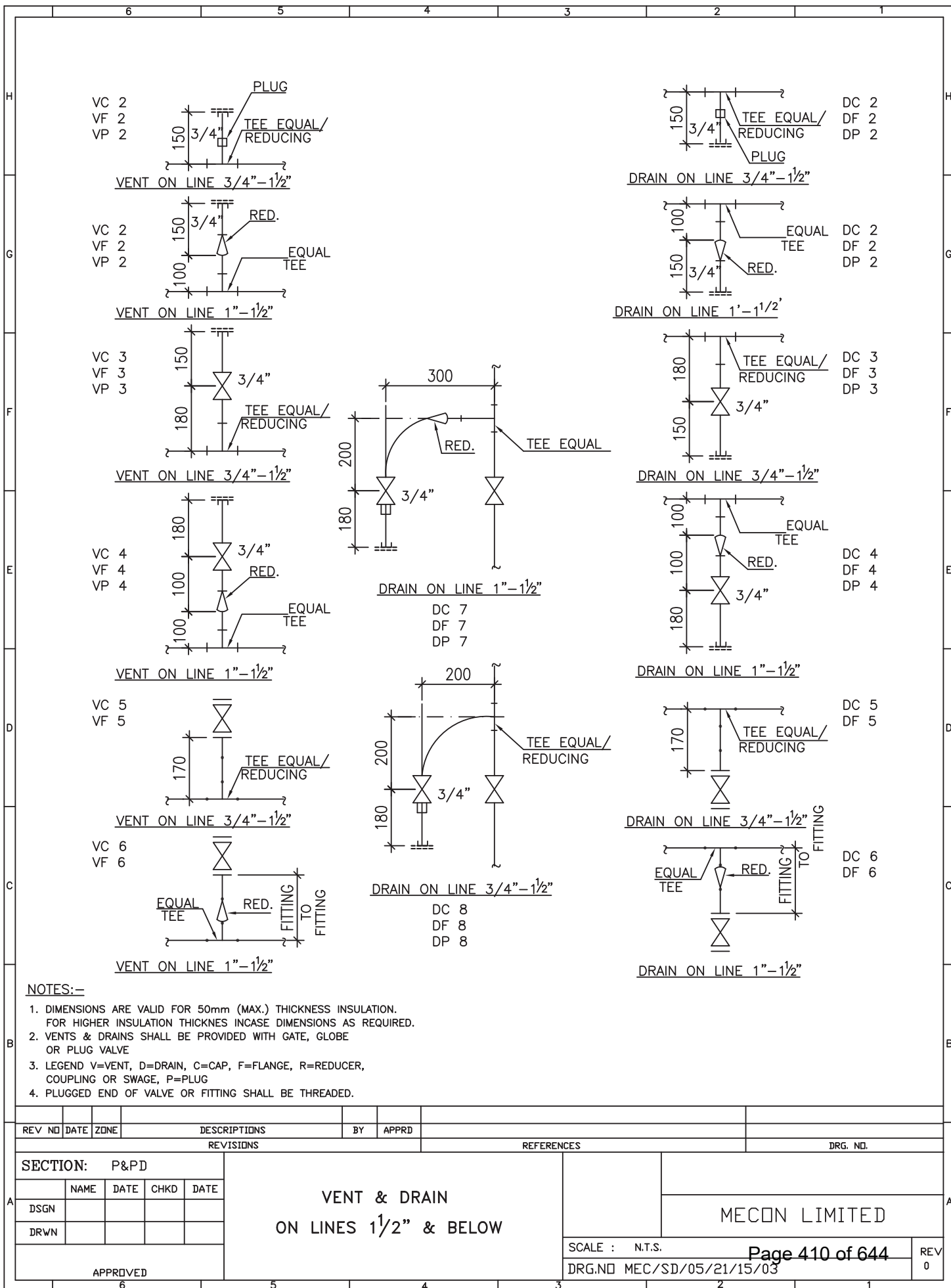
LINE DIA	L 1.5" FLANGED WELD
4"	200
6"	300
8"	300
10"	300
12"	300
14"	300
16"	400
18"	400
20" & LARGER	500
VESSELS	AS REQUIRED

6. ELBOW MIN. 4" ϕ OR LARGER
7. VERTICAL LINE 4" ϕ OR LARGER
8. HORIZONTAL LINE 4" ϕ OR LARGER
9. VERTICAL LINE DIA LESS THAN 4"
10. HORIZONTAL LINE DIA LESS THAN 4"

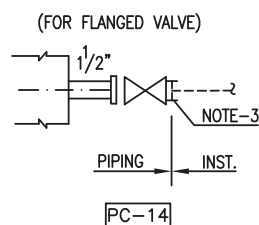
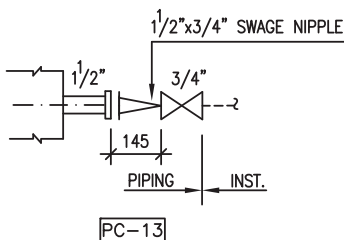
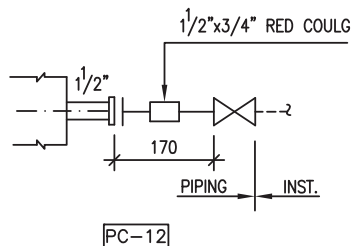
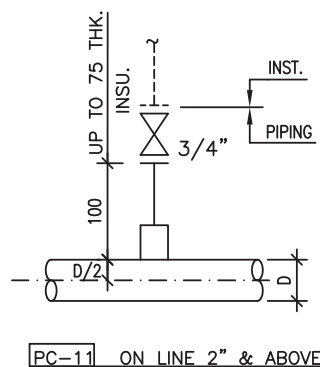
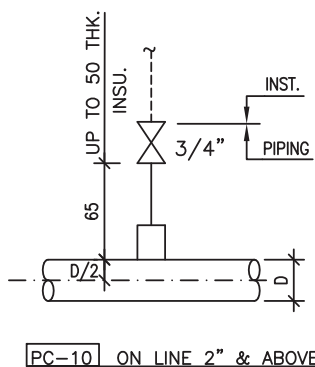
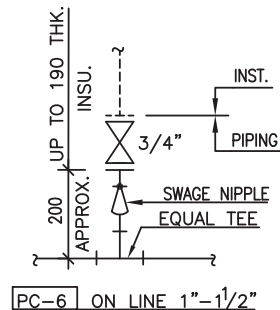
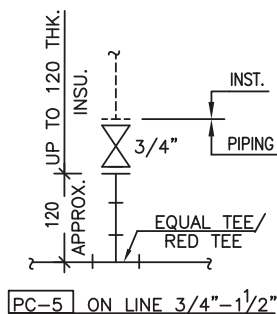
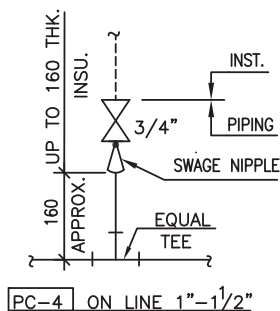
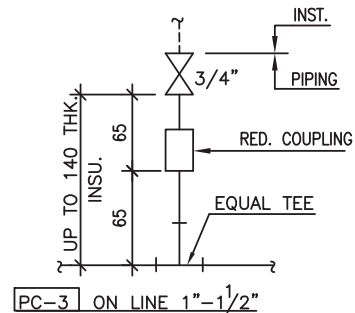
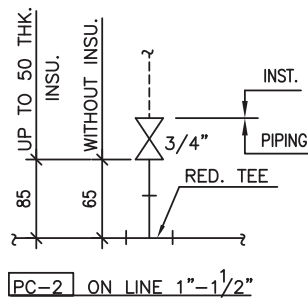
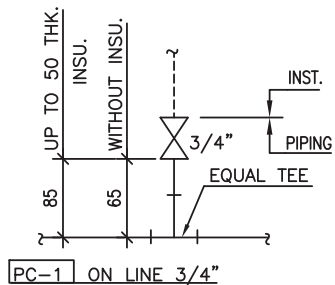
NOTES:

1. BOLTS, NUTS AND GASCKETS BY PIPING.
2. MIN. CLEARANCE FOR REMOVAL L+350.
3. COUPLING TO BE SPECIAL LENGTH.

REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.	
REVISIONS								
SECTION: P&PD			WELLS INSTALLATION 1 1/2" DIA TAPS			MECON LIMITED		
NAME	DATE	CHKD						DATE
DSGN								
DRWN								
APPROVED			SCALE : N.T.S.			Page 409 of 644		
			DRG.NO MEC/SD/05/21/15/02 (SH. 2 OF 2)			REV 0		



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PC-15 WITH 2" VALVE

ON VESSELS/ COLUMNS

NOTES:-

1. THE INDICATED DIMENSIONS ARE IN 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 WITH TEE, HALF COUPLING 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 TAPPINGS PROVIDED OTHER THAN INDICATED IN THIS STD FOR LAYOUT REASONS DETAILED DIMENSIONS WILL BE CALLED OUT.

REV	NO	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.
SECTION: P&PD				PRESSURE TAPPING				MECON LIMITED
NAME				DATE				SCALE : N.T.S.
DSGN				CHKD				DRG.NO MEC/ SD/05/21/15/05
DRWN				APPROVED				Page 411 of 644
								REV 0

SPECIFICATION FOR FLUSHING AND TESTING OF PIPING SYSTEMS

SPECIFICATION NO.: MEC/S/05/21/11



**(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	FLUSHING AND TESTING OF PIPING SYSTEMS	DOCUMENT NO.	Page 1 of 1
		MEC/S/05/21/11	REVISION : 0
			EDITION : 1

C O N T E N T S

<u>SL. NO.</u>	<u>DESCRIPTION</u>
1.0	SCOPE
2.0	REFERENCES
3.0	INSPECTION
4.0	FLUSHING
5.0	TESTING
5.1	EXTENT OF TESTING
5.2	GENERAL REQUIREMENT/TEST PREPARATION FOR TESTING
5.3	TESTING MEDIA, TEST PRESSURE AND TEST PRESSURE GAUGES.
5.4	TESTING PROCEDURE
5.5	COMPLETION OF TESTING
5.6	TEST RECORDS

PREPARED BY: (Shalini Singh)	CHECKED BY: (Sunil Kumar)	APPROVED BY: (A.K. Johri)	ISSUE DATE : Dec. 2008

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
	OIL & GAS SBU, DELHI		
TITLE	FLUSHING AND TESTING OF PIPING SYSTEMS	DOCUMENT NO.	Page 1 of 1
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AMENDMENT STATUS

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD TECHNICAL SPECIFICATION		
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1.0 SCOPE

This specification covers the general requirements for Inspection, flushing and testing of piping systems. However testing of steam lines falling under IBR shall also be governed by Indian Boiler Regulations.

Flushing and testing of all piping system shall be witnessed by the Consultant Representative / Engineer-in- Charge.

2.0 REFERENCE

ASME B31.3-2004 : Process Piping

IBR : Indian Boiler Regulations

3.0 INSPECTION

During various stage and after completion fabrication and erection, the piping system shall be inspected by the Consultant Representative / Engineer- in - Charge to ensure that :

- Proper piping material has been used.
- Piping has been erected as per drawings and the instruction of the engineer- in charge.
- 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 'dry compressed air, wherever water flushing is not desirable' to clean the pipe of all dirt, debris or loose foreign materials.

Required pressure of water, flushing shall meet the fire hydrant pressure or utility water pressure. For air flushing the line, system will be pressurised 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 the line 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 the flushing circuit.

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	OIL & GAS SBU, DELHI		
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			EDITION : 1

From all permanent strainers the screens/meshes shall be removed before flushing. Screens/meshes shall be re- installed 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 an equipment such as column, vessel, exchanger etc. forms part of a piping circuit during flushing, this shall be done with the approval of Engineer- in - Charge. However equipment thus included in the circuit, shall be completely cleaned and dried with compressed air, after flushing is completed.

During flushing discharged water/air shall be drained at the place directed the Engineer- in - Charge. 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, 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, online 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 Engineer-in-Charge. 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 re-installed by the contractor with permanent gaskets. However, flanges of equipment nozzles and other places where isolation is required during testing, only temporary gaskets shall be provided.

Records in triplicate shall be prepared and submitted by the Contractor for each piping system for the flushing done in the proforma provided / approved by EIC.

5.0

TESTING

Pressure testing, in general shall be as per clause 345 of ASME B31.3, unless otherwise specified, herein. Lines carrying highly hazardous / poisonous fluids must have a sensitive leak test. For IBR lines, 'IBR Regulations' shall also be followed.

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5.1 Extent of testing

With the exclusion of instrumentation. piping system fabricated or assembled in the field shall be tested irrespective of whether or not they have been pressure tested prior to site welding of fabrication.

To facilitate the testing of piping systems, vessels and other equipments may be included in the system with the prior approval of Engineer-in-charge, if the test pressure specified is equal to or less than that for the vessels and other equipments.

Pumps, compressors and other votary equipments shall not be subjected to field test pressures.

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 upto the first block valve.

Seats of all vales shall not be subjected to a pressure in excess of the maximum cold welding pressure of the valve. Test pressure applied to vales shall not be grater than the manufacturer is recommendation nor less than that required by the applicable code. Where desirable set 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 removal, unless approved otherwise by the Engineer-in-charge. Restrictions which interfere with filling, venting and drawing such as orifice plates etc. shall not be installed unless testing is complete.

Control valves shall not be included in the test system. Where by-passes are provided test shall be performed through the by-pass end/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 tests with other agencies, the piping to be tested shall be isolated from such piping by physical disconnection such as valves or blinds.

5.2 General Requirement/Test preparation for Testing

Test shall be carried out with permanent gaskets installed unless specified otherwise or instructed by the Engineer-in- charge.

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No pressure test shall be carried out against close valve unless approved by the Engineer-in-charge.

The Engineer-in-charge shall be notified in advance by the contractor, of the testing sequence and programme, to enable him to be present for witnessing the test. The contractor shall be fully responsible for making arrangements with the local boiler inspector to witness the tests for steam lines falling under IBR. IBR certificates for these tests shall be obtained in the relevant IBR forms and furnished to the Engineer-in-charge. Before testing, all piping shall be cleaned by flushing to make it free from dist 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 is existing due to any reasons, for absence of control valve, safety valve, check valves etc. it shall be filled with temporary spools.

All joints welded, screwed or flanged shall be left exposed for examination during the test. Before pressuring the lines, each weld joint shall be cleaned by wire brush to free it from rest and any other foreign matter.

Where a system is to be isolated of 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 spool have been received 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 portion of the system. For longer lines and vertical lines, two or more pressure gauges shall be installed at locations selected by the Engineer-in-charge. For lines containing check valves any of the following alternatives shall be adopted for pressure testing. Wherever possible pressurise up-stream side of valve.

Replace the valve by a temporary spool and re-install 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. All 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

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removed during testing (if possible). After completion of testing the flopper/ seat shall be refitted.

Gas lines when hydrostatically tested shall be provided with additional temporary supports during testing as directed by Engineer-in-charge.

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/cm² (g) may be used as preliminary test to detect missing gaskets etc. as this avoids the necessity of purging the gas to make repairs. However, this method may not be used for this purpose, if the steam temperature is more than the design temp. of the line.

For jacketed pipes testing of core pipes shall be done on individual pieces where the pipe is continuously packed, 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 system.

5.3 Testing Modes, Test pressure and Test Pressure Gauges

5.3.1 Testing Modes

In general all pressure test shall be hydrostatic using iron free water, which is clean and free of silt. Maximum chlorine content in water for hydrostatic testing for MS 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 Engineer-in-charge.

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 vapor 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 fluid such as gas, oil, 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.

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5.3.2 Test Pressure

The hydrostatic/pneumatic test pressure shall be as indicated in the line list or as per the instruction of Engineer-in-charge.

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.

5.3.3 Test Pressure Gauge

All gauge used for field testing shall have suitable range so that the test pressure of the various system falls in 35% to 65% of gauge scale range. Pressure gage 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 programmes, all test gauges shall be calibrated using a standard dead weight gauge tester or other suitable approved testing apparatus. Any gauge having an incorrect zero reading or error of more than $\pm 2\%$ of full scale range shall be discarded. The Engineer-in-charge shall check the accuracy of master pressure gauge used for calibration.

5.4 Testing Pressure

5.4.1 Hydrostatic Test

All vents and other connections used as vents shall be kept open while filling the line with test fluid for complete removal of air. For pressurising and depressurising the system, temporary isolating valves shall be provided if valves, vents, drains do not exist in the system.

Pressure shall be applied only after the system/line is ready and approved by the Engineer-in-charge.

Pressure shall be applied by means of a suitable test pump or other pressure source which shall be isolated from the system as the desired test pressure is reached and stabilised in the system.

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A pressure gauge shall be provided at the pump discharge for guiding the system to the required pressure.

The pump shall be attended constantly during the test by an authorised person. The pump shall be isolated from the system wherever the pump is to be left unattended.

Test pressure shall be maintained for a sufficient length of time to permit through inspection of all joints for leakage or signs of failure. Any joint found leaking during a pressure test, shall be re-tested 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. These gauges are to be checked by the standard test gauge before each pressure test.

Care shall be taken to avoid increase in the pressure due to atmospheric variation during the test.

5.4.2 Air 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 & 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 activities shall be same as per hydrotesting procedure (specified above).

5.5 Completion of Testing

After the hydrostatic test has been completed, pressure shall be released in a manner and at a rate so as not to endanger personnel or damage equipments.

All vents and drains 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.

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).

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Pressure tests shall be considered complete only after approved by the Engineer-in-charge. 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.

5.6

Test Records

Records in triplicate shall be prepared and submitted by the contractor for each piping system, for the pressure test done in the proforma provided / approved by the Engineer-in-charge.

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- 1.0 Compliance with Specification:** The valve manufacturer shall be completely responsible for the design, materials, manufacture & fabrication, testing, inspection, preparation for shipment and transport of the valves. Minimum all pressure containing and pressure controlling parts of valves and actuators shall be provided with EN 10204-3.2 certificates.
- 2.0 Valve manufacturer's Scope:** Valve manufacturer scope of work includes the equipment with all internals and accessories shown on the datasheets, specifications and all unmentioned parts necessary for a satisfactory operation and testing, except those which are indicated to be out of the valve manufacturer's supply.
- 3.0 Inspection:**
Inspection shall be in accordance with EN 10204 3.2 certification shall be issued for each dispatched valve. Valve manufacturer shall appoint anyone of the TPIA for inspection purpose. Valve manufacturer has to intimate the TPIA name to MECON prior to perform any inspection activity.
- 4.0** Apart from inspection by TPIA, Inspection shall also be performed by MECON and or its authorized representative / MECON and or its authorized inspection agency (AIA), as set out and specified in the codes and particular documents forming this tender document.
- Valve manufacturer shall provide office along with furniture for MECON/ TPIA personnel for entire duration of the manufacturing. AC Office shall have table/ chair/internet connectivity/stationary/courier and printing facilities for inspection officers for round the clock inspection during manufacturing.
- 5.0** For all valves to be used in Gaseous Hydrocarbons service, impact & hardness tests / values as per clause 3.4, 3.5 & 3.6 of specification no. MEC/TS/05/21/002 shall be applicable.
- 6.0** Valve manufacturer shall inform separately spares for two years normal operation for valves & actuators, if applicable .
- 7.0** Valve manufacturer to include the start up and commissioning spares for valves & actuators (if applicable) in the quoted price for valves.
- 8.0** Valve manufacturer to indicate in his offer the gross weight (in kg or Metric Tonne) per unit, volume (in m3) per unit and dimensions (L x B x H) of package (wooden box, etc.) to accommodate unit quantity or number of quantities (as applicable).
- 9.0** Valve manufacturer must submit duly filled up & signed data sheets, check list and forms along with his offer.

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- 10.0** Valve manufacturer shall establish the equivalence/superiority of any material proposed (With justification of material properties and availability) other than that specified in Datasheet. Vendor shall also indicate the ASTM equivalent of his proposed material as well as of all the AISI designated materials specified in datasheets.
- 11.0** Valve manufacturer to note that for minimum inspection and testing requirement of the valves shall be governed by attached QAP. However, valve manufacturer shall submit their QAP for approval covering the requirement specified in attached QAP.
- 12.0** In the event of Conflict/inconsistency among the documents attached/ referred, the following order of precedence generally shall govern in interpretation of various requirements / data.
- Additional notes for valves
 - Datasheets
 - Technical Specification
 - Codes and Standards
 - Vendor's Standards
- However, Owner/Consultant reserves the right to consider most stringent requirement among the document attached / referred.
- 13.0** Successful bidder shall submit hard copies of all documents/ drawings to MECON for review and approval. The date of receipt of these documents/ drawings at MECON shall be deemed as the date of submission. If any documents/ drawings require re-submission due to any error/ deficiency noticed during review/ approval stage, in that event the additional time required by the successful bidder to get the revised document/ drawing reviewed/approved by MECON shall be solely to successful bidder's account and in no case the vendor/ supplier shall be entitled for any time or cost benefit.
- 14.0** Successful bidder to note that the valves supplied by them shall be capable to withstand the field hydro test pressure (i.e., 1.5 times of design pressure) for 6 to 24 hours test holding duration under field / site conditions. The valve's obturator shall be kept in either partial or full open condition for entire test duration and test medium will be non-corrosive water. Successful bidder shall be liable for repair/ replacement of valve if found faulty during site hydro test at his risk & cost. All cost for associated activities like packaging, transportation etc. in connection to repair / replacement of valve shall be borne by the successful bidder. No claim shall be entertained by the Owner / Purchaser in this regard.
- 15.0** Valve manufacturer to note that packing & transportation of the valves shall be done strictly as per attached technical specification for handling and transportation.
- 16.0** Valve manufacturer to note that the entire ordered quantity shall be offered for MECON's inspection as per following table. In case no. of visits of MECON engineer become more

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than as specified in table below for complete order quantity, vendor shall bear the touring expenditure of MECON engineers as per company rules. MECON reserves the right to waive off this requirement in case of project exigencies.

S.No.	Size	Minimum Quantity for one lot
1	30" and higher	Upto 5 valves
2	16" to 28"	Upto 8 valves
3	8" to 14"	Upto 20 valves
4	3/4" to 6"	Upto 200 valves

In case of any multiple of the ordered quantity the no. of valves shall be divided by quantity specified for one lot in above mentioned table to arrive at the no. of lots. No. of lots shall be determined by rounding off to next integer.

17.0 Valve manufacturer to note that TPI inspection is either to be conducted before MECON inspection or in parallel. In no case TPI inspection shall be permitted after MECON inspection. For the valves where MECON inspection extent is 100% witness, TPI inspection maybe allowed in parallel with MECON. However, for valves requiring 10% MECON witness inspection, vendor has to finish TPI inspection before raising call and upload TPI inspection report in Inspection Management System of MECON.

18.0 Extent of MECON witness during final inspection shall be as follows:

Sl. No.	Size range	Class	Mecon Inspection extent
1.	2" to 8"	150	10% random witness and document review for 100% valves.
2.	10" and more	150	100% witness.
3.	2" to 6"	300 and higher	10% random witness and document review for 100% valves.
4.	8" and more	300 and higher	100% witness.
5.	Below 2"	All classes	10% random witness and document review for 100% valves.

19.0 Strip Test: Valve manufacturer need to demonstrate strip test of bolted body ball valves. For this test one valve of each ordered type, size and rating shall be selected at random after successful hydro and pneumatic tests by TPI & MECON inspector. The valve shall be dismantled completely. Alloy steel parts shall be checked for compliance to relevant material code using Positive material identification technique. Selected valve(s) shall then be re-assembled after replacing sacrificial parts like gasket & O-rings and complete final inspection as per approved QAP shall be carried out once again to ensure the repeatability of body seals and seats.

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STANDARD TECHNICAL SPECIFICATION FOR BALL VALVES

SPECIFICATION NO.: MEC/TS/05/21/002



**(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

PREPARED BY:	CHECKED BY:	APPROVED BY:	ISSUE DATE :

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AMENDMENT STATUS

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Rev.	Date	By		Verified	
					Name	Sig.	Name	Sig.
1.	Cl. No. 4.6	4	1	April 09	Gurdeep Singh		K.K. De	
2.	Overall Revision	All	1	July 20	K.P. Singh		A.K. Tyagi	

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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
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

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1.0 **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 ANSI pressure rating class 150 to 900 to be used in on-shore pipeline systems handling non-sour hydrocarbons in liquid or gaseous phase, including Liquefied Petroleum Gas (LPG).

This specification does not cover ball valves for sour hydrocarbon (liquid / gas) service as defined in NACE standard MR-01-75.

2.0 **REFERENCE DOCUMENTS**

2.1 All valves shall be manufactured and supplied in accordance with the latest edition of American Petroleum Institute (API) Specification 6D / ISO 14313, 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 of the following Codes, Standards and Specifications:

ASME B 16.5	:	Pipe flanges and flanged fittings
ASME B 16.10	:	Face-to-face and end-to-end dimensions of valves
ASME B 16.25	:	Butt welding ends
ASME B 16.34	:	Valves – flanged, threaded and welding ends
ASME B16.47	:	Large diameter steel flanges
ASME B 31.3	:	Process piping
ASME B 31.4	:	Pipeline transportation systems for liquid hydrocarbons and other liquids
ASME B 31.8	:	Gas transmission and distribution piping systems
ASME Sec VIII	:	Boiler and pressure vessel code - Rules for construction of pressure vessels
ASME Sec IX	:	Boiler and pressure vessel code - Welding and brazing qualifications
ASTM A 370	:	Standard test methods and definitions for mechanical testing of steel products
ASTM B 733	:	Autocatalytic nickel phosphorous coating on metals
API 6FA	:	Fire test for valves

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API 607	:	Fire test for soft-seated quarter-turn valves
API 1104	:	Welding of pipelines and related facilities
BS EN ISO 10497	:	Testing of valves – Fire type-testing requirements
MSS-SP-6	:	Standard finishes for contact faces of pipe flanges and connecting-end flanges of valves and fittings
MSS-SP-44	:	Steel pipeline flanges
SSPC-VIS-1	:	Steel structures painting council-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 :

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

3.0 **MATERIALS**

3.1 Material for major components of the 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 Data Sheet) and shall be subject to approval by Purchaser. In addition, the material shall also meet the requirements specified hereinafter.

3.2 Carbon steel used for 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 Purchaser, shall not exceed 0.43% (as calculated by the following formula) on check analysis for each heat of steel used:

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

3.4 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 Clause 8.5, for all pressure containing parts such as body, end flanges and welding ends as well as bolting material for pressure containing parts. Unless stated otherwise, the Charpy V-notch test shall be conducted at 0 °C. Test procedure shall conform to ASTM A370. The average absorbed energy value of three full sized specimens shall be 27 J. The

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minimum impact energy value for any one specimen of the three specimens analysed as above, shall not be less than 22 J.

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 For all such valves where carbon steel is used as ball material, the ball shall have 75 micrometer (0.003 inch) thick Electroless Nickel Plating (ENP) as per ASTM B733 with following classification : SC2, Type II, Class 2. The hardness of plating shall be minimum 50 RC.
- 3.6 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.
- 3.7 All process-wetted parts, metallic and non-metallic, shall be suitable for the fluids and service specified by the Purchaser. The service gas composition shall be as given elsewhere in the Material Requisition. In addition, Manufacturer shall confirm that all wetted parts are suitable for treated water / seawater environment, which may be used during field testing.
- 3.8 Non-metallic parts of the valves (including O-rings, soft seal etc.) intended for hydrocarbon gas service at pressures of PN 100 (600 #) and above shall be resistant to explosive decompression.

4.0 **DESIGN AND CONSTRUCTION**

- 4.1 Valve design shall meet the requirements of API 6D and other referred codes and shall be suitable for the service conditions indicated in Valve Data Sheet. The ASME Boiler & Pressure Vessel Code, Section VIII, Division 1, may be used to design the valve body. Allowable stress requirements shall comply with the provisions of ASME B31.3. In addition, 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 a valid license to use API 6D monogram for manufacture of ball valves.
- 4.2 For above ground valves, valve body design shall be either fully welded or bolted type, as indicated in Valve Data Sheet. Valve body joints with threads are not permitted.
- For buried valves, valve body design shall be fully welded type only. Valve body joints with bolts or threads are not permitted.
- 4.3 Ball shall be of single piece, solid type construction.

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- 4.4 Valves shall be Full Opening (FO) or Reduced Opening (RO) as indicated in Valve Data Sheet. FO valves shall be suitable for the passage of all types of pipeline scraper and inspection pigs on regular basis without causing damage to either the valve component or the pig. The FO valve shall provide an unobstructed profile for pigging operations in either direction. FO valves shall be designed to minimize accumulation of debris in the seat ring region to ensure that valve movement is not impeded.

The opening size of RO valves shall be corresponding to that of a FO valve of smaller nominal diameter as indicated in table below. For sizes of a particular rating not covered in API 6D, the opening sizes of the RO valve shall be as per Manufacturer's standard.

Nominal Valve Size	Nominal Valve Size for Reduced Opening	Nominal Valve Size	Nominal Valve Size for Reduced Opening
DN mm (NPS inches)	DN mm (NPS inches)	DN mm (NPS inches)	DN mm (NPS inches)
50 (2)	50 (2)	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)		

- 4.5 Ball mounting shall be trunnion / pivot type or as indicated in Valve Data Sheet. Ball mounting, either trunnion or floating, unless otherwise specified, shall be as follows.

Sl. No.	ANSI Pressure Rating	Nominal Valve Size (NPS inches)	
		Floating Ball	Trunnion Mounted
1.	150#	$\leq 8"$	$> 8"$
2.	300#	$\leq 4"$	$> 4"$
3.	600#	Nil	$\geq 2"$

Valve design shall minimize the possibility of debris ingress into the trunnion as far as practicable.

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- 4.6 Valve seats shall have metal to metal contact. O-rings or other seals, if used for drip tight sealing, shall be encased in a suitable groove in such a manner that it can not 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 have double block and bleed feature to facilitate complete flushing, draining and venting of the valve body cavity.
- 4.8 For valves to be used in liquid service, the body cavity over-pressure shall be prevented by self relieving seat rings / assemblies. A pressure relief hole in the ball is not permitted. Self relieving seat rings shall relieve at a body cavity differential pressure not exceeding 50% of the valve class rating pressure.
- 4.9 Valves shall be designed to withstand a sustained internal vacuum of at least 1 (one) milli-bar in both open and closed positions.
- 4.10 FO valves of nominal size DN 200 mm (8") & above and RO valves of nominal 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 a needle valve, a grease fitting and 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 Figure-1.
- 4.11 Valves shall be provided with vent and drain connections. Location and arrangement of vents and drains shall be as per Figure-1. Body vent and drain shall be provided with valves (ball or plug type). Number and size shall be as per Figure-1.
- 4.12 Valve design shall ensure repair of stem seals / packing under full line pressure.
- 4.13 a) Valve ends shall be either flanged or butt welded or one end flanged and one end butt welded as indicated in Valve Data Sheet. Flanges of the flanged end cast/ forged body valves shall be integrally cast / forged with the body of 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 Purchaser.
- b) Flanged ends shall have flanges as per ASME B16.5 for valve sizes up to DN 600 mm (24 inches) excluding DN 550 mm (22 inches) and as per MSS-SP-44 / ASME B 16.47 series A for valve sizes DN 550 mm (22 inches) & 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. Smooth finish when specified shall be 125 to 200 microinches AARH. In case of RTJ flanges, the groove hardness shall be minimum 140 BHN.

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- c) Butt weld end preparation shall be as per ASME B16.25. The thickness of the pipe to which the valve has to be welded shall be as indicated in Valve Data Sheet. Valves shall be without transition pups, unless otherwise specified in Valve Data sheet. In case significant 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.

4.14 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) are 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.

4.15 Valves shall be provided with ball position indicator and stops of rugged construction at the fully open and fully closed positions.

4.16 FO valves of nominal size $\geq$ DN 200 mm (8") and RO valves of nominal size $\geq$ DN 250 mm (10") shall be equipped with support foot and lifting lugs. Tapped holes and eye bolts shall not be used for lifting lugs. Height of support foot shall be kept a minimum. The location and size of support foot / lifting lugs shall ensure unrestrictive operation of vent / drain valves.

4.17 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.

4.18 Valves shall be of fire resistant design as per API 607/BS EN ISO 10497/API 6FA, as indicated in Valve Data Sheet.

4.19 Valves shall be provided with anti-static devices to ensure electrical continuity between stem / ball and valve body.

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

4.21 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) 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. Pipe used shall be API 5L Gr. B / ASTM A 106 Gr. B, with Sch. 80. Fittings shall be ASTM A 105 / ASTM 234 Gr. WPB, Socket Welded, ANSI class 6000.

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- c) Stem extension and stem housing design shall be such that the complete assembly will form a rigid unit giving a positive drive under all conditions with no possibility of free movement between valve body, stem extension or its operator.
- d) 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.

4.22 Operating Devices

- a) Valves shall have a power actuator or manual operator as indicated in Valve Data Sheet. In case of manual operator, valve sizes $\leq$ DN 100 mm (4 inches) shall be wrench operated and valve sizes $\geq$ DN 150 mm (6 inches) 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 Purchaser specification issued for the purpose and as indicated in 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 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 manual operator of all valves, the diameter of the hand wheel or the length of operating wrench shall conform to API 6D requirements and be such that under maximum differential pressure, the total force required to operate the valve does not exceed 350 N. 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.
- 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/ dust proof/ weather proof enclosure and shall be filled with suitable grease.
- f) Operating devices shall be designed for easy operation of the valve under maximum differential pressure corresponding to the valve rating.

4.23 All welds shall be made by welders and welding procedures qualified in accordance with the provisions of ASME Section IX. The procedure qualification shall include impact test and hardness test and shall meet the requirements of clauses 3.4 and 3.6 of this specification, respectively.

4.24 All welds shall be stress relieved in accordance with ASME Section VIII.

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4.25 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 and shall meet the requirements of clauses 3.4 & 3.6 of this specification, respectively.

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

4.27 When indicated in Material Requisition, valves shall have locking device 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.

4.28 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 I. In case of 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.

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:

5.1.1 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.

5.1.2 Dimensional check on all valves shall be carried out as per the Purchaser approved drawings.

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

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

- a) Body castings of all valves shall be radiographically examined on 100% of the surface of critical areas as per ASME B16.34. Procedure and acceptance criteria shall be as per ASME B16.34. The extent of radiography shall be as follows:

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ANSI Pressure Rating	Valve Size	Extent of Radiography
150 #	All sizes	Nil
300 #	≤ DN 400mm (16") ≥ DN 450mm (18")	Nil 100%
≥ 600 #	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 valves, with body fabricated from plates or made by forgings, shall be ultrasonically examined in accordance with the procedure and acceptance standard of Annexure E of ASME B16.34.

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

- 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 clause 5.1.4 a) for cast components or clause 5.1.4 b) for forged components and plates.

5.1.5 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.

5.1.6 Welds, which in Purchaser'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 Section VIII, Division 1, Appendix 12 and Appendix 6, respectively.

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

- b) 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.

- c) 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 defects between 6.35 mm and 1.59mm 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.

5.1.8 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

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either included in the hydrostatic shell test or tested independently. Test pressure shall be held for at least 30 minutes. No leakage is permissible during hydrostatic testing. The body cavity self-relieving feature meeting the requirements of clause 4.8 of this specification shall also be checked.

5.1.9 A supplementary air seat test as per API 6D (Annex B, Clause B.3.3, Type II) shall be carried out for all valves. A bubble tight seal is required without the use of any sealant. No leakage is allowed. Test pressure shall be held for at least 15 minutes.

5.1.10 Manufacturer who intends bidding, must submit at bid stage, certificate and report for successful fire type-tests for valves in accordance with API-607/ BS EN ISO 10497 / API 6FA, as applicable in Valve Data Sheet.

Failure to comply with this requirement shall be a cause of rejection of the Bidder's offer.

5.1.11 Valves shall be subjected to Operational Torque Test as per API 6D (Annex B, Clause B.6) under hydraulic pressure equal to maximum differential pressure corresponding to the valve pressure class rating.

For manual operator of all valves, it shall be established that the force required to operate the valve does not exceed the requirements stated in clause 4.22(c) of this specification.

5.1.12 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 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 times are within the limits stated in Actuator Data Sheet issued for the purpose.

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 Purchaser's Inspector.

5.1.13 Subsequent to successful testing as specified in clause 5.1.11 and 5.1.12 above, one (1) valve out of the total ordered quantity shall be randomly selected by the Purchaser's Representative for cyclic testing as mentioned below :

- The valve shall be subjected to at least 100 Open-Close-Open cycles with maximum differential pressure corresponding to the valve rating.
- Subsequent to the above, the valve shall be subjected to hydrostatic test and supplementary air seat test in accordance with clause 5.1.8 and 5.1.9.

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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.

5.1.14 Checks shall be carried out to demonstrate that the dissimilar metal used in the valves are successfully insulated as per the requirement of clause 4.17 of this specification.

5.1.15 When indicated in Valve Data Sheet, valves shall be subjected to anti-static testing as per supplementary test requirement of API 6D (Annex B, Clause B.5).

5.2 Purchaser 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 Purchaser's Inspector.

Purchaser 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 Purchaser or his Inspector relieve the Manufacturer of his responsibility for material, design, quality or operation of valves.

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

6.0 **EXTENT OF INSPECTION & TESTING**

6.1 Purchaser's Inspector shall perform inspection and witness tests on all valves or as indicated in the Quality Assurance Plan (QAP) attached with this specification.

6.2 The hydrostatic testing and cyclic opening and closing of the valves with the operator shall be witnessed by Purchaser's Inspector.

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7.0 **TEST CERTIFICATES**

7.1 Manufacturer shall submit the following certificates:

- a) Mill test certificates relevant to the chemical analysis and mechanical properties of the materials used for valve construction as per the relevant standards.
- b) Test certificates of hydrostatic and pneumatic tests complete with records of timing and pressure of each test.
- c) Test reports on radiograph and ultrasonic inspection.
- d) Test report on operation of valves conforming to clause 5.1.11, 5.1.12 and 5.1.13 of this specification.
- e) All other test reports and certificates as required by API 6D and this specification.

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

8.0 **PAINTING, MARKING & SHIPMENT**

- 8.1 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 valves to be installed underground, when indicated in Valve Data Sheet, the external surfaces of the buried portion of valves shall be painted with three coats of suitable coal tar epoxy resin with a minimum dry film thickness of 300 microns.
- 8.2 Manufacturer shall indicate the type of corrosion resistant paint used, in the drawings submitted for approval.
- 8.3 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.
- 8.4 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.
- 8.5 All sealant lines and other cavities of the valve shall be filled with sealant before shipment.

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8.6 Packaging and shipping instructions shall be as per API 6D.

8.7 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 & 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.

9.3 Manufacturer shall quote for spares & accessories as per Material Requisition.

10.0 **DOCUMENTATION**

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

- a) General arrangement / assembly drawings showing all features and relative positions and sizes of vents, drains, gear operator / actuator, painting, coating and other external parts together with overall dimensions as well as weights of valve & actuator.
- b) Sectional drawing showing major parts with reference numbers and material specification. In particular, a blow-up drawing of ball-seat assembly shall be furnished complying the requirement of clause 4.6 of this specification.
- c) Reference list of similar ball valves manufactured and supplied in last five years indicating all relevant details including project, year, client, location, size, rating, service, etc.
- d) Torque curves for the power actuated valves along with the 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.

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- 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.
- i) List of recommended spares required during start-up and commissioning.
- j) List of recommended spares required for 2 years of normal operation and maintenance.
- k) Other documents / drawings / data as per Material Requisition.

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 Purchaser's final approval :

- a) Detailed sectional arrangement drawings showing all parts with reference numbers and material specifications as referred to in clause 10.1 above.
- b) Assembly drawings with overall dimensions and features. Drawing 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 and the painting scheme. Complete dimensional details of support foot (where applicable) shall be indicated in these drawings as referred to in clause 10.1 above.
- c) Welding, heat treatment and testing procedures.
- d) Procedure for cyclic testing.
- e) Details of corrosion resistant paint to be applied on the valves.
- f) Design calculation for pressure containing parts.
- g) Other documents / drawings / data as per Material Requisition.

Manufacture of valves shall commence only after approval of the documents indicated in clause 10.2a) to 10.2c) above. Once approval has been given by Purchaser, any changes in design, material and method of manufacture shall be notified to Purchaser whose approval in writing of all changes shall be obtained before the valve is manufactured.

10.3

Within 2 weeks from the approval date, Manufacturer shall submit to Purchaser six copies of the approved drawings, documents and specifications as listed in clause 10.2 above.

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10.4 Prior to shipment, Manufacturer shall submit six hard copies and six soft copies (on CD-ROMs) of the following:

- a) Test certificates as per clause 7.0 of this specification.
- b) Manual for installation, erection, maintenance and operation instructions, including a list of recommended spares for the valves.
- c) Other documents / drawings / data as per Material Requisition.

10.5 All documents shall be in English language.

10.6 **The above documents & data requirements shall also be supplemented by all requirements of clause 2.0 of the Material Requisition.**

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.

TITLE

BALL VALVE

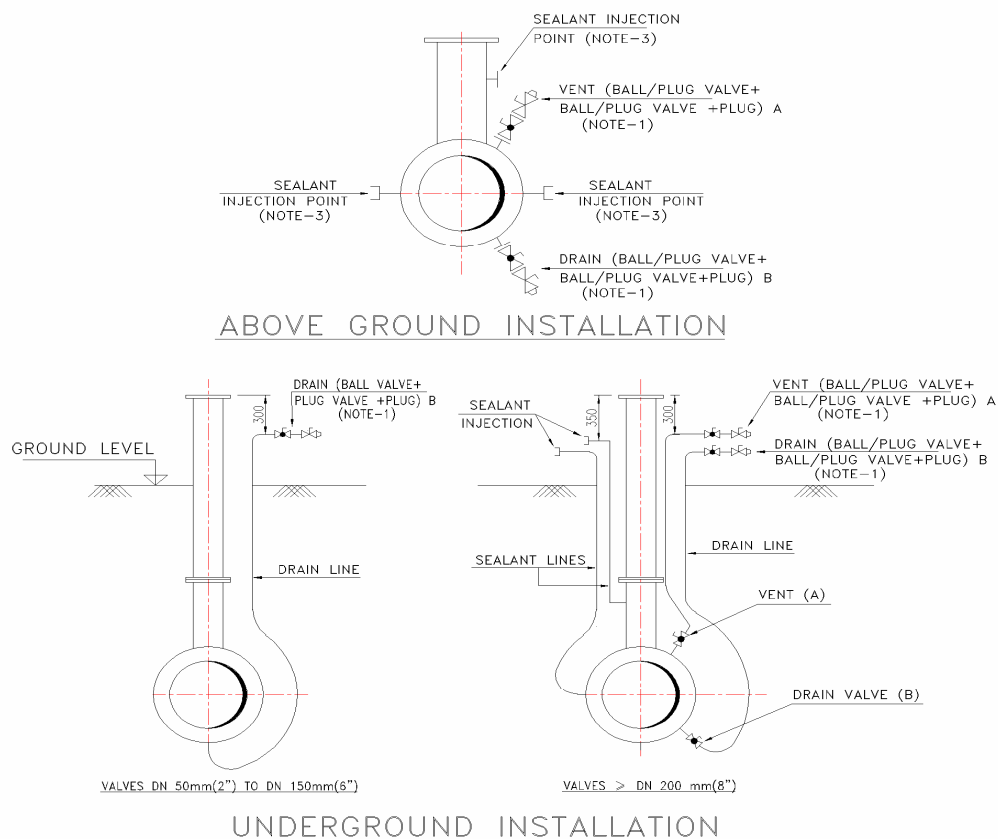
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SIZES OF VENT & DRAIN CONNECTIONS		
NOM. VALVE SIZE	A, DN(mm)	B, DN(mm)
50 TO 150	—	15
200 TO 600	15	25
750 & ABOVE	15	50 (REFER NOTE-2)

LEGEND:

 BALL VALVE
 PLUG VALVE
 PLUG

NOTES:

1. ALL VALVES (BALL OR PLUG) AND PLUGS FOR A AND B SHALL BE APPROVED BY THE PURCHASER.
2. VALVES OF SIZE 50mm SHALL BE MANUFACTURED AS PER API-6D.
3. SEALANT INJECTION POINTS SHALL BE PROVIDED FOR FULL OPENING VALVES OF NOMINAL VALVE SIZE 200mm (8") & ABOVE AND REDUCED OPENING VALVES OF NOMINAL VALVE SIZE, DN 250mm (10") AND ABOVE ONLY.
3. IN BURIED SECTION, ALL VENT & DRAIN CONNECTION SHALL BE OF WELDED CONSTRUCTION.

FIGURE—1

VENT, DRAIN & SEALANT INJECTION DETAILS

PROCESS & PIPING DESIGN SECTION
MECON LIMITED



DELHI - 110 092

TECHNICAL SPECIFICATION
FOR
PLUG VALVES
(NB $\geq$ 2")

SPECIFICATION NO.: MEC/TS/05/62/003, Rev-2

MECON LIMITED Delhi	PROCESS & PIPING DESIGN SECTION	TECHNICAL SPECIFICATION FOR PLUG VALVES	
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PREPARED BY : Gurdeep Singh Date	CHECKED BY : A.K. Sarkar Date	APPROVED BY : A.K. Johri Date

MECON LIMITED Delhi	PROCESS & PIPING DESIGN SECTION	TECHNICAL SPECIFICATION FOR PLUG VALVES	
TECHNICAL SPECIFICATION NO. : MEC/TS/05/62/003		REV-2	Page 2 of 13

1.0 **SCOPE**

This specification covers the minimum requirements for design, manufacture and supply of carbon steel plug valves of size DN 50mm (2") and above and ANSI Class 150# thru 900# for use in onshore pipeline systems handling non sour hydrocarbons in liquid phase 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 Twenty Second Edition, January, 2002, or the latest edition of American Petroleum Institute (API) Specification 6D, twenty first edition, 1994 including supplement 1 & 2 thereof 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 of the following Codes, Standards and Specifications :

ASME B 16.5	:	Pipe flanges and flanged fittings
ASME B 16.25	:	Buttwelding ends
ASME B 16.34	:	Valves – Flanged, threaded and welding end
ASME B16.47	:	Large diameter steel flanges
ASME B 31.3	:	Chemical & process plant piping system
ASME B 31.4	:	Liquid transportation systems for hydrocarbons and other liquids
ASME B 31.8	:	Gas transmission and distribution piping systems
ASME Sec.VIII	:	Boiler and pressure vessel code
ASTM A 370	:	Standard test methods and definitions for mechanical testing of steel products
ASTM B 733	:	Autocatalytic nickel phosphorous coating on metals
API 6FA	:	Fire test for valves
API 1104	:	Welding of pipelines and related facilities
BS:6755 (Part-II)	:	Testing of valves – Specification for fire type - testing requirements
MSS-SP-6	:	Standard finishes for contact faces of pipe flanges and connecting-end flanges of valves and fittings

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MSS-SP-44 : Steel pipeline flanges

SSPC-VIS-1 : Steel structures painting council-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 & TEST PROCEDURES**

3.1 Material for major components of the valves shall be as indicated in Valve Data Sheet. Other components shall be as per Manufacturer's standard which will be subject to approval by Purchaser.

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

3.3 Chemical composition (check analysis) of valve end connection which are subject to further welding by Purchaser shall meet the following requirements for each heat of steel used:

a)	Carbon	:	0.22% (max.)
b)	Manganese	:	1.70 % (max.)
c)	Silicon	:	0.55 % (max.)
d)	Phosphorus	:	0.030 % (max.)
e)	Sulphur	:	0.030 % (max.)

Total percentage of Vanadium, Niobium and Titanium shall not exceed 0.20. Residual elements shall not exceed the following limits :

a)	Nitrogen	:	0.019 %
b)	Nickel	:	0.30 %
c)	Copper	:	0.20 %
d)	Aluminum	:	0.070 %
e)	Chromium	:	0.15 %
f)	Molybdenum	:	0.05 %

Carbon equivalent (CE) as calculated by the following shall not exceed 0.45%.

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

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- 3.4 For valves specified for Gas Service or high vapour pressure liquid 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 the bolting material for pressure containing parts. Unless specified otherwise in Valve Data Sheets, the Charpy impact test shall be conducted at 0°C. The Charpy impact test specimen shall be taken in the direction of principal grain flow and notched perpendicular to the original surface of plate or forging.

Unless specified otherwise in Valve Data Sheets, the minimum average absorbed energy per set of three specimens shall be 27 J with an individual minimum per specimen of 22 J.

- 3.5 For valves specified for Gas Service or high vapour pressure liquid service, the hardness of base material of body and principal parts of the valve such as plug, stem, etc., shall not exceed 22 RC.

- 3.6 Plug for valve size DN 200mm (8") and above or as specified in Valve Data Sheets shall have Electroless Nickel Plating (ENP) or equivalent. 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.

- 3.7 All process-wetted parts, metallic and non-metallic, shall be suitable for the fluids and service specified by the Purchaser. The service gas composition when applicable shall be as given in Annexure-I.

4.0 **DESIGN & CONSTRUCTION**

- 4.1 The Manufacturer shall have a valid license to use API 6D monogram for manufacture of Plug Valves.

- 4.2 Valve pattern shall be short, regular or venturi as specified in the following table:

Class	Size Range, NB mm (inch)	Pattern
150	50-100 (2-4)	Short
	150-300 (6-12)	Regular
	350 (14) & above	Venturi
300	50-100 (2-4)	Short
	150-250 (6-10)	Regular
	300 (12) & above	Venturi
600	50-250 (2-10)	Regular
	300 (12) & above	Venturi
900	50-250 (2-10)	Regular
	300 (12) & above	Venturi

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- 4.3 Valve shall have an inherent feature using line pressure to ensure that the line pressure cannot cause taper locking of the plug/ plug movement into taper i.e. valves shall be of pressure balanced design.
- 4.4 Cover shall be bolted to the body and screwed connections are not acceptable.
- 4.5 Soft seats to achieve a seal between plug and body are not permitted.
- 4.6 All valves shall have provisions for secondary sealant injection under full line pressure for seat and stem seals. Sealant injection points shall be provided with a ball type check valve or needle valve to replace the sealant injection fitting under full line pressure.
- 4.7 Valves shall have vent and drain connections as per API 6D.
- 4.8 When specified in the Valve Data Sheet, valves shall be designed to withstand a sustained internal vacuum of at least one milli-bar in both open and closed position.
- 4.9 Valve design shall ensure repair of gland packing under full line pressure.
- 4.10 a) Valve ends shall be either flanged or butt welded or one end flanged and one end butt welded as indicated in Valve Data Sheet. Flanges of the flanged end cast/ forged body valves shall be integrally cast/forged with the body of valve. Face-to-face/ end-to-end dimensions shall conform to API 6D.
- b) Flanged end shall have dimensions as per ASME B16.5 for valve sizes upto DN 600mm (24 inches) excluding DN 550mm (22 inches) and as per MSS-SP-44 for valve sizes DN 550mm (22 inches) & for DN 650mm (26 inches) and above. Flange face shall be either raised face or ring joint type as indicated in Valve Data Sheet. Flange face finish shall be serrated or smooth as indicated in Valve Data Sheet. Smooth finish when specified shall be 125 to 200 AARH. In case of RTJ flanges, the groove hardness shall be minimum 140 BHN.
- c) Butt weld end preparation shall be as per ASME B16.25. The thickness of the pipe to which the valve has to be welded shall be as indicated in Valve Data Sheet. Valves shall be without transition pups. In case significant 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.
- 4.11 Valves shall be provided with position indicator and stops at the fully open and fully closed positions.
- 4.12 Valves of size DN 200mm (8") and above shall be equipped with lifting lugs. Tapped holes and eye bolts shall not be used for lifting lugs.
- 4.13 Valves shall have locking devices to be locked either in full open or full close position when indicated in the Valve Data Sheets. Locking devices shall be permanently attached to the valve operator and shall not interfere with operation of the valve.

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4.14 Valves shall be of fire safe design as per BS:6755 (Part-II)/ API 6FA, if indicated in Valve Data Sheet.

4.15 Valves shall be suitable for either buried or above ground installation as indicated in the Valve Data Sheet.

4.16 Valves with stem extension, when indicated in Valve Data Sheet shall have following provisions :

- a) Valves provided with stem extension shall have water proof outer casing. Length of stem extension shall be as indicated in the Valve Data Sheet. The length indicated corresponds to the distance between the centreline of the valve opening and the top of the mounting flange for valve operating device (gear operator/ power actuator as applicable).
- b) Vent and drain connections shall be terminated adjacent to the valve operator by means of suitable piping anchored to the valve body. Pipe used shall be API 5L Gr. B/ ASTM A106 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 a positive drive under all conditions with no possibility of free movements 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.

4.17 **Operating Devices**

- a) Valves shall have a power actuator or manual operator as indicated in the Valve Data Sheet. Manual operated valves of size $\leq$ DN 100mm (4") shall be wrench operated and valves of sizes $\geq$ DN 150mm (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 damaged parts can be replaced without the bonnet being removed.
- b) The power actuator shall be in accordance with the 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 torque shall be atleast 1.25 times the maximum torque required to operate the valve under maximum differential pressure corresponding to the valve class rating.
- c) Operating device shall be designed for easy operation of valve under maximum differential pressure corresponding to the valve rating.

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- d) For manual operation of all valves, the diameter of the hand wheel or the length of operating lever shall be such that under the maximum differential pressure, the total force required to operate the valve does not exceed 350 N. Manufacturer shall also indicate the number of turns of hand wheel (in case of gear operator), required to operate the valve from full open to full close position.
- e) 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.
- f) Gear operators, if specified, shall have a self locking provision and shall be fully encased in waterproof/ dustproof/ weatherproof/ splashproof enclosure and shall be filled with suitable grease.

4.18 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. 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 3.6 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.

4.20 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 the valves stem.

5.0 **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 :

5.1.1 All valves shall be visually inspected.

5.1.2 Dimensional check shall be carried out as per the Purchaser approved drawings.

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

5.1.4 a) 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.

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- b) Valves castings shall be radiographically examined at the cover and body portion, seat location, flanged body ends and circumference of ends to be field welded. Procedure and acceptance criteria shall be as per ASME B16.34. The extent of radiography shall be as follows :

ANSI Class 150-	All Sizes	-	Nil
ANSI Class 300-	≤ DN 400mm (16")	-	Nil
	≥ DN 450mm (18")	-	100%
ANSI Class 600- and above	All Sizes	-	100%

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

- c) Valve forgings shall be examined by ultrasonic method. Inspection procedure and acceptance criteria shall be as per Annexure E of ASME B16.34.

5.1.5 Areas which, in Purchaser's Inspector'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 I, Appendix 12 and Appendix 6 respectively.

- 5.1.6
- Weld ends of all cast valves 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 penetrant, or wet magnetic particle methods. Any defects longer than 6.35mm shall be rejected and also defects between 6.35mm and 1.59mm that are separated by a distance less than 50 times their greatest length. Weld repair of bevel surface is not permitted. Rejectable defects must be removed.
 - All finished wrought weld ends subject to welding in the field shall be 100% ultrasonically tested for lamination type defects for a distance of 50mm from the end. Laminations shall not be acceptable.

5.1.7 All valves shall be tested in compliance with the requirements of 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. No leakage is permissible during hydrostatic testing.

5.1.8 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.

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5.1.9 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.

5.1.10 Valve shall be subjected to Operational Torque Test as per supplementary test requirement of API 6D under hydraulic pressure equal to the maximum differential pressure corresponding to the valve rating. The maximum handwheel force shall not exceed 350 N.

5.1.11 Power actuated valves shall be tested after assembly at the valve Manufacturer's works. Actuator shall be capable to allow minimum five consecutive "opening" and "closing" cycles. To achieve this, the Manufacturer shall provide "closing" and "opening" operations. This test shall be conducted on one valve out of a lot of five valves of the same size, rating and actuator type. In case the test result dose not meet the requirements, retesting/ rejection of the lot shall be as decided by Purchaser's Inspector.

The actuator shall be adjusted to ensure that opening and closing time is within the limits stated in Actuator Data Sheet issued for the purpose.

The hand operator installed on the actuator shall also be checked after the cyclic testing, for satisfactory manual over-ride performance.

5.2 Purchaser reserves the right to perform stagewise inspection and witness tests as indicated in para 5.1 at Manufacturer's works prior to shipment. Manufacturer shall give reasonable access and facilities required for inspection to Purchaser's Inspector.

Purchaser reserves the right to request additional testing at any time to confirm or further investigate a suspected fault. If the suspected fault is confirmed, the cost incurred shall be to Manufacturer's account.

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

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

6.0 **EXTENT OF INSPECTION & TESTING**

6.1 Purchaser's Inspector shall perform inspection and witness test on all valves as indicated in the Quality Assurance Plan (QAP) attached with this specification.

6.2 The hydrostatic testing and cyclic opening and closing of the valves with the operator shall be witnessed by Purchaser's Inspector.

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7.0 **TEST CERTIFICATES**

7.1 Manufacturer shall submit the following certificates :

- a) Mill test certificates relevant to the chemical analysis and mechanical properties of the materials used for valve construction as per the relevant standards.
- b) Test certificates on hydrostatic and pneumatic test complete with records of timing and pressure of each test.
- c) Test reports conforming to clause 5.1.9 of this specification, if applicable.
- d) Test reports on radiographic and ultrasonic inspection.
- e) Test reports on operation of valves conforming to clause 5.1.10 and 5.1.11 of this specification.
- f) All other test reports and certificates as required by API 6D and this specification.

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

8.0 **PAINTING, MARKING & SHIPMENT**

- 8.1 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, external surfaces of the buried portion of valves shall be painted with three coats of suitable coal tar epoxy resin with a minimum dry film thickness of 300 microns.
- 8.2 Manufacturer shall indicate the type of corrosion resistant paint used, in the drawings submitted for approval.
- 8.3 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.
- 8.4 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 bevel protectors.

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8.5 All sealant lines and other cavities of the valves shall be filled with sealant before shipment.

8.6 Packaging and shipping instructions shall be as per API 6D.

8.7 Packages shall be marked legibly, with suitable marking ink, the following.

- a) Order Number
- b) Manufacturer's Name
- c) Valve Size and Rating
- d) Tag Number
- e) Serial Number

9.0 **SPARES & ACCESSORIES**

9.1 Manufacturer shall recommend and quote separately the spares for valves required for commissioning and two years of normal operation. List of such spares without price shall be indicated alongwith technical bid and separately with price.

9.2 Manufacturer shall recommend and quote unit price separately for the accessories (like wrench, sealant injector, etc.), sealant and special tools required for maintenance of valves.

10.0 **DOCUMENTATION**

10.1 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 alongwith 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.

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- 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.

IMPORTANT

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 :-

- a) Test 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.

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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.

PROCESS & PIPING DESIGN SECTION
MECON LIMITED
DELHI – 110 092



TECHNICAL SPECIFICATION
FOR
CHECK VALVES

SPECIFICATION NO. : MEC/TS/05/62/004, Rev-2

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PREPARED BY	CHECKED BY	APPROVED BY

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1.0 **SCOPE**

This specification covers the minimum requirements for design, manufacture and supply of carbon steel check valves of size DN 50mm (2") and above and ANSI class 150, 300 and 600 , for use in onshore pipeline systems handling non-sour hydrocarbons in liquid phase 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 latest edition of American Petroleum Institute (API) Specification 6D or 594 or British Standard BS:1868, with additions and modifications as indicated in the following sections of this specification.

For Contractual purpose, the edition in force at the time of floating of the enquiry shall be termed as "latest edition".

3.0 **MATERIALS**

3.1 Material for major components of the valves shall be as indicated in Valve Data Sheet. Other components shall be as per Manufacturer's standards which will be subject to approval by Purchaser.

3.2 Carbon steel used for 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 Purchaser, shall not exceed 0.45% (as calculated by the following formula) on check analysis for each heat of steel used :

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

3.4 Charpy V-Notch test on each heat of base material shall be conducted as per API 6D, clause 7.5, 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. The Charpy impact test specimen shall be taken in the direction of principal grain flow and notched perpendicular to the original surface of plate or forging.

The minimum average absorbed energy per set of three specimens shall be 27 J with an individual minimum per specimen of 22 J. No specimen shall exhibit less than 80 percent shear area.

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

4.0 **DESIGN AND CONSTRUCTION**

4.1 Following types of check valves, meeting the requirements of applicable standards (refer clause 2.1 of this specification) are acceptable :

- a) Swing check valve
- b) Dual plate check valve
- c) Axial flow (Nozzle) check valve

Valve design shall be suitable for the service conditions indicated in Valve Data Sheet. Corrosion allowance indicated in Valve Data Sheet shall be considered in valve design.

4.2 In case of swing check valves, the disc hinge shall be mounted on the valve body and shall not be attached to the valve body cover. Valve body cover joint shall be of bolted design. Screwed covers shall not be used.

4.3 Valves shall be provided with non-renewable integral type seats as indicated in Valve Data Sheet. Non-renewable seats shall be of a design which does not required renewal over the design life of the valve.

4.4 Valves shall be provided with drain connection as per the Manufacturer's standard. Drain tapping shall be provided in a position suitable to completely drain the valve with valve in horizontal position.

4.5 Valve ends shall be either flanged or butt welded or one end flanged and one end butt welded as indicated in Valve Data Sheet. Flanged end shall have dimensions as per ASME B16.5 for sizes upto DN 400mm (16"). Flanges of the flanged end cast body valves shall be integrally cast with the body of the valve.

4.6 Butt weld end preparation shall be as per ANSI B16.25. The thickness of the pipe to which the valve has to be welded shall be as indicated in Valve Data Sheet. Valves shall be without transition pups. In case difference exists between thickness of valve neck end and connecting pipe, the bevel end of valve shall be prepared as per ANSI B31.8 or ANSI B31.4, as applicable.

4.7 Valves of size DN 200mm (8") and above shall be equipped with lifting lugs. Tapped holes and eye bolts shall not be used for lifting lugs.

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4.8	An arrow indicating the direction of flow shall be embossed or cast on the body of all valves.																				
4.9	All welds shall be made by welders and welding procedures qualified in accordance with the provisions of ASME Section IX. The welding and repair welding procedure qualification shall include impact test and shall meet the requirements of clause 3.4 of this specification.																				
4.10	Repair by welding is permitted for cast body valves subject to written approval by Purchaser and shall be carried out as per ANSI B16.34. Repair shall be carried out before any heat treatment of casting is done.																				
5.0	<u>INSPECTION AND TESTS</u>																				
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 :																				
5.1.1	All valves shall be visually inspected.																				
5.1.2	Dimensional check on all valves shall be carried out as per the Purchaser approved drawings.																				
5.1.3	Chemical compositions and mechanical properties shall be checked as per relevant material standards and this specification, for each heat of steel used.																				
5.1.4	a) Where applicable, the body castings of valves shall be radiographically examined on 100% of the surface of critical areas as per ANSI B16.34. Procedure and acceptance criteria shall be as per ANSI B16.34. b) Where applicable, valve body made by forging and plate components shall be ultrasonically examined in accordance with procedure and acceptance standard of Annexure E of ANSI B16.34. c) The extent of radiography/ ultrasonic examination shall be as follows : <table><tr><td>ANSI class 150</td><td>-</td><td>All sizes</td><td>-</td><td>Nil</td></tr><tr><td>ANSI class 300</td><td>-</td><td>$\leq$ DN 400mm (16")</td><td>-</td><td>Nil</td></tr><tr><td></td><td></td><td>$\geq$ DN 450mm (18")</td><td>-</td><td>100%</td></tr><tr><td>ANSI class 600</td><td>-</td><td>All sizes</td><td>-</td><td>100%</td></tr></table>	ANSI class 150	-	All sizes	-	Nil	ANSI class 300	-	$\leq$ DN 400mm (16")	-	Nil			$\geq$ DN 450mm (18")	-	100%	ANSI class 600	-	All sizes	-	100%
ANSI class 150	-	All sizes	-	Nil																	
ANSI class 300	-	$\leq$ DN 400mm (16")	-	Nil																	
		$\geq$ DN 450mm (18")	-	100%																	
ANSI class 600	-	All sizes	-	100%																	

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5.1.5 All valves shall be tested in compliance with the requirements of applicable standard (refer clause 2.0).

5.2 Purchaser 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 Purchaser's Inspector.

Purchaser 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 Purchaser or its Inspector relieve the Manufacturer of his responsibility for material, design, quality or operation of valves.

Inspection and tests performed/ witnessed by the Purchaser'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 :

- 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) Hydrostatic test certificates complete with records of timing and pressure of each test.
- c) Test reports of radiograph and ultrasonic inspection, as applicable.
- d) All other test reports and certificates as required by applicable standard and this specification.

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

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7.0 **PAINTING, MARKING AND SHIPMENT**

- 7.1 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".
- 7.2 All valves shall be marked as per applicable standard. The units of marking shall be metric except nominal diameter which shall be in inches.
- 7.3 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.
- 7.4 Packaging and shipping instructions shall be as per applicable standard.
- 7.5 On packages, the following shall be marked legibly with suitable marking ink:
- Order Number
 - Manufacturer's Name
 - Valve Size and Rating
 - Tag Number

8.0 **SPARES AND ACCESSORIES**

- 8.1 Manufacturer shall recommend and quote separately the spares for valves required for commissioning and two years of normal operation.

9.0 **DOCUMENTATION**

- 9.1 At the time of bidding, Manufacturer shall submit the following documents :
- General arrangement drawings showing all features together with overall dimensions and actual valve bore size.
 - Sectional drawing showing major parts with reference numbers and material specification.

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- c) Details of corrosion resistant paint proposed to be applied.
- d) Reference list of similar supplies of check valves, including project, year, client, location, size, rating, services, etc. shall be furnished by the Manufacturer for the last three years. **(The valves shall be proven for service indicated in Valve Data Sheet).**

9.2 Within three weeks of placement of order, the Manufacturer shall submit four copies of, but not limited to, the following drawings, documents and specifications for Purchaser's approval.

- a) Detailed sectional drawings showing all parts with reference numbers and material specification.
- b) Assembly drawings indicating overall dimensions, features and painting scheme.

Once the approval has been given by Purchaser, any changes in design, material and method of manufacture shall be notified to Purchaser whose approval in writing of all changes shall be obtained before the valve is manufactured.

9.3 Within 30 days from the approval date, Manufacturer shall submit to Purchaser one reproducible and six copies of all approved drawings, documents and specifications as listed in clause 9.2 above.

9.4 Prior to shipment, Manufacturer shall submit to Purchaser one reproducible and six copies of the following :

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

9.5 All documents shall be in English language.

10.0 **GUARANTEE**

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

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- 10.2 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.
- 10.3 If valve defect or malfunctioning cannot be eliminated, Manufacturer shall replace the valve without delay,
- 10.4 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.
- 10.5 All expenses shall be to Manufacturer's account.

TECHNICAL NOTES FOR GATE & GLOBE VALVES

1.0 General

- 1.1 Valves shall be designed, manufactured, tested, inspected, marked and supplied as per the specifications, applicable design standards & codes and manufacturing standards (latest editions) as specified.
- 1.2 Material test certificates (Physical property, Chemical composition & Heat treatment report) of the pressure containing parts shall be furnished for the valves supplied. Material test certificates of other parts shall also be furnished for verification during inspection.
- 1.3 For heavy valves, provision for lifting shall be made by way of lugs, eyebolts, or similar standard devices.
- 1.4 Unless otherwise stated, all flanged valves shall have end flanges integral with valve body. Weld on flanges are not acceptable. Flange finish shall be serrated finish 250 AARH (250 AARH to 500 AARH) or 125 AARH (125 AARH to 250 AARH) or 63 MRH (32 AARH to 63 AARH) as per valve specification sheet.
- 1.5 For all weld end valves, with bevel end as per ANSI B 16.25, the bevel contour shall be as follows:

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

- 1.6 If an overlay weld-deposit is used for the body seat ring, seating surface, the seat ring base material shall be at least equal to the corrosion resistance of the materials of the shell.
- 1.7 For valve body/ bonnet, forging is acceptable where castings are specified but not vice versa.
- 1.8 Material of construction of yoke shall be as a minimum equivalent to body/ bonnet material.
- 1.9 Stem shall be forged or machined from a forged bar. Castings are not permitted except integral stem.
- 1.10 Stellite/ hard facing by deposition shall have minimum 1.6mm thickness. Renewable seat rings shall be seal welded.
- 1.11 Face to face dimension of flanged valves shall conform to ANSI B 16.10 to the extent covered. For valves not covered in the ANSI specification, Contractor shall furnish certified dimensional drawings.

- 1.12 Flange dimensions of steel, alloy steel and stainless steel flanged valves shall conform to ANSI B 16.5 for sizes up to 24" and API 605 for size 26" and above.
- 1.13 Flange dimensions for cast iron flanged valves shall conform to ANSI B 16.1 for size up to 24" class 125 and API 605 with flat face for sizes greater than 24".
- 1.14 Unless otherwise mentioned, various valves should conform to following standards / codes.
- | | | |
|------------------------------------|---|------------------|
| SW gate valves (1 1/2" and below) | : | API 602 |
| SW Globe valves (1 1/2" and below) | : | BS 5352 |
| Flanged gate valves | : | API 600 & API-6D |
| Flanged Globe valves | : | BS 1873 |
- 1.15 Wherever stellite is specified, it means facing of seat and disc are welded by Cr-Co-W alloy. Stellite facing shall maintain minimum hardness of 375 BHN at high temperature.
- 1.16 All weld end valves shall have bevel ends as per ANSI B 16.25.
- 1.17 If an overlay weld deposit is used for the body seat ring or seating surface, the seat ring base material shall be at least equal to corrosion resistance of the material of the shell.
- 1.18 By Pass
- Unless otherwise noted, by-pass requirement for gate valves shall be under -

150 Class	:	on sizes 26" and above
300 Class	:	on sizes 16" and above
600 Class	:	on sizes 6" and above
900 Class	:	on sizes 4" and above
1500 Class	:	on sizes 4' and above
2500 Class	:	on sizes 3" and above
 - By-pass valve shall be a globe valve.
 - Contractor shall supply the by-pass valve duly tested and fitted to 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.
- 1.19 Spiral wound bonnet gasket is to be provided with inner / outer ring except when encapsulated gaskets type body bonnet joints are employed. Outer ring may be avoided in case of non-circular spiral wound gasket used in 150# valve provided the outermost layer of spiral touches the bolts ascertaining the centering.
- 1.20 Pressure Test
- Valves covered under API codes shall be tested as per API 598 unless otherwise specified in the applicable valve code.
 - Valves covered under BS code shall be tested as per BS 6755 unless otherwise specified in the applicable valve codes.
- 1.21 For all austenitic stainless valves, inter-granular corrosion test shall have to be

conducted as per following: -

- ASTM A 262 Practice 'E' with acceptance criteria of "60 mils / year (max.)".
OR
- ASTM A 262 practice 'E' with acceptance criteria of "No cracks as observed from 20X magnification U & Microscopic structure to be observed from 250X magnification".

1.22 When specifically asked for high temperature application of some grades of austenitic stainless steel (like SS 309, 310, 316, 316H etc.) ASTM A 262 practice 'C' with acceptance criteria "15 MILS/YEAR" shall have to be conducted. When testing is conducted as per practice 'E' photograph of microscopic structure shall be submitted for record.

1.23 For the IGC test as described in 1.16.1 & 1.16.2 two sets of samples shall be drawn from each solution treatment lot, one set corresponding to highest carbon content and other set corresponding to the highest rating/ thickness.

2.0 **OPERATION**

2.1 Valves shall be supplied with gear operations based on the following requirements:

Valve Types	Class	Size Requiring Gear Operation
Gate & Diaphragm Valves	150	14" and larger
	300	14" and larger
	600	12" and larger
	900	6" and larger
	1500	3" and larger
	2500	3" and larger
Globe Valves	900	6" and larger
	1500	3" and larger
	2500	3" and larger

2.2 Gear operator shall be as under with position indicators for open / close positions, with limit stops.

For Gate / Globe / Diaphragm Valves	Totally enclosed bevel gear in grease case with grease nipples/ CHECK

2.3 Gear operators shall be so designed to operate effectively with the differential pressure across the closed valve equal to the cold non-shock pressure rating.

2.4 Hand wheel diameter shall not exceed 750 mm and effort to operate shall not exceed 35 kg at hand wheel periphery. In case these limits cannot be satisfied for any valve, a gear operation shall be provided.

3.0 **INSPECTION AND TESTING**

3.1 All the mandatory shop tests and inspection required by the respective data sheet and applicable standards & codes etc. shall be carried out.

3.2 The extent of inspection by shall be as under. However the exact extent with hold

points shall be decided during review of the inspection plan to be submitted to Company as part of the post-order documentation.

3.3 Valves under NACE should follow the requirements of MR-01-75

FORGED VALVES

- Visual and dimensional inspection
- Review of material test certificates
- Any mandatory or supplementary test
- Hydrostatic test of all valves
- Strip check on 1% of total ordered quantity of valves at random to verify compliance with specification requirements.

CAST STEEL VALVES

- Visual and dimensional inspection
- Review of material test certificates
- Review of radiographs / radiographic reports and reports of any other NDT tests, wherever applicable as per data sheets
- Any mandatory or supplementary tests
- Hydrostatic test 100% for body
- Strip check on 1% of total ordered quantity of valves at random to verify compliance with specification requirements.

3.4 For motor /actuator operated valves, functional / operational checks as per the requirements of the specifications shall be made on each valve.

4.0 **RADIOGRAPHY OF CAST VALVES**

4.1 When specifically not mentioned in individual data sheets, valves castings shall undergo radiographic examination as specified hereunder:

MATERIAL	RATING	SIZE RANGE	RADIOGRAPHY
All	150#	24" and below	Nil
	150#	26" and above	100%
	300#	16" and below	Nil
	300#	18" and above	100%
	600# and above	All sizes	100%

4.2 Radiography procedure areas of casting to be radiographed shall be as per ANSI B 16.34 and acceptance criteria shall be as per ANSI B 16.34 Annexure — B. However for areas of casting to be radiographed for types of valve not covered in ANSI B 16.34, Contractor shall enclose details of areas to be radiographed in line with ANSI B 16.34.

5.0 **IBR VALVES**

5.1 All valves described as "IBR Valves" shall be in accordance with the latest IBR (Indian Boiler Regulations) as well as the other requirements specified in the specification.

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

Carbon (Max.) : 0.25%

Others (S, B, Mn) : As per IBR

Above composition is not applicable for non-IBR valves.

5.3 For all "IBR Valves", test certificate in form III-C shall be furnished duly signed by IBR inspection authority or an IBR approved representative.

5.4 All valves shall be painted red.

6.0 **MARKING**

6.1 Valves markings, symbols, abbreviations, etc. shall be in accordance with MSS-SP-25 or the standard referred to in the specifications as applicable Manufacturer's name, valve size and rating, material designation, nominal size, direction of flow (if any) etc. shall be integral on the body.

6.2 Each valve shall have a corrosion resistant tag giving size and valve tag/code no. securely attached on the valve body.

6.3 Paint or ink used for marking shall not contain any harmful metal or metal salts such as zinc, lead or copper which may result in corrosive attack on heating.

6.4 Carbon steel valves shall be painted with two coats of red oxide zinc chromate primer.

6.5 All alloy steel high temp valves shall be painted with heat resistant silicone paint suitable for intended temperature.

7.0 **DESPATCH**

7.1 Valves shall be dry, clean and free from moisture, dirt and loose foreign material of any kind.

7.2 Valves shall be protected from rust, corrosion and any mechanical damage during transportation, shipment, and storage.

7.3 Rust preventative applied on machined surfaces to be welded shall be easily removable with a petroleum solvent or shall not be harmful to welding.

7.4 Each end of valves shall be protected as follows:

Flange Face	:	Wood, plastic or metal cover
Beveled End	:	Wood, plastic or metal cover
SW / Screwed End	:	Plastics cap

7.5 End protectors to be used on flange faces shall be attached by at least three bolts or wires through bolt holes and shall not be smaller than the outside diameter of the flange. Plastic caps for SW / Screwed and valves shall be press fit type.

7.6 End protectors to be used on beveled ends shall be securely attached.

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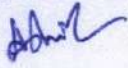
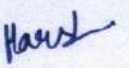
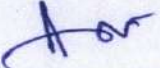
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			EDITION : 1

STANDARD TECHNICAL SPECIFICATION FOR PACKING, TRANSPORTATION AND HANDLING OF VALVES

SPECIFICATION NO.: MEC/TS/05/21/061



**(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

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AMENDMENT STATUS

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Rev.	Date	BY		Verified	
					Name	Sig.	Name	Sig.

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1.0 SCOPE

This specification covers the minimum requirements for Packing, Handling & transportation of valves and actuators. Though this specification covers the minimum requirement for packing, handling and transportation of valves, it is to be noted that any defect/ damage arising out of improper packing, handling & transportation shall be the responsibility of vendor. The delay due to rectification of such faults shall be to vendor's account. The date of delivery of material at site shall be considered as the day on which last such rectified material is delivered/ rectified at designated store.

2.0 PACKING

2.1 All valves shall be completely drained of test fluid and thoroughly dried after hydrotesting. The machined surfaces shall be coated with a light film of high viscosity rust inhibiting oil which will not become fluid and run off at temperatures below 80°C.

2.2 Flanged valves NPS 6" and smaller in Class 150 and Class 300 shall be fitted with UV resistant plastic covers. For other sizes, valve end flanges shall be fitted with plywood covers. The cover diameter shall be the same as the outside diameter of the flange and shall be at least 10 mm thick for valves up to NPS 24" and 12 mm thick for valves NPS 26" and larger. The cover shall be attached by machine bolts with a nut and washer fitted on the inside of the flange. There shall be minimum four (4) bolts on valves up to NPS 24" nominal size and eight (8) bolts on valves NPS 26 inch and larger. The bolts diameter shall not be less than ¼ the size of the flange bolt hole.

2.3 In addition to the above, all flange facings (ring joint, raised and flat) shall be covered with NBR (based) rubber Self-Adhesive protection (see fig below) that meets the following:

- ☐ ☐ Oil, ozone and weather resistant
- ☐ ☐ Minimum thickness of 1.5 mm
- ☐ ☐ Withstand temperatures up to 75°C
- ☐ ☐ Non deforming, loosening or detaching
- ☐ ☐ Proof against sand blasting
- ☐ ☐ No glue residue
- ☐ ☐ Chloride free

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- 2.4 Buttweld end valves shall be blanked on each end by high impact plastic bevel protectors, so that bevels are protected from possible mechanical damage during transportation.
- 2.5 The ends of threaded and socket weld end valves shall be protected with tight fitting plastic caps.
- 2.6 Packing shall be strong and sturdy such that it can withstand loading/unloading, pushing and crane lifting etc. All packaging shall be done in such a manner as to reduce volume and weight as much as possible without jeopardizing the safety of the material. All packing materials shall be new.
- 2.7 Stacking of multiple valves in single box is permitted upto 4" NB. However, in such case suitable partitions are to be made inside packing box.
- 2.8 Where height limitations restrict transportation of valve with actuator in assembled condition, actuator should be dismantled after successful testing at shop. However, the same need to be proposed by valve manufacturer during inspection of said valves and take the approval for Client/ PMC.
- 2.9 When valve, extended stem and actuators are transported in dismantled condition, the same shall be reassembled after fitment of valve at site. Valve vendor to deploy their representative within 3 days once the intimation is sent from site. Any delay beyond 3 days shall be to supplier's account.
- 2.10 Valve manufacturers to note that the safe transportation of assembled valve with actuator is in their scope of work. It is therefore required that the valve manufacturer should order actuator meeting the packing guidelines given in this specification. No claim shall be entertained on account of actuator manufacturer's non compliance of requirements specified in this specification, and the valve with actuator shall leave manufacturer's workshop after meeting the terms given in this specification.
- 2.11 Valves shall not be packed in poly wrap irrespective of the increase in shipping/ transport volume. Box of wood/ ply board etc. shall only be used to pack the valves with/ without actuator irrespective of the size/ rating of the valve.
- 2.12 The packing shall have suitable lifting arrangement to enable the lifting of valve with the packing. Suitable provisions/ supports shall be provided from support foot/ lifting lugs to enable to lift the valve with packing.

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- 2.13 Where it is required to transport valve and actuator separately, above clauses shall be individually applicable for valve and actuator.
- 2.14 Assembled Valves shall be properly secured inside packing in order to avoid any contact with packing material during transport.
- 2.15 For extended stem valves, it is permissible to dismantle stem extension and actuator and as such the valve may be transported in three parts, each part complying individually the requirements of this specification.
- 2.16 Actuators shall be packed in wooden box with proper cushioning of damage prone parts like sockets, tubing, panel boxes etc.
- 2.17 Actuator cylinders shall be mounted on base with the help of metallic U-clamps/ welding on reinforcement plate. Metallic U-clamps to be used with double bolts on either side of U clamp.
- 2.18 Actuator components layout shall be such that to minimize packing volume. Back-up tank shall be put in horizontal position only, wherever feasible.
- 2.19 The manufacturer shall exhibit the packing meeting to the requirement of this specification during inspection and take clearance.

3.0 HANDLING

- 3.1 Manufacturer to ensure that during lifting hooks for assembly are attached to body/ end piece casting/ forging only and not on the pup piece. Any pup piece having hook attachment mark may be rejected.
- 3.2 Assembled valves, at all times, shall be lifted through lifting lugs only and not from the pup pieces.
- 3.3 Support foot shall be provided on body only in bolted design. In no case, the support foot shall be fastened in body bolting.
- 3.4 Lifting Lugs shall be provided on body/ tail piece in bolted design. In no case, the lifting lugs shall be fastened in body bolting.
- 3.5 Valve vendor to work in close coordination with actuator vendor to ensure that the sling put in lifting lug of valve do not interfere with the actuator/ tubing during lifting at site. Any breakage during site lifting due to fouling of tubing/

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actuator components during site lifting shall be in supplier' account.

- 3.6 Extended Stem valves shall have placement of lifting lugs to ensure the lifting of valve in stem vertical condition only. Under no condition the valve is to be lifted in Stem horizontal/ inclined position.

4.0 TRANSPORTATION

- 4.1 If the valve and actuator in assembled condition can be accommodated on low bed trailer, low bed trailer shall only be used for inland transportation. Dismantling of valve and actuator shall not be permitted under such case.
- 4.2 Valve shall be secured on trailer/ truck bed with ropes suitably attached with valve boxes. Type of rope selection shall depend upon weight of valve.
- 4.3 Tack welds on trailer/ truck bed shall not be used as a fastening method.
- 4.4 Bolting may be used to securely fasten the valve base on trailer if the provision is available. No. and diameter of bolts shall be suitably chosen as per weight of valve to ensure that bolts do not shear off during transportation.
- 4.5 For large size valves, Loading shall be done preferably by hanging the valve in position and moving the vehicle to valve sitting position.
- 4.6 Since unloading of valves is under valve manufacturer's scope, it is to be ensured that valve manufacturer's representative shall be available at designated store to facilitate the same. Valve manufacturer has to keep the track of vehicle movement accordingly. If due to project exigency/ time constraint the unloading has to be done during manufacturer's representative's absence, any damage during such unloading shall be attributable to manufacturer only.

SPECIFICATION FOR SHOP & FIELD PAINTING

SPECIFICATION NO.: MEC/S/05/21/07



**(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

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PREPARED BY:	CHECKED BY:	APPROVED BY:	ISSUE DATE :
(Shalini Singh)	(Sunil Kumar)	(A.K. Johri)	Dec. 2008

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1.0 **GENERAL**

1.1 These technical specifications shall be applicable for the work covered by the contract, and without prejudice to the various codes of practice, standard specifications etc. it is understood that contractor shall complete 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.

1.2 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 within deviation permit from appropriate authority will result in rejection to job.

2.0 **SCOPE**

Scope of work covered in the specification shall include, but not limited to the following.

2.1 This specification defines the requirements for surface preparation, selection and application of paint on external surfaces of equipment, vessels, machinery, piping, ducts, steels structures, external & internal protection of storage tanks for all services RCC Chimney & MS Chimney with or without refractory lining and flare lines etc.

2.2 **Extent of Works**

2.2.1 The following surface and materials shall require shop, pre-erection and field painting.

- a. All uninsulated C. S. & A.S. equipment like columns, vessels, drums, storage tanks, heat exchangers, pumps, compressors, electrical panels and motors etc.
- b. All uninsulated carbon and low alloy piping fitting 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.

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- e. RCC/ MS chimneys with or without refractory lining & Flare lines.
- f. Identification colour bands on all piping as required including insulated aluminium clad, galvanised, SS and non-ferrous piping.
- g. Identification lettering/ numbering on all painted surface of equipment/ piping insulated aluminium clad, galvanised, SS and non-ferrous piping.
- h. Marking/ identification signs on painted surfaces of equipment/ piping for hazardous service.
- i. Supply of all primers, paints and all other materials required for painting other than owner's supply.
- j. Over insulation surface of equipments and pipes wherever required.
- k. Painting under insulation for carbon steel and stainless steel as specified.
- l. Repair work of damaged/ preerection/ fabrication shop primer and weld joints at field.

2.2.2 The following surface and materials shall not be painted unless otherwise specified:

- a. Uninsulated austentic stainless steel.
- b. Plastic and/ or plastic coated materials.
- c. Non ferrous materials like aluminium, galvanised "piping", "gratings" and "handrails" etc. except G. I. Towers.

2.3 Documents

2.3.1 The contractor shall perform the work in accordance with the following documents issued to him for executions of work.

- a. Bill of quantities for piping, equipment, machinery and structure etc.
- b. Piping line list.
- c. Painting specifications including special civil defence requirement.

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2.4 Unless otherwise instructed final painting on pre-erection/ shop primed pipes and equipments shall be painted in the field, only after mechanical completion and testing on system are completed as well as, after completion of steam purging wherever required.

2.5 Changes and deviations required for any specific job due to clients requirement or otherwise shall be referred to MECON for deviation permit.

3.0 CODES & STANDARDS

3.1 Without prejudice to the provision of clause 1.1 above and the detailed specifications of the contract, the following codes and standards shall be followed for the work covered by this contract.

IS:5	:	Colour coding
IS-101	:	Methods of test for ready mixed paint and enamels.
IS-2379:1990	:	Indian standard for pipe line Identification –Colour code.
ASTM Vol. 6.01 and 6.03	:	American standard test methods for Paints and coatings.
ANSI A 13.1-1981	:	Scheme for Identification of piping systems : American National Standard Institution.

3.2 Surface Preparation Standards:

Following standards shall be followed for surface preparations:

3.2.1 Swedish Standard : SIS-05 5900-1967/ ISO-8501-1-1998
(Surface preparation standards for painting steel surfaces).

This standard contains photographs of the various standards on four different degrees of rusted steel and as such is preferable for inspection purpose by the Engineer-in-Charge.

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3.2.2 Steel structure painting Council, U.S.A (surface preparations specifications (SSPC-SP).

3.2.3 British standard (surface finish or Blast-cleaned for painting) BS:4232

3.2.4 National Associations of Corrosion Engineers, U.S.A. (NACE)

3.2.5 Various International Standards equivalent to swedish Standard for surface preparation are given in Table-I.

3.3 The contractor shall arrange, at his own cost, to keep a set of latest edition of any one of the above standards and codes at site.

3.4 The paint manufacturer's instructions shall be followed as far as practicable at all times. Particular attention shall be paid to the following:

- a. Instructions for storage to avoid exposure as well as extremes of temperature.
- b. Surface preparations prior to painting.
- c. Mixing and thinning.
- d. Application of paints and the recommended limit on time intervals between coats.

4.0 EQUIPMENT

4.1 All tools, brushes, rollers, spray guns, abrasive materials hand/ power tools for leaning and all equipments, scaffolding materials, shot/ wet abrassive blasting, water blasting equipments & air compressors etc. required to be used shall be suitable for the work and all in good order and shall be arranged by the contractor at site and in sufficient quantity.

Mechanical mixing shall be used for paint mixing operations in case of two pack systems except that the Engineer-in-Charge may allow the hand mixing of small quantities at his discretion.

5.0 SURFACE PREPARATION, SHOP COAT, COATING APPLICATION & REPAIR AND DOCUMENTATION

5.1 General

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5.1.1 In order to achieve the maximum durability, one or more of following methods of surface preparation shall be followed, depending on condition of steel surface and as instructed by Engineer-in-Charge. Adhesion of the paint film to surface depends largely on the degree of cleanliness of the metal surface. Proper surface preparation contributes more to the success of the paint protective system:

- a. Manual or hand tools cleaning.
- b. Mechanical or power tool cleaning.
- c. Blast cleaning.

5.1.2 Mill scale, rust, rust scale and foreign matter shall be removed fully to ensure that a clean and dry surface is obtained. The minimum acceptable standard in case of manual or hand tool cleaning shall be St. 2 or equivalent, in case of mechanical or power tool cleaning it shall be St. 3 or equivalent, in case of blast cleaning it shall be Sa 2½ or equivalent as per Swedish Standard SIS-055900-1967/ ISO-8501-1-1988. Where highly corrosive condition exists, then blast cleaning shall be Sa3 as per Swedish Standard.

Remove all other contaminants, oil, grease etc. by use of an aromatic solvent prior to surface cleaning.

5.1.3 Blast cleaning shall not be performed where dust can contaminate surfaces undergoing such cleaning or during humid weather conditions having humidity exceeding 85%.

5.1.4 Irrespective of the method of surface preparation, the first coat of primer must be applied on dry surface. This should be done immediately and in any case within 4 hours of cleaning of surface. However, at times of unfavourable weather conditions, the Engineer-in-Charge shall have the liberty to control the time period, at his sole discretion and / or to insist on recleaning, as may be required, before primer application is taken up. In general, during unfavourable weather conditions, blasting and painting shall be avoided as far as practicable.

5.1.5 The external surface of R.C.C. chimney to be painted be dry and clean. Any loose particle of sand, cement, aggregate etc. shall be removed by rubbing with soft wire brush if necessary, acid etching with 10-15% HCL solution about 15 minutes shall be carried out and surface must be thoroughly washed with water to remove acid & loose particles then dry completely before application of paint.

5.2 Procedure of Surface Preparation.

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5.2.1 Blast Cleaning

5.2.1.1 Air Blast Cleaning

The surface shall be blast cleaned using one of the abrasives: AL_2O_3 particles chilled casts iron or malleable iron and steel at pressure of 7kg. Cm^2 at appropriate distance and angle depending on nozzle size maintaining constant velocity and pressure. Chilled cast iron, malleable iron and steel shall be in the form of shot or grit of size not greater than 0.055" maximum in case of steel and malleable iron and 0.04" maximum in case of chilled iron. Compressed air shall be free from moisture and oil. The blasting nozzles should be venturi style with tungsten carbide or boron carbide as the material for liners. Nozzles orifice may vary from 3/16" to 3/4". On completion of blasting operation, the blasted surface shall be clean and free from any scale or rust and must show a grey white metallic lustre. Primer or first coat of paint shall be applied within 4 hours of surface preparation. Blast cleaning shall not be done outdoors in bad weather without adequate protection or when there is dew on the metal which is to be cleaned, surface profile shall be uniform to provide good key to the paint adhesion (i.e. 35 to 50 μ). If possible vacuum collector shall be installed for collecting the abrasive and recycling.

5.2.1.2 Water Blast cleaning

Environmental, health and safety problems associated with abrasive blast cleaning limit the application of air blast cleaning in many installations. In such case water blast cleaning is resorted to.

Water blast cleaning can be applied with or without abrasive and high-pressure water blasting. The water used shall be inhibited with sodium chromate/ phosphate. The blast cleaned surface shall be washed thoroughly with detergents and wiped solvent and dried with compressed Air. For effective cleaning abrasives are used. The most commonly used pressure for high pressure water blast cleaning for maintenance surface preparation is 3000 to 6000 psi at 35-45 liters/ minute water volume and pressure upto 10000 psi and water volume of 45 liters/ minute provide maximum cleaning.

The water blast cleaned surface shall be comparable to SSPC-SP-12/ NACE No. 5. The operation shall be carried out as per SSPC guidelines for water blast cleaning. The indicative values for sand injection is

Air : 300 to 400 Cu.ft/ min.

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Water : 5-10 liter/ min. with corrosion inhibitor
 Sand : 200-400 lbs/ hr.
 Nozzle : 0.5 to 1" dia

Special equipments for water blast cleaning with abrasives now available shall be used.

5.2.2 Mechanical of Power tool cleaning

Power tool cleaning shall be done mechanical striking tools, chipping hammers, griding wheels or rotating steels wire-brushes. Excessive burnish of surface shall be avoided as it can reduce paint adhesion. On completion of cleaning, the detached rust mill scale etc. shall be removed by clean rags and/ or washed by water or stream and thoroughly dried with compressed air jet before application of paint.

5.2.3 Manual or hand tool cleaning

Manual or hand tool cleaning is used only where safety problems limit the application of other surface preparation procedure and hence does not appear in the specifications of paint systems.

Hand tool cleaning normally consists of the following:

- a. Hand descaling and/ or hammering
- b. Hand scraping
- c. Hand wire brushing

Rust, mill scale spatters, old coating and other foreign matter, shall be removed by hammering, scraping tools, emery paper cleaning, wire brushing or combination of the above methods. On completion of cleaning, loose materials shall be removed from the surface by clean rags and the surface shall be brushed, swept, deducted and blown off with compressed air/ steam to remove all loose matter. Finally the surface may be washed with water and dried for effective cleaning.

5.3 Non compatible shop coat primer

The compatibility of finishing coat should be confirmed from the paint manufacturer. In the event of use of primer such as zinc rich epoxy, inorganic zinc silicate etc. as shop coat the pant system shall depend on condition of shop coat, if shop coat is in satisfactory condition showing no major defects, the shop

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coat shall not be removed. The touch up primer and finishing coat(s) shall be identified for application by Engineer-in-Charge.

5.4 Shop coated (coated with primer & finishing coat) equipment should not be repainted unless paint is damaged.

5.5 Shop primed equipment and surface will only be 'spot cleaned' in damaged areas by means of power tool brush cleaning and then spot primed before applying one coat of filed primer unless otherwise specified. If shop primer is not compatible with field primer then shop coated primer should be completely removed before applications of selected paints system for particular environment.

5.6 For packaged units/ equipment, shop primer should be as per the paint system given in this specification. However, manufacturer's standard can be followed after review.

5.7 **Coating Procedure and Application:**

5.7.1 Surface shall not be coated in rain, wind or in environment where injurious airborne elements exists, when the steel surface temperature is less than 5° F above dew point when the relative humidity is greater then 85% or when the temperature is below 40° F.

5.7.2 Blast cleaned surface shall be coated with one complete application of primer as soon as practicable but in no case later than 4 hrs. the same day.

5.7.3 To the maximum extent practicable, each coat of material shall be applied as a continuous film uniform thickness free of probes. Any spots or areas missed in application shall be recoated and permitted to dry before the next coat is applied. Applied paint should have the desired wet film thickness.

5.7.4 Each coat shall be proper state of cure or dryness before the application of succeeding coat. Material shall be considered dry for recoating when an additional coat can applied without the development of any detrimental film irregularities such as lifting or loose of adhesion of the under coat. Manufacturer instruction shall be followed for intercoat interval.

5.7.5 When the successive coat of the same colour have been specified, alternate coat shall be tinted, when practical, sufficiently to produce enough contrast to indicate complete coverage of the surface. The tinting material shall be compatible with the material and not detrimental to its service life.

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5.7.6 Air spray application shall be in accordance with the following:

- a. The equipment used shall be suitable for the intended purpose, shall be capable of properly atomizing the paint to be applied, and shall be equipped with suitable pressure regulators and gauges. The air caps, nozzles, and needles shall be those recommended by the manufacturer of the equipment for the material being sprayed. The equipment shall be kept in satisfactory condition to permit proper paint application.
- b. Traps or separators shall be provided to remove oil and condensed water from the air. These traps or separators must be of adequate size and must be drained periodically during operations. The air from the spray gun impinging against the surface shall show condensed water or oil.
- c. **Ingredients shall be kept properly mixed in the spray pots or containers during application by continuous mechanical agitation.**
- d. The pressure on the material in the pot and of the air at the gun shall be adjusted for optimum spraying effectiveness. The pressure on the material in the pot shall be adjusted when necessary for change in elevation of the gun above the pot. The atomizing air pressure at the gun shall be high enough to properly atomize the paint but not so high as to cause excessive fogging of paint, excessive evaporation of solvent, or less by overspray.
- e. Spray equipment shall be kept sufficiently clean so that dirt, dried paint, and other foreign materials are not deposited in the paint film.

Any solvents left in the equipment shall be completely removed before applying paint to the surface being painted.

- f. Paint shall be applied in a uniform layer, with overlapping at the edge of the spray pattern. The spray patterns shall be adjusted so that the paint is deposited uniformly. During application the gun shall be held perpendicular to the surface and at a distance which will ensure that a wet layer of paint is deposited on the surface. The trigger of the gun should be released at the end of each stroke.
- g. All runs and sags shall be brushed out immediately or the paint shall be removed and the surface repainted.

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- h. Areas inaccessible to the spray gun shall be painted by brush: if not accessible by brush, daubers or sheepking shall be used.
- i. All nameplates, manufacturer's identification tags, machined surface instrument glass, finished flange faces, control valve items and similar items shall be masked to prohibit coating disposition. If these surface are coated, the component shall be cleaned and restored to its original condition.
- j. Edges of structural shapes and irregular coated surface shall be coated first and an extra pass made later.
- k. If spray gun shown choking, immediately dechoking procedure shall be followed.

5.7.7

Airless spray application shall be in accordance with the following procedure: as per steel structure paint manual vol. 1 & vol. 2. By SSPC, U.S.A., Air less spray relies on hydraulic pressure rather than air atomization to produce the desired spray. An air compressor or electric motor is used to operate a pump to produce pressures of 1,000 to 6,000 psi. Paint is delivered to the spray gun at this pressure through a single hose within the gun, a single paint stream is divided into separate streams, which are forced through a small orifice resulting in atomization of paint without the use of air. This result in more repaid coverage with less overspray. Airless spray usually is faster, cleaner, more economical and easier to use than conventional airspray.

Airless spray equipment is mounted on wheels, and paint is aspirated in a hose that sucks paint from any container, including drums. The unit shall have in built agitator that keep the paint uniformly mixed during the spraying. The unit shall consists of in built strainer. Usually very small quantities of thinning is required before spray. Incase of High Build epoxy coating (two pack), 30:1 pump ratios and 0.020-0.023" tip size will provide a good spray pattern. Ideally fluid hoses should no be less than 3/8" ID and not longer than 50ft to obtain optimum results.

In case of gun choking, decoking steps shall be followed immediately.

5.7.8

Brush application of paint shall be in accordance with the following:

- a. Brushes shall be of a style and quality that will enable proper application of paint

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- b. Round or oval brushes are most suitable for rivets, bolts, irregular surfaces and rough or pitted steel. Wide flat brushes are suitable for large flat areas, but they shall not have width over five inches.
- c. Paints shall be applied into all corners.
- d. Any runs or sags shall be brushed out.
- e. There shall be minimum of brush marks left in the applied paint
- f. Surface not accessible to brushes shall be painted by spray, duubers, or sheepkin.

5.7.9 Manual application by sling (where 6 O' clock position of pipe is not approachable)

A canvas strip (alternatively a tinplate strip) about 450mm wide and 1.5m long is held under the pipe by two men. Liquid coating is poured on the sling at each side of the pipe. The men holding this sling move it up and down and walk slowly forward while fresh coating is poured on the pipe and they manipulate the sling so that an even coating is obtained all round the bottom. This work shall be done very carefully and by experienced personnel. There shall not be any formation of "Whiskers" and holes in the coating. The coating film shall be inspected by mirror.

5.7.10 For each coat the painter should know the WFT corresponding to the specified DFT and standardise the paint application technique to achieve the desired WFT. This is to be ensured in the qualification trial.

5.8 Drying of Coated Surface

5.8.1 No coat shall be applied until the preceding coat has dried. The material shall be considered dry for re-coating when another coat can be applied without the development of any film irregularities such as lifting or loss of adhesion of undercoats. Drying time of the applied coat should not exceed maximum specified for it as a first coat; if it exceeds the paint material has possibly deteriorated or mixing is faulty.

5.8.2 No paint shall be forced dried under conditions which will cause checking, wrinkling, blistering, formation of pores, or detrimentally affect the condition of the paint.

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No drier shall be added to a paint on the job unless specifically called for in the manufacturer's specification for the paint.

Paint shall be protected from rain, condensation, contamination snow and freezing until dry to the fullest extent practicable.

5.9 **Repair of damaged paint surface.**

5.9.1. Where paint has been damaged in handling and in transportation, the repair of damaged coating of pre-creation/ fabrication shall be as given below.

5.9.2. Repair of damaged inorganic zinc silicate primer after erection/ welding:

Quickly remove the primer from damaged area by mechanical scraping and emery paper to expose the white metal. Blasts clean the surfaces possible. Feather the primer over the intact adjacent surface surrounding the damaged area by emery paper.

5.9.3 Repair of damaged pre-erection and shop priming in the design temperature of 90° C to 500° C.

- Surface preparation shall be done as per procedure 5.9.2
- One coat of F-9 shall be applied wherever damaged was observed on pre-erection/ pre-fabrication/ shop primer of inorganic zinc silicate coating (F-9) shall not be applied if damaged area is not more than 5 x 5 cm.

5.10 **PAINT APPLICATION**

5.10.1 Shop priming/ pre-erection priming with F9 of F12 shall be done only on blasted surface.

5.10.2 Shop priming/ pre-erection priming with F-9 or F-12 shall be done only with airless spray.

5.10.3 For large flat surface field painting shall be done by airless spray otherwise brush can be used.

5.11 **Assessment of Painting Requirement**

The paint system to be applied for a specific job shall be arrived as sequentially as given below :

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- Identify the environment from area classification details and chose the appropriate table.
- Identify the design temperature from the technical documents.
- Identify the specific field paint system and surface preparation requirement from the above identified table and temperature range.
- Identify the shop priming requirement from Table 7.1 based on compatibility of the above paint system.
- Identify the need of repair of shop primer and execute as per Table 7.2.

5.12

Documentation.

A written quality plan with procedure for qualification trials and for the actual work.

Daily progress report with details of weather condition, particular of application no of coats and type of materials applied, anomalies, progress of work versus programme.

Result of measurement of temperature relative humidity, surface profile, film thickness, holiday detection, adhesion tests with signature of appropriate authority.

Particular of surface preparation and paint application during trials and during the work.

Details of non-compliance, rejects and repairs.

Type of testing equipments and calibration.

Code and batch numbers of paint material used.

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TABLE-I (for clause 5.0)
SURFACE PREPARATION STANDARDS

S. NO.	DESCRIPTION	VARIOUS INTERNATIONAL STANDARDS (EQUIVALENT)				REMARK
		SWEDISH STANDARD SIS-05-5900 1967	SSPC-SP USA	NACE USA	BRITISH STANDARD BS-4232: 1967	
1.	MANUAL OR HAND TOOL CLEANING REMOVAL OF LOOSE RUST LOOSE MILL SCALE AND LOOSE PAINT, CHIPPING, SCRAPING, SANDING 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 CONDITION 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, DESCALING, SANDING, WIRE BRUSHING AND GRINDIN, AFTER REMOVAL OF DUST, SURFACE SHOULD HAVE A PRONOUNCED METALLIC SHEEN.	ST.3	SSPC-SP- 3	-	-	-DO-

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TABLE-I (for clause 5.0)
SURFACE PREPARATION STANDARDS

S. NO.	DESCRIPTION	VARIOUS INTERNATIONAL STANDARDS (EQUIVALENT)				REMARKS
		SWEDISH STANDARD SIS-05-5900 1967	SSPC-SP USA	NACE USA	BRITISH STANDARD BS-4232: 1967	
3.	BLAST CLEANING (AIR & WATER) 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	FIRST QUALITY	WHERE EXTREMELY CLEAN SURFACE CAN BE EXPECTED FOR PROLONG LIFE OF PAINT SYSTEMS.
3.2	NEAR WHITE METAL BLAST CLEANING TO NEAR WHITE METAL CLEANLINESS, UNIT AT LEAST 95% OF EACH ELEMENTS OF SURFACE AREA IS FREE OF ALL VISIBLE RESIDUES WITH DESIRED SURFACE PROFILE.	SA 2 ½	SSPC-SP-10	NACE #2	SECOND QUALITY	THE MINIMUM REQUIREMENT FOR CHEMICALLY RESISTANT PAINT SYSTEM SUCH AS EPOXY, VINYL, POLYURETHANE BASED AND INORGANIC ZINC SILICATE PAINTS, ALSO FOR CONVENTIONAL PAINT SYSTEM USED UNDER FAIRLY CORROSIVE CONDITIONS TO OBTAIN DESIRED LIFE OF PAINT SYSTEM.

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TABLE-I (for clause 5.0)
SURFACE PREPARATION STANDARDS

S. NO.	DESCRIPTION	VARIOUS INTERNATIONAL STANDARDS (EQUIVALENT)			REMARKS
		SWEDISH STANDARD SIS-05-5900 1967	SSPC-SP USA	NACE USA	
3.3	COMMERCIAL BLAST BLAST CLEANING UNIT 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	THIRD QUALITY 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	

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6.0 PAINT MATERIALS

Paint manufacturers shall furnish all the characteristics of paint material on printed literature, alongwith the test certificate for all the specified characteristics given in this specifications. All the paint materials shall be of first quality and conform to the following general characteristics as per the table 6.1, 6.2 and 6.3.

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PAINT MATERIALS
TABLE NO.: 6.1 PRIMERS

S. No.	DESCRIPTION	P-2	P-4	P-6
1.	Technical Name	Chlorinated rubber Zinc Phosphate primer	Etch primer/ wash primer	Epoxy zinc phosphate primer
2.	Type and composition	Single pack, air drying chlorinated rubber based medium plasticised with unsaponifiable plasticizer, pigmented with Zic phosphate.	Two pack polyvinyl butyral resin medium cured with phosphoric acid solution pigmented with zic tetroxy choromate.	Tow component polyamide cured epoxy resin medium, pigmented with zinc phosphate.
3.	Volume solids (approx)	40%	7-8%	40%
4.	DFT (Dry dilm thickness) per coat (approx)	40-50μ	8-10μ	40-50μ
5.	Theoretical covering capacity in M2/ coat/ litre (approx)	8-10	8-10	8-10
6.	Weight per litre in kgs/ litre (approx)	1.3	1.2	1.4
7.	Touch dry at 30° C (approx)	30 minutes	2 hrs.	After 30 mins.
8.	Hard dry at 30° C (approx)	Min.: 8 hrs. Max.: no limitation	Min.: 2 hrs. Max.: 24 hrs.	Min.: 8 hrs. Max.: 3-6 months
9.	Over Coating Interval (approx.)	Min : 8 hrs Max : No limitation	Min : 4.6 hrs Max : 24 hrs	Min : 8 hrs Max : 3-6 months
10.	Pot life (approx) at 30° C for two component paints (approx).	Not applicable	Not applicable	8 hrs.
11.	Temperature Resistance	60°C	Not applicable	80°C

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PAINT MATERIALS
TABLE NO.: 6.2FINISH PAINT

S. No	DESCRIPTION	F-2	F-3	F-6	F-7
1.	Technical Name	Acrylic polyurethane finish paint	Chlorinated rubber based finish paint	Epoxy-High build finish paint	High build coaltar epoxy coating.
2.	Type and composition	Two-pack aliphatic isocyanate cured acrylic finish paint	Single pack plasticised chlorinated rubber based medium with chemical and weather resistant pigments.	Tow- pack polyamide/ ployamine cured epoxy resin medium suitable pigmented.	Tow pack polyamide cured epoxy resin blended with coal/ tar medium, suitably pigmented.
3.	Volume solids (approx)	40%	40%	62%	65%
4.	DFT (Dry film thickness) per coat (approx)	30-40μ	40-50μ	100-125μ	100-125μ
5.	Theoretical covering capacity in M2/ coat/ litre (approx)	10-13	8-10	5-6	5-2-6.5
6.	Weight per litre in kgs/ litre (approx)	1.3	1.2	1.4	1.5
7.	Touch dry at 30° C (approx)	1 hrs.	30 minutes	3 hrs.	4 hrs.
8.	Hard dry at 30° C (approx)	Overnight	8 hrs.	Overnight	48 hrs.
9.	Overcoating interval (approx)	Min.: Overnight (12) hrs. Max.: Unlimited	Min.: Overnight Max.: Unlimited	Min.: Overnight Max.: 5 day	Min.: 24 hrs. Max.: 5 day
10.	Pot life at 30° C for two component paints (approx).	6-8 hrs.	Not applicable	4-6 hrs.	4-6 hrs.
11.	Temperature Resistance	80°C	60°C	80°C	125°C

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PAINT MATERIALS
TABLE NO.: 6.3 FINISH PAINTS

S. No	DESCRIPTION	F-8	F-9	F-11	F-12
1.	Technical Name	Self priming type surface tolerant high build epoxy coating (Complete rust control coating)	Inorganic Zinc Silicate coating	Heat resistant synthetic based two pack aluminum paint suitable upto 250°C dry temperature	Heat resistant silicone aluminum paint suitable upto 500° C temperature
2.	Type and composition	Two-pack epoxy resin based suitable pigmented and capable of adhering to manually prepared surface and old coating	A two-pack air drying self-curing solvent based inorganic zinc silicate coating.	Heat resistant synthetic medium based two pack aluminum paint suitable upto 250°C	Single pack silicone resin based medium with aluminum flakes.
3.	Volume solids (approx)	72%	60%	25%	20%
4.	DFT (Dry film thickness) per coat (approx)	100-125μ	65-75μ	20-25μ	20-25μ
5.	Theoretical covering capacity in M2/ coat/ litre	6.0-7.2	8-9	10-12	8-10
6.	Weight per litre in kgs/ litre (approx)	1.4	2.3	1.2	1.1
7.	Touch dry at 30° C (approx)	3 hrs.	30 min.	3 hrs.	30 min.
8.	Hard dry at 30° C (approx)	24 hrs.	12 hrs.	12 hrs.	24 hrs.
9.	Overcoating interval (approx)	Min.: 10 hrs. Max.: 6 months	Min.: 8 hrs. at 20°C and 50% RH. Max.: Unlimited	Min.: 16 hrs. Max.: Unlimited	Min.: 16 hrs. Max.: Unlimited

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S. No	DESCRIPTION	F-8	F-9	F-11	F-12
10.	Pot life (approx) at 30° C for two component paints (approx).	90 min.	4-6 hrs.	Not applicable	Not applicable
11.	Temperature resistance	80° C	400° C	250° C	500° C

F-14: Specially for mulated polyamine cured coal tal epoxy suitable for-45°C to 125°C for application under insulation

F-15: Two pack cold cured epoxy phenolic coating suitable for 45°C to 125°C for application under insulation

F-16: Eoxy siloxane anser coat 738

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PAINT MATERIALS
TABLE NO. 6.4 FINISH PAINTS

Sl. No.	Description	F-14	F-15	F-16	F-17
1.	Technical name	Polyamine cured coal tar epoxy	Two-component Epoxy phenolic coating cured with polyamine adduct hardner system (primer + intermediate coat + finish paint)	Ambient temperature curing Poly Siloxane coating / High build cold applied inorganic copolymer based aluminum coating suitable for under insulation coating of CS and SS piping for high temperature service.	Two component solvent free type high build epoxy phenolic / novalac epoxy phenolic coating cured with Polyamine adduct hardner system.
2.	Type & composition	Specially formulated polyamine cured coal tar epoxy suitable for application under insulation	Two pack ambient temperature curing epoxy phenolic coating system suitable for application under insulation of CS / SS piping.	Amercoat 738 from Ameron Products, USA / Berger 938 from Berger Paints Ltd., or Intertherm 751 CSA from Akzo Nobel coating. Note : 6	Two component solvent free type high build epoxy phenolic / novalac epoxy phenolic coating cured with Polyamine adduct hardner system.
3.	Volume Solids (minimum)	70%	65%	60%	98-100%
4.	DFT (Dry Film thickness) per coat (minimum)	125 μ m	75 - 100 μ m	75 - 100 μ m	125- 150 μ m
5.	Theoretical covering capacity in M ² / coat / litre (minimum)	5.5	6.5-8.5	6.0-8.0	6.5-8.0
6.	Weight per liter in kgs/litre (max paint) (minimum)	1.5	1.7	1.3	1.7
7.	Touch dry at 30°C (maximum)	4 hrs.	2 hrs.	1 hr.	2 hrs.

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Sl. No.	Description	F-14	F-15	F-16	F-17
8.	Hard dry at 30°C (maximum) Full cure 30°C (for immersion / high temp. service)	24 hrs. 168 hrs.(7 days)	24 hrs. 168 hrs.(7 days)	16 hrs. -	24 hrs. 168 hrs.(7 days)
9.	Over-coating interval	Min. 6 hrs. Max. 5 days	Min. 36 hrs. Max. 21 days	Min. 16 hrs. Max. Not applicable	Min. 16 hrs. Max. 21 days.
10.	Pot life at 30°C for two component paints (minimum)	4 hrs.	1.5 hrs.	1 hr.	1 hr.
11.	Temperature Resistance (min.)	-45°C to 125°C under insulation	-45°C to 125°C under insulation (Note : 5)	Up to 400°C for CS & SS under insulation	-45°C to 150°C for immersion service

Notes:

- Covering capacity and DFT depends on method of application. Covering capacity specified above are theoretical. Allowing the loose during the application, minimum specified DFT should be maintained.
- All primers and finish coats should be cold cured and air drying unless otherwise specified.
- All paints shall be applied in accordance with manufacturer's instruction for surface preparation, intervals, curing and application. The surface preparation, quality and workmanship should be ensured.
- Technical data sheets for all paints shall be supplied at the time of submission of quotations.

6.4 List of recommended manufacturers

The paint shall conform to the specifications given above and the best quality in their products range of the manufacturers listed in Annexure-I.

7.0 PAINT SYSTEM

The paint system should vary with type of environment envisaged in and around the plants. Three types of environment as given below are considered for selection of paint system. The paint system is also given for specific requirements.

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Primers & finish coats covered in table nos. 7.0 to 15.0

PRIMERS

- P-2 : Chlorinated Rubber Zinc Phosphate Primer
- P-4 : Etch Primer/ Wash Primer
- P-6 : Epoxy Zic Phosphate Primer

FINISH COATS/ PAINTS

- F-2 : Acrylic- Polyurethane finish paint
- F-3 : Chlorinated Rubber Finish Paint
- F-6 : High Build Epoxy finish coating
- F-7 : High Build Coal Tar epoxy coating
- F-8 : Self-priming surface tolerant high build epoxy coating
- F-9 : Inorganic Zinc Silicate Coating.
- F-11 : Heat resistant Synthetic medium based Aluminum paint.
- F-12 : Heat resistant Silicone Aluminum paint.
- F-14 : Specially formulated polyamine-cured coal for Epoxy coating
- F-15 : Epoxy phenolic coating
- F-16 : Epoxy Siloxane Coating : Amercoat 738
- F-17 : Two component solvent free type high built epoxy phenolic / novalac epoxy phenolic coating cured with polyamine.

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TABLE 7.1: PRE-ERECTION/ PRE-FABRICATION AND SHOP PRIMING FOR CARBON STEEL, LOW TEMPERATURE CARBON STEEL & LOW ALLOY STEEL, STEEL STRUCTURE, PIPING AND EQUIPMENT ETC.

S. No.	DESIGN TEMPERATURE IN °C	SURFACE PREPARATION	PAINT SYSTEM	TOTAL DFT IN MICRONS (MIN.)	REMARKS
7.1.1	-90 TO 400	SSPC-SP-10	1 COAT OF F-9	65-75	No overcoating is to be done
7.1.2	401 To 500	SSPC-SP-10	1 COAT OF F-12	40-50	Finish Coat at Site
7.1.3	-40 to 150 for Structures, hand rails and Grating only	SSPC-SP-3	1 COAT OF F-9 OR 2 COATS OF P-7 @ 40μ DFT / COAT	65-75 OF F-9 OR 80 (P-7)	For Damaged Area of more than 5 x 5 Cm2.

TABLE 7.2: REPAIR OF PRE-ERECTION/ PRE- FABRICATION AND SHOP PRIMING AFTER ERECTION/ WELDING FOR CARBON STEEL LOW TEMPERATURE CARBON STEEL & LOW ALLOY STEEL, ITEMS IN ALL ENVIRONMENT.

S. No.	DESIGN TEMPERATURE IN °C	SURFACE PREPARATION	PAINT SYSTEM	TOTAL DFT IN MICRONS (MIN.)	REMARKS
7.2.1	-90 TO 400	SSPC-SP-3 (FOR REPAIR ONLY) SSPC-SP-10	1 COAT OF F-9	65-75	FOR DAMAGED AREA OF MORE THAN 5X5 CM.
7.2.2	401 TO 550	SSPC-SP-3	1 COAT OF F-12	20	FOR DAMAGED AREA OF MORE THAN 5X5 CM.

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TABLE 8.0: FIELD PAINT SYSTEM FOR NORMAL CORROSIVE ENVIRONMENT (FOR CARBON STEEL, LOW TEMPERATURE CARBON STEEL & LOW ALLOY STEEL)

ALL NORMAL CORROSIVE AREAS SUCH AS OFF SITES EXTERNAL SURFACE OF UNINSULATED COLUMNS, VESSELS, HEAT EXCHANGERS, BLOWERS, PIPING, PUMPS, TOWERS, COMPRESSORS, STRUCTURAL STEEL WORKS, RCC CHIMNEY WITH OR WITHOUT REFRACTORY LINE INSIDE CHIMNEY (ALL ENVIRONMENTS), EXCLUDING TANK TOPS, FLARE LINES, D.M. PLANTS, INTERIOR OF TANKS ETC. FLARE LINES FOR NORMAL CORROSIVE ENVIRONMENT ALSO TO BE PAINTED AS PER TABLE 9.0

S. NO.	DESIGN TEMPERATURE IN C	SURFACE PREPARATION	PAINT SYSTEM		TOTAL DFT IN MICRONS (MIN.)	REMARKS
			<u>FIELD PRIMER</u>	FINISH PAINT		
8.1	-90 TO -15	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 @65-75μ DFT/COAT	NONE	65-75	No over coating to be done follow repair procedure only on damaged areas of pre-erection/ pre-fabrication primer/ coating F-9
8.2	-14 TO 60	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 @ 65-75μ DFT/COAT + 2 COATS OF P-2 @ 40μ DFT/COAT 2 X 40 = 80	2 COATS OF F-3 @ 40 μ DFT/ COAT 2 X 40 = 80	225	
8.3	61 TO 80	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 @ 65-75μ DFT/COAT + 2 COATS OF P-6 @ 40μ DFT/ COAT 2 X 40 = 80	1 COATS OF F-6 @ 100 μ DFT/ COAT	245	

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S. NO.	DESIGN TEMPERATURE IN C	SURFACE PREPARATION	PAINT SYSTEM		TOTAL DFT IN MICRONS (MIN.)	REMARKS
			<u>FIELD PRIMER</u>	FINISH PAINT		
8.4	81 TO 250	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 @ 65-75 μ DFT/COAT	3 COATS OF F-11 @ 20 μ DFT/ COAT 3 X 20 = 60	125	
8.5	251 TO 400	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 @ 65-75 μ DFT/COAT	2 COATS OF F-12 @ 20 μ DFT/ COAT 2 X 20 = 40	105	
8.6	401 TO 500	SSPC-SP-10	REPAIR AS PER 7.2.2	2 COATS OF F-12 @ 20 μ DFT/ COAT 2 X 20 = 40	80	

NOTE 1 : FOR MS CHIMNEY OR WITHOUT REFRACTORY LINING 8.3, 8.4 AND 8.5 SHALL BE FOLLOWED.

NOTE 2 : FOR EXTERNAL SURFACE OF RCC CHIMNEY: 2 COATS OF F-6 @ 100 μ DFT/ COAT TO OBTAIN 2 X 100=200 μ SHALL BE APPLIED AFTER MAKING SURFACE PREPARATION AS PER GUIDELINES IN 1.5

NOTE 3 : WHEREVER REQUIRED S.NO. 8.3 SHALL BE USED FOR 14°C TO 80°C AND S.NO. 8.2 WILL BE DELETED.

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TABLE 9.0: FIELD PAINT SYSTEM FOR CORROSIVE ENVIRONMENT (FOR CARBON STEEL, LOW TEMPERATURE CARBON STEEL & LOW ALLOY STEEL)

FOR ALL CORROSIVE AREAS ABOVE GROUND WHERE H₂S, SO₂ FUMES OR SPILLAGE'S OF ACID/ ALKALI/ SALT ARE LIKELY TO COME IN CONTACT WITH SURFACE SUCH AS EXTERNAL SURFACE OF UNINSULATED COLUMNS, VESSELS, HEAT EXCHANGERS, BLOWERS, PIPING, PUMPS, TOWERS, COMPRESSORS, FLARE LINES, STRUCTURAL STEEL ETC.

S. NO.	DESIGN TEMPERATURE IN °C	SURFACE PREPARATION	PAINT SYSTEM		TOTAL DFT IN MICRONS (MIN.)	REMARKS
			FIELD PRIMER	FINISH PAINT		
9.1	-90 TO -15	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 @ 65-75μ DFT/ COAT	NONE	65-75	Repair of pre-erection/ pre fabrication primer shall be done wherever damage is observed.
9.2	-14 TO 80	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 @ 65-75μ DFT/ COAT + 1 COATS OF P-6 @40 μ DFT/ COAT	1 COATS OF F-6 @ 100μ DFT/ COAT + 1 COAT OF F-2 @ 40μ DFT/ COAT	225	Surface preparation is required only for repairing of damaged pre-erection/ fabrication primer
9.3	81 TO 400	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 @ 65-75μ DFT/ COAT	2 COATS OF F-12 @ 20 μ DFT/ COAT 2 X 20 = 40	105	
9.4	401 TO 500	SSPC-SP-10	REPAIR 2S PER 7.2.2	2 COATS OF F-12 @ 20 μ DFT/ COAT	80	

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TABLE 10.0: FIELD PAINT SYSTEM FOR HIGHLY CORROSIVE (FOR CARBON STEEL, LOW TEMPERATURE CARBON STEEL & LOW ALLOY STEEL) EXTERNAL SURFACES OF UNINSULATED COLUMNS, VESSELS, HEAT EXCHANGERS, BLOWERS, PIPING PUMPS, TOWERS, COMPRESSORS, FLARE LINES, STRUCTURE STEEL ETC.

EXPOSED TO SPILLAGE OR FUMES OF HCL H₂SO₄, SALTY WATER IMPINGEMENT, CHLORIDE ETC.

S. NO.	DESIGN TEMPERATURE IN °C	SURFACE PREPARATION	PAINT SYSTEM		TOTAL DFT IN MICRONS (MIN.)	REMARKS
			FIELD PRIMER	FINISH PAINT		
10.1	-90 TO -15	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 65-75μ DFT/ COAT	NONE	65-75	Repair of pre-erection/ fabrication primer shall be followed. No over coating is allowed
10.2	-14 TO 80	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 @ 65-75μ DFT/ COAT + 1 COATS OF P-6 @40 μ DFT/ COAT	2 COATS OF F-6 @ 100μ DFT/ COAT = 2 X 100= 200 + 1 COAT OF F-2 @ 40μ DFT/ COAT	345	Surface preparation is required only for repairing of damaged pre-erection/ fabrication primer.
10.3	81 TO 400	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 @ 65-75μ DFT/ COAT	2 COATS OF F-12 @ 20 μ DFT/ COAT 2 X 20 = 40	105	
10.4	401 TO 500	SSPC-SP-10	REPAIR AS PER 7.2.2	3 COATS OF F-12 @ 20 μ DFT/ COAT 2 X 20 = 40	80	

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TABLE 11.0 : FIELD PAINT SYSTEM FOR CARBON STEEL STORAGE TANKS (EXTERNAL) FOR ALL ENVIRONMENTS.

S. NO.	DESIGN TEMPERATURE IN °C	SURFACE PREPARATION	PAINT SYSTEM		TOTAL DFT IN MICRONS (MIN.)	REMARKS
			FILED PRIMER	FINISH PAINT		
1.1	EXTERNAL SHELL. WIND GIRDERS APPARATUSES, ROOF TOPS OF ALL GROUND TANK INCLUDING TOP SIDE OF FLOATING ROOF OF OPEN TANK AS WELL AS COVERED FLOATING ROOF AND ASSOCIATED STRUCTURAL WORK ROLLING AND STATIONARY LADDERS, SPIRAL STAIRWAYS, HAND TAILS FOR ALL ENVIRONMENTS FOR GRUDE OIL, LDO, HSD, ATF KEROSENE, GASOLINE, MOTOR SPIRIT, DM WATER, FIREWATER, RAW WATER, POTABLE WATER, ACIDS, ALKALIS SOLVENTS AND CHEMICALS ETC.					
11.1.1	-14 TO 80	SSPC-SP-10	1 COAT OF F-9 @ 65-75µ DFT/ COAT + 1 COATS OF P-6 @ 40 µ DFT/ COAT 65 X 40 = 105	1 COATS OF F-6 @ 100µ DFT/ COAT + 2 COATS OF F-2 @ 40µ DFT/ COAT 2 X 40 = 80	285	F-6 should be suitable for occasional water immersion
11.1.2	81 TO 500	SSPC-SP-10	1 COAT OF F-9 @ 65-75µ DFT/ COAT	2 COATS OF F-12 @ 20 µ DFT/ COAT 2 X 20 = 40	105	
11.2	EXTERNAL SURFACE OF BOTTOM PLATE (SOIL SIDE) FOR ALL STORAGE TANKS.					
11.2	-14 TO 80	SSPC-SP-10	1 COAT OF F-9 @ 65-75µ DFT/ COAT	3 COATS OF F - 7 @ 100 µ DFT/ COAT 3 X 100 = 300	365	F7 should be suitable for immersion service of the products given.

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TABLE 12.0 : FIELD PAINT SYSTEM FOR CARBON STEEL AND ALLOY STORAGE TANK: (INTERNAL)

S. NO.	DESIGN TEMPERATURE IN °C	SURFACE PREPARATION	PAINT SYSTEM		TOTAL DFT IN MICRONS (MIN.)	REMARKS
			FILED PRIMER	FINISH PAINT		
INTERNAL SURFACE OF UNDERSIDE OF FLOATING ROOF, INTERNAL STRUCTURAL OF CONE ROOF, BOTTOM PLATE, ROOF STRUCTURE, STEEL, LADDERS SUPPORTS FOR STORING GRUIDE OIL, LDO AND HSD (EXCLUDING WHITE OIL PRODUCTS)						
12.1	-14 TO 80	SSPC-SP-10	1 COAT OF F-9 @ 65-75µ DFT/ COAT	3 COATS OF F-7 @ 100µ DFT/ COAT 3 X 100 = 300	365	F7 should be suitable for immersion service of the products given.
12.2	BARE SHEEL OF INSIDE FLOATING ROOF TANK AND CONE ROOF TANK FOR PRODUCTS MENTIONED IN 12.1					
12.2.1	-14 TO 80	SSPC-SP-10	PHOSPATING TREATMENT WITH PHOSPATING CHEMICALS (2 COATS)	2 COATS OF @10 µ 2 X 10 = 20	20	
12.3	FLOATING CONE ROOF TANKS FOR PETROLEUM PRODUCTS SUCH AS ATF, GASOLINE, NAPHTHA, KEROSENE, MOTOR SPIRIT, OF BOTTOM PLATE, UNDERSIDE OF FLOATING ROOF AND SHELL ABOVE MAXIMUM LIQUID LEVEL AND STRUCTURAL STEEL, LADDERS ETC.					
12.3.1	-14 TO 80	SSPC-SP-10	1 COAT OF F-9 @ 65-75µ DFT/ COAT	3 COATS OF F-6 @ 100µ DFT/ COAT 3 X 100 = 300	365	F-6 should be suitable for immersion service of petroleum produce like ATF, Kerosene, petrol etc.
12.4	BARE SHELL OF INSIDE OF FLOATING CONE ROOF TANKS FOR PRODUCTS MENTIONED IN 12.3					
12.4.1	-14 TO 80	SSPC-SP-10	1 COAT OF F-9 @ 65-75µ DFT/ COAT	NONE	65-75	No over coating is allowed same as per pre-erection primer, if any
12.5	INTERNAL PROTECTION IF FIXED ROOF TYPE STORAGE TANKS FOR POTABLE WATER: INSIDE OF SHELL, UNDER SIDE OF ROOF AND ROOF STRUCTURE INSIDE SURFACE BOTTOM PLATE AND STRURAL STEEL WORKS, LADDERS, WALKWAYS, PLATFORMS ETC.					
12.5.1	-14 TO 80	SSPC-SP-10	2 COAT OF F-6 @ 40µ DFT/ COAT 2 X 40 = 80	2 COATS OF F-6 @ 100µ DFT/ COAT 2 X 100 = 200	280	F-6 shall be suitable for immersion service.
12.6	D. M. (DEMINERALISED WATER) AND HYDROCHLORIC ACID (HCL): INTERNAL SHELL, BOTTOM PLATE AND ALL ACCESSORIES					
12.6.1	-14 TO 80	SSPC-SP-10	EBONITE RUBBER LINING AS PER SMMS SPECIFICATION 6-06-204			
12.7	EG TANKS (INTERNAL SHELL, BOTTOM PLATE ROOF AND ALL ACCESSORIES)					
12.7.1	ALL	SSPC-SP-10	3 COATS VINYL CHLORIDE AMERCOAT 23 @ 75µ / COAT	CO-POLYMER	225	

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S. NO.	DESIGN TEMPERATURE IN °C	SURFACE PREPARATION	PAINT SYSTEM	REMARKS
12.8	INSIDE PONTOON AND INSIDE OF DOUBLE DECK OF ALL FLOATING ROOFS.		FILED PRIMER	TOTAL DFT IN MICRONS (MIN.)
12.8.1	-14 TO 80	SSPC-SP-3	FINISH PAINT	
		1 COAT OF F-8 @ 100µ DFT/ COAT	1 COATS OF F-6 @ 100µ DFT/ COAT	200
		100µ DFT/ COAT	1 X 100 = 100	
12.9	INTERNAL SURFACE OF AMINE & SOUR WATER STORAGE TANKS			
12.9.1	-14 TO 80	SSPC-SP-10	1 COAT OF F-9 @ 65-75µ DFT/ COAT	215-225
		2 X 40 = 80	2 COATS OF F-15 @ 75µ DFT/ COAT	
			2 X 75 = 150	

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TABLE 13.0 : COATING SYSTEM FOR EXTERNAL SIDE OF UNDERGROUND CARBON STEEL PLANT PIPING AND TANKS

S. NO.	DESIGN TEMPERATURE IN °C	SURFACE PREPARATION	PAINT SYSTEM		TOTAL DFT IN MICRONS (MIN.)	REMARKS
			PRIMER	FINISH PAINT		
13.1	CARBON STEEL PLANT PIPING (UNDERGROUND)					
13.1.1	YARD COATING					
13.1.1.1	25 TO 60	SSPC-SP-10	1 COAT OF SYNTHETIC FAST DRYING PRIMER TYPE-B AS PER AWWA-C-203 (1991)	4mm THICK COALTAR COATING WRAPPING AS PER AWWA-C-203 IN 2 LAYER OF EACH 2mm THICKNESS	4mm	CTE coating shall confirm to 120/ 5 as per BS: 4164
13.1.2	OVER THE DITCH COATING					
13.1.2.1	25 Tto 60	SSPC-SP-10	1 COAT OF SYNTHETIC FAST DRYING PRIMER TYPE-B AS PER AWWA-C-203 (1991)	2 LAYERS OF COALTAR BASED TAPE COATING AS PER AWWA-C-203.	4 mm	
13.2	CARBON STEEL PLANT PIPING (UNDERGROUND)					
13.2.1	61 TO 400	SSPC-SP-10	1 COAT OF F-9 @ 65-75µ DFT/ COAT	NONE	65-75	
13.3	EXTERNAL SIDE OF UNINSULATED UNDERGROUND STORAGE TANKS:					
13.3.1	40 TO 80	SSPC-SP-10	1 COAT OF F-9 @ 65-75µ DFT/ COAT	3 COATS OF F-7 @ 100µ DFT/ COAT 3 X 100 = 300	365	
13.3.2	-90 TO -41 81 TO 400° c	SSPC-SP-10	1 COAT OF F-9 @ 65-75µ DFT/ COAT 1 COAT OF AMERCOAT 738 @ 250µ DFT/ COAT	NONE	65-75 250	

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TABLE 14.0 : PAINTING UNDER INSULATION FOR INSULATED (HOT COLD SAFETY CARBON STEEL, LOW ALLOY STEEL, LOW TEMPERATURE CARBON STEEL & STAINLESS STEEL PIPING, STORAGE TANKS EQUIPMENTS IN ALL ENVIRONMENT

S. NO.	DESIGN TEMPERATURE IN °C	SURFACE PREPARATION	PAINT SYSTEM		TOTAL DFT IN MICRONS (MIN.)	REMARKS
			PRIMER	FINISH PINTS		
14.1	INSULATED CARBON STEEL, LOW ALLOY STEEL AND LTCS PIPING AND EQUIPMENT & TANKS					
14.1.1	-4 TO 125	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER F-9 @ 65-75µ DFT	2 COATS OF F-14 @ 125µ DFT/ COAT 2 X 125 = 250 OR 3 COATS OF F-15= 3 X 80=240	315	For other temprature ranges no painting is required under insulation.
14.1.2	OPERATING TEMPERATURE -45 TO 125° C BUT DESIGN TEMPERATURE 126-400° C	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER F-9 @ 65-75µ DFT	3 COATS OF F-12 @ 20µ DFT/ COAT 3 X 20 = 60	105-115	
14.2	INSULATED STAINLESS STEEL INCLUDING ALLOY-20- PIPING					
14.2.1	BELOW 0° C TO ALL MINUS TEMPERATURE	ALUMINUM SHEETING WITH ALUMINUM FOIL AND CHLORIDE FREE MINERAL SEALANT CONTAINING BARIUM CHROMATE SHALL BE APPLIED				If the piping & equipments are already erected then surface shall be prepared by cleaning with emery paper and wash/ flush with chloride free DM water followed by wiping with organic solvent
14.2.2	0 TO 120	SSPC-SP-10 (15-25µ SURFACE PROFILE)	NONE	2 COATS OF F-14 @ 125µ DFT/ COAT 2 X 125 = 250 OR 3 COATS OF F-15= 3 X 80 = 240	250	

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S. NO.	DESIGN TEMPERATURE IN °C	SURFACE PREPARATION	PAINT SYSTEM		TOTAL DFT IN MICRONS (MIN.)	REMARKS
			PRIMER	FINISH PINTS		
14.2.3	121 TO 500	SSPC-SP-10	NONE	3 COATS OF F-12 @ 20µ DFT/ COAT 3 X 20 = 60	60	No pre erection primer to be applied
14.2.4	501 TO 1000	SSPC-SP-10	NONE	1 COAT OF AMERCOAT 738 @ 150µ DFT/ COAT	150	Only Amorcoat 738 from Amorcon is available for this temperature range.
14.2.5	CYCLIC SERVICE-196 TO 480 EXCEPTING -45 TO 120	SSPC-SP-10	NONE	1 COAT OF AMERCOAT 738 @ 150µ DFT/ COAT	150	
14.3	NO PAINTING REQUIRED FOR INSULATED MONEL, IN COLOY AND NICKEL LINES					

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TABLE 15.0 : INTERNAL PROTECTION OF CARBON STEEL WATER BOXES AND TUBE SHEETS OF COOLERS/ CONDENSERS WATER BOXES, CHANNELS, PARTITION PLATES, END COVERS AND TUBE SHEETS ETC.

S. NO.	DESIGN TEMPERATURE IN °C	SURFACE PREPARATION	PAINT SYSTEM		TOTAL DFT IN MICRONS (MIN.)	REMARKS
			PRIMER	FINISH PAINT		
15.1	Upto 65	SSPC-SP-10	1 COATS OF F-6 @ 40 μ DFT/ COAT	2 COATS OF F-7 @ 125 μ DFT/ COAT 2 x 125 = 250	290	For C. S.
15.2	Upto 65 NON FERROUS AND BRASS TUBE SHEETS	SSPC-SP-10	1 COATS OF P-4 @ 8 μ DFT/ COAT 1 COATS OF P-6 @ 40 μ DFT/ COAT	2 COATS OF F-7 @ 125 μ DFT/ COAT 2 x 125 = 250	300	FOR FERROUS SURFACE NON

TABLE 16.0 FIELD PAINTING SYSTEM FOR GI TOWERS/ NON-FERROUS TUBE SHEET

S. NO.	DESIGN TEMPERATURE IN °C	SURFACE PREPARATION	PAINT SYSTEM		TOTAL DFT IN MICRONS (MIN.)	REMARKS
			FILED PAINT	FINISH PAINT		
16.1	Upto 65	SSPC-SP-10	1 COATS OF P-4 @ 8-10 μ DFT/ COAT + 1 COAT OF P-6 @ 4 μ DFT/ COAT	2 COATS OF F-2 @ 40 μ DFT/ COAT 2 x 40 = 250	130	SHADE AS PER DEFENCE REQUIREMENTS
16.2	Upto 65 NON FERROUS AND BRASS TUBE SHEETS	SSPC-SP-10	1 COATS OF P-4 @ 8 μ DFT/ COAT 1 COATS OF P-6 @ 40 μ DFT/ COAT	2 COATS OF F-7 @ 125 μ DFT/ COAT 2 x 125 = 250	300	

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17.0 STORAGE

- 17.1 All paints and painting materials shall be stored only in rooms to be arranged by contractor and approved by Engineer-in-Charge 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 “ PAINT STORAGE NO NAKED LIGHT-HIGHLY INFLAMMABLE” shall be clearly displayed outside.

18.0 COLOUR CODE FOR PIPING

For identification of pipeline, the colour code as per Table 18.1 shall be used. Paint material for color-coding shall be as specified in this standard in clause- 6.0.

- 18.1 Colour coding scheme for pipe, equipment, machinery & structure:

SR. NO.	DESCRIPTION	GROUND COLOUR	FIRST COLOUR BAND	SECOND COLOUR BAND
18.1.1	ALL KINDS OF WATER DRINKING WATER DE-MINERALISED WATER COOLING WATER BOILER FEED WATER CONDENSATE QUENCH WATER WASH WATER PROCESS WATER PROCESS WATER FIRE WATER SEA WATER	Sea Gree -do- -do- -do- -do- -do- -do- -do- -do- -do- Fire red Sea Green	French Blue Gulf Red French Blue Gulf Red Light Brown Dark Grey Ganary Yellow Oxide Red Crimson Red White	Signal Red - - - Signal Red - - - - - -
18.1.2	STEAM VERY HIGH PRESSURE STEAM (VHP) HIGH PRESSURE STEAM (SH) MEDIUM PRESSURE STEAM (SH) LOW PRESSURE STEAM (SL) DILUTION STEAM/ PURGE STEAM	Aluminiumto IS2339 -do- -do- -do- -do-	Signal Red French Blue Gulf Red Canary Yellow Grey	- - Canary Yellow

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SR. NO.	DESCRIPTION	GROUND COLOUR	FIRST COLOUR BAND	SECOND COLOUR BAND
18.1.3	COMPRESSED AIR PLANT AIR INSTRUMENT AIR NITROGEN OXYGEN CO ₂	Sky Blue -do- -do- Canary Yello -do- -do-	Signal Red Silver Grey French Blue Black White Light Grey	- - - - - -
18.1.4	GASES FUEL GAS AND SOUR GAS CHARGE GAS RESIDUE GAS, LPG ACETYLENE SWEET GAS	Canary Yellow -do- -do- -do- -do-	Grey Signal Red Oxide Red Service Brown Grey	Dark Violet French Blue White - -
18.1.5	ACIDS AND CHEMICALS SULFURIC ACID NITRIC ACID HYDROCHLORIC ACID ACETIC ACID CAUSTIC CHLORINE	DARK Violet -do- -do- -do- smoke Grey Canary Yellow	Briliant Green French Blue Signal Red Silver Grey Light Orange Dark Violet	Light Orange -do- -do- -do- - -do-
18.1.6	HYDRO CARBONS NAPTHAS PROPYLENE PROPYLENE C.G. (LIQ) ETHYLENE GLYCOL ETHYLENE DICHLORIDE BENZENE BUTADIENE ETHANE(LIQ) PROPYLENE(LIQ) ETHYLENE(LIQ) TAR AROMATIC GASOLINE METHANOL (LIQ) PYROLYSIS GASOLINE MIXED C4(LIQ) LPG(LIQ) KEROSENE DIESEL OIL (WHITE) DIESEL OIL (BLACK)	Dark Admiralty Grey -do- -do- -do- -do- -do- -do- Dark Admiralty Grey -do- -do- -do- -do- -do- -do- -do- -do- -do- Light Brown -do- -do-	Brilliant Green -do- -do- -do- Gulf Red Canary Yellow Black Light Grey Signal Red Light Grey Signal Grey Brilliant Green White Brilliant Green Signal Green Brilliant Gren -do- -do- -	Black Smoke Grey Gulf Red - - - French Blue Black Black Brilliant Green Canary Yellow Gulf Red Black Light Brown Dark Violet - - -

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18.2 The colour code scheme is intended for identification of the individual group of the pipeline. The system of colour coding of a ground colour and colour bands superimposed on it.

18.3 Ground colours as given in Table 18.1 shall be applied throughout the entire length for uninsulated pipes, on the metal cladding & on surfaces covered by Clause 2.2.2, ground colour coating of minimum 2m length or of adequate length not to be mistaken as colour band shall be applied at places requiring colour bands. Colour band(s) shall be applied at the following location.

- a. At battery limit points
- b. Intersection points & change of direction points in piping ways.
- c. Other points, such as midway of each piping way, near valves, junction joints of services appliances, walls, on either side of pipe culverts.
- d. For long stretch/ hard piping at 50M interval.
- e. At start and terminating points.

18.4 **Identification Sign**

18.4.1 Flow direction shall be indicated by an arrow in the location stated in Para a,b,c & d and as directed by Engineer-in-charge.

18.4.2 Colours of arrows shall be black or white and in contrast to the colour on which they are superimposed.

18.4.3 Product names shall be marked at pump inlet, outlet and battery limit in a suitable size as approved by Engineer-in-charge.

18.4.4 Size of arrow shall be either of those given in 18.5.

18.5 **Colour Bands**

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- 18.5.1 As a rule minimum width of colour band shall conform to the following table:

Nominal Pipe Size	Width : L(mm)
3" NB and below	25mm
Above 3" NB upto 6" NB	50mm
Above 8" NB upto 12" OD	75mm
Above 12" OD	100mm

Note: For insulated pipes, nominal pipe size means the outside diameter of insulation.

Nominal pipe size figures are to be inches.

- 18.5.2 Colour band(s) shall be arranged in the sequence shown in Table 18.1 and the sequence follows the direction of flow. The relative proportional width of the first colour band to the subsequent bands shall be 4:1, minimum width of any band shall be as per Clause 18.5.1.

- 18.5.3 Whenever it is required by the Engineer-in-charge to indicate that a pipeline carries a hazardous material, a hazard marking of diagonal strips of black and golden yellow as per IS:2379 shall be painted on the ground colour.

- 18.6 Wherever it is required by the Engineer-in-charge to indicate that a pipeline carries a hazardous material, a hazard marking of diagonal strips of black and golden yellow as per IS:2379 shall be painted on the ground colour.

19.0 **IDENTIFICATION OF VESSELS, PIPING ETC.**

- 19.1 Equipment number shall be stencilled in black or white on each vessel, column, equipment & machinery (insulated or uninsulated) after painting. Line number in black or white shall be stencilled on all the pipelines of more than one location as directed by Engineer-in-charge, size of letters printed shall be as below :

Column & Vessels	-	150mm(high)
Pump, Compressor and other machinery	-	50mm (high)
Piping	-	40-150mm

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19.2 Identification of storage tanks

The storage tanks shall be marked as detailed in the drawing.

20.0 PAINTING FOR CIVIL DEFENCE REQUIREMENTS

20.1 Following items shall be painted for camouflaging if required by the client.

- a. All columns
- b. All tanks in offsites
- c. Large vessels
- d. Spheres

20.2 Two coats of selected finishing paint as per defence requirement shall be applied in a particular pattern as per 20.3 and as per the instructions of Engineer-in-charge.

20.3 Method of Camouflaging

20.3.1 Disruptive painting for camouflaging shall be done in three colours in the ratio of 5:3:2 (all matt finish).

Dark Green	Light Green	Dark Medium Brown
5:	3:	2

20.3.2 The patches should be asymmetrical and irregular.

20.3.3 The patches should be inclined at 30 degree to 60 degree to the horizontal.

20.3.4 The patches should be continuous where two surfaces meet at an angle.

20.3.5 The patches should not coincide with corners.

20.3.6 Slits and holes shall be painted and dark shades.

20.3.7 Width of patches should be 1 to 2 meters.

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21.0 **INSPECTION AND TESTING**

21.1 All painting materials including primers and thinners brought to site by contractor for application shall be procured directly from manufacturers as per specifications and shall be accompanied by manufacturer's test certificates. Paint formulations without certificates are not acceptable.

21.2 Engineer-in-Charge at his discretion, may call for tests for paint formulations. Contractor shall arrange to have such tests performed including batchwise test of wet paints for physical & chemical analysis. All costs there shall be borne by the contractor.

21.3 The painting work shall be subject to inspection by Engineer-in-Charge at all times. In particular, following stagewise inspection will be performed and contractor shall offer the work for inspection and approval of every stage before proceeding with the next stage. The record of inspection shall be maintained in the registers. Stages of inspection are as follows:

- a. Surface preparation
- b. Primer application
- c. Each coat of paint

In addition to above, record should include type of shop primer already applied on equipment e. g. Redd 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 Engineer-in-Charge 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, the extra cost should have prior approval of Engineer-in-Charge.

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21.4 **Primer Application**

After surface preparation the primer should be applied to cover the crevices, corners, sharp edges etc. in the presence of inspector nominated by Engineer-in-Charge.

21.5 The shades of successive coats should be slightly different in colour in order to ensure application of individual coats, the thickness of each coat and complete coverage should be checked as per provision of this specification. This should be approved by Engineer-in-Charge before application of successive coats.

21.6 The contractor shall provide standard thickness measurement instrument with appropriate ranges(s) for measuring.

Dry film thickness of each coat, surface profile guage for checking of surface profile in case of blast cleaning. Holiday directors and pinhole detector and positector whenever required for checking in case of immersion conditions.

21.7 Prior to application of paints on surface of chimneys the thickness of the individual coat shall be checked by application of each coat of same paint on M. S test panel. The thickness of paint on test panel shall be determined by using guage such as 'Elkomere'. This thickness of each coat shall be checked as per provision of this specification. This shall be approved by Engineer-in-Charge before application of paints on surface of chimney.

21.8 At the discretion of Engineer-in-Charge, the paint manufacturer must provide the expert technical service at site as and when required. This service should be free of cost and without any obligation to the owner, as it would be in the interest of the manufacturer to ensure that both surface preparation and application are carried out as per their recommendations.

21.9 Final inspection shall include measurement of paint dry film thickness. Adhesion Holiday detection check of finish and workmanship. The thickness should be measured at as many points/ locations as decided by Engineer-in-Charge and shall be within + 10% of the dry thickness, specified in the specifications.

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21.10 The contractor shall arrange for spot checking of paint materials for Sp. Gr., flow time (ford cup) and spreading rate.

22.0 **GUARANTEE**

22.1 The contractor shall guarantee that the chemical and physical properties of paint materials used are in accordance with the specifications contained herein/ to be provided during execution of work.

22.2 The contractor shall produce test report from manufacturer regarding the quality of the particular batch of paint supplied. The Engineer-in-Charge shall have the right the test wet samples of paint at random, for quality of same as stipulated in clause 11 above. Batch test report of manufacturer's for each batch paint supplied shall be made available by the contractor.

23.0 **QUALIFICATION CRITERIA OF PAINTING CONTRACTOR**

Painting contractor who is awarded any job for MECON, projects under this standard must have necessary equipments, machinery, tool and tackles for surface preparation, paint application and inspection. The contractor must have qualified trained and experienced surface preparation, paint applicator, inspector, and supervisors. The contractor supervisor, inspector surface perpetrator and paint applicator must be conversant with the standards referred in this specification the contractors capacity, capability and competency requirements for the job shall be quantified in the tender document and shall be assessed by an MECON team before awarding any job.

24.0 **PROCEDURE FOR APPROVAL OF NEW COATING MATERIALS AND MANUFACTURER'S**

Following procedure is recommended to be followed for approval of new manufacturers.

24.1 The manufacturer should arrange testing of the inorganic zinc silicate coating materials as per the list of tests given in para 24.5 below from one of the reputed Government laboratories.

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24.2 Samples of coating should be submitted to the Govt. laboratory in sealed containers with batch no. and test certificate on regular format of manufacturer's testing laboratory. The sampling shall be certificate and sealed by a citifying agency.

24.3 All test panels should be prepared by govt. testing agency coloured photographs of test panels should be taken before and after the test should be enclosed alongwith test report.

Sample batch. No. and manufacturer's test certificate should ne enclosed alongwith the report. Test reports contain details of observation and rusting if any, as per the testing code. Suggested government laboratories are:

RRL, Hayderabad
 HBTI, Kanpur
 DMSRDE, Kanpur
 IIT, Mumbai
 BIS Laboratory
 UDCT, Mumbai
 RITES, Calcutta
 PDIL

24.4 Manufacturers should intimate the company, details of sample submitted for testing name of Govt. testing agency, date, contact personnel of the Govt. testing agency. At the end of the test the manufacturer should submit the test report to the company for approval. The manufacturer(s) shall be qualified based on the result of these tests and other assessment and the Company's decision in this regard shall be final and binding on the manufacturer.

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24.5 Tests required for evaluation of acceptance of coating materials for offshore application.

Test	ASTM Test Method
Density	D 1475
Dipping properties	D 823
Film Characteristics	
Drying time	D 1640
Flexibility	D 1737/ D 522
Hardness	D 3363
Adhesion	D 2197
Abrasion resistance	D 968/ D 1044
DFT/ Coat	AS PER SSPC GUIDELINES
Storage Stability	D 1849
Resistance to	
Humidity for 2000 hrs.	D 2247
Salt Spray for 2000 hrs.	B 117
Accelerated Weathering	D 822
% Zn in DFT	G 53

24.6 Coating system for panel test shall be decided after discussion with MECON.

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ANNEXURE-I

LIST OF RECOMMENDED MANUFACTURERS

Indian Vendors

- 1.0 Asian Paints(l) Ltd.
- 2.0 Berger Paints Ltd.
- 3.0 Goodlass Nerlolac Paints Ltd.
- 4.0 Jenson And Nicholson Paint Ltd & chokuGu Jenson & Nicholson Ltd.
- 5.0 Shalimar Paints Ltd.
- 6.0 Sigma Coating, Mumabai
- 7.0 CDC Carboline Ltd.
- 8.0 Premier Products Ltd.
- 9.0 Coromandel Paints & Chemicals Ltd.
- 10.0 Anupam Enterprises
- 11.0 Grand Polycoats
- 12.0 Bombay Paints Ltd.
- 13.0 Vanaprabha Esters & Glycer, Mumbai
- 14.0 Sunil Paints and Varnishes Pvt. Ltd.
- 15.0 Courtaulds Coating & Sealants India (Pvt.) Ltd.
- 16.0 Mark-chem Incorporated, Mumbai (for phosphating chemicals only)
- 17.0 VCM Polyurethane Paint (for polyurethane Paint only)

FOREIGN VENDORS FOR OVERSEAS PRODUCTS

- 1.0 Sigma Coating, Singapore
- 2.0 Ameron, USA
- 3.0 Kansai Paint, Japan
- 4.0 Hempel Paint, USA
- 5.0 Valspar Corporation, USA
- 6.0 Courtaulds Coating, UK.

Note: This list subjected to revision based fresh approval which will be intimated to PDD/ Vendor Cell.

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ANNEXURE-II

LIST OF RECOMMENDED MANUFACTURER'S PRODUCTS

S. No.	MANUFACTURER NAME	P2 CHLORINATED RUBBER Zp PRIMER	P4 ETCH PRIMER/ WASH PRIMER	P6 EPOXY ZINC PH. PRIMER	F9 INORGANIC ZINC SILICATE PRIMER/ COATING
1.	ASIAN PAINTS (I) LTD.	ASIOCHL OR HB. ZN.PH PRIMER RO PC 168	APCONYL WP 636 (PC 335)	APCODUR HB. RO.ZP-PC433	APCOCIL 605
2.	BARGER PAINT LTD.	LINSOL HIGH BUILD ZP PRIMER	BISON WASH PRIMER	EPILUX 610	ZINC ANODE 304
3.	AMERON/ GODDLASS NEROLAC PAINTS LTD.	-	AMERCOAT 187	AMERCOAT 71	DIMET COTE-9
4.	JENSON & NICHOSON PAINTS LTD. AND CHOKUGU JENSON NICHOLSON	JENSOLAC CHLORINATED RUBBER HB ZN.PH. PRIMER	J & N ETCH PRIMER	EPILAC ZINC PHOSPHATE PRIMER	-
5.	SHALIMAR PAINTS LTD.	CHIOROKOTE ZINC PHOSPHATE PRIMER GREY	TUFFKOTE ETC PRIMER	EPIGUARD 4 ZINC PHOSPHATE PRIMER GREY	TUFFKOTE ZILICATE TL
6.	SIGMA COATING	SIGMA NUCOL UNICOAT 7321	SIGMA COVER PRIMER (7413)	COLTURE CM PRIMER 7412	SIGMASIL MC (7568)
7.	CDC CARBOLINE LTD.	-	-	CARBOLINE 893	CARBOZINC 11
8.	PRIMER PRODUCTS LTD.	-	-	P-15/3A U-16/92	U17/ 92 ETHYL SILICATE INORGANIC ZINC
9.	CORAMANDEL PAINTS CHEMICALS LTD.	COROCLORE CR HB. ZN. PH. PRIMER	CPC WASH PRIMER	COROPEX EPOXY ZH. PH. HIGH BILD PRIMER	-

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S. No.	MANUFACTURER NAME	P2 CHLORINATED RUBBER Zp PRIMER	P4 ETCH PRIMER/ WASH PRIMER	P6 EPOXY ZINC PH. PRIMER	F9 INORGANIC ZINC SILICATE PRIMER/ COATING
10.	ANUPAM ENTERPRISES	ANUCLOR ZP PRIMER	ANUPRIME 291	ANUPAM ANILICOR A-EZP-500	-
11.	GRAND POLYCOATS	GP CHILOROPRIME 601	GP PPRIME 401	-	-
12.	BOMBAY PAINTS LTD. THEMPEL MAKEINE PAINTS	HEMPA TEX HIGHBUILD 4633	PENTOLITE WASH PRIMER 8520	HEMPEL'S SHOP PRIMER E-1530	GALVASOL 1570
13.	VANAPRABHA ESTERS & GLYCERIDES,	VEGCHLOR HB PRIMER 1143	VEG WASH PRIMER 1181	VEGPOX 1241 Z/P	-
14.	SUNIL PAINTS AND VARNISHED PVT. LTD.	SUNCHLOR HB ZINC PHOSPHATE PRIMER	SUN WASH	SUNPOXY ZINC PHOSPHATE PRIMER	-
15.	COURTAULDS COATING LTD.	-	-	INTERGARD 251	INTERZINC
16.	MARK-CHEM INCOPORATED, (FOR PHOSPHATING CHEMICAL ONLY)	RUST PREVENTIVE LIQUID DRSAIO			
17.	VCN POLYURETHANE PAINTS (FOR POLY EURETHANE PAINTS ONLY)				
18.	JOTUN PAINTS			EPOXY CQ	JOTACOTE -2

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S. No.	MANUFACTURER NAME	P2 CHLORINATED RUBBER Zp PRIMER	P4 ETCH PRIMER/ WASH PRIMER	P6 EPOXY ZINC PH. PRIMER	F9 INORGANIC ZINC SILICATE PRIMER/ COATING
				SPECIAL ZINC PHOSPHATE PRIMER	
19.	KCC PRODUCTS (KOREA)				EZ 180(N)

LIST OF RECOMMENDED MANUFACTURER'S PRODUCTS (Contd....)

S. No.	MANUFACTURER NAME	F2 ACRYLIC-POLY YURETHANE FINISH PAINT	F3 CHLORINATED RUBBER FINISH PAINT	F6 HIGH BUILD FINISH PAINT	F7 HIGH BUILD COAL TAR EPOXY COATING
1.	ASIAN PAINTS (I) LTD.	APCOTHANE CF76 (PC 1109)	ASIOCHLOR CF 621 (PC 161)	APCODUR HB COATING 9466	APCODUR CF 300
2.	BARGER PAINT LTD.	BARGER THANE ENAMEL (81)	LINOSOL CHLORINATED RUBBER HB COATING	EPILUX 04 AND 78 HB EPOXY COATING	EPILUX 555
3.	AMERON/ GODDLASS NEROLAC PAINTS LTD.	AMERCOAT 450GL	AMERCOAT 515	AMER COAT 383 HS	AMERCOAT 78 HB
4.	JENSON & NICHOSON PAINTS	J & N 993 HB POLYURETHANE	JENSON HB CHLORINATED	EPILAC 981 ENAMEL	EPILAC SOLVENTLESS COAT

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S. No.	MANUFACTURER NAME	F2 ACRYLIC-POLY YURETHANE FINISH PAINT	F3 CHLORINATED RUBBER FINISH PAINT	F6 HIGH BUILD FINISH PAINT	F7 HIGH BUILD COAL TAR EPOXY COATING
	LTD. AND CHOKUGU JENSON NICHOLSON	FINISH PAINT.	RUBBER FINISH PAINT		TAR EPOXY COATING
5.	SHALIMAR PAINTS LTD.	SHALITHANE FINISH	CHLORKOTE FINISH	EPIGARD KL FINISH	BIPIGARD'S BLACK HB COAL TAR EPOXY COATING
6.	SIGMA COATING	SIGMADOUR HS SEMIGLOSS 7530	SIGMA NUCOL FINISH 7308	SIGMA COVER CM 7456	COLTURIET TCN 300
7.	CDC CARBOLINE LTD.	CARBOLINE 132	-	CARBOLINE 191	CARBOMASTIC-14
8.	PRIMER PRODUCTS LTD.	U3/ 92 POLYURETHANE	CR-71 FINISH PAINT	42B/ 4A HIGH BUILD EPOXY	350B/ 3A, COAL TAR EPOXY COATING
9.	CORAMANDEL PAINTS CHEMICALS	-	COROCLORE CR FINISHING	COROPEX EPOXY HB COATING	COROPEX EPOXY COAL TAR COATING
10.	ANUPAM ENTERPRISES	ANUTHANE ENAMEL	ANUCHLOR HB ENAMEL	DURACOAT-6000	COROGUARD
11.	GRAND POLYCOATS	GP COAT 131, 132 GP BOND 141	GP CHILOROGAURD 631	GP GUARD HP 234	POLYGUARD GE

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S. NO.	MANUFACTURER'S NAME	F2	F3	F6	F7
12.	BOMBAY PAINTS LTD./ PAINTS	PENTATHANE FP 4510	HEMPATEX HIBUILD 4633	HEMPADUR HIGH BUILD 5520	HEMPADUR 1510
13.	VANAPRABHA ESTERS & GLYCERIDES,	VEGTHANE FP 3641	VEGCHLOR FP 3140	VEGPOX- 3265 VEGPOX 3562	VEGPOX 4265
14.	SUNIL PAINTS AND VARNISHED PVT. LTD.	SUNTHANE (ALIPHATIC)	SUNCHLOR HB CR COATING	LPOXY HB 'PS 901'	LPOXY BLACK P. S. 551
15.	COURTAULDS COATING LTD.	INTERTHANE	-	INTEGARD EM SERIES	INTERTUF JXA 006/ 007/ 010
16.	MARK-CHEM INCOPORATED, (FOR PHOSPHATE PAINTS ONLY)				
17.	VCM POLYURETHANE PAINTS (FOR POLY EURETHANE PAINTS ONLY)	PIPCOTHANE ALIPHATIC POLYURETHANE FINISH PAINT			
18.	JOTUN PAINTS	HARDTOP AS		PENGUARD	JOTAGUARD 85
19.	KCC PRODUCTS (KOREA)			KOPOX TOPCOAT HB ET 5740	EH 173

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S. NO.	MANUFACTURER'S NAME	F-8 EPOXY MASTIC COATING SURFACE TOLERANT	F-11 HEAT RESISTANCE SYNTHETIC MEDIUM ALUMINUM PAINT	F-12 HEAT RESISTANCE SILICON AL. PAINT
1.	ASIAN PAINTS (I) LTD.	APCODOR CF 640	ASIAN HR ALUMINUM PAINT (PC 300)	HR SILICON ALUMINUM PAINT (PC 189)
2.	BARGER PAINT LTD.	PROTECTOMASTIC	FERROLOT HR ALUMINUM PANT	BARGER HEAT RISISTANT SILICON ALUMINUM PAINT
3.	AMERON/ GODDLASS NEROLAC PAINTS LTD.	AMERLOCK 400		AMERCOAT 878
4.	JENSON & NICHOSON PAINTS LTD. AND CHOKUGU JENSON NICHOLSON	-	FERROTECT SYNTHETIC RUBBER H/R ALUMINUM PAINT 4000	FERROTECT SILICON HEAT RESISTANCE 1000
5.	SHALIMAR PAINTS LTD.	EPIPLUS 56	HEAT RESISTING LUSTROL ALUMINUM	LUSTOTHERM HIGH TEMP ALUMINUM PAINT
6.	SIGMA COATING	SIGMA ETPC ALUMINUM	HIGH TEMPERATURE RESISTANT EPOXY SUSTEM UPTO 200° C 4062	AROSTA FINISH HR
7.	CDC CARBOLINE LTD.	CARBOMASTIC-15	CARBOLINE 1248	CARBOLINE 4674
8.	PRIMER PRODUCTS LTD.	HB EPOXY MATIC 150B/ 150A		
9.	CORAMANDEL PAINTS CHEMICALS	-	SILVOTOL HR ALUMINUM PAINT	CPC SILICONE HR ALUMINUM PAINT
10.	ANUPAM ENTERPRISES	ANUMASTIC-102	-	ANUPAM HEAT GUARD

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S. NO.	MANUFACTURER'S NAME	F8	F11	F12
11.	GRAND POLYCOATS	GP PRIME GUARD 235		-
12.	BOMBAY PAINTS LTD./ HEMPEL MARINE PAINTS	HEMPADUR 1708	KANGAROO HHR ALUMINUM 4950	HEMPADUR HIGH BUILD 5520
13.	VANAPRABHA ESTERS & GLYCERIDES,	VEGEPOX MASTIC 2255	VEG HR AL PAINT TO IS211339	VEG HHR AL PAINT TO 600°C
14.	SUNIL PAINTS AND VARNISHED PVT. LTD.	LPOXY HIGHBUILD P.S.901	-	-
15.	COURTAULDS COATING LTD.	INTERPLUX	-	INTERTHERM 50
16.	MARK-CHEM INCOPORATED, (FOR PHOSPHATE PAINTS ONLY)			
17.	VCM POLYURETHANE PAINTS (FOR POLY EURETHANE PAINTS ONLY)	-		
18.	JOTUN PAINTS	JOTUMATIC 87		SOLVELITT HEAT RESISTANT SILICON PAINT
19.	KCC PRODUCTS (KOREA)	EH 4158H		QT 606

SPECIFICATION FOR INSTALLATION OF INSTRUMENTS

SPECIFICATION NO.: MEC/S/05/26/01



**ELECTRICAL & INSTRUMENTATION
(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

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AMENDMENT STATUS

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)

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C O N T E N T S

- 1) SCOPE
- 2) STANDARDS OF MATERIALS
- 3) INSTALLATION OF INSTRUMENTS
- 4) TESTING
- 5) CALIBRATION OF INSTRUMENTS

PREPARED BY: (R. SANJAY BABU)	CHECKED BY: (RAKESH SHUKLA)	APPROVED BY: (PANKAJ SHIVASTAVA)	ISSUE DATE : 08Th DEC 08

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INSTALLATION, TESTING AND CALIBRATION OF INSTRUMENTATION AND CONTROL SYSTEM

1.0 SCOPE

- 1.1 The purpose of this specification is to define the general requirements for the installation, installation materials, testing and calibration of instruments and control system.
- 1.2 The work shall be carried out in accordance with the codes, standards and recommended practice listed in this specification and in accordance with local 'Statutory regulations'.
- 1.3 For installation of instruments and control system, of the new material where quality is of the prescribed standards and which is in every way fit for its intended purpose shall be used.
- 1.4 Unless otherwise specified all the materials shall be indicated in this specification except where it is not compatible with fluids being handled. In such cases the selection of the material shall be approved by MECON.
- 1.5 Only the best trade practices shall be used. All the work shall be carried out in a neat, workman like manner and to the satisfaction of MECON.

2.0 STANDARDS OF MATERIALS

- 2.1 Instrument process piping / tubing upto and including the first block valve and 'in-line' instrument equipment shall conform to the line class or vessel rating concerned instrument piping or tubing after the first lock valve may use alternate materials consistent with service conditions. In general they shall conform to the following specification as a minimum.
 - 2.1.1 Stainless tubes shall be fully annealed and cold drawn seam less as per ASTM A 269 TP316 with size 1/2"OD x 0.65" WT (wall thickness).
 - 2.1.2 Monel tubing shall be fully annealed seamless as per ASTM B165 with size 1/2" OD x 0.35"WT.
 - 2.1.3 Carbon steel pipe shall be 1/2" seamless and shall be as per ASTM A106 Gr B min of sch 80 & dimensions as per ANSI B36.10.
 - 2.1.4 Seamless stainless steel pipes shall be as per ASTM A 312 Gr TP 316L Sch 80S, dimensions as per ANSI B 36.19.

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- 2.1.5 Instrument air supply piping from the main instrument air header shall be galvanised heavy class pipes to IS 1239.
- 2.2 Individual pneumatic signal and air supply tubing shall conform to the following specifications:
- 2.2.1 Stainless tubes shall be used in general and shall be fully annealed and cold drawn seamless as per ASTM A269 TP 316 with 6mmOD x 1mmWT.
- 2.2.2 Copper tubing where specified shall be seamless 6mmOD x 1.0mmWT soft annealed as per ASTM 868.74a cd No. 122 (DHP) sheathed with PVC 1.0mm thick coloured Black.
- 2.3 All fittings shall be as a minimum of 100 rating except for tube fittings. The fittings shall have threading as per B2.1 and socket weld connections as per B 16.11. These shall conform to the following specifications in general.
- 2.3.1 Tube fittings shall be flare type compression fittings double ferrule and pressure seat type.
- All tube fittings in impulse lines shall be rated to 5000 PSIG at 38°C.
- 2.3.2 Carbon steel pipe fittings shall be forged as per ASTM A105 stainless steel pipe fittings shall be as per ASTM –182 Grf 316L
- 2.4 Valve shall have normally Globe body and shall be fabricated out of Bar-stock and rated to min. of 1500. These shall be screwed bonnet type with 13% GSS trim and plug shall be integral with the stem. Face to face dimensions shall be approx. 80mm. End connections shall be socket weld to ANSI 16.11 and threaded to B2.1
- 2.5 Multibore tubing shall have a maximum 19 single polyethylene tubes, 6mmOD x 1mm numbered for easy identification. The bundle shall be marked with inner and outer fire resistance PVC sheath. They shall carry a pair of telephone wire 0.6mm diameter flexible.
- 2.6 Single pair and multi pair extension cables for Thermocouples shall be matched and calibrated in accordance with ISA MC 96.1. Conductor size shall be AWG for single pair and 20 A for Multipair.

The cable shall be armoured, each twisted pair shall be individually shielded with aluminium Mylar tape and a tinned copper drain wire. The wires and the cable shall be colour coded as per ISA recommended practices.

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2.7 Instrument Electrical cables shall conform to the following specifications:

2.7.1 Instrument electronic signal cables single pair/ Multipair shall have copper conductor, twisted in pair and individually shielded with Aluminium Mylar tape with drain wire. In multipair cables, each pair shall be armoured with inner and cut PVC sheath. Minimum conductor size shall be 1.5 mm².

2.7.2 Control Cables for control signal, alarms actuating devices and solenoid valves of the interlock and shutdown valves shall generally be 1.5 mm² copper conductors armoured with inner and cut PVC sheath.

2.7.3 All power supply cables shall have copper/Aluminium conductor depending upon the conductor size. The cables shall be armoured with inner and cut PVC sheath. The cables shall be sized adequately. Minimum conductor size shall be 2.5 mm².

2.7.4 2-core armoured cable shall be used for illuminator on level gauges.

2.7.5 The material and construction of all electrical cables shall conform to IS- 1554 Part I or appropriate equivalent code and standard.

3.0 INSTALLATION OF INSTRUMENTS

3.1 Instrument Mounting

3.1.1 No instrument shall be installed in such a way that it bends for support on the impulse piping or electrical connection on it.

3.1.2 Pressure gauges and temperature indicator shall normally be mounted directly on line. However direct on line mounting shall be avoided where vibrations are likely to be present.

3.1.3 Local mounted instruments shall be mounted on brackets, panels or placed on a suitable pedestal. Transmitters shall be mounted on 2" pipe supports where practical. Instruments to be mounted on steel columns, masonry structure etc. These shall not be mounted on heating equipments, pipelines and structures.

3.1.4 Blind transmitters shall be mounted at 130mm above graded platform. Local controllers, indicating transmitters and indicating instruments shall be mounted at approximately 1500 mm.

3.1.5 All the instruments shall be accessible from grade, ladder or platform etc. Pressures gauges and other local indicating instruments shall be readable from grade or operating level and if used for manual control shall be visible from the related valve.

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All the instruments shall be located such that they don't impede the process operation.

- 3.1.6 Local mounted instruments which are not available in weather proof housing shall be mounted inside a weather proof case.
- 3.1.7 Items such as pilot valves, solenoid valves etc. shall be located local to its point of application or near to the device being actuated by them.
- 3.1.8 For blind transmitters output meters shall be mounted on instrument supports.
- 3.1.9 Filter regulators shall be mounted on the instrument supports below pneumatic transmitter or on the control valve yoke.
- 3.1.10 Instruments or instrument lines shall not be supported on hand rails, in general.
- 3.1.11 The use of process piping to support instrument lines shall be avoided as far as possible.
- 3.1.12 The instrument impulse piping shall be kept as short as possible.
- 3.1.13 Instruments and impulse lines shall be protected against mechanical damage.
- 3.1.14 In case of capillary tube instruments, capillary tube is to be supported and protected against mechanical damage.
- 3.1.15 Orifice meters shall not be installed on the top of orifice fittings. On horizontal lines orifice pressure taps shall be located as follows:
 - a) On top for air and gas service
 - b) Horizontal for liquid and condensable vapour service.

3.2 Instrument Piping & Tubing.

3.2.1 Impulse Piping/tubing

- 3.2.1.1 The primary instrument block valves for all instruments shall be as per piping specifications.

3.2.1.23-Valve manifold in general shall be integral type. For pressure gauges, 2-valve manifolds shall also be acceptable instead of isolation valve, drain valve and pipe fittings.

3.2.1.3 Differential or static pressure sensing lines shall not exceed 6 mtrs. (20 feet) in general for direct connected or locally mounted instruments.

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3.2.1.4 All impulse lines shall be run with a slope not less than 1 in 12 except where otherwise specified. Direction of slope is to be downward from the process for liquid service and upward from the process for gas service.

3.2.1.5 Tubing shall be joined by compression fittings.

3.2.1.6 Piping shall be joined by pipe fittings/flanges as per the piping specifications.

3.2.1.7 All instruments pipes and tubes shall run in horizontal and vertical planes only and shall run with minimum number of changes in direction, consistent with good engineering practices and neat appearance.

3.2.1.8 Tubing shall be bent with correct size tube bender as far as possible to avoid use of fittings. Hot bending shall be totally avoided.

Tube cutter shall always be used to cut tubing. The use of short lengths of tubing in long runs shall be avoided in order to avoid the fittings.

3.2.1.9 All tubing shall run in such a manner as to give the maximum protection against mechanical damage. Tubing runs shall be grouped together and clamped.

3.2.1.10 Tubing shall be arranged so that the unions can be tightened without distorting lines.

3.2.1.11 Instrument tubing or piping shall not run on trays intended for cables and shall not share the same transit.

3.2.1.12 No pipe or tube shall be left with mechanical strain on them.

3.2.1.13 A mechanical ferrule seater shall be used on tubing for 140 kg/cm² (2000 psi) or more.

3.2.1.14 Pipe bushings shall not be used.

3.2.1.15 Pipe plugs shall be fabricated out of bar stock and shall have hex-head.

3.2.2 Air/Signal Tubing

3.2.2.1 Signal Transmission tubes shall be laid on perforated trays prefabricated out of min 2.5 mm. thick steel plates. The width of the tray shall be selected as per the number of tubes to be laid.

3.2.2.2 Where tubing is run in permanent enclosures, it should be ensured that entry and exit of such enclosures is clean and smooth.

3.2.2.3 Tubing run in permanent enclosures shall not have joints, except at special junctions

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boxes provided for this purpose.

- 3.2.2.4 Where permanent enclosures are left with space for instrument tubing to be laid at some later date, a galvanised pull wire of adequate size shall be left in the tray.
- 3.2.2.5 Where the length of transmission tubing exceeds 60 mtrs (200ft) necessity of installing signal booster relays shall be considered.
- 3.2.2.6 In case of 'Skidded' equipment or vessels with instrumentation, where off- skid alarms shutdown or control functions are provided the signal tubes shall be terminated on the control bulk head near the skid boundary.
- 3.2.3 All threaded pipe joints shall be joined after applying Teflon tape. It should be applied in a manner to ensure that the tape does not spill over the end of the male fitting. No other pipe joining compound shall be used except on high temperature service where graphite sealing compounds shall be used.
- 3.2.4 All reasonable precautions shall be taken to prevent foreign materials entering pipe lines or tubing before and during erection.
- 3.2.5 Pipes and tubes installed but not connected, shall have the ends clad in approved fashion to prevent the entry of foreign material. For a period upto one week adhesive tape may be used, for longer periods, caps or plugs shall be used.
- 3.2.6 Piping/Tubing supports
- 3.2.6.1 Piping and tubing shall be adequately supported and fixed at a distance not exceeding that in the following table:

Table

Single tubing/Piping	Max. distance between supports
3/8" OD or less	Continuous
1/2" to 3/4" Nom. size	2 meters (6ft.)
3/4" to 1" Nom. size	3 meters (9ft.)
Multitube bundle	3 meters (9ft)

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3.2.6.2 All field mounted instrument air tubing shall be supported with galvanised steel angles or channels of minimum 1/8" thickness fabricated to present neat appearance.

3.2.6.3 All instruments tubing supports shall be galvanised prior to installation

3.2.6.4 Trays shall be properly supported either from any rigid steel structure or concrete member. In case of non-availability of above, a suitable support shall be fabricated.

3.3 Instrument Air Supply Distribution

3.3.1 Piping material for instrument main and branched air headers upto the isolation valve at each take-off from main or branch header shall conform to piping specification.

3.3.2 The air header size shall be established in accordance with the table below, unless otherwise specified, for a header pressure of 4 to 8.5 kg/cm²

Table – 2

Max number of users	Nominal pipe size
upto 5	1/2"
upto 10	3/4"
upto 25	1"
upto 80	1-1/2"
upto 150	2"
upto 500	3"

3.2.3 All take off for branch lines are to be from the top of the main header with block valves equal in size to the branch line. All low point shall have a 1/2" valve installed as a drain and blow down point.

3.3.4 A minimum size of 1/2" pipe shall be run to the instrument with a 1/2" valve for each user. Tubing from the isolation valve to the instrument shall be 6.0 mm.

3.2.5 Union shall be provided at convenient location in the air header.

3.3.6 Filter regulator shall be provided for individual field mounted consumer and shall be complete with an output gauge.

3.3.7 In case of skid mounted equipments or vessels which incorporate instrumentation requiring pneumatic supply, on skid supply piping shall terminate at the skid boundary location and size of the supply connections shall be noted on the vendor approval drawings.

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3.4 Installation of multitude and Multicore cables.

3.4.1 Multicore/ Multitube cables shall generally be installed on trays or ducts and properly clamped. At bends minimum radius shall be maintained as per cable manufacturer's standards.

3.4.2 All cables shall be rigidly supported on structural steel and masonry. Drilling of steel member should normally be avoided. However, if the drilling of steel must be resorted to, it must be drilled where minimum of weakening of structure will result cables shall be support at every 500 mm. At every vertical drop these shall be clamped at more frequent intervals max of 300 mm.

3.4.3 Directly buried cables shall be laid underground in excavated cable trenches. Trenches shall have sufficient depth and width to accommodate all cables correctly spaced and arranged with a view of heat dissipation and economy of design construction of trenches laying of cables and filling up of trenches shall be as per relevant standard.

3.4.4 Each underground cable shall be provided with identifying tag of load securely fastened every 30 M of its underground length with at least one tag at each end before the cable enters the ground.

Before cables are placed, the trench bottom shall be filled with a layer of sand. The cables shall be covered with 150 mm of sand on the top of the largest dia. cable tube and sand shall be lightly pressed. A protective covering of 75 mm thick second class red bricks shall be laid flat and the balance portion of the trench shall be filled with soil, compacted and levelled.

3.4.5 At each road crossing and other places where cables enter pipe sleeves, adequate bed of sand shall be given so that the cables don't slack and get damaged by pipe ends after back filling.

3.4.6 At the entry into concrete blocks loops shall be provided at either end to prevent any damage to cable.

3.4.7 The cable entry to control room shall be suitably filled and sealed after laying of cables so as to achieve a positive sealing against the entry of gas/water.

3.4.8 All wiring, tubing, cables, Junctions boxes and auxiliary equivalent shall be suitably identified as per applicable codes and practices. All piping and tubing shall be tagged with slip-on or clip on wire marker at both ends.

3.4.9 Jointing of cables is generally not permitted. Cables shall be cut after the exact site measurements at the cable drums shall be so selected before cutting the lengths as to avoid any unnecessary wastage.

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3.4.10 Low signal cables like alarms, analysers cables, special cables for turbine meter, thermocouple compensating cables etc. shall be layed separated from power supply cables in ducts/trenches/trays.

3.4.11 Electric signal lines for electronic transmitters to receive and to final control element shall be continuously shielded with the shield grounded at the same point as the signal circuit generally at the control instrument.

3.4.12 Separate junction boxes shall be used for intrinsically sage cables.

3.4.13 Different intrinsically safe system e.g., systems having different rounds shall not be run in the same multicore cable, in general.

Recommended minimum separation distance between twisted pair signal leads and AC Power Lines.

AC Power Cable		Minimum Distance to Signal Lead
Voltage (Volts)	Current (Am) in (cm)	
0 to 125	0 to 10	12" (30)
125 to 250	0 to 50	15" (38)
250 to 440	0 to 200	18" (46)
5KV & Up	200 Amp. & Up	24" (61)

Different intrinsically safe circuits e.g., circuits having different voltage levels, of the same intrinsically safe system shall not be run in the same cable unless each conductor insulation is at least 0.25mm or no hazard can result from interconnection.

3.4.14 The physical separation of power and signal cables shall be as per API 550 Part I Section VII. Cable in intrinsically safe circuits shall preferably be not run in the same tray where-- on intrinsically safe circuits cables are being run. If these are being run in the same tray, a metallic earthed separately shall be provided.

3.4.15 For temperature controllers, single pair thermocouple extension cable or cable for resistance thermometer, shall be layed directly from the element to the transducer in the control room without intermediate terminal blocks.

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3.4.16 In case of skid mounted equipment or equipment which incorporate skid instrumentation like alarms, shutdown or control function shall terminate signals or control junction box near skid boundary for connection of off skid equipment.

3.4.17 No wire shall be terminated or left with mechanical strain within any conductor.

3.4.18 Splices shall be made only at terminals, in instruments or approval equipment/ junction boxes using lugs and screwed connections. No intermediate splices shall be made in cable trays or in conduct. Number of junction boxes in any cable path shall be limited to only one.

3.5 Installation of Zener barriers

3.5.1 Zener barriers shall be installed in the circuit to make the system intrinsically safe provided:

- There is no energy storage system in excess to the minimum permitted by the barrier design on the hazardous side of the barrier. The same shall be met by taking intrinsically safe transmitters and selecting the cable electrical parameters like inductance L/R ratio & capacitance in accordance with the maximum parameters given in barrier specifications.
- No power source exceeding the voltage rating of Zener barrier shall be connected on safe side of the Zener barrier.
- No outside power source including other intrinsically safe circuits shall be connected to the hazardous side of the barrier.

3.5.2 Zener barriers shall be located as close as possible to the field wiring entry point in the control room.

3.5.3 Single barrier are bolted directly to copper bus bar and multiple barriers on the barrier mounting plates. Copper bus or barriers mounting plates shall be isolated from the panel frame.

3.5.4 The signal ground system for intrinsically safe system shall be separate from power ground system and shall be connected to the signal ground reference point. The maximum resistance allocable between the farthest point on intrinsically safe barrier ground bus and signal ground reference point shall be less than 1 ohm.

3.5.5 Field wires shall directly terminate at the barriers and not through intermediate terminals.

3.6 Installation of Analyser / Gas Chromatograph

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- 3.6.1 Installation of all analyser shall be in general, as per APIP 550 Part II.
- 3.6.2 The analyser housing at its installation shall meet all safety requirements as per classifications.
- 3.6.3 Sampled process fluid, if not returned to the process shall be disposed to a safe location. Piping shall be provided so that vapours can be vented to a safe location and liquids shall be drained in a clean and orderly fashion to a safe place. Toxic vapours shall not be vented to atmosphere.
- 3.6.4 Analyser shall be located as near to the sampling point as possible.
- 3.6.5 Analyser equipment must be protected from the following:
- Hot equipment
 - Severe ambient temperature changes
 - Shock
 - Mechanical damage
 - Vibration
- 3.6.6 If a separate vent for the analyser is used, the location of that vent shall be in area of minimum air Turbulence. If the vents of different analysers are vented into a common vent, a back pressure regulator shall be used.
- 3.6.7 Vent piping shall be designed to prevent condensate from accumulation in low point and obstruct a free vent flow.
- 3.7 Ducts, Trays and Supports
- 3.7.1 Main cable duct shall be of bottom open type with flat/angle --- construction with side sheet and top cover of 3.2 mm thickness.
- 3.7.2 The ducts and trays shall be properly supported at regular intervals. Wherever insert plates are not available, support on concrete structure or ceiling shall be fixed with a minimum of 10 mm expansion bolts Angle supports for ducts shall be fabricated from minimum of 40 mm angle.
- 3.7.3 All supports shall be neatly cut with hacksaw only and not with gas cutting. Free ends of angle supports shall not have sharp ends and shall be properly rounded off.
- 3.7.4 Ducts and supports shall be painted with one coat of Red oxide Zinc chromate primer conforming to IS-2074 after cleaning to remove scale and then painted with 2 coats of final enamel paint as given below:

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- a) Duct - Dark admirately Grey as per IS0632.
- b) Supports - Black.

3.8 Instrument Steam Tracing

- 3.8.1 Steam for Tracking of instruments shall be taken from main steam header take of valve through carbon steel pipes supported at regular intervals.
- 3.8.2 Steam tracing around individual instrument shall be by copper tube of 1/8" diameter.
- 3.8.3 Piping or tubing for steam tracing shall be installed in such a way as to avoid condensate pockets.
- 3.8.4 After steam tracing, the line is connected to drain funnel through steam trap.

3.9 Identification of Lines and Instruments

- 3.9.1 All site mounted instruments, junction boxes, air headers, tubing and wiring terminations shall be labelled or tagged.
- 3.9.2 Instruments shall be furnished with stainless steel name tags containing Tag no., manufacturer's name, and model no. serial number. This tag number shall be approximately 3"x1" size and shall be attached to the instruments with -- gauge stainless steel wire.
- 3.9.3 Unused cable entries in junction boxes and field instruments are to be plugged.

4.0 **TESTING**

4.1 Instrument Impulse piping/Tubing

- 4.1.1 All process impulse lines shall be disconnected both from the instrument and vessel/piping end and flushed with water.
- 4.1.2 After thorough flushing the impulse lines shall be isolated from the instruments and pressurised hydraulically to 1.5 times the maximum working pressure corrected for ambient temperature. They shall then be isolated from the pressure source and the pressure reading on a test pressure gauge shall not fall at a rate exceeding one psig/hour.

In case no isolation valve is provided near the instrument, impulse piping/tubing shall be pressurised along with the instrument to the maximum pressure of scale in case of pressure transmitter and max. Operating pressure in case of differential pressure instrument with equalising valve open

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4.1.3 In special conditions where hydro- testing is not permissible due to service requirements, testing shall be carried out by using compressed air/nitrogen.

4.1.4 The external displacer type instruments and cage type level switches shall be tested to 1.5 times the operating pressure using air/nitrogen after thorough flushing.

4.2 Instrument Air lines/signal tubing.

4.2.1 Instrument air lines/signal tubing shall not be hydrostatically tested.

4.2.2 Instrument air tubing shall be disconnected upstream of all filter regulators and blown down to remove water, slag and mill scale, from lines at 7.0 kg/cm² G for fifteen minutes.

Air filter shall be taken in line and tubing shall be disconnected at instrument end, and blown for 3 minutes to remove traces of dirt.

4.2.3 Testing of instrument air shall be carried out with instrument air at 7 kg/cm²G upto the upstream of the filter regulator after thorough flushing. All lines shall be checked with soap solution and bubbler unit for possible leak at joints.

4.2.4 All signal tubing shall be checked with 1.5 kg/cm² after proper flushing. After pressuring, source shall be cut off and rate of fall in pressure shall be less than IPSL for each 100 feet of tubing for a test period of 2 minutes as per instrument society of American RP 7.1 'Pneumatic Control Circuit Pressure Test'

4.3 Cables

4.3.1 All wiring shall be checked to ensure that it is correctly connected and properly grounded.

4.3.2 All cables shall be checked for continuity proper connection and insulation testing.

Insulation test shall be carried out on all wiring with a certified magger after disconnecting the cables at both ends.

4.4 All the results of the above mentioned testing shall be recorded and submitted for check.

4.5 All the in line instruments like orifice plates, turbine meters, Rotameters, Target meters, vortex meters, control valves, safety valves etc. shall be removed and spool pieces shall be provided prior to the flushing of the lines.

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5.0 CALIBRATION OF INSTRUMENTS

5.1 All instruments shall be calibrated strictly as per manufacturer's instructions prior to the installation. In addition to calibration of instruments, setting of safety devices like process switches, safety valves etc. and simulation testing of all interlock and shutdown system shall be carried out.

5.2 In general, all tests shall simulate, as closely as possible, design process condition by the use of manometers, potentiometers, deadweight testers, test pressure gauges etc. Four point calibration shall refer to the input signal to an instrument equivalent to 0, 25, 50, 75, 100% of instrument range upscale (rising) and 75, 50, 25, 0% of instrument (downscale) (falling).

All instruments unless otherwise noted shall be calibrated in upscale and downscale direction and if necessary, adjusted until their accuracies conform to those limits state by the manufacturer.

Upon completion of these tests, the instruments shall be drained, completely.

5.3 Temperature Instruments

5.3.1 Temperature Gauges Filled type and Bi metallic dial type Thermometers shall be four point bench checked for proper operation and calibration using a temperature bath prior to installation.

5.3.2 Temperature Elements and Temperature Transmitters.

Temperature Elements and Transmitter shall be four point bench calibrated using a temperature bath precision meter or precision gauge prior to installation.

5.4 Pressure Instruments

5.4.1 Pressure Gauges

5.4.1.1 Direct connected bourdon type pressure gauges shall be dead weight tested or tested against a test gauges prior to installation.

5.4.1.2 Receiver type pressure gauges shall be four points calibrated using a precision gauge and precision air regulator.

5.4.1.3 Pressure and Differential Pressure Transmitters.
Pressure and differential pressure transmitters shall be four points calibrated using a hydraulic or dead weight tester or a precision pneumatic calibrator prior to the

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installation. A precision output meter or gauge shall be used to monitor the output.

- 5.5.1 Orifice plates shall be checked visually for the name plate and for an upstream sharp edge. Bore dia. shall be checked for compliance with the specification.
- 5.5.2 Differential pressure type of flow instruments shall be four points calibrated using precision pneumatic calibrator or a manometer and precision regulator. A precision output meter or gauge shall be used to monitor the output of the transmitter.
- 5.5.3
- a) Rotameters shall be installed as received. A check shall be made to confirm that shipping stops have been removed and float has been installed.
 - b) Where rotameters have transmitting mechanism, the float shall be raised and lowered mechanically and output shall be checked. Vendor calibration data/ curve shall be checked.
 - C) A check shall be conducted with plumb for a vertical installation.
- 5.5.4 Turbine meters, Annubar, positive displacement meters, vortex meter, ultrasonic flow meter, etc. shall be installed as received.
- 5.5.5 Target meters shall be checked for calibration using calibration weights. Output shall be monitored using precision output meter.
- 5.6 Level Instruments
- 5.6.1 Level Gauge Glasses
- Gauge glasses shall be installed as received installation of illuminators, frost protectors and other accessories shall be checked.
- 5.6.2 Displacer Type, Level Transmitter
- Displacer type level transmitter shall be checked by raising and lowering mechanically the displacement and checking the pilot or transmitter action. Check transmitter with out put gauge or meter for smooth and full output change.
 - A check shall be conducted with plumb for a vertical installation.
- 5.6.3 Differential pressure type level transmitter Differential pressure type level transmitter shall be calibrated with pneumatic calibrator at four points prior to installation. A precision meter or gauge shall be used to monitor the output of the transmitter.

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- 5.6.4 Tank level gauges
- Tank level gauges shall be checked by raising and lowering mechanically the displacer and checking the indicator on the gauge board.
 - Check for proper liquid seal prior to installation in case of liquid seal tank gauges.
 - In case of servo type gauges, the displacer is hoisted from the tank into the calibration chamber.
- 5.7 Control Valves, shutdown valves and self actuated valves
- 5.7.1 All diaphragm and piston operated control valve shall be stroked pneumatically using a pressure regulator and pressure gauge against the spring range specified on the name plate of the valve.
- 5.7.2 Mechanical seating and travel of the valve stem shall be checked against the side indicator and the name plate
- 5.7.3 Valve positioner shall be calibrated with the control valve in accordance with the name plate data and specifications with the help of pneumatic calibrator or gauge with precision regulator. Zero position or fully close position of the valve shall be a live zero i.e., the plug shall be just off the seat at the minimum setting.
- 5.7.4 Volume bottles, where used shall be checked for proper filling. The signal line shall be bled to zero pressure and failure action shall be confirmed.
- 5.7.5 Control valve accessories such as handwheels, boosters, relays etc. shall be checked operationally. Declutch able handwheel shall be operable both with and without an air signal to the diaphragm.
- 5.7.6 Self actuated control valves shall be installed as received, checking inlet and outlet points and name plate data. Regulators with external pressure connections shall be inspected for proper installation.
- 5.7.7 Butterfly shall be checked carefully to see that the vane moves freely into the upstream and down stream piping. Proper vane movement to stroke shall be confirmed.
- 5.7.8 All control valves and regulators shall be removed from the line prior to flushing and during hydro testing.

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5.8 Safety Relief Valves

5.8.1 Safety relief valves shall be installed as received after carefully checking the name plate data. Pilots, if used, shall be checked carefully for installation on the proper safety valve.

5.8.2 Valves, which are installed in such a manner as to permit on line testing, shall be pressure tested after installation to determine proper operation and setting. Compressed air or nitrogen shall be used for testing of safety relief valves.

5.9 Switches

5.9.1 Level Switches shall be actuated mechanically for switch operation but shall not be calibrated for level setting.

5.9.2 Pressure switches shall be calibrated using hydorlic or dead weight tester or precision air regulator and gauge. The setting/trip point shall be checked using a continuity tester.

5.9.3 Temperature switches shall be calibrated using a temperature both prior to installation and set to the required alarm/ trip point using a continuity tester.

5.10 Receiver Instruments

5.10.1 Receiver Indicator/Recorders

5.10.1.1 Pneumatic indicators/ Recorders shall be calibrated using pneumatic calibrator/ precision pressure regulator and gauge.

5.10.1.2 Electronics indicators/ Recorders shall be calibrated using a current generator and a precision meter.

5.10.1.3 Chart drive assembly shall be checked for proper operation.

5.10.2 Controllers

5.10.2.1 Proper balancing of the controller shall be checked as per the manufacturers catalogues.

5.10.2.2 Controllers shall be checked for manual and Auto operation and Transfer. The transfer from manual to Auto and vice versa shall be bumpless and smooth.

5.10.3.1 Manual loader station Output of the manual loader shall be checked with a precision meter.

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5.10.4.1 Multipoint Temperature Recorders

Each point shall be calibrated using a temperature simulator/ decade box for RTD / voltage generator and precision meter for the thermocouples.

5.10.4.2 Point synchronisation shall be checked.

5.10.5 Pneumatic receiver switches shall be calibrated using precision air regulator and gauge. The setting/alarm/trip point shall be checked using continuity tester.

5.10.6 Trip Amplifiers Trip amplifiers shall be calibrated using a temperature simulators or voltage generator and precision meter for thermocouple or Resistance box for RTD's. The required setting/ alarm point/ trip point shall be checked using a continuity tester.

5.10.7 Receiver Switch module Receiver switch modules shall be calibrated using a current source and a precision meter. The required setting/alarm/trip point shall be checked using a continuity tester.

5.10.8 Alarm and Annunciator system

5.10.8.1 Alarm and annunciator system shall be checked for visual and audio alarm operation using dummy signals. Full alarm sequence of each alarm point shall be checked.

5.10.8.2 Each point shall be checked for proper engraving.

5.10.9 Shutdown System

5.10.9.1 Operation of final actuating elements shall be checked for proper operation using dummy signals.

5.10.9.2 All timers, push buttons and switches shall also be checked for their proper operation.

5.11 Analytical Instruments

5.11.1 Check the full analyser system including sample handling system for leakage.

5.11.2 Check the full sample handling system for its proper operation. Calibrate and check completely all analysers using zero and span samples as per vendor catalogues.

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5.12 Flow computer / Volume corrector

5.12.1 Corrected flow values shall be checked for various D.C. inputs and pressure and temperature variations for upscale and downscale ranges.

5.13 The list of test and calibration instruments with traceability certificates shall be submitted to MECON for approval before carrying out the tests / calibration of instruments at site.

5.14 The formats / description of tests / calibration of all instruments shall be submitted to MECON for approval.

5.15 Daily / weekly reports shall be submitted during execution of work at site.

SPECIFICATION FOR INSTRUMENT TUBING

SPECIFICATION NO.: MEC/S/05/26/02



**ELECTRICAL & INSTRUMENTATION
(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

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AMENDMENT STATUS

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)

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C O N T E N T S

- 1.0 GENERAL
- 2.0 CONSTRUCTION
- 3.0 TESTING
- 4.0 SHIPPING
- 5.0 REJECTION

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1.0 GENERAL

1.1 Scope

1.1 This standard specifications, together with the data sheets attached herewith, covers the requirements for the design, materials, testing and shipping of Instrument Tubing which includes the following types:-

- a) SS tubes
- b) Copper tubes

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

- ASTM A 269 - Specification for seamless and welded ferritic stainless steel tubing for general services.
- ASTM B 251 - Specification for general requirements for wrought seamless copper and copper alloy tube.
- ASTM B 251M - Specification for general requirements for wrought seamless copper and copper alloy tube (Metric)
- ASTM B 68 - Specification for seamless copper tube, bright annealed.
- ASTM B 68M - Specification for seamless copper tube, bright annealed. (Metric)

1.1.3 In the event of any conflict between these specifications, data sheets, related standards, codes, etc., the vendor shall refer the matter to the purchaser for clarifications and only after obtaining the same shall proceed with the manufacture of the items in question.

1.2 Bids

1.2.1 Vendor's quotation shall include a detailed specification sheet for each type of tube which shall provide the following information:

- a) All the details regarding the type, construction, materials etc. of the items.
- b) Overall the dimensions in mm.

1.2.2 All the units of measurement and material specifications for various parts in the vendor's specification sheets shall be to same standards as in purchaser's data sheets.

1.2.3 Vendor shall attach a list of items, type wise, summing up all the deviations from this specification and purchaser's data sheets if there are any. Also vendor shall provide reasons for these deviations.

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
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1.2.4 Vendor shall enclose catalogues giving detailed technical specifications and other information for each type of tube in the bid.

1.2.5 Vendor's quotation, catalogues, drawings etc. shall be in English language.

1.3 Drawings, Data and Certification

Detailed drawings, data, catalogues and manuals etc. required from the vendor are indicated by the purchaser in vendor data requirement sheets. The required number of reproducible and prints shall be despatched to the address mentioned, adhering to the time limits indicated.

2.0 CONSTRUCTION

2.1 Stainless Steel Tubes

2.1.1 SS tubes of the tubes shall be Rockwell RB 70-70. Tubes shall be free from scratches and to be suitable for bending.

2.1.3 Tube wall thickness shall be 0.049" for 1/2" OD and 1mm for 6 mm unless otherwise specified.

2.1.4 Maximum working pressure shall be 153.0 kg/cm² at 38°C for 1/2" OD Tube, unless otherwise specified and 80.0 kg/cm² at 38° for 6mm OD tube.

2.1.5 Tubes shall be supplied in minimum length of 6 metres without brazing in between.

2.1.6 Dimensional tolerances shall be as per ASTM A 269.

2.1.7 The following shall be marked on the tube:

- a) Name of manufacturer
- b) Type and material grade of tube
- c) Tube O.D. and wall thickness

2.2 Copper Tubes

2.2.1 Copper Tubes (PVC Jacket)

2.2.1.1 The tube shall be soft annealed copper with 6mm OD and a wall thickness of 1.0 mm as per ASTM B 68M Copper No.C12200.

2.2.1.2 The tube shall be jacketed with black PVC. The jacket thickness shall be 1.6mm. The PVC jacket shall confirm to ASTM D-1047.

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2.2.1.3 The tube ends shall be plugged prior to transportation.

2.2.1.4 The tube shall be of continuous length without any brazing in between for 100 metres length.

2.2.1.5 Minimum length of single tube shall be 100 metres.

2.2.1.6 The dimensional tolerances shall be as per ASTM B 251M.

2.2.2 Bare Copper Tubes (For Steam Tracing)

2.2.2.1 The tube shall be soft annealed copper with 3/8" OD or 6mm OD with a wall thickness of 1.0 mm as per ASTM B68 copper No.C12200.

2.2.2.2 The tube ends shall be plugged prior to transportation.

2.2.2.3 The tube shall be of continuous length without any brazing in between for 100 metres length.

2.2.2.4 Minimum length of tube shall be 100 metres.

2.2.2.5 The dimensional tolerances shall be as per ASTM B 251.

3.0 TESTING

3.1 The following tests shall be done for SS tubes.

- Hardness test
- Hydrostatic test at 153.0 kg/cm² at 38° C for 1/2" tube and at 80.0 kg/cm² at 38°C for 6mm tube, unless otherwise specified.

3.2 PVC jacketed copper tubes shall be tested at 7.0kg/cm²g with dry air for leak check.

3.3 Bare copper tubes shall be hydrostatically tested at 80.0 kg/cm²g at 38°C.

3.4 Final test before delivery shall include ball test to ensure clear opening of the tube for copper tubes. The O.D of the ball shall be minimum 1mm for 6mm O.D tube and 2mm for 3/8" tube.

4.0 SHIPPING

4.1 The tubes shall be plugged at both ends to avoid entry of foreign matter. The tubes shall be packed carefully so as to avoid damage during transport.

5.0 REJECTION

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Vendor shall make his offer in detail, with respect to every item of the purchaser's specifications. Any offer not conforming to this shall be summarily rejected.

SPECIFICATION

FOR

**INLET / OUTLET SECTIONS
AND FLOW STRAIGHTENER**

SPECIFICATION NO.: MEC/S/05/26/03



**ELECTRICAL & INSTRUMENTATION
(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
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C O N T E N T S

- 1.0 FLOW STRAIGHTNER
- 2.0 INLET SECTION/OUTLET SECTION

PREPARED BY: (R. SANJAY BABU)	CHECKED BY: (RAKESH SHUKLA)	APPROVED BY: (PANKAJ SRIVASTAVA)	ISSUE DATE : 08Th DEC 08

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
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1.0 FLOW STRAIGHTNER

- 1.1 Flow straightener shall be installed in the inlet section upstream of flow meter.
- 1.2 Flow straightener shall consist of a bundle of tubes designed and assembled as per ISO 5167-1980 (E) or AGA Report no.3 or AGA Report no.7.
- 1.3 Tube diameter shall be 0.2 D or less where D is the diameter of Meter inlet section pipe. Tube shall be seamless quality of SS 316 material thickness 1.5 or 1 mm Tube shall be hydrostatically tested for 75kg/cm² pressure and then cut to the required length for assembly.
- 1.4 On both the sides of tube bundle a very thin retaining rings of SS316 shall be provided for avoiding the dislocation of pipes.
- 1.5 The tube bundle shall be kept in position by 6mm threaded bolt. After tightening the bolt shall seal welded.
- 1.6 Tube ends shall be tempered at 45° angle.

2.0 INLET SECTION/OUTLET SECTION

- 2.1 Inlet/Outlet sections of pipe for flow meter shall be of same inside diameter (ID) as turbine meter.
- 2.2 The pipe used should be circular and with no ovality or any other deformation, the inside surface of pipe shall be smooth, welded portion shall be grinded to smooth finish.

SPECIFICATION FOR INSTRUMENT TUBE FITTINGS

SPECIFICATION NO.: MEC/S/05/26/04



**ELECTRICAL & INSTRUMENTATION
(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
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- 1.0 GENERAL
- 2.0 CONSTRUCTION
- 3.0 TESTING
- 4.0 SHIPPING
- 5.0 REJECTION

PREPARED BY: (R. SANJAY BABU)	CHECKED BY: (RAKESH SHUKLA)	APPROVED BY: (PANKAJ SHIVASTAVA)	ISSUE DATE : 08Th DEC 08

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
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1.0 GENERAL

1.1 Scope

1.1.1 This standard specifications, together with the data sheets attached herewith, covers the requirements for the design, materials, testing and shipping of instrument tube fittings which includes the following types:-

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

1.1.2 The related standards referred to herein and mentioned below shall be of the latest edition prior to the date of Purchase's enquiry:

- ANSI B 2.1 - Pipe Threads
- B16.11 - Forged steel fittings-socket welding and threaded.
- IS:319 - Specification for free cutting brass bars, rods and sections.
- ISA RP 42.1 - Nomenclature for instrument tubing - fittings.

1.1.3 In the event of any conflict between these specifications, data sheets, related standards, codes etc., the vendor shall refer the matter to the purchaser for clarifications and only after obtaining the same shall proceed with the manufacture of the items in question.

1.2 Bids

1.2.1 Vendor's quotation shall include a detailed specification sheet for each type of tube fittings which shall provide the following information:

- a) All the details regarding the type, construction, materials, etc. of the items.
- b) Overall dimensions in mm.

1.2.2 All the units of measurement and material specifications for various parts in the vendor's specification sheets shall be to same standards as in purchaser's data sheets.

1.2.3 Vendor shall attach a list of items, typewise, summing up all the deviations from this specification and purchaser's data sheets if there are any. Also vendor shall provide reasons for these deviations.

1.2.4 Vendor shall enclose catalogues giving detailed technical specifications and other information for each type of fitting in the bid.

1.2.5 Vendor's quotation, catalogues, drawings, etc. shall be in English language.

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1.3 Drawings, Data and Certification

Detailed drawings, data, catalogues and manuals etc., required from the vendor are indicated by the purchaser in vendor data requirement sheets. The required number of reproducibles and points shall be despatched to the address mentioned, adhering to the time limits indicated.

2.0 CONSTRUCTION

2.1 SS Tube fittings:

2.1.1 Nomenclature of all tube fittings shall be as per ISA RP 42.1.

2.1.2 Fittings shall be flareless compression type and of three piece construction with ferrule, nut and body suitable for use on SS tubes conforming to ASTM A 269 TP316, hardness not exceeding RB80.

2.1.3 All parts shall be of SS 316.

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

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

2.1.6 Spanner hold shall be metric.

2.1.7 Threaded ends of fittings shall be NPT as per ANSI B 2.1.

2.1.8 Copper Tube Fittings

2.2.1 Nomenclature of all tube fittings shall be as per ISA 42.1.

2.2.2 Fittings shall be of flareless 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.

2.2.3 All parts shall be manufactured from Brass as per IS 319 barstock and Nickel plated.

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

2.2.5 Nuts & ferrules of particular size shall be interchangeable for each type.

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2.2.6 Threaded ends of fittings shall be NPT as per ANSI B 2.1.

2.2.7 Spanner hold shall be metric.

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

3.0 TESTING

3.1 Random samples of SS tube fittings shall be hydrostatically tested as follows:-

For 6 mm fittings at 80.0 kg/cm², 1/2" fittings at 153.0 kg/cm² at 38°C unless otherwise specified.

3.2 Random samples of brass compression fittings shall be hydrostatically tested as follows:-

For 1/4" fittings, at 10 kg./cm², 3/8" at 80.0 Kg/cm² and all at 38°C.

4.0 SHIPPING

4.1 All thread/ends shall be protected with plastic caps to prevent damage/entry of foreign matter.

5.0 REJECTION

Vendor shall make his offer in detail, with respect to every item of the purchaser's specifications. Any offer not conforming to this shall be summarily rejected.

SPECIFICATION FOR INSTRUMENT VALVES AND MANIFOLDS

SPECIFICATION NO.: MEC/S/05/26/05



**ELECTRICAL & INSTRUMENTATION
(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
	ELECTRICAL & INSTRUMENTATION OIL & GAS SBU, DELHI		
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5.0	REJECTION

PREPARED BY: (R. SANJAY BABU)	CHECKED BY: (RAKESH SHUKLA)	APPROVED BY: (PANKAJ SRIVASTAVA)	ISSUE DATE : 08Th DEC 08

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
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1.0 GENERAL

1.1 Scope

1.1.1 This standard specifications, together with the data sheets attached herewith, covers the requirements for the design, materials, testing and shipping of Instrument Valves & Manifolds which includes the following types:-

- a) Miniature instrument valves
- b) Instrument valve manifolds
- c) Instrument air valves

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

- ANSI B 2.1 - Pipe threads
- ANSI B 16.11 - Forged steel fittings-socket welding and threaded.

1.1.3 In the event of any conflict between these specifications, data sheets, related standards, codes etc, the vendor shall refer the matter to the purchaser for clarifications and only after obtaining the same shall proceed with the manufacture of the items in question.

1.2 Bids

1.2.1 Vendor's quotation shall include a detailed specification sheet for each type of Valves & Manifolds which shall provide the following information:

- a) All the details regarding the type, construction, materials etc. of the items.
- b) Overall dimensions in mm.

1.2.2 All the units of measurement and material specifications for various parts in the vendor's specification sheets shall be to same standards as in purchaser's data sheets.

1.2.3 Vendor shall attach a list of items, typewise, summing up all the deviations from this specification and purchaser's data sheets if there are any. Also vendor shall provide reasons for these in the bid.

1.2.5 Vendor's quotation, catalogues, drawings etc. shall be in English language.

1.3 Drawings, Data and Certification

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Detailed drawings, data, catalogues and manual etc. required from the vendor are indicated by the purchaser in vendor data requirement sheets. The required number of reproducible and prints shall be despatched to the address mentioned, adhering to the time limits indicated.

2.0 CONSTRUCTION

2.1 Instrument Valves (Miniature)

- 2.1.1 The instrument valves shall be globe pattern-needle valves forged/ barstock with inside screwed bonnet.
- 2.1.2 Body and trim material shall be 316 SS unless otherwise specified.
- 2.1.3 The valve body rating shall be 3000 lbs unless specified in piping material specification which shall govern in case it is specified.
- 2.1.4 The end connection shall be 1/2" NPTF to ANSI B2.1.
- 2.1.5 The packing material shall be teflon unless otherwise specified.
- 2.1.6 The hand wheel material shall be carbon steel zinc plated.
- 2.1.7 Flow direction shall be marked on the body.
- 2.1.8 The valve dimension shall be as follows:
 - a) End to end dimensions 76 mm (approximately).
 - b) Height in fully open condition - 135mm maximum.

2.2 VALVE MANIFOLDS

2.2.1 3-Valve & 5-Valve manifolds:

2.2.1.13 Valve manifold shall be designed for direct coupling to differential pressure transmitters having 2 bolt flanges with 54 mm (2-1/8") centre to centre connections and 41.3 mm (1-5/8") bolt to bolt distance. The manifold shall contain two main block valves and an equalizing by-pass valve. The valves shall be needle valves. They shall use self aligning 316SS ball seats.

2.2.1.25 Valve manifold shall contain two main line block valves and a combination double block and bleed for the bypass line.

2.2.1.3 The manifold shall be suitably for mounting directly on the stanchion (2" pipe).

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2.2.1.4 All bonnets shall have teflon packing unless otherwise specified.

2.2.1.5 The material of construction shall be 316 SS unless otherwise specified.

2.2.1.5 The material of construction shall be 316SS unless otherwise specified.

2.2.1.6 The flanges shall be integral part of the block.

2.2.1.7 The process connection shall be 1/2" NPTF to ANSI B2.1.

2.2.1.8 The manifolds shall be supplied along with mounting accessories. The bolts and nuts shall be alloy steel as per ASTM A 193 Gr B ASTM A 194 GR 2H respectively. Rings shall be teflon and other accessories shall be cadmium plated.

2.2.1.9 Vendor shall furnish the material certificate for body.

2.2.2 3 Way 2 Valve Manifold for pressure gauges.

2.2.2.1 The manifold shall be designed for use with pressure gauges.

2.2.2.2 The valve shall be a ball valve.

2.2.2.3 The body shall be either straight or angle as specified in data sheets.

2.2.2.4 The body and trim material shall be 316SS, packing material shall be teflon unless otherwise specified.

2.2.2.5 The inlet connection shall be 3/4" plain end (female) for socket weld as per ANSI B 16.11.

2.2.2.6 The gauge connections shall be with union nut & tail piece threaded 1/2" NPT (F).

2.2.2.7 The drain connection shall 1/2"NPTF.

2.3 Instrument Air Isolation Valves

2.3.1 The valves shall be full bore ball valves.

2.3.2 Body material shall be Nickel or Cadmium plated carbon steel.

2.3.3 Trim material shall be 316SS.

2.3.4 The end connection shall be 1/2" NPTF to ANSI B2.1 unless otherwise specified.

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2.3.5 The packing material shall be teflon.

2.3.6 The handle/wrench material shall be cadmium or nickel plated carbon steel.

2.3.7 The valve body rating shall be ANSI 800 lb.

2.3.8 End to end dimensions shall be 70mm (approximately).

3.0 TESTING

3.1 The instrument valves (miniature) shall be hydrostatically tested at 200kg/cm² g at 38°C.

3.2 All manifolds (3 valves, 5 valves and 3 ways, 2 valves) shall be hydrostatically tested at 200 kg/cm² at 38C.

3.3 The instrument air valves shall be hydrostatically tested at 15.0 kg/cm²g at 38°C and at 10.5 kg/cm²g with dry air.

4.0 SHIPPING

4.1 All threads/ends shall be protected with plastic caps to prevent damage/entry of foreign matter.

5.0 REJECTION

Vendor shall make his offer in detail, with respect to every item of the purchaser's specifications. Any offer not conforming to this shall be summarily rejected.

SPECIFICATION
FOR
JUNCTION BOXES AND CABLE GLANDS

SPECIFICATION NO.: MEC/S/05/26/06



ELECTRICAL & INSTRUMENTATION
(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
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C O N T E N T S

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2.0	JUNCTION BOXES
3.0	CABLE GLANDS & PLUGS, REDUCERS/ ADAPTORS
4.0	NAME PLATE
5.0	SHIPPING
6.0	REJECTION

PREPARED BY: (R. SANJAY BABU)	CHECKED BY: (RAKESH SHUKLA)	APPROVED BY: (PANKAJ SRIVASTAVA)	ISSUE DATE : 08Th DEC 08

MECON LIMITED REGD. OFF: RANCHI 834002	STANDARD SPECIFICATION		
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1.0 General

1.1 Scope

1.1.1 This standard specifications, together with the data sheets attached herewith, covers the requirements for the design, materials, nameplate marking, testing and shifting of junction boxes & cable glands which include the following types:

- a) Electrical junction boxes.
- b) Pneumatic junction boxes
- c) Cable glands (whenever specified)

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

- ANSI B 2.1 : Pipe threads
- IS-5 : Colours for ready mixed paints and enamels
- IS-2147 : Degrees of protection provided by enclosures for Low voltage switchgear and control gear.
- IS-2148 : Flame proof enclosure of electrical apparatus.

1.1.3 In the event of any conflict between specifications, data sheets, related standards, codes etc., the vendor shall refer the matter to the purchaser for clarifications and only after obtaining the same should proceed with the manufacture of the items in questions.

1.2 Bids

1.2.1 Vendor's quotation shall include a detailed specification sheet for each type of junction box and cable gland which shall provide the following information:

- a) All the details regarding the type, construction, materials, housing, entries, etc.
- b) All dimensions in millimetre.
- c) Sketch for each type of JB with dimensional details showing the terminal and entries arrangement.
- d) Mounting details.
- e) Vendor shall furnish certificate from statutory body for explosion proof enclosure, indicating the gas group and temperature class.

1.2.2 All the material specifications for various parts in the vendor's specification sheets shall be to the same standards as those in purchaser's data sheets (e.g. BS IS, etc.)

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1.2.3 Vendor shall attach a list of items, tag number wise, summing up all the deviations from the purchaser's data sheets, if there are any. Also vendor shall furnish reasons for these deviations.

1.2.4 Vendor shall enclose catalogues giving detailed technical specifications and other information for each type of JB/cable glands and its accessories covered in the bid.

1.2.5 Vendor's quotation, catalogues, drawings, etc. shall be in English language.

1.3 Drawings, Data and Certification

1.3.1 Detailed drawings, data, catalogues required from the vendor are indicated in vendor data requirements sheets. The required number of reproducible and prints shall be despatched to the address mentioned, adhering to the time limits indicated.

1.3.2 After placement of purchaser order, vendor shall submit certified drawings and specifications sheets for each type of JB/cable gland which shall include the following:

- a) Detailed dimensional drawings
- b) Weight of each in grams/Kg.
- c) Certificate from statutory body suitable for installation in specified hazardous area.

2.1 **Junction Boxes**

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

- I. Weather proof junction boxes.
- II. Weather proof & Explosion proof junction boxes.

2.2 The enclosure shall be as per IS-2147 for weather proof junction boxes and for Explosion proof it shall be as per IS-2148 suitable for the area classification specified.

2.3 Number of entries and locations shall be as per data sheets.

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

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2.5 Electrical Junction boxes

- 2.5.1 Material shall be die-cast aluminium of minimum 5 mm thick (LM-6 alloy)
- 2.5.2 Explosion proof junction boxes shall have detachable cover which is fixed to the box by means of cadmium plated triangular head/hexagonal head screws.
- 2.5.3 Weather proof junction boxes shall have doors which shall be hinged type and these shall be fixed with cadmium plated countersunk screws.
- 2.5.4 Explosion proof junction boxes shall have a warning engraved/integrally cast on the cover as given below:
- "Isolate power supply elsewhere before opening"
- 2.5.5 Terminals shall be spring loaded, vibration proof, clip-on type, mounted on nickel plated steel rails complete with end cover and clamps for each row.
- 2.5.6 All terminals shall be suitable for accepting minimum 2.5 sq. mm copper conductor, in general. However for power supply distribution boxes, terminal detail shall be as per job specification/Data sheets.
- 2.5.7 Sizing shall be done with due consideration for accessibility and maintenance in accordance with the following guidelines.
- i) 50 to 60 mm between terminals and sides of box parallel to terminal strip for upto 50 terminals and additional 25mm for each additional 25 terminals.
 - ii) 100 to 120mm between terminals for upto 50 terminals and additional 25mm for each additional 25 terminals.
 - iii) Bottom/top of terminal shall not be less than 100 mm from bottom/top of the junction box.

2.5.8 Terminals shall be marked as per the various types indicated in data sheets.

2.5.9 Shall be provided with external earthing lugs.

2.6 Pneumatic junction boxes

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

2.6.2 Single tube entries shall be suitable for 6mm O.D. copper tube with bulk head fittings. Multi tube bundle entry shall be suitable for the data furnished in data sheets.

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2.7 Painting

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

2.7.2 Two coats of lead-free base primer and two final coats of lead free epoxy based paint shall be applied both for interior and exterior surfaces.

2.7.3 The colour shall be as specified in data sheets.

3.0 **Cable glands & plugs, Reducers/Adaptors**

3.1 Cable glands shall be supplied by vendor whenever specified.

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

3.3 The cable glands shall be of Nickel plated brass.

3.4 The cable gland shall be weather proof. Whenever specified they shall be explosion proof and certificate from statutory body shall be furnished.

3.5 Cable glands shall be supplied to suit the cable dimensions indicated along with tolerance indicated in data sheets. Various components like rubber ring, metallic ring, metallic cone and the outer/inner nuts etc. shall be capable of adjusting to the above tolerances of cable dimensions.

3.6 Reducers/Adaptors shall be supplied as per details indicated in data sheets. They shall be nickel plated brass. These shall be weather proof in general. These shall also be explosion proof wherever specified and certificate from statutory body for explosion shall be furnished.

3.7 Plugs shall be provided wherever specified. They shall be of Nickel plated brass.

3.8 Plugs shall be certified explosion proof when used with explosion and junction boxes.

4.0 **Name Plate**

4.1 Each junction box shall have an anodised aluminium name plate permanently fixed to it at a visible place bearing the tag no. & enclosure. The name plate shall also bear the stamp of certifying agency with certificate number.

5.0 **Shipping**

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

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

6.0 Rejection

Vendor shall furnish his offer in detail, with respect to every item of the purchaser's specifications. Any offer not conforming to this shall be summararily rejected.

ELECTRICAL & INSTRUMENTATION SECTION
MECON LIMITED
DELHI - 110 092



SPECIFICATION
FOR
SIGNAL CABLES

SPECIFICATION NO.: MEC/S/05/26/07

MECON LIMITED Delhi	ELECTRICAL & INSTRUMENTATION SECTION DELHI	SPECIFICATION FOR SIGNAL CABLES	
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PREPARED BY	CHECKED BY	APPROVED BY

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1.0 GENERAL

1.1 Scope:

This specification together with the job Specifications attached herewith forms the requirements for design, materials, manufacturing, testing and shipping of PVC insulated signal cables.

1.2 Standards:

The cables shall conform to the latest editions of the various standards mentioned in the specification.

In case of any conflict between any standard and this - specification the matter shall be referred to the purchaser before proceeding with the manufacture of the cables.

1.3 Bids:

1.3.1 Vendor's quotation shall include the following as a minimum.

Completed job specs., Pair identification method, type test certificates, technical literatures, various testing methods and cross sectional dimensional drawings. All information/data shall be in English language.

1.3.2 Vendor's quotation shall include a list of deviations if any from purchaser's specifications and shall also indicate the reasons for such deviations for consideration to arrive at mutually agreed deviations. However vendor shall note that no deviation shall be accepted in respect of the permissible limits of resistance capacitance and L/R ratio of cables.

1.3.3 Vendor shall quote unit price per meter for each type of cable.

1.4 Instructions to Bidder:

1.4.1 The quantity indicated against each type of cable in the job specification may vary by $\pm 25\%$ at the time of placement of order. Vendor shall confirm that there shall be no price implication on this account in unit prices type wise.

1.4.2 Drum length for each type of cable shall be 500 to 1000 meters. Vendor shall indicate the maximum drum length possible for each type of cable in his bid. Exact requirements of drum length will be specified after purchase order during detailed engineering and vendor shall confirm that the same shall not affect the price or delivery schedule. The actual produced drum length shall not vary by more than $\pm 5\%$ from the value indicated in the purchase order.

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- 1.4.3 Tolerance over the total ordered length shall be as follows:
 $\pm 5\%$ for total length less than 5 km.
 $\pm 2\%$ for total length 5 km or more.
- 1.4.4 Cable dimensions furnished by vendor in his bid shall be firm. Vendor shall comply with all the values during execution.
- 1.5 All cables shall be suitable for laying in open air, corrosive hydrocarbon plant atmosphere, direct sun and in trenches. The cable shall also be designed for prolonged use in tropical atmosphere.
- 1.6 On demand vendor shall furnish documents such as invoice and test certificates to prove the quality and composition of the materials used for manufacturing the cable to the satisfaction of client/ consultant or authorized representative during various stages of expediting and inspection.
- 2.0 Construction:
- 2.1 Type 1 (single pair/triad shielded cable)
- 2.1.1 Each core shall be 1.5 sq. mm made of 7 stranded annealed electrolytic copper conductor. Each strand shall be 0.53 mm dia.
- 2.1.2 Primary insulation shall be 85°C polyvinyl chloride (PVC) as per IS-5831 Type C. Thickness shall be 0.5 mm minimum.
- 2.1.3 Each wire shall have twisted cores and No. Of twists shall be not less than 10 per meter. Color of cores insulation shall be black blue in a pair and black, blue and brown in a triad.
- 2.1.4 Individual pair and triad shall be shielded. Shield shall be Aluminium backed by mylar/polyester tape bonded together with the metallic side down helically applied with either side 25% overlap and 100% coverage. Minimum shielded thickness shall be 0.05mm. Drain wire shall be 0.5 sq.mm multistrand bare tinned annealed copy conductor. The drain wire shall be in continuous contact with Aluminium side of the shield.
- 2.1.5 Inner and outer jacket shall be made of extruded flame retardant low smoke 90°C PVC to IS 5831-Type ST2. Oxygen index of PVC shall be 30. Temp. Index shall be over 250° C.
Inner jacket color shall be black. Outer jacket color shall be black except for cable to be used in intrinsically safe systems it shall be light blue. Rip cord shall be provided.
- 2.1.6 Armour over inner jacket shall be of galvanised steel wire/flat as per IS-1554 part-I.

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2.1.7	A pair or triad identification shall be with numbers at interval of not more than 250 mm as per vendor's standard.
2.1.8	Tolerance in overall diameter of cable shall be within $\pm 2\text{mm}$ over offered value for cables with OD less than 30mm and $\pm 3\text{mm}$ for cables with OD more than 30mm.
2.2	Type-II (Multipair/multitriad cable with individual pair shield and overall shield) The cable shall be same as single pair shielded cable except conductor size shall be 0.5 sq.mm made of 16 strands of annealed electrolytic copper conductor. Each strand shall be of 0.2mm dia. Additional feature shall be as follows:
2.2.1	Overall shield shall be of Aluminum backed up by mylar/polyester tape helically applied with the metallic side down either side 25% overlap and 100% coverage. Minimum shield thickness shall be 0.075mm Drain wire shall be similar to individual pair drain wire and shall be in continuous contact with the Aluminium side of the overall shield.
2.2.2	Overall twist of all pair/triads shall be as per vendor's standard.
2.2.3	A pair of communication wire shall be provided for multipair/multitriad cables. Each wire shall be 0.5 sq. mm of plain annealed single or multistrand copper conductor with 0.4 mm thick 85°C PVC insulation. Insulation shall be green and red colour coded.
2.3	Type-III (Multipair/Multitriad cable with only overall shield) These cables shall be same as type-II cables except that the individual pair/triad shall not have shielding.
2.4	Type-IV (Multipair/ multitriad cable with individual pair shield and overall shield) The cable shall be same as Type II except conductor size shall be 1.5 sq.mm made of 7 stranded annealed electrolytic copper conductor. Each strand shall be 0.53 mm dia.
2.5	Type-V (Multipair/ Multitriad cable with overall shield only) The cable shall be same as type IV except that the individual pair/triad shall not have the shielding.

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3.0 Electrical Characteristics

3.1 Maximum d.c. resistance of the conductor of the completed cable shall not exceed 12.3 ohms/km at 20° C for cables with 1.5 sq.mm conductor and 39.7 ohms/km at 20°C for cables with 0.5 sq.mm conductor.

3.2 Capacitance

3.2.1 Mutual Capacitance

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

3.2.2 Capacitance between any core or screen.

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

3.3 L/R ratio of adjacent core shall not exceed 40 micro henry/ohm for cables with 1.5 sq. mm conductor & shall not exceed 25 micro henry/ohm for cables with 0.5 sq. mm conductor.

3.4 The drain wire resistance including shield shall not exceed 30 ohms/km. Insulation resistance on drum length @ 20 Deg. C shall be 25 M-Ohm/Km (as per BS 5308 Part-2).

3.5 Electrostatic noise rejection ratio shall be over 76 dB.

3.6 High Voltage Test shall be carried out between conductors & between core & screen @ 1 KV-AC for one minute (as per BS 5308 Part-2).

3.7 Flammability test shall be as per IEC part 3.

4.0 Testing

4.1 Type test: Cable shall be flame retardant to IEC 332 Part III Cat. A. For qualification, certificates from third party or client /consultants authorised representative for this test shall be furnished by vendor for cables similar to those being offered.

4.2 Routine tests: (To be carried out by vendor during various stages of manufacture. Purchaser / purchaser's representative shall review the related documentation).

4.2.1 Insulation and jackets: All tests as per IS-5831 except insulation resistance, voltage and spark test shall be as per BS-5308. Part-II(1986)

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4.2.2	Armour test as per IS-3975.
4.2.3	Conductor resistance.
4.2.4	Cable capacitance and L/R ratio.
4.3	<u>Acceptance test</u> (The test shall be carried out in the presence of purchaser or his authorised representative.)
4.3.1	Continuity test
4.3.2	Voltage test as per BS-5308 Part II.
4.3.3	Conductor resistance, Insulation resistance and drain wire resistance.
4.3.4	Cable capacitance and L/R ratio test.
4.3.5	Tests for uniformity of galvanisation of armour as per IS 2633.
4.3.6	Oxygen and temp. index test as per ASTM D 2863 & Flammability test.
4.3.7	Dimensional check for overall diameter and under armour/over armour diameter.
4.3.7	Visual Check of outer sheath marking (Manufacturer's name, voltage grade, type & size of cable, length marking, year of manufacturing, etc.), colour coding, construction as per datasheet / tech. spec. etc.
4.3.8	Overall finish check. In case of any lump purchaser will have the right to cut outer sheath for lump portion and reject the cable.
4.3.9	Check of drum length and overall length tolerances.
	Immediately after completion of electrical tests, the ends of the cable shall be sealed to prevent ingress of moisture with suitable PVC/Rubber caps.
5.0	<u>Shipping</u>
	Cables shall be despatched in wooden drums, securely battened with take off end fully protected against damage. Each drum shall be marked with following:
	a. Manufacturer's name.
	b. Details of the cable.
	c. Length of the cable contained in the drum in metres.
	d. Gross wt.
	e. Direction of rotation of drum for unwinding by means of an arrow.
	f. Purchase order no.

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6.0

Rejection

Vendor shall make his offer in detail with respect to every item of the purchaser's specifications. Any offer not conforming to this shall be summarily rejected.

GENERAL SPECIFICATIONS FOR INSTRUMENTATION

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**ELECTRICAL & INSTRUMENTATION
(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

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AMENDMENT STATUS

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)

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C O N T E N T S

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- 2.0 DEFINITIONS
- 3.0 SCOPE OF WORK
- 4.0 DESCRIPTION OF WORK
- 5.0 DRAWINGS AND DOCUMENTS TO BE PROVIDED BY OWNER
- 6.0 DRAWINGS AND DOCUMENTS TO BE PROVIDED BY CONTRACTOR
- 7.0 SCRAP AND EXCESS MATERIAL
- 8.0 SPECIAL INSTRUCTIONS TO CONTRACTOR

PREPARED BY: (R. SANJAY BABU)	CHECKED BY: (RAKESH SHUKLA)	APPROVED BY: (PANKAJ SRIVASTAVA)	ISSUE DATE : 08Th DEC 08

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1.0 GENERAL

1.1 INTRODUCTION

1.1.1 This part of the technical specifications covers in general, definitions, standards, scope of works, specifications of work, documentation, scope of supply of materials and scrap and excess materials and different requirements to be adhered to during the course of execution of instrumentation works.

1.1.2 Instrumentation works shall be performed in accordance with this technical specification and various other drawings and schedules supplied during the execution and time to time instructions from Engineer-in-Charge or his authorised representative(s) during the progress of the work.

2.0 DEFINITIONS

2.1 MANIFOLDS

2.1.1 For close coupled instruments "Manifold" shall mean complete piping of instruments from first block valve upto the instruments, if the distance of the Instrument is within 2 feet (0.6m), from the Instrument tapping. If the distance of instrument is more than 2 feet (0.6m) from primary tapping such as orifice, then the installation is to be considered under remote installation.

2.1.2 For remote mounted instrument, "Manifold" shall mean the assembly of nipples, valves and fittings around the instrument to form a block and bleed or by pass manifold or drain manifold as the case may be. These shall be generally according to the hook up drawings enclosed with tender. Wherever the instruments are with 3--way-valve manifold, this definition shall not be applicable as 3-way manifold forms part of instrument.

2.2 FIRST BLOCK VALVE

First block valve shall mean the valve/valves that are mounted directly on equipment, columns, pipe, standpipe etc. and shall be operated to isolate the instrument and connected instrument piping from the above items.

2.3 SUPPORTS

Supports shall mean the MS angles, flats, channels that are generally provided to support the main cable ways, cable ducts, junction boxes, angle trays, perforated trays, instrument piping, signal tubing, instrument air supply lines etc., at specified intervals from the structures, concrete columns etc. to keep all items firmly secured against vibration, warping, bending etc.

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2.4 SCRAP

2.4.1 Salvageable scraps

Salvage scrap shall mean lengths of tubes, pipes, multicables, other cables etc. that can be used one time or other at later date and normally they are recovered from the cut-pieces of tubes, pipes, multicables, cables, etc.

2.4.2 Non Salvageable Scrap

Non salvageable scrap shall mean the lengths of tubes, pipes, multicables, cables, etc. that cannot be used at all one time or other.

2.5 Standards

The instrumentation erection and calibration works shall be carried out generally in accordance with various international and Indian standards in instrumentation listed below but not limited to the following:

2.5.1 API -RP-550 Manual on Practices for instrumentation.

2.5.2 ISA standards and Practices for instrumentation

2.5.3 Instrumentation hook-up standards enclosed.

2.5.4 Instrumentation supports standard enclosed.

2.5.5 Manufacturer's standards and Practices.

3.0 **SCOPE OF WORK**

3.1.0 The Scope of work shall consist of supply of instrument items (as per schedule of quantities/rates and SCC), instruments, their erection, testing, calibration and commissioning and making it ready for commercial operation. The scope covers various jobs listed under the schedule of quantities/rates. However to ensure proper execution and completeness of instrument--work any or all of the following shall also form the part of the scope and shall be covered in the quoted rates.

3.1.1 Fabrication of pipe nipples, including threading whenever required.

3.1.2 Fabrication of seal pot/syphon/drain pot as per standards. Filling of seal pots with filling liquids as per instructions from Engineer-in-charge.

3.1.3 Back/seal welding of screwed fittings as required by standards.

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- 3.1.4 Laying of cable underground including excavation, sand filling, brick laying and back filling.
- 3.1.5 Connection of purging devices for instruments to the systems provide as per drawings.
- 3.1.6 Civil works including the casting of foundation as per requirements for instruments supports where paved surface do not exist.
- 3.1.7 Minor civil works like chipping of pavement and grouting on the pavements the instrument panels/supports/stanchions, and chipping and refilling of the pavement for conduits.
- 3.1.8 Sealing of cables/ tube entries into the control room after laying and testing of all tubes, cables etc.
- 3.1.9 Degreasing of handwheels of control valves, stud bolts, nuts of side and bottom flange of control valves, orifice plates, other primary elements flanges, oxygen service impulse lines, instruments as per manufacturers instructions and other items as required by Engineer- in-charge.
- 3.1.10 Rotation of control valve bonnet wherever required.
- 3.1.11 Reversing the action of control valves either the replacement of springs, accessories or in positioner wherever required.
- 3.1.12 Minor modification/repairs required to be done on the instruments namely, changing the dial, glasses for pressure gauges, temperature gauges and other instruments, replacement of rotameter tubes, level gauge glasses, replacement of damaged signal tubes, threads, couplings etc.
- 3.1.13 Painting of all structural supports for trays, pipes, junction boxes, instruments, etc, as per painting specification.
- 3.1.14 Identification with approved colour of paint the instruments/impulse, lines manifold connected with alarm/trap circuit. Also, punching of tag numbers on items shall be carried out as per instructions of Engineer-in-charge.
- 3.1.15 Coordination with mechanical and other sub-contractors for proper installation of line/ vessels/ equipment mounted instruments like control valves, orifice assemblies, turbine meters, PD meters, level transmitters, level gauges, level switches etc. which involves removal of instruments, disconnection of tubes/cables, reconnection for alignment proper installation etc.
- 3.1.16 Drilling holes on all panels, shut down cabinets, power supply cabinets, control panels pneumatic enclosures etc., for cables/ multitubes/ glands/ groomats.

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- 3.1.17 Grounding of shield of all shielded cables to respective instruments earth bus provided in the control room/local panel/thermocouple head.
- 3.1.18 Laying and termination at both ends between instrument earth buses provided in control room/ local panel to instrument earth pit provided by others.
- 3.1.19 Supply of all types of consumables required for the execution of the job.
- 3.1.20 Submission of monthly material appropriation statements for cables, piping materials fittings, including the quantity issued and expended in standard proforma.
- 3.1.21 Completion of owners drawings/documents, as per the execution of work at site.
- 3.1.22 Preparation and submission of as built drawings as required.
- 3.1.23 Start-up and commissioning.
- 3.1.24 Submission of final material appropriation statements for all the materials issued by the owner.
- 3.1.25 Any other work not mentioned above, but required for the proper execution of the works.
- 3.1.26 Where requested by owner/Engineer-in-charge or his authorised representatives, all or any of the works detailed above and schedule quantities shall also be performed on package units, local panels/cabinets/gauge board installed by owner or by others.
- 3.1.27 Sealing of safety valves/switches with standard lead seals after final setting in the presence of Engineer- in-charge.

4.0 DESCRIPTION OF WORK

4.1.0 INSTRUMENT PIPING

- 4.1.1 All primary piping shall be installed in the best workman like manner and shall follow installation standards in each case. Where there is no installation standard, the instruction of the Engineer-in-charge shall be followed.
- 4.1.2.1 Horizontal and vertical lines shall be installed using levels and plumo bobs.
- 4.1.3 Unless otherwise specified in the drawings pipelines shall have a slope of 8% on the horizontal runs.

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4.1.4 All welding shall be carried out as per welding procedures and codes with electrodes approved by Engineer-in-charge. Only qualified welders approved by Engineer-in-charge shall carry out welding. Charges for non-destructive testing like radiography, Dye penetration tests, post heat treatment tests and stress relieving shall be carried out on the basis of actual man hours spent towards these works and man-hour charges with cost of all materials, test equipments, etc. shall be used. However, any materials like electrode, equipments, testing charges for various tests, etc., required for the initial qualification of the welder/welders shall be or the scope of the contractor.

4.1.3.1 Pipe shall be bent using pipe benders only and any bending will be totally rejected. Pipes shall be cut using pipe cutting device. Hot cutting will not be allowed.

4.1.6 Piping for steam tracing shall be installed according to the standards and avoiding condensate pockets.

4.1.7 All threaded joints shall be jointed with Teflon tape and no other pipe jointing compound shall be used except on high temperature service where graphited sealing compounds shall be used.

4.1.8 All primary piping shall be properly supported at regular intervals of 1.0 meters. Angle supports shall be fabricated from 40mmx40mmx5mm MS angles as minimum.

4.2.0 PVC COVERED/BARE TUBE (COPPER/SS/ALUMINIUM)

4.2.1 Single copper/SS/Aluminium tubes shall be laid as per standards on trays. Fabricated out of 2.5 mm thick perforated steel plate. The width of the trays shall be selected as per the number of tubes laid. Tubes shall be clamped to the trays at every 300 mm using clamps made of galvanized steel/Aluminium strips. The practice of flattening tubes for clamping purposes shall be avoided. In case of PVC covered tubes, any exposed portion at ends and connection shall be neatly taped to appropriate thickness.

4.2.2 Trays shall be properly supported either from any rigid steel structure or concrete member as detailed under trays and supports below.

4.2.3 All male/female tube connectors shall be installed with Teflon tape only. Identification tag plates/ferrules shall be provided on either side of copper tubing as per tubing/junction box schedules. Ferrules shall be single sleeve type with letters and numbers neatly printed.

4.3.0 INSTALLATION OF MULTITUBES AND MULTICORE CABLES

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4.3.1 Multiple cables/ multitubes shall always be installed on ducts/trays and properly clamped. At every vertical drop to junction boxes, they shall be clamped at more frequency intervals (Maximum of 300mm). They shall be connected inside junction boxes strictly according to the number system as mentioned in cable schedule. At bends minimum radius shall be maintained as per manufacturer's standard. The angle tray supports shall be fabricated from 40mmx40mmx5mm angles minimum size.

4.3.2 Identification tags shall be provided on either end of multitubes, multicore cables as per cable/tubing/cable schedules. Engraved tag plates or PVC ferrules shall be used for identification of tubes/cables.

4.3.3 All Multitubes and Multicables shall be cut after the exact site measurements are taken between ends and the cable/tube drums shall be selected before cutting the lengths so as to avoid any wastage.

4.3.4 In the field, the cables shall be laid in perforated trays as per layout drawings. Cables shall also be buried or laid in concrete trenches. Inside control room, these shall be laid in concrete trenches or under false floorings.

4.3.5 In the field, the cables shall be laid in perforated trays as per layout drawings. Cables shall also be buried or laid in concrete trenches. Inside control room, these shall be laid in concrete trenches or under false floorings.

4.4.0 INSTALLATION OF INSTRUMENTS

4.4.1 All instruments shall be generally installed on supports as per installation standards in each case, and shall be accessible.

4.4.2 Receiver gauges shall be mounted on instrument support itself as per tubing hook up standards.

4.4.3 Filter regulators shall be mounted on the instruments support itself below the instruments or on the control yoke.

4.5.0 INSTRUMENT AIR SUPPLY

4.5.1 The main instrument air header in each area is laid by other contractor. Air supply from the main air header take off valve to individual instrument shall be through either galvanized steel pipe or 1/4" OD PVC covered copper tube or SS tubes.

4.5.2 Individual takes off valves shall always be located on top of the main air header. Unions shall be provided at convenient locations. There shall be one isolation valve at each instrument end. The galvanised pipe shall be supported at a minimum interval of 1000 mm with 40mmx40mmx5mm angles. Page 6 of 64

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connection to be instrument shall be copper/SS tubing as per tubing hookup standards.

4.5.3 Teflon tapes shall be used on all threaded joints.

4.6.0 INSTRUMENT STEAM TRACING

4.6.1 The mainsteam header in each area is laid by the other contractor. From the main steam header take off valve, steam to individual instrument shall be taken through carbon steel pipes supported at regular intervals. Steam tracing around individual instruments shall be to copper tubes. After steam tracing, the line is connected to the drain funnel through individual steam trap/condensate return header/tapper point as the case may be.

4.6.2 Electrical tracing shall be done by others.

4.7.0 PERFORATED TRAYS AND SUPPORTS

4.7.1 The perforated trays / angle trays shall be properly supported at a regular interval of max. 1000mm from insert plates or steel structures. Wherever insert plates are not available supports on concrete structures on ceiling shall be fixed with a minimum 10mm diameter expansion bolts. Angle supports for perforated trays/angle trays shall be fabricated from 40mmx40mmx5mm M.S. angles minimum size.

4.7.2 All supports shall be cut with hacksaw and any work executed by gas cutting for cutting and drilling holes will be totally rejected. Free ends of angle support shall not have sharp edges and shall be properly rounded off.

4.7.3 Perforated trays/angle trays shall be used for branching cables and tubes from main trays. Perforated trays shall be used for branching cables and tubes from main trays. Perforated trays shall be fabricated out of 2.5 mm perforated steel sheet. Width of trays shall be selected according to number of tubes and cables. Trays shall be laid generally as per site conditions with the approval of Engineer-in-charge.

4.8.0 LAYING OF CABLES

4.8.1 All cables shall be laid in accordance with installation drawings and cable schedules. Before laying, cable/multicable on drums shall be meggered and tested to ascertain the transit damages.

4.8.2 All cables routes shall be carefully measured and cables cut to the required lengths, leaving sufficient amount for the final connection of the cable to the terminals on either end. The various cable lengths cut from the cable reels shall be carefully selected to prevent undue wastage of cables. Sufficient extra length

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of cable shall be kept at the terminal on points.

- 4.8.3 Cables shall have complete uncut lengths from one terminal to the other.
- 4.8.4 All cables shall be identified close to their termination point by cables number as per cable schedules/junction boxes schedules. PVC ferrule/tag plate shall be used and these identification tags shall be securely fastened to the cables.
- 4.8.5 All cores of electrical cables shall be identified by their wire numbers by means of the PVC ferrules. Wire numbers shall be as per schedules. All temporary ends of cables shall be protected against dirt and moisture. For this purpose, ends of all PVC insulation cables shall be taped with an approved PVC or rubber insulating tape. Use of function type or other fabric type is not permitted.
- 4.8.6 The cable shall be bent in a large radius. Cables installed above ground shall be run exposed on walls, ceilings, structures and shall run parallel or at right angles with beams, walls or columns.
- 4.8.7 Cables shall be rigidly supported on structural steel and masonry individually or in groups as required using galvanised clips, multiple cable supports or cable trays. If drilling of steel must be resorted to, approval must be obtained and steel must be drilled where the minimum of weakening of the structure will result. Cable shall be supported at every 500 mm.
- 4.8.8 All special cables and power supply cables will be laid directly to the field instrument without any junction boxes, unless otherwise specified.
- 4.8.9 While laying cable in trenches or burying them care shall be taken to ensure that low signal cables like alarm, analyser cables, special cables, special cables from turbine meters, compensating cable etc. are separated from other power supply cables.
- 4.8.10 Each underground cable (either in concrete trenches or buried) shall be provided with identifying tag of lead securely fastened every 30m of its underground length with atleast one tag at each end before the cable leaves/enters the ground.
- 4.8.11 Directly buried cables shall be laid underground in excavated cable trench wherever specified in layout drawings. Trenches shall have sufficient depth and width to accommodate all cables correctly spaced. Before cables are placed the trench bottom shall be filled with 100 mm layer of sand and leveled. Each layer of cables shall be covered with 150 mm of sand on top and sand shall be lightly pressed. A protective covering of 75 mm thick second-class red bricks shall be placed flat on the final layer of sand and cable. The remaining portion of the trench shall be then back filled with soil compacted and leveled. On complete of every group of cable laying and before sand filling, every cable shall be given insulation test in the presence of Engineer-in-charge. Any cable proved to be defective should be replaced before the next groups of cables are laid. Cable route markers indicating number of cables, depth and direction will be placed

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enroute, on crossovers/turnings, etc. to mark the cable route.

4.8.12 At each road crossings and other places, where cables enter pipe sleeves, adequate bed of sand shall be given so that the cables do not slack and get damaged by pipe ends after pack filling.

4.8.13 At the entry into concrete blocks at road crossings cable loops shall be provided at either end to prevent any damage to cables. Each cable shall have one tag at each end before the cable enters/leaves conduct pipes

4.8.14 After laying of all the cables and multitubings, cables, the cable entry to control room shall be suitably filled and sealed so as to achieve a positive seal against the entry of gas/water.

4.8.15 All cables and tubes shall be laid in accordance with the layout drawings with sand and precast concrete slabs shall be placed on the trench.

4.8.16 On completion of cable laying in concrete trenches, the trenches shall be filled with sand and precast.

4.9.0 EARTHING

4.9.1 Earthing of junction boxes, local cabinets as per the documents and instruction from Engineer-in-charge.

4.10.0 PAINTING

4.10.1 This part of the specification is applicable to cable ducts, MS cable ways, angle trays, instrument supports, perforated trays, all structural supports for the above items, etc.

4.10.2 The surface to be painted shall be thoroughly cleaned with wire brush, sand paper to remove all scales. After cleaning, the surface is painted with one coat of red oxide zinc chromate primer conforming to IS- 207 and allowed to dry completely.

4.10.3 Primer coated surface is painted with one coat of paint to the colour nearest to the final paint and allowed to dry. The colour number shall be specified from IS-5.

4.10.4 Final second coating shall be with the paint of desired colours and shall be selected from IS-5.

4.10.5 It shall be noted that final second coating of external surfaces not covered by cables, copper tubes etc. shall be applied just before handing over the plant or commissioning of the plant whichever is earlier.

4.10.6 The name of manufacturer, colour and quality of all types of prime paint shall be

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subject to approval of Engineer-in-charge.

4.11.0 TESTING

4.11.1 Electrical cables for signal power supply alarms, and compensating cables for thermocouples; resistance thermometer cables shall be checked for megger values and continuity before proper termination and ferruling.

4.11.2 Testing shall be carried out after the installation of instrument with primary piping complete in all respects and approved by Engineer-in-charge.

4.11.3 Primary piping shall be tested hydraulically pneumatically to 1.5 times the operating pressure after isolating the instruments. Flushing of piping shall be carried out as per instructions of Engineer-in-charge. Lines shall be blown after hydro-testing. All external displacement /float type level instrument level gauges shall also be tested as per instructions of Engineer- in-charge.

4.11.4 Tubes and air line shall be tested with compressed air to 7 kg/cm² upto the filter regulator. The down steam side of the filter regulator shall be tested for 1.5kg/cm². The lines shall be blown with the instrument air upto the regulator for 15 minutes to remove any traces of oil, dust & moisture. All lines shall be checked with soap solution and bubbler unit for possible leak at joints. After pressurizing, source shall be cut off and rate of fall in pressure shall be less than 1 p.s.i. for each 100 ft. of copper tubing for a test period of 2 minutes as per I.S.A.R.P.7-1 "Pneumatic control circuit pressure test".

4.11.5 All test results shall be recorded in the approved format.

4.12.0 CALIBRATION

4.12.1 All instruments shall be calibrated strictly as per manufacturer's instructions prior to installation. The scope of calibration includes all field and control rooms of all types namely, pneumatic, electronic, electrical etc.

4.12.2 Contractor shall use his own oil free instruments, air compressor for calibration purposes.

4.12.3 The level switches (external cage type) shall be set by filling the cage with water to the desired alarm/trip level, while setting the switches, it shall be ensured that the micro switches do not reset for full rated travel of the float.

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- 4.12.4 Control valves and positioners shall be checked for hysteresis and linearity and calibration for rated strokes. Prior to calibration, valves shall be cleaned externally. The stem is then lubricated if required, and stroked few times to extreme positions of plug to ensure that movement is free from friction. The valve shall then be calibrated for rated stroke and linearity also. Subsequently the valves shall be checked for hysteresis to the accuracy of 1% FS with positioners and 5% FS without positioners.

Stroke speed has to be evaluated for all trip/shutdown valves.

- 4.12.5 All calibrations reading shall be recorded in the enclosed format and submitted to Engineer-in-Charge for approval. Where significant deviations from specifications are obtained, the matter shall be brought to the immediate notice of the Engineer-in- Charge for corrective actions.

- 4.12.6 Furnished hereunder is a list of recommended calibration and test equipments required as a minimum for calibration work. The contractor shall clearly state in his offers the complete list of calibration and test equipments along with the range, accuracy and quantity, which he proposes to use for this job. Contractor should also ensure that any equipment not listed below but required at the time of calibration shall be made available at his own cost.

- 4.12.7 All test equipments/kits shall be approved by NPL authorities.

- 4.12.7.1 Controller test stands Mft. Standard

- 4.12.7.2 Indicator/recorder test stands -do-

- 4.12.7.3 Squeeze bulb (Flow calibrator
Range: 0-770, 10,000 mm wg. -

- 4.12.7.4 Dead weight testers (Budenberg or equivalent)
For ranges upto 350 kg/cm² - +/- 0.1%

- 4.12.7.5 Gauge comparator for pressure gauges
Rating : upto 350 kg/cm² -

- 4.12.7.6 Oil bath for temperature calibrations
max. Temp 350°C. Mfr's Std

- 4.12.8.7 Standard Mercury in glass thermometers
Range : -50 to + 50°C. 0 to 100°C
(NPL certified) 0-250°C, 0-350°C ± 0.25%

- 4.12.7.8 Standard gauges for Ranges upto 350kg/cm² ±0.25%

- 4.12.7.9 U-tube differential manometers/inclined

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	tube manometer Static pr. rating : 7 kg/cm ²	+ _ 1mm
4.12.7.10	Single leg manometers Scale: -1500 mm water and 1500 mm hg. Static pr. rating : 7 kg/cm ² .	+ _ 1mm
4.12.7.11	Decade resistance box	MFR' std.
4.12.7.12	Millimeters	+0.05Mv
4.12.7.13	Potentiometer (Cable of generating and measuring mV)	-
4.12.7.14	Meggers 500V/1000V	-
4.12.7.15	Air hydro pump/hydraulic pump	-
4.12.7.16	Vacuum pump	-
4.12.7.17	Instrument air compressor with filters and Regulators and deoilers.	-
4.12.7.18	Current generator (instrument checker) 4-20mA dc(YEW make or equivalent)	-

4.13.0 LOOP TEST

- 4.13.1 Loop test shall be performed after calibration of all instruments and leak test of signal lines. Loop tests are conducted to check the functional performance of all elements comprising the loop, thereby ensuring proper connections and operations.
- 4.13.2 Before proceeding for loop tests the calibration results of individual elements shall be recorded on the enclosed proforma and shall get it approved by Engineer-in-Charge for correctness of installation, measurements and calibration results.
- 4.13.3 Loop testing for all control loops shall be generally by simulation of process

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conditions and shall fix points namely 0%, 25%, 50%, 75% and 100% of full-scale inputs. Detailed procedure shall be submitted to Engineer-in-charge for approval before proceeding with the loop testing.

In case of shutdown system field/receiver pressure switches are simulated for abnormality by disconnecting the wires at terminal and function of all associated systems are checked.

4.13.5 Performance of individual loops may be accepted for an overall accuracy of $\pm 1.5\%$ where deviations exist, contractor shall recalibrate the instruments, which form part of loop testing wherever required, at no extra cost.

4.13.5.1 After the loop test is complete, the contractor shall connect back any terminations and connections removed for loop test.

4.13.7 A loop shall be considered as handed over only after measurements in that particular loop are complete and certified by Engineer-in-Charge, in addition to loop sheets being duly filled in all respects and approved and accepted by Engineer-in-Charge and client.

4.13.8 In case of loops in which certain instruments of the loops are calibrated by other agency, loop testing shall be performed in coordination with the agency involved. Any defect in the calibration of the instrument in contractor's scope is observed, it shall be rectified to the satisfaction of the Engineer-in-Charge. However, defect in calibration of the instruments in the scope of other agency, same shall be rectified by the agency involved. After the calibration has been rechecked by the other agency/agencies the loop checking would be performed to the satisfaction of Engineer-in-Charge, and this part covers under the scope of the contract.

4.13.9 Final certified loop sheets shall be submitted in 4 copies and one transparency.

5.0.0 DRAWINGS AND DOCUMENTS TO BE SUPPLIED FOR EXECUTION BY OWNER/ENGINEER IN CHARGE

5.1.1 Piping and Instrumentation diagrams.

5.1.2 General layout plan for all units, showing all information like position of field instruments junction boxes indicative routes of cables, main ducts/cable trays.

5.1.3 Cable schedules for alarm, signal, shutdown, power supply and pneumatic cables, earthing guide lines.

5.1.4 Termination details/drawings for connecting at control room end.

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5.1.5 Individual Instrument specifications

5.1.6 Bill of materials

5.1.7 Installation standards/ Hook-up

5.1.8 Manufacturers hand book with instructions for installation and calibration wherever necessary for reference.

6.0 DRAWINGS AND DOCUMENTS TO BE PROVIDED BY CONTRACTOR

6.1.1 The drawings for materials that are included on their supply and erection scope namely local control panel, junction boxes and local cabinets.

6.1.2 The detailed engineering drawing wherever such drawing is assigned.

6.1.3 Two sets of layout drawings, standards bill of materials cable schedules etc., duly incorporating the changes/modification carried out during the course of execution of works.

6.1.4 Final material appropriation statement for all free issue materials indicating shortages of any in the proforma duly approved by Engineer-in-Charge.

7.1.0 SCRAP AND EXCESS MATERIAL

7.1.1 Every month, the contractor shall submit an account for all the materials issued by the Owner in the standard proforma prescribed for this purpose by the Engineer- in-Charge.

7.1.2 On completion of the work, the contractor shall submit 'Material appropriation' statements for all materials issued by the Owner in the proforma prescribed by the Engineer-in-Charge.

7.1.3 The following scrap allowances are permissible.

Length below 0.5 mm	Non-salvageable	Unaccountable
Steel pipes, SS Tubes single pair/ Twocore / Three Core cables.	2%	0.5%

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length below
20 m

Non-salvageable

Unaccountable

Multitube,
Multicables

2%

0.5%

8.0 SPECIAL INSTRUCTIONS TO CONTRACTOR:

- 8.1.4 All excess materials and scrap shall be returned after duly accounting for, to the storage points designated by the Owner. Where materials are to be weighed before return, the contractor shall be responsible for making the necessary section obtained during the course of construction for fabricating temporary supports or other items, without prior permission of the Engineer - in -Charge.
- 8.1.5 If the contractor fails to return the surplus material as aforesaid, the owner will charge the contractor for such unreturned materials at panel rates, which will be deducted from whatever amount is due to the contractor. In case any material issued by the Owner deteriorates during storage by the contractor, new materials will be issued to him at penal rates, but the delay in procuring such materials will be at the contractor's account only.

STANDARD SPECIFICATION FOR CABLING

SPECIFICATION NO.: MEC/S/05/E5/021



**ELECTRICAL & INSTRUMENTATION
(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

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AMENDMENT STATUS

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)

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C O N T E N T S

1.0	SCOPE
2.0	STANDARD
3.0	CABLE SPECIFICATIONS
4.0	MISCELLANEOUS MATERIALS SPECIFICATIONS
5.0	CABLE LAYING
6.0	TERMINATION
7.0	TESTING

PREPARED BY: (R. SANJAY BABU)	CHECKED BY: (RAKESH SHUKLA)	APPROVED BY: (PANKAJ SRIVASTAVA)	ISSUE DATE : 08Th DEC 08

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1.0 SCOPE

This is to define the requirements for supply, wherever applicable, the installation, testing and commissioning of the cabling system.

2.0 STANDARDS

The work shall be carried out in the best workman like manner in conformity with this specification, the relevant specifications, codes of practice of Indian Standards Institution, approved drawings and instructions of Engineer-in-Charge or his authorized representative issued from time to time. In case of any conflict between the standards, the instruction of Engineer-in-Charge shall be binding.

3.0 CABLE SPECIFICATIONS

3.1 Power Cables

Power cables for use on 415 V systems shall be of 1100 Volts grade, aluminium stranded conductor, PVC insulated, PVC sheathed, armoured and overall PVC sheathed. Power cables for 3.3 KV 6.6 KV and 11 KV system shall be aluminium conductor, XLPL insulated, screened, PVC bedded galvanized steel flat armoured and PVC sheathed cable. All L.T. Cables conform to standard specification and relevant sections of IS: 1554 Part-I and H.T. Cables shall conform to IS: 7098 (Part II). Unarmoured cables will be used wherever specified on the cable schedule.

3.2 Control Cables:

Control cables shall be 1100 Volt Grade, 2.5 mm² copper conductor PVC insulated PVC sheathed, single wire armoured with an overall PVC sheath, as per IS: 1554 Pt. Unarmoured cables shall be used wherever specified on the cable schedule.

3.3 Communication cables:

Communication cables shall comprise 1 pair unarmoured, 2-pair, 5-pair and multipair armoured cables of sizes as specified in the cable schedule. Minimum conductor size shall be 0.5 mm telephone system and 0.71 for plant communication system.

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4.0 MISCELLANEOUS MATERIALS SPECIFICATIONS

4.1 Connectors:

Cable terminations shall be made with aluminium / tinned copper crimped type solder less lugs of M/s. Dowell's make or approved equivalent for all aluminium conductors and stud type terminals.

4.2 Cable Identification

Cable tags shall be of 2 mm thick, 20 mm wide aluminium strap of suitable length to contain cable number, equipment no., etc.

4.3 Ferrules

Ferrules shall be of approved type size to suit core size mentioned and shall be employed to designate the various cores of control cable by the terminal numbers to which the cores are connected for ease in identification and maintenance.

4.4 Cable Glands:

Cable glands to be supplied shall be nickel-plated Brass double compression type of approved/ reputed make. Glands for classified hazardous areas shall be certified by CMRS.

4.5 Cable Trays:

This shall be either prefabricated hot dip galvanized sheet steel trays or site fabricated angle iron trays as specified elsewhere. Prefabricated hot dip galvanized sheet steel cable trays shall be used for maximum support span of 2000 mm unless design is approved for larger span. For requirements of larger than 750 mm width two trays shall be run side by side. Cable trays shall be suitable for a cable weight of 50 kg/meter running length of tray. Minimum thickness of sheet steel/galvanizing shall be 2mm/86 microns respectively.

Cable trays fabricated from standard rolled sections shall use 50x50x6 /ISMC 100 Sections for runners for supporting spans limited to 2000 mm/more than 2000 mm respectively. Cross support shall be 32 x 6 mm flat/ 25x25x6 angle for width upto 500 mm/ more than 500 mm respectively.

Vertical supports for both the above type of trays shall be fabricated out of ISMC 100 and horizontal supports with 75 x 50 x 6 angle iron/ ISMC 75 as approved by Engineer-in-Charge.

If unit rate is not included in schedule of rates, then cable trays if required, shall be fabricated and installed at site as per tone rate for electrical structural supports etc.

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5.0 CABLE LAYING

- 5.1 Cable network shall include power, control, lighting and communication cables, which shall be laid in trenches, cable trays or conduits as detailed in the relevant drawings and cable schedules. Erection of cable trays as required shall be checked after erection and marked in as built drawings. Cable routing given on the layout drawings shall be checked in the field to avoid interference with structures, heat sources, drains, piping, air-conditioning duct etc. and minor adjustments shall be done to suit the field conditions wherever deemed necessary without any extra cost.

- 5.2 High voltage, medium voltage and other control cables shall be separated from each other by adequate spacing or running through independent pipes, trenches or cables trays, as applicable.

All communication cables (telephones, P.A.S.) RTD Cables shall run on instrument trays/ducts/trenches. Wherever these are not available, cables shall be taken in a separate trench with a minimum clearance of 300 mm away from electrical trench as per the direction of Engineer-in-Charge and Communication cables shall cross power cables at right angles.

All cable routes shall be carefully measured and cables cut to the required lengths, leaving sufficient lengths for the final connection of the cable to the terminal of the equipment. The various cable lengths cut from the cable reels shall be carefully selected to prevent undue wastage of cables. The quantity indicated in the cable schedule is only approximate. The contractor shall ascertain the exact requirement of cable for a particular feeder by measuring at site and avoiding interference with structure, foundation, pipelines or any other works. Before the start of cable lying, cable drum schedule; shall be prepared be electrician contractor and get that approved by Engineer-in-Charge to minimize/avoid straight through joints required. Contractor shall work out the actual number of straight through joints required.

- 5.4 Cables as far as possible shall be laid in complete, uncut lengths from one termination to the other.

- 5.5 Cables shall be neatly arranged in the trenches/trays in such a manner so that criss-crossing is avoided and final take off to the motor/switchgear is facilitated. Arrangement of cables within the trenches/trays shall be the responsibility of the Contractor. Cable routing between lined cable trench and equipment/motors shall be taken through GI pipe sleeves of adequate size. Pipe sleeves shall be laid at an angle of maximum 45° to the trench wall. In case of larger dia cables, i.e., 50 mm and above, adequately sized pipe with larger bend radius shall be provided for ease of drawing of cable or for replacement. In places where it is not possible, a smaller trench may be provided if approved by Engineer-in-Charge.

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- 5.6 All cables will be identified close to their termination point by cable numbers as per cable schedule. Cable numbers will be punched on aluminium straps (2 mm thick) securely fastened to the cable and wrapped around it. Alternatively cable tags shall be circular in construction to which cable numbers can be conveniently punched.

Each underground cable shall be provided with identity tags of lead securely fastened every 30 m of its underground length with at least one tag at each end before the cable enters the ground. In unpaved areas, cable trenches shall be identified by means of markers as per standard drawing. These posts shall be placed at location of changes in the direction of cables and at intervals of not more than 30 M and at cable joint locations.

- 5.7 All temporary ends of cables must be protected against dirt and moisture to prevent damage to the insulation. For this purpose, ends of all PVC insulated cables shall be taped with an approved PVC or rubber insulating tape. Use of friction type or other fabric type tape is not permitted. Lead sheathed cables shall be plumbed with lead alloy.

- 5.8 RCC cable trenches shall be with removable covers. Cables shall be laid in 3 or 4 tiers in these trenches as indicated on the sectional drawings. Concrete cable trenches shall be filled with sand where specified to avoid accumulation of hazardous gases, RCC covers of trenches in process area shall be effectively sealed to avoid ingress of chemicals etc. The electrical Contractor at no extra cost shall do removal of concrete covers for purpose of cable laying and reinstating them in their proper positions after the cables are laid.

Cables shall be handled carefully during installation to prevent mechanical injury to the cables. Ends of cables leaving trenches shall be coiled and provided with a protective pipe or cover, until such times the final termination to the equipment is connected.

- 5.9 Directly buried cables shall be laid underground in excavated cable trenches where specified in layout drawings. Trenches shall be of sufficient depth and width for accommodation of all cables correctly spaced and arranged with a view of heat dissipation and economy of design.

Minimum depth of buried cable trench shall be 750 mm for low voltage and 900 mm for H.V. Cables, the depth and the width of the trench shall vary depending upon the number of layers of cables.

Cables shall be laid in trenches at depth as shown in the drawing. Before cables are placed, the trenches bottom shall be filled with a layer of sand. This sand shall be levelled and cables laid over it. These cables shall be covered with 150

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mm of sand on top of the largest diameter cable and sand shall be lightly pressed. A protective covering of 75 mm thick second class red bricks shall then be laid flat. The remainder of the trench shall then be back-filled with soil, rammed and levelled.

- 5.10 As each row of cables is laid in place and before covering with sand every cable shall be given an insulation test in the presence of Engineer-in-Charge / Owner. Any cable, which proves defective, shall be replaced before the next group of cables is laid.

All wall openings / pipe sleeves shall be effectively sealed after installation of cables to avoid seepage of water inside building/-lined trench.

Where cables rise from trenches to motor, control station, lighting panels etc., they shall be taken in G.I. Pipes for mechanical protection upto a minimum of 300 mm above finished ground level.

Cable ends shall be carefully pulled through the conduits, to prevent damage to the cable. Where required, approved cable lubricant shall be used for this purpose. Where cable enters conduit the cable should be bent in large radius. Radius shall not be less than the recommended bending radius of the cables specified by the manufacturer.

Following grade of the pipe fill shall be used for sizing the pipe size:

a)	1 cable in pipe	-	53% full
b)	2 cables in pipe	-	31% full
c)	3 or more cables	-	43% full
d)	Multiple cables	-	40% full

After the cables are installed and all testing is complete, conduit ends above grade shall be plugged with a suitable weatherproof plastic compound/ 'PUTTI' for sealing purpose. Alternatively G.I. Lidsor PVC bushes shall be employed for sealing purposes. The cost for the same shall be deemed to have been included in the installation of G.I. Pipe and no separate payment shall be allowed.

- 5.11 Where cables pass through foundation walls or other underground structures, the necessary ducts or openings will be provided in advance for the same. However, should it become necessary to cut holes in existing foundations or structures, the electrical contractor shall determine their location and obtain approval of the Engineer-in-Charge before cutting is done.

- 5.12 At road crossing and other places where cables enter pipe sleeves adequate bed of sand shall be given so that the cables do not slack and get damaged by pipe ends.

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5.13 Drum number of each cable from which it is taken shall be recorded against the cable number in the cable schedule.

5.14 Cables installed above grade shall be run in trays, exposed on walls, ceilings or structures and shall be run parallel or at right angles to beams, walls or columns.

Cables shall be so routed that they will not be subjected to heat from adjacent hot piping or vessels.

5.15 Individual cables or small groups which run along structures/walls etc. will be clamped by means of 10 SWG GI saddles on 25x6 mm saddle bars. The cost of saddle and saddle bars shall be deemed to have been included in the installation of cables and no separate payment shall be made on this account. Alternatively small group of cables can be taken through 100 mm slotted channel/ISMC 100. They shall be rightly supported on structural steel and masonry, individual or in groups as required, if drilling of steel must be resorted to, approval must be secured and steel must be drilled where the minimum weakening of the structure will result.

Cables shall be supported so as to prevent unsightly sagging. In general distance between supports shall be approximately 300 mm for cables up to 25 mm diameter and maximum 450 mm for cables larger than 25 mm dia.

5.16 All G.I. Pipes shall be laid as per layout drawings and site requirements. Before fabrication of various profiles of pipe by hydraulically operated bending machine (which is to be arranged by the contractor), all the burrs from the pipes shall be removed. GI Pipes with bends shall be buried in soil/concrete in such way that the bends shall be totally concealed. For G.I. Pipes buried in soil, bitumen coating shall be applied on the buried lengths. Installation of G.I. Pipes shall be undertaken well before paving is completed and necessary co-ordination with paving agency shall be the responsibility of Electrical Contractor. The open ends of pipes shall be suitably plugged with G.I. Plugs after they are laid in final position. The Contractor at no extra cost shall supply G.I. Plugs.

5.17 Cable laid on supporting angle in cable trenches, structures, columns and vertical run of cable trays shall be suitably clamped by means of G.I. Saddles/Clamps, whereas cable in horizontal run of cable trays shall be tied by means of nylon cords.

5.18 Supporting steel shall be painted before laying of cables. The painting shall be done with one coat of red lead paint and two coats of approved bituminous aluminium paint unless otherwise specified.

6.0 TERMINATION

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- 6.1 All PVC cables up to 1.1 KV grade shall be terminated at the equipments by means of double compression type cable glands. They shall have a screwed nipple with conduit electrical threads and check nut.

All Cable entries shall be through bottom only and top entry terminations are made only after getting approval of Engineer-in-Charge.

- 6.2 Power cables wherever colour coding is not available shall be identified with red, yellow and blue PVC tapes. Where copper to aluminium connections is made, necessary bimetallic washers shall be used. For trip circuit identification additional red ferrules shall be used only in the particular cores of control cables at the termination points in the Switchgear/Control panels and Control Switches.

- 6.3 In case of control cables all cables shall be identified at both ends by their terminal numbers by means of PVC ferrules or Self-sticking cable markers. Wire numbers shall be as per schematic/ wiring /inter- connection diagram. Bidders shall have the samples of PVC ferrules/cable markers approved before starting the work. All unused spare cores of control cables shall be neatly bunched and ferruled with cable tag at both ends.

- 6.4 Where threaded cable gland is screwed into threaded opening of different size, suitable galvanized threaded reducing bushing shall be used of approved type, at no extra cost. All switchgear and control panels shall have undrilled gland plate.

Contractor shall drill holes for fixing glands wherever necessary at no extra cost. Gland plate shall be of non-magnetic material/aluminium sheet in case of single core cables.

- 6.5 The cable shall be taken through glands inside the panels or any other electrical equipment such as motors. The individual cores shall then be dressed and taken along the cable ways (if provided) or shall be fixed to the panels with polyethylene straps. Only control cables of single strand and lighting cables may be directly terminated on to the terminals.

In case of termination of cables at the bottom of a panel over a cable trench having no access from the bottom close fit hole should be drilled in the bottom plate for all the cables in one line, then bottom plate should be split in two parts along the centre line of holes. After installation of bottom plate and cables it should be sealed with cold setting compound. Cables shall be clamped over the open armouring to connect it to earth bus.

- 6.6 Cable leads shall be terminated at the equipment terminals, by means of crimped type solder less connector as manufactured by M/s. Dowell Electro

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works or approved equivalent.

Crimping shall be done by hand crimping hydraulically operated tool and conducting jelly shall be applied on the conductor. Insulation of the leads should be removed immediately before the crimping. Conductor surface shall be cleaned and shall not be left open.

6.7 Cable accessories for H.V. Systems

6.7.1 The 11, skilled and experienced jointers duly approved by the Engineer-in-Charge shall do 6.6 and 3.3 KV cables terminations joints. Termination including supplying of jointing kit shall be threaded in Contractor scope unless specified otherwise.

6.7.2 The termination and straight thro' joint kit. For use on high voltage system shall be suitable for the type of cables red by the contractor or the type of cables issued by owner for installation. The materials required for termination and straight through joints shall be supplied in kit form. The kit shall include all insulating and sealing materials apart from conductor fitting and consumables items. An installation instruction shall be included in each sheet.

6.7.3 The termination kits shall be suitable for termination of the cables to indoor switchgear or to a weatherproof cable box of an outdoor mounted transformer motor. The terminating kits shall preferably be of the following types:

- a) TAPLEX' of M-seal make using non-linear resistance material fortress grading.
- b) 'PUSH-ON' type of CCI make using factory - moulded silicone rubber insulators.
- c) 'TROPOLINK' type of CCI makes.
- d) Heat-shrinkable sleeve type of M/s. Raychem.

For outdoor installations, weather shields/sealing ends and any other accessories required shall also form part of the kit.

6.7.4 The straight thro jointing kits shall be suitable for underground-buried installation

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with uncontrolled backfill and possibility of flooding by water. The jointing kit shall be one of the following types.

- a) 'TAPLEX' of M-seal make
- b) 'TROPOLINK' type of CCI make
- c) Heat-shrinkable sleeve type of M/s. Raychem.

6.7.5 Makes of kits other than those specified in 6.7.3 and 6.7.4 may be considered provided the Contractor furnishes type test certificates, along with the offer.

6.7.6 Type tests are to be carried out at manufacturer's works to prove the general qualities and design of a given type of termination/jointing system. The type tests shall include the following tests conforming to the latest IEC 502.2, 466 and VDE 0278 specifications. The Contractor along with the offer for the jointing system considered shall submit the type test certificates.

- a) A.C. Voltage withstand dry test for 1 minute
- b) Partial discharge test - Discharge magnitude shall be less than 20 p.c.
- c) Impulse voltage withstand test with 10 impulses of each polarity.
- d) A.C. high voltage test following load cycling test with conductor temperature at 95°C.
- e) Thermal short circuit test of 250°C for 1 second.
- f) DC Voltage withstand test for 30 minutes.
- g) Humidity test.
- h) Dynamic short circuit test.
- i) Salt fog test
- j) Impact test

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7.1 Before energizing, the insulation resistance of every circuit shall be measured from phase to phase and from phase to ground.

7.2 Where splices or termination are required in circuits rated above 600 volts, measure insulation resistance of each length of cable before splicing and or terminating. Repeat measurement after splices and/or terminations are completed.

7.3 Measure the insulation resistance of directly buried cable circuits before cable trenches are back-filled. Repeat measurement after back- filling.

For cables up to 1.1 KV grade, 1KV Megger and for H.V. Cables 2.5 KV/5 KV, 2.4 KV/4.9 KV Megger shall be used

7.4 D.C. High Voltage Test shall be conducted after installation on the following and test results are recorded.

a) All 1000volts grade cables in which straight through joints have been made.

b) All cables above 1100 V grade.

For record purposes test data shall include the measure values of leakage current versus time.

The D.C. High Voltage test shall be performed as detailed below in the presence of the Engineer-in- Charge or his authorized representative only.

Cables shall be installed in final position with the entire straight through joints complete. Terminations shall be kept unfinished so that motors, switchgears, transformers etc. are not subjected to test voltage.

The test voltage shall be as under: -

i)	For cables 3.3 KV grade	5.4 KV DC
ii)	For cables 6.6 KV grade	10.8 KV DC
iii)	For cables 11 KV grade	18 KV DC

7.5 All cables shall be tested as per standard test Performance available with site

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engineer.

- 7.6 Cable schedule and layout drawings must be marked for AS BUILT conditions during the installation work and shall be approved by Site Engineer.

SPECIFICATION FOR EARTHING AND LIGHTNING PROTECTION

SPECIFICATION NO. MEC/S/05/26/23A



(ELECTRICAL SECTION)
MECON LIMITED
DELHI 110 092

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1.0

SCOPE:

The intent of this specification is to define the requirements for the supply, installation, testing, and commissioning of the Earthing System.

2.0

STANDARDS:

The work shall be carried out in the best workmanlike manner in conformity with this specification, the relevant specifications/codes of practice of Indian Standard Institution, approved drawings and instructions of the Engineer-in-Charge or his authorized representative issued from time to time. In case of any conflict between the standards, the instructions of Engineer-in-Charge shall be binding.

3.0

CONDUCTOR ELECTRODE:

The main grid conductor shall be hot dip galvanized G.I. Flat or PVC insulated aluminum conductor/copper conductor. Sizes for main conductors shall be marked on the drawings. Thickness of hot dip galvanizing shall not be less than 75 microns.

4.0

EARTHING NETWORK:

4.1

The earthing installation shall be done in accordance with the earthing drawings, specifications and the standard drawings of reference attached with this document. The entire earthing system shall fully comply with the Indian Electricity Act and Rules framed thereunder. The contractor shall carry out any changes desired by the Electrical Inspector or the owner, in order to make the installation conform to the Indian Electricity Rules at no extra cost. The exact location on the equipment shall be determined in field, in consultation with the Engineer-in-Charge or his authorized representative. Any changes in the methods, routing, size of conductors etc. shall be subject to approval of the Owner/Engineer-in-Charge before execution.

Excavation and refilling of earth, necessary for laying underground earth bus loops shall be the responsibility of the contractor.

4.3

The earth loop impedance to any point in the electrical system shall have a value which will ensure satisfactory operation of protective devices.

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4.4	The main earth loop shall be laid at a depth of 500 mm below grade level. Wherever cable trenches are available, the earth lead shall be laid in the trenches and shall be firmly cleared to the walls of concrete lined trenches. The earthing strip shall be protected against mechanical damage.			
4.5	In process unit areas, the earthing cable shall be run along cable trays wherever specified in the layout drawings. The earthing cable shall be suitably cleated and electrically bonded to the cable tray at regular intervals.			
4.6	Joints and tapping in the main earth loop shall be made in such a way that reliable and good electrical connections are permanently ensured. All joints below grade shall be welded and suitably protected by giving two coats of bitumen and covering with Hessian tape. All joints above ground shall be by means of connectors/lugs as far as practicable. Tee connectors shall be used for tapping, earth leads from the main earth loop wherever it is installed above ground. Earthing plates shall be provided for earthing of two or more equipment at a place from earth grid. Where aluminum cable risers are to be connected to the underground GI earth bus, the aluminum cable riser shall be taken to the nearest earth pit and terminated through a bolted joint. If this is not practicable, then a G.I. risers shall be brought above grade and a bolted joint shall be made between this GI riser and the aluminum cable termination. This G.I. Riser shall be protected applying two coats of bituminous paint/bitumen on the exposed portion.			
4.7	Conduits in which cables have been installed, shall be effectively bonded and earthed. Cable arm ours shall be earthed at both ends.			
5.0	<u>EARTH ELECTRODES:</u>			
5.1	Earth pipe electrodes shall be installed as shown in the earthing layout drawings and in accordance with the standard drawings of reference and IS:3043. Their location shall be marked to enable accurate location by permanent markers.			
5.2	All earth electrodes shall preferably be driven to sufficient depth to reach permanently moist soil. Electrodes shall preferably be situated in a soil which has a fine texture and which is packed by watering and ramming as tightly as possible. Wherever practicable, the soil shall be dug up, all lumps broken and stones removed from the immediate vicinity of the electrodes.			

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5.3	All earth electrodes shall be tested for earth resistance by means of standard earth test meter. The tests shall take place in dry months, preferably after a protracted dry spell. If necessary, a number of electrodes shall be connected in parallel to reduce the earth resistance. The distance between two electrodes shall not be less than twice the length of electrode.			
5.4	The electrodes shall have a clean surface, not covered by paint, enamel, grease or other materials of poor conductivity.			
5.5	The exact location and number of earth electrodes required at each location shall be determined in the field in consultation with the owner/Engineer-in- Charge, depending on the soil strata and resistivity, to meet the ohmic values prescribed in clause 5.3. Earth Electrodes shall be located avoiding interference with road, building foundation, column etc. Individual earth electrode shall be provided for each lightning arrestor and lightning mast. The electrodes shall be so placed that all lightning protective earths may be brought to earth electrode by a short and straight a path as possible to minimize surge impedance.			
5.6	The disconnect facility shall be provided for the individual earth pits to check their earth resistance periodically. All the earth electrodes shall be suitably numbered and this should be indicated in as built drawings.			
6.0	<u>CONNECTION:</u>			
6.1	All electrical equipment is to be doubly earthed by connecting two points on equipment to a main earthing ring. The earthing ring will be connected via links to several earth electrodes. The earth grid formed shall be a closed loop as shown in the drawing with earth electrodes connected to the grid with double strip connection. The cable armour will be earthed through the cable glands.			
6.2	In hazardous areas all major process equipments shall be connected to the earthing ring by means of anti- loosening connections and all pipelines will be bonded and earthed on entering the battery limit of the process area.			
6.3	The following shall be earthed.			
	1. Transformer neutrals, CT/PT neutrals.			
	2. Neutral Grounding Resistors.			

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3. Transformer Housing. 4. Lightning Arrestors. 5. All switchgear and their earth buses, bus duct. 6. Motor Frames. 7. Non-current carrying metallic parts of electrical equipment such as switchgear, switch racks, panel boards, motor control centers, lighting, power and instrument panels, push button stations, cable trays, pipes, conduits, terminal boxes, etc. 8. All fences, gates/enclosures, housing electrical equipment 9. All steel structures, rails etc. including bonding between sections. 10. Shield Wire 11. Structural steel and Columns. 12. Loading racks. 13. Lighting Mast, poles. 14. Lighting rods (Mast). 15. Tanks and vessels containing flammable materials. 16. Rotating parts of the agitators, pumps etc. through spring loaded brushes of suitable grade. 17. Earth continuity conductor shall be provided for flanges. Conductor size for connection to various equipments shall be as indicated on Earthing Layout Drawings.				
6.4	Two distinct conductors directly connected to independent earth electrodes, which in turn, shall be connected to the earth too, shall earth system.			

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The earth connection shall be properly made. A small flexible aluminum cable loops to bridge the top cover of the transformer and the tank shall be provided to avoid earth fault current passing through fastening bolts when there is a lightning surge, high voltage surge or failure of the bushings.				
6.5	Each Lightning Arrestor shall be connected to a separate electrode located as close as possible to it and within the fenced area for each set of arrestors. The three nos. electrodes for each set of arrestors shall be spaced about 5 meters apart so that they are all within the enclosing fence. Each of these electrodes shall be connected to the main earth grid.			
6.6	The shield wire shall be connected with the main grid solidly and not through supporting steel structures.			
6.7	All paint, scale and enamel shall be removed from the contact surface before the earthing connections are made.			
6.8	All earthing connections for equipment earthing shall be preferably from the earth plate mounted above ground. In case of G.I. Earth Loop all underground "T" connections shall be of the same size as main loop however in case of PVC insulated aluminum conductor loops underground joints shall be completely avoided. Connections to motors from earth plate or main loop conductor brought above ground shall not be less than following: i) No.8 SWG G.I. Wire upto 3.7 KW motors. ii) 3/8" DIA G.I. FINE WIRE ROPE for all motors above 3.7 KW upto 30 KW with tinned copper lug at both ends or 35 mm² PVC insulated stranded aluminum conductor with crimped lug. iii) 5/8" DIA G.I. FINE WIRE ROPE OR 70 mm² PVC insulated aluminum stranded conductor for motors above 30 KW upto 75 KW terminated as described above. iv) For all motors above 75 KW conductor size shall be same as that of loop conductor with equivalent size flexible, if required.			
Anchor bolts or fixing bolts shall not be used for earthing connection.				

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6.9	All hardware used for earthing installations shall be hot dip galvanized or zinc passivated. Spring washers shall be used for all earthing connections of equipment.			
6.10	Lighting fixtures shall be earthed through the extra core provided in the lighting cable for this purpose.			
7.0	<u>TESTING:</u> Earthing systems/connections shall be tested as follows:			
7.1	Resistance of individual electrodes shall be measured after disconnecting it from the grid.			
7.2	Earthing resistance of the grid shall be measured after connecting all the electrodes to the grid. The resistance between any point on the metallic earth grid and the general mass of earth shall not exceed 1 ohm.			
7.3	The resistance to earth shall be measured at the following: a) At each electrical system earth or system neutral earth. b) At each earth provided for structure lightning protections. c) At one point on each earthing system used to earth electrical equipment enclosures. d) At one point on each earthing system used to earth wiring system enclosures such as metal conduits and cable sheaths or armor. e) At one point on each fence enclosing electrical equipment. Measurement shall be made before connection is made between the ground and the object to be grounded.			

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8.0 LIGHTNING PROTECTION

- 8.1 Lightning protection system shall generally comprise lightning finials (air terminals), roof conductors, down conductors, test links, and earth electrodes. the number, types, materials and sizes shall be in accordance with the drawings.
- 8.2 Air terminals shall be mounted on top of buildings or structure as required. All air terminals shall be inter-connected with roof conductors, pipes, hands rails or any other metallic projection above the roofs shall also be bonded to the roof conductors.
- 8.3 Down conductors from air terminals or from roof conductors shall be routed as directly as possible to the test links on earth buses, with minimum bends.
- 8.4 All provisions regarding connections of conductors for equipment earthing system shall also apply to lightning protection system.
- 8.5 In corrosive atmospheres, plumbing metal for corrosion protection shall cover lightning finials or air terminals.

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9.0

TEST PROFORMA

(INSTALLATION TESTING REPORT EARTHING INSTALLATIONS)

1. Earth system data

Type of electrode :

Total number of electrodes :

Main grid size :

Material :

2. General checks Put Tick ✓ if O.K.; otherwise give details.

Construction of earth electrodes as per Standard.

Size of earth conductor for various equipment
O.K. as per Standard.

Minimum distance kept between two electrodes.

Cleanliness and tightness of connectors.
Inspect bolted & clamped connectors.

3. TESTS

3.1 Measured earth resistance of each electrode in ohms

No. 1
2
3
4
5

3.2 Measurement of earth grid resistance (with all electrodes connected to grid)

- a) At each electrical system :
earth or system neutral earth.
- b) At each point provided :
for structure lightning
protection
- c) At one point on each :
earthing systems used
to earth electrical
equipment enclosure
- d) At one point on each :
earthing systems used
to earth wiring systems
such as metal conduits
etc.
- e) At one point on each :
fence enclosing
electrical equipment.

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4. Remarks:

PROJECT:		UNIT:	
TESTED BY	WITNESSED BY		DATE
CONTRACTOR	MECON	OWNER	