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

ANNUAL RATE CONTRACT 2(TWO) YEARS BASIS FOR SUPPLY & INSTALLATION OF METERING SKIDS & ASSOCIATED FACILITIES

OPEN DOMESTIC COMPETITIVE BIDDING

Tender No.: 05/51/23VC/IGGL/030

VOLUME – II OF II

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PREPARED AND ISSUED BY

MECON LIMITED

(A Govt. of India Undertaking)

Delhi, India

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ANNEXURE

MATERIAL REQUISITION

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

Item No.	Description	Unit	Qty	Remarks
GROUP – A (USM SKIDS) Under 2 Year ARC				
	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 *(1W+1S)*Filtration, *(1W+1S)*Pressure Reduction *(active-monitor configuration)* (For Item No. A.5 only) &*(1W+1S)*Metering through USM with panel mounted Flow Computer & Metering Supervisory System including Metering Panel along with the accessories (barriers / isolators, SDC, Terminal block duly mounted, wired and fully assembled), Gas Chromatograph *(For Item No. A.1 & A.3, A.5 only)*, H2S Analyser *(For Item No. A.1 & A.3 only),* Moisture Analyser (For Item No. A.1 & A.3 only), Total Sulphur analyzer (For Item No. A.1 & A.3 only), Gas Detection System, Flow Control (For Item No. A.5 only), 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 AT DT GUWAHATI (SECTION-1) (WITH GC, H2S, MOISTURE analyzer, Total Sulphur analyzer) (Ref P & ID No.: MEC/23UU/05/28/M/004/0001)	Nos.	01	
A.1.1	Assistance in Installation, Testing and Commissioning of skids at site, consisting of Filtration, Metering through Ultrasonic Flow Meter, Panel mounted Flow Computer including Metering Panel, LEL Detectors, etc. The price shall be inclusive of Airfare Boarding, Lodging, Local Transport, Incidental, Traveling etc. & all other expenses.	Man Days	07	
A.2	CHECK METERING AT IPS-3 (SECTION-1) (Ref P & ID No.: MEC/23UU/05/28/M/004/0002)	Nos.	01	
A.2.1	Assistance in Installation, Testing and Commissioning of skids at site, consisting of Filtration, Metering through Ultrasonic Flow Meter, Panel mounted Flow Computer including Metering Panel, LEL Detectors, etc. The price shall be inclusive of Airfare Boarding, Lodging, Local Transport, Incidental, Traveling etc. & all other expenses.	Man Days	07	
A.3	CHECK METERING AT DT GUWAHATI (SECTION-6) (WITH GC, H2S, MOISTURE analyzer, Total Sulphur analyzer) (Ref P & ID No.: MEC/23UU/05/28/M/004/0005)	Nos.	01	

A.3.1	Assistance in Installation, Testing and Commissioning of skids at site, consisting of Filtration, Metering through Ultrasonic Flow Meter, Panel mounted Flow Computer including Metering Panel, LEL Detectors, etc. The price shall be inclusive of Airfare Boarding, Lodging, Local Transport, Incidental, Traveling etc. & all other expenses.	Man Days	07	
A.4	CHECK METERING AT IPS-2 (SECTION-6) ; CHECK METERING AT RT CUM DT AT PANISAGAR (SECTION-5) (Ref P & ID No.: MEC/23UU/05/28/M/004/0006)	Nos.	02	
A.4.1	Assistance in Installation, Testing and Commissioning of skids at site, consisting of Filtration, Metering through Ultrasonic Flow Meter, Panel mounted Flow Computer including Metering Panel, LEL Detectors, etc. The price shall be inclusive of Airfare Boarding, Lodging, Local Transport, Incidental, Traveling etc. & all other expenses.	Man Days	14	
A.5	METERING AT NUMALIGARH REFINERY LTD. (NRL) (SECTION-1) (Ref P & ID No.: MEC/23UU/05/28/M/004/0003)	Nos.	01	
A.5.1	Assistance in Installation, Testing and Commissioning of skids at site, consisting of Filtration, Pressure reduction, Metering through Ultrasonic Flow Meter, Panel mounted Flow Computer including Metering Panel, LEL Detectors, etc. The price shall be inclusive of Airfare Boarding, Lodging, Local Transport, Incidental, Traveling etc. & all other expenses.	Man Days	07	
GROUP – B (TURBINE SKIDS) Under 2 Year ARC				
	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 *(1W+1S)*Filtration, *(1W+1S)*Pressure Reduction (active-monitor configuration) *(For Item No. B.4 to B.7 only) &(1W+1S)*Metering through Turbine Meter with panel mounted Flow Computer (including Metering Panel along with the accessories like barriers / isolators, SDC, Terminal block duly mounted, wired and fully assembled), Gas Detection System, flow Control*(For Item No. B.5 only),* Consumables, Compulsory & Commissioning Spares, Special Tools Tackles including Assistance in Configuration, Interfacing Integrated Testing & Commissioning as per Job specifications and Special Instructions enclosed.			
B.1	CHECK METERING AT SILIGURI DT (Ref P & ID No.: MEC/23UU/05/28/M/004/0007)	Nos.	01	
B.1.1	Assistance in Installation, Testing and Commissioning of skids at site, consisting of Filtration, Metering through Turbine Flow Meter, Panel mounted Flow Computer including Metering Panel & LEL Detectors. The price shall be inclusive of Airfare Boarding, Lodging, Local Transport, Incidental, Traveling etc. & all other expenses.	Man Days	07	
B.2	CHECK METERING AT GNPL SV-15 FOR DIMAPUR (SECTION-8) (Ref P & ID No.: MEC/23UU/05/28/M/004/0009)	Nos.	01	

B.2.1	Assistance in Installation, Testing and Commissioning of skids at site, consisting of Filtration, Metering through Turbine Flow Meter, Panel mounted Flow Computer including Metering Panel, LEL Detectors, etc. The price shall be inclusive of Airfare Boarding, Lodging, Local Transport, Incidental, Traveling etc. & all other expenses.	Man Days	07	
B.3	CHECK METERING AT GNPL SV-10 FOR ITANAGAR (SECTION-2) (Ref P & ID No.: MEC/23UU/05/28/M/004/0010)	Nos.	01	
B.3.1	Assistance in Installation, Testing and Commissioning of skids at site, consisting of Filtration, Metering through Turbine Flow Meter, Panel mounted Flow Computer including Metering Panel, LEL Detectors, etc. The price shall be inclusive of Airfare Boarding, Lodging, Local Transport, Incidental, Traveling etc. & all other expenses.	Man Days	07	
B.4	METERING SKID FOR CGD (TYP-1) (Ref P & ID No.: MEC/23UU/05/28/M/004/0004)	Nos.	09	
B.4.1	Assistance in Installation, Testing and Commissioning of skids at site, consisting of Filtration, Pressure reduction, Metering through Turbine Flow Meter, Panel mounted Flow Computer including Metering Panel & LEL Detectors. The price shall be inclusive of Airfare Boarding, Lodging, Local Transport, Incidental, Traveling etc. & all other expenses.	Man Days	63	
B.5	METERING SKID AT NEEPCO AGARTALA (SECTION-13) (Ref P & ID No.: MEC/23UU/05/28/M/004/0008)	Nos.	01	
B.5.1	Assistance in Installation, Testing and Commissioning of skids at site, consisting of Filtration, Pressure reduction, Metering through Turbine Flow Meter, Panel mounted Flow Computer including Metering Panel & LEL Detectors. The price shall be inclusive of Airfare Boarding, Lodging, Local Transport, Incidental, Traveling etc. & all other expenses.	Man Days	07	
B.6	METERING SKID FOR CGD (TYP-2) (Ref P & ID No.: MEC/23UU/05/28/M/004/0011)	Nos.	01	
B.6.1	Assistance in Installation, Testing and Commissioning of skids at site, consisting of Filtration, Pressure reduction, Metering through Turbine Flow Meter, Panel mounted Flow Computer including Metering Panel & LEL Detectors. The price shall be inclusive of Airfare Boarding, Lodging, Local Transport, Incidental, Traveling etc. & all other expenses.	Man Days	07	
B.7	METERING SKID FOR CGD (TYP-3) (Ref P & ID No.: MEC/23UU/05/28/M/004/0012)	Nos.	01	
B.7.1	Assistance in Installation, Testing and Commissioning of skids at site, consisting of Filtration, Pressure reduction, Metering through Turbine Flow Meter, Panel mounted Flow Computer including Metering Panel & LEL Detectors. The price shall be inclusive of Airfare Boarding, Lodging, Local Transport, Incidental, Traveling etc. & all other expenses.	Man Days	07	

Notes:

1 Evaluation shall be done separately for each Group i.e. Group A & B.

2 The Metering skid supplier shall be responsible for assistance in Installation, Testing and Commissioning of quoted skid. For this purpose, 7 mandays per skid is considered for evaluation purpose. However, payment shall be as per actual requirement. Bidders shall indicate separate price for each quoted Item nos. A.1, A.2, A.3, A.4, A.5, B.1, B.2, B.3, B.4, B.5, B.6 & B.7 against item nos. A.1.1, A.2.1, A.3.1, A.4.1, A.5.1, B.1.1, B.2.1, B.3.1, B.4.1, B.5.1, B.6.1, B.7.1 respectively.

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. 3.1 certification is acceptable for USM only.

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:

1. Categories proceeded with "*" will be approved for fabrication by MECON LIMITED. The remaining drawings are needed for information only.

2. Fold all drawing to 210mm x 297mm.

3. Vendor to provide all printed matter and the soft copy to MECON LIMITED.

4. 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.

CHECK LIST (Technical)		
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

ANNEXURE - A

Check List (BEC DOCUMENT)

NAME OF BIDDER:

OFFER NO & DATE :

QUOTED FOR ITEM NO. :
(AS PER SOR)

Item No.	BEC CLAUSE NO.	Furnished By Bidder					
		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 (Attached with Bid Document)	Remarks
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.							

ANNEXURE - B

Check List
(Mechanical & Instrumentation Items)

NAME OF BIDDER:

OFFER NO & DATE :

QUOTED FOR ITEM NO. :
(AS PER SOR)

Item No.	ITEM DESCRIPITION	Furnished By Bidder				
		SIZE & Rating	Make	Offered Model No.	Page No. Ref (Attached with Bid Document)	Remarks
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#				

10	Globe valve	300#				
		600#				
11	Flow Computer (panel mounted / field mounted)	----				
12	Pressure Transmitter	----				
13	Pressure Gauge	----				
14	Temperature Gauge	----				
15	Resistance Temperature Detector	----				
16	Temperature Transmitter	----				
17	Differential Pressure Transmitter	----				
18	Differential Pressure Gauge (if Applicable)	----				
19	Metering Control Panel					
20	Gas Chromatograph (if Applicable)	----				
21	LEL Dectector (if Applicable)	----				
22	Metering Supervisory System (if Applicable)	----				
23	Laptop	----				
24	Printer (Colour & Dot matrix)	----				
25	GSM Modem	----				
26	HOV actuator					

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.						

JOB SPECIFICATION

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

CONTENTS

1.0 GENERAL

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

For Group – A : The scope of work / supply includes Design, Engineering, Manufacturing, Inspection, Testing and Supervision for Installation & commissioning of metering skid consisting of (1W + 1S) Filtration, Pressure reduction (*active-monitor configuration*) *(For Item No. A.5 only),* Flow measurement through Ultrasonic meter (min.10D before flow profiler, 10 D between flow profiler and US meter and downstream meter runs (min.5D)) with panel mounted Flow Computer, Metering Supervisory system including Metering Panel & its accessories, Gas Chromatograph *(For Item No. A.1, A.3 & A.5 only)*, H2S Analyser *(For Item No. A.1 & A.3 only)*, Moisture Analyser *(For Item No. A.1 & A.3 only)*, Total Sulphur analyzer *(For Item No. A.1 & A.3 only)*, LEL Detection System, Flow Control *(For Item No. A.5 only)* 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.

For Group – B : The scope of work / supply includes Design, Engineering, Manufacturing, Inspection, Testing and Supervision for Installation & commissioning of metering skid consisting of (1W + 1S) Filtration, Pressure Reduction system (*active-monitor configuration*) *(For Item No. B.4 to B.7 only)*, Flow measurement through Turbine meter with panel mounted Flow Computer including Metering Panel & its accessories, LEL Detection System, flow control *(For Item No. B.5 only)* 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.

(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 and Metering Supervisory system (for USM based Metering System), converters etc duly mounted completely wired & GC Controllers (As applicable) 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:

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 form 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 as applicable.

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).

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 (as applicable) 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, Pressure regulators, metering supervisory system 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 for Group A & B 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 Pressure Reduction (as applicable) & Gas metering (through Ultrasonic Meter / Turbine Meter (as applicable)) 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 (as applicable) such as Pressure Transmitters, Differential pressure transmitters, pressure gauges, temperature gauge, Temperature Transmitters & RTDs, Pressure Safety Valve, Creep relief valves,

PCV/SSV/FCV, LEL Gas detectors, etc.

c) Supply of Gas Chromatograph is envisaged for Group-A *(For Item No. A.1, A.3 & A.5 only)* as per MR. The G.C Controller to be mounted in the same metering panel.

d) Supply of fully wired metering panel for each Metering skid of Group A & B 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, Metering supervisory system (hardware and software) 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, USM/Turbine (as applicable), Laptop, Metering supervisory system, SCADA/ RTU, GC (as applicable), FC, LEL Controller etc) mentioned elsewhere. All the control room hardware (GC controllers (as applicable), LEL controller, Metering supervisory system (as applicable), GSM Modem, FC, printer, laptop, 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 (as applicable), Metering supervisory system 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 (as applicable). 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 (USM/Turbine (as applicable)), flanges, fittings & GC impulse line (as applicable) 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.

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 DeskJet / LaserJet Printer (with metering supervisory system) to be supplied with each Metering skid of Group A and one no. of dot matrix printer (for panel mounted Flow Computers) with auto switch between flow computers / network laserjet B&W printer shall be provided for flowcomputer with each Metering skid of Group A & B.

s) Compulsory spares and commissioning spares (for each skids 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 (as applicable), PRS, flow measurement, Stream Flow computers (for each stream), IR type LEL Detection system, safety valves, Pressure Instruments, Temperature Instruments Control Panel, metering supervisory system (for USM based Metering System), 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 & Pressure reduction skid.

b) Metering skids shall consist of complete metering package (consisting of Filtration (as applicable), PRS 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 (as applicable), PRS 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, PRS & 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, Pressure reduction, 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 dry gas filters (1 operating + 1 standby stream) (for each skid of Group A & B), each of 100 % of maximum flow capacity. Fire case Pressure safety Valves (PSV) shall also be provided on each filter.

e) One Gas metering system with two metering stream (for each skid of Group A) of multi-path (minimum 4 path) ultrasonic gas flow meters (1 operating + 1 stand by stream) with flow profiler, meter runs. Flow computer shall be provided for each meter stream with all interface accessories. Each metering stream shall be designed for 100 % of capacity.

One Gas metering system with two metering stream (for each skid of Group B) of Turbine flow meters (1 operating + 1 stand by stream) with flow conditioner, meter runs. Flow computer shall be provided for each meter stream with all interface accessories. Each metering stream shall be designed for 100 % of capacity.

f) The Pressure Reduction system with 2 streams (1 operating + 1 standby stream) (For Item Nos. A.5, B.4 to B.7 only) of Slam shut and Pressure Regulators shall be designed. Each stream to contain two regulators (Active – monitor), it means, if one regulator fails the other one will maintain output parameters. Under normal conditions, the downstream regulator is considered as active regulator and upstream regulator performs the monitoring function. Active regulator shall be "fail to open" and monitor regulator shall be "fail to close" type. Vendor shall confirm that the noise level for the PCV (ACTIVE & MONITOR) and Slam Shut Valves is within 85 dBA. In case, noise level is 85 dBA, vendor shall provide noise treatment to limit the noise level and include silencers or expanders as required in the scope of supply. Set Point of the PCV Pilots and Slam Shut Valves shall be adjustable. Vendor shall furnish the adjustable range of the offered pilots and slam shut valves.

g) Gas Chromatograph system *(For Item No. A.1, A.3 & A.5 only)* 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.

h) Flow control through Flow Control Valve (For Item No. A.5 & B.5 only) shall be installed with low bleed positioner & I/P converter (or electro pneumatic positioner) for limiting flow to consumer (Since Instrument air is not available at site, line gas required for FCV operation shall be taken from pipe line of metering system. Necessary filtration and double stage regulator arrangement (well proven for this specific application) shall be considered to provide the gas supply to I/P converter (or electro pneumatic positioner) & valve positioner / actuator. The I/P converter, positioner / electro-pneumatic positioner, filter regulator and actuator shall be designed & certified for high pressure natural gas application (instead of air). The supplied positioned / electro-pneumatic positioner for FCV shall be low bleed type.

i) The Filtration, pressure reduction system shall be designed to minimize the generation of noise in the frequency range of Ultrasonic metering. Bidders shall provide frequency analysis for all the Noise generating devices and the Manufacturer of Ultrasonic Meter shall confirm that the noise generated by these equipments shall not affect the performance.

j) Also, the pressure reduction system, Ultrasonic metering system should be separated with blocking tees / other piping lay-outs, so that the Ultrasonic noise generated through various components of skid does not affect Ultra Sonic Meter performance. (The requirement and design of blocking Tees / Double Tees or any other piping layout is to be decided by vendor and shall be approved by the original meter manufacturer.)

k) The USM meters shall be configured with check & pay i.e at a time both the meters can be run in series (if required). The details of “CHECK” and “PAY” configuration is mentioned elsewhere in the tender. 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.

l) The wet calibration of meter (USM) shall be performed with Natural gas with its upstream and down stream meter runs and profiler / Flow straightner. The wet calibration of meter (Turbine) shall be performed with Natural gas with its profiler / Flow straightner. The upstream & downstream meter runs (for USM/Turbine) shall be honed and the maximum meter tube roughness should not exceed 250 RA.

m) 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.

n) 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.

o) 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.

p) 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.

q) Panel mounted Flow computer (for all the item nos. as per MR) along with dot matrix printer, GSM Modem & its accessories shall be supplied for Metering Skids 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 along with metering supervisory system. 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.

r) Complete Metering Supervisory system package is also required for USM based Metering skid. Supply of complete Metering supervisory system (consisting of CPU, 17" industrial grade LCD Monitor, accessories like power/ communication cables, connectors, converter etc.) along with colour Printer & laptop is in scope of bidder. The complete package (including CPU, Display unit, Input devices and Printers) shall be installed in the control panel. Access from front shall be provided for Printers installed in panel. Printer with paper shall be mounted in drawer/ sliding arrangement installed in panel.

s) Supply of metering panel to house all the required control room components including Metering supervisory system (for USM based Metering System), LEL detection system, GC, Flow computers, Ball valve status indication, other hard-wares like signal converter, barriers, relays, cables, connecters, 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.

t) Internal or external USB converter shall also be provided with each flow computer for connecting it to USB port of Laptop for configuration. Additionally, suitable converter / hardware and cable is also required for Laptops to read/ view USM data directly in supplied Laptop.

u) Supply of all pipes, tubing, fittings, valves, gaskets, bolts, nuts, spades, etc, are in bidder's scope.

v) 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.

w) 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.

x) 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.

y) 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.

z) 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.

aa) The sun/ rain protection shed for Gas chromatograph field unit and for electronic instruments shall also be supplied by the bidder.

bb) **Softwares:**

a) Flow Computer shall have type approval for flow calculation (as per AGA-9/AGA-7) 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.

c) Vendor to provide the necessary software (licensed in favor of CLIENT) for accessing all data including Flow meter, flow computer and Gas chromatograph from Metering Supervisory System.

d) Vendor to supply all the hardware / software (licensed in name of CLIENT) of metering supervisory system.

e) Licensed software shall be provided in name of CLIENT for Speed of Sound calculation which is a part of AGA 8.

cc) 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 copy (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, supply & performance of the Gas Pressure Reducing and custody 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) Approval from NMI/ PTB/ NPL or original flow meter manufacturer for the complete USM based Metering skid (including up-stream/down stream piping) design including GAD & P&ID for custody transfer application.

b) Calculation of metering system uncertainty based on the approved design and it shall be within +/-0.3 %. (Vendor shall submit the Calculation for overall system uncertainty including all components of the metering system). Wet Calibration of **Ultrasonic Meters** shall be done by the bidder considering the above mentioned overall uncertainty. 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 9.

For Turbine flowmeter, the calibration shall be done at minimum 7 points initially. The calibration shall be done at the following nominal flow rates: 0.025 qmax, 0.05 qmax, 0.1 qmax, 0.25 qmax, 0.5 qmax, 0.75 qmax, and qmax. However, may be finalized during detail engg.

c) Based on the approved design Sizing of flow meters, Pressure relief valves, PCV/SSV/FCV.

d) Instrument ranges to meet the Process operating and design conditions

e) Vendor to provide detailed Noise calculation and standard used and any assumption considered.

f) Response and transportation time calculation for Gas chromatograph

g) Blocking Tee/ Double Tee/ other Noise attenuation devices downstream of Pressure reduction skid and at up-stream of control valve for proper protection / functioning of Ultrasonic meters as required. Check & pay facility for USM meter run to be provided and facility for meter verification as per "CHECK & PAY" configuration shall be provided in the Metering Supervisory System. Z-configuration for taking the Ultrasonic meters in series should have 2 nos. of FB Ball vales and a spectacle blind in between. Spectacle blinds to be considered at the inlet lines, outlet lines and inlet valve bypass lines of Metering section of skid & in drain line of filter. All spectacle blinds to be greased.

h) All the instruments/ equipments to be procured as per the approved vendor list of CLIENT/Mecon.

2.3.11 Typical instrument data sheets for USM/Turbine flow meters , Gas chromatograph, pressure relief valves, PCV/SSV/FCV, 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, USM/Turbine flow meters , and pressure relief valves, PCV/SSV/FCV and accessories are vendor's responsibility.

2.3.12 All the major items like valves (Plug, Ball, Globe and Check), Filtration, USM/Turbine flow meters , 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 including piping duly approved by NMI/ PTB/ NPL or Meter manufacturer 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. Bidder to provide approval of P&ID and GAD of skid, from OEM of Meters.

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 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.
	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 All the mainline ball valves of complete skid package shall be full bore type & Limit switch shall be provided for all the Metering & Z – configuration Ball valves of USM Based Metering Skid.

3.3.4 The complete station shall be designed in such a way that the mean gas velocity remains within 20 Meter per second except in Pressure regulating valve / slam shut valve. Velocity in the piping upstream / downstream of Pressure reduction station shall be within 20 Meter per second. Maximum seat velocity of Slam shut valves is limited to 40 meter / second. The complete skid shall be designed for 100% of the maximum flow capacity.

3.3.5 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. 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.

3.3.6 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.

- Design Approval of the complete skid including GAD & P&ID from NMI / PTB/ NPL/ equivalent body or original meter manufacturer for custody transfer application.

- 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

3.3.7 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.

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

3.3.9 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.

3.3.10 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.

3.3.11 The sizing for PIPES, Safety valves, USM/TURBINE is bidder's responsibility.

3.3.12 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.

3.3.13 All line mounted temperature elements shall be RTD type as per IEC 60751.

3.3.14 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.

3.3.15 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.

3.3.16 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 be is not 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 JBs and cable are required for power supply to Meters and GC. The JBs 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.
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 / 110 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 / 110 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 requirement.

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 USM/TURBINE based metering skid is 3.0 kg/cm^{2}g.

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.

The Upstream of PRS of Metering skid and its components shall be designed for Pressure as specified in the P& ID's & Data Sheet. The Slam shut valves and Pressure Regulators shall be selected such that these instruments can be set in the Pressure range as specified in the data sheet. In case a single Pilot/ spring is not capable of meeting the above pressure set point requirement, additional spring/ pilot shall be provided along with the Pressure Regulators. The PSVs for each Filter shall be designed for fire case and shall have set point as specified in the data sheet.

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 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, statuary 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**. A system of positive material identification (PMI) shall be implemented for the items mentioned in PMI specification attached elsewhere.

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 Vendor to carry out 3.2 certification for the complete supplied items. 3.1 certification is acceptable for USM only.

6.1.4 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.

6.1.5 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.

6.1.6 Supplier shall perform the usual standard tests to maintain quality control procedures. These test certificates shall be 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.

6.1.7 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.

6.1.8 Other inspection and testing requirements shall be as per respective Standard specifications of various instrument items.

6.1.9 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

a. Hydro testing for the integrated skid / individual pipe spools.
b. Pneumatic Leak test of complete skid at 7 Kg/cm2g pressure.
c. Skid functional testing considering metering, limiting and safety characteristics.
d. 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.

e. Radiography/ X-ray, Charpy impact testing for line mounted instrument items such as pressure relief valves, PCV/SSV/FCV, USM/Turbine meters and meter runs etc.
f. 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, PCV/SSV/FCV, USM/Turbine meters, Profiler and meter runs shall be carried out strictly as per following specification.

a) 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.
b) 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.
c) Each USM/Turbine meter along with meter runs shall be subjected to hydrostatic test with a pressure of 1.5 times the design pressure.
d) 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:

a) Physical/ dimensional checks and workmanship. Checking of meter tube roughness. Calibration including establishing linearity and repeatability over the entire range. **Wet calibration of Ultrasonic Flow Meter for USM based skid shall be performed along with UP (10D + Profiler + 10D) & Down (5D) meter runs.**

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 USM/Turbine flow meters 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, supervisory system, barriers, isolators, power supplies, metering supervisory system, 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 as applicable.
- 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, reseat 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 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.
- 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 pieces 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 skid 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 require 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 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)/ JBs 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 JBs.

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, Gas pressure reducing 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, PCV/SSV/FCV, gas chromatograph, pressure/ differential pressure transmitter, Temperature transmitters, hydrocarbon (LEL) detector and pressure/ temperature gauges, limit switches, metering supervisory system, 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, PCV/SSV/FCV. Calculation for Gas velocities and Pressure drop across slam shut valves and 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.

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/ model 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 multi-path ultrasonic flow meters, flow computers, pressure relief valve, PCV/SSV/FCV, gas chromatograph, LEL gas detection system, pressure/ differential pressure transmitter, temperature transmitters, Ball valves, plug valves, temperature gauges, pressure gauges, portable configurator, Metering supervisory system, 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 Ultra Sonic Meter (multi path-Minimum 04 path), flow computers and on line 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 Ultra Sonic gas flow Meter to be submitted along with the bid.

12.8 It is compulsory that bidder utilises 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 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. If the Metering skid consists of Filtration and Pressure reduction/ let down, spares for Filtration and Pressure reduction to be provided. In case, the Skid consists of either Filtration or PRS (but not both), then only the relevant spares is to be provided. 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. (As applicable to respective P& IDs of Group –A & B):

a) Repair kit for PCV (Diaphragm, O-rings, cone etc.)- 02 set (one set means one stream)

b) Repair kit for Pilot (Diaphragm, O-rings, etc.)- 02 set (one set means one stream)

c) Repair kit for SSV (Diaphragm, O-rings, etc.)- 02 set (one set means one stream)

d) Filter element- 02 set. (one set means all the elements required for one stream)

e) 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)

f) O-ring for Filter end closure -02 set (one set means one stream)

g) All type of IO barrier/ relay/ terminal as applicable (max. of 20% or 01 no.)

h) GC spares like Column set, Solenoid Valve, Filter, Repair Kits etc. (if applicable).

14.0 CHECK & PAY CONFIGURATION & PROCEDURE FOR USM BASED METERING SKIDS:

The following Procedure is applicable for Metering skid having Z-Configuration (for Meter Verification through PAY-CHECK configuration). This scheme/ configuration shall be implemented in the Supervisory system being provided by the Bidder:

Stream-1 shall be selected in "PAY" mode and Stream-2 can be selected in "CHECK" mode. Both "PAY" and "CHECK" Flow computers (Stream-1 and 2) shall do fiscal metering separately/ independently and update data in the supervisory computer.
In "PAY" Flow computer all fiscal totals get incremented.
In "CHECK" Flow computer only maintenance totals get incremented.

When the User decides to do meter verification and selects the "PAY" and "CHECK" streams at the meter verification window. The stream selected as "CHECK" shall put its Flow computer in "Maintenance mode" automatically by the HMI system and thereby its maintenance mode totals in the Flow computer shall increment, keeping the fiscal totals at the last reading.

Once the streams-1 and 2 are selected in "PAY" and "CHECK" mode respectively and the User clicks on the begin button, a confirmation is required from the user to proceed ahead. Once the user confirms, system prompts to align the Valves according to PAY-CHECK streams configuration. The **Valve alignment procedure during meter verification** is mentioned below**.** Once User manually aligns the Valves according to PAY-CHECK streams, reconfirmation is requested from the User that the Valve alignment has been completed. HMI system also verifies the correct valve alignment by checking valve open / close feedbacks. After User confirmation by clicking Start button, the system captures cumulative UVOL, CVOL, Mass and Energy Totals of "PAY" Flow computers and are stored as Start status. For "CHECK" Flow computer, Maintenance UVOL, CVOL, Mass and Energy Totals are recorded as Start status of "CHECK" Flow computer.

Cumulative Totalisers of "PAY" Flow computer and "CHECK" Flow computer increment till User Clicks on Stop Button. When verification is stopped, the system displays respective Totalisers for the Flow computers as Stop status and also calculates the difference between Stop status and Start Status.
Percentage difference between "PAY" Flow computer Totalisers and "CHECK" Flow computer Maintenance Totalisers are calculated and displayed as accuracy indication of Meter under Test.
After Meter verification has been stopped, User can either press Yes Button to continue with the meter verification or else press NO Button to move ahead in the sequence and then align the valves as per the procedure mentioned below.

After User clicks "RESET" Button, and confirms the "Reset" then the Flow computer status of "CHECK" stream is changed from Check to Offline, resets all other parameters like difference and accuracy readings.

This completes the Meter Verification.

a. Valve Alignment procedure during meter verification:

Correct sequence of Valve operation is as follows when "PAY" stream is to be verified using "CHECK" Stream.

1. **Open "PAY" stream Inlet Valve**
2. **Open Crossover Valve(s) and rotate spectacle blind to open position.**
3. **Ensure closure of "CHECK" Stream Inlet valve**
4. **Open Outlet valve of "CHECK" Stream**
5. **Close "PAY" stream Outlet Valve.**

b. Valve Re-alignment procedure after completion of meter verification:

1. **Close Cross over Valve(s) and put spectacle blind in close position.**
2. **Open "PAY" stream Outlet Valve**

3. Close Outlet valve of "CHECK" Stream

15.0 ATTACHMENTS

a) TECHNICAL SPECIFICATION OF ULTRASONIC FLOW METER (REF.: TS No. - MEC/05/E5/ TS/USM-030)

b) TECHNICAL SPECIFICATION OF TURBINE FLOW METER (REF.: TS No. -MEC/05/E5/TS/TM-030)

c) TECHNICAL SPECIFICATION OF PRESSURE CONTROL VALVES AND SLAM SHUT VALVES (REF.: TS No. - MEC/ 05 / E5 / TS/ PCV_SDV - 030)

d) TECHNICAL SPECIFICATION OF CONTROL PANEL (REF.: TS No.- MEC/05/E5/TS/CP -030)

e) TECHNICAL SPECIFICATION OF GAS CHROMATOGRAPHS (REF.: TS No. - MEC/ 05/E5/ TS/ GC - 030)

f) 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
ULTRASONIC FLOW METER

SPEC. No.: MEC / 05 / E5 / TS / USM-030

MECON LIMITED
DELHI - 110 092

Revision	Date	Description	Prepared by	Checked by	Approved by
1	16.04.2012	Cl. 10 & 11			
0	21.10.2009				

CONTENTS

1.0 INTRODUCTION:

The purpose of this specification is to define the Custody Transfer Application requirement of Ultrasonic Flow Meter (with Flow Computer) .

1.1. In case of any conflict between the specifications, enclosed data sheets, enclosed attachments, related codes and standards etc. Vendor shall refer the matter in writing to the purchaser, and shall obtain clarification in writing before starting the manufacturing of the instrument.

1.2. 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 has to be changed at a later date to meet the Purchaser's Specifications, the same shall be done by the vendor without any price and delivery implications

1.3. The Instrument selected for the unit shall be rugged in design and must be well proven in the Custody Transfer Applications for Natural Gas. Vendor must ensure that all the instruments being supplied must be operating continuously for a period of at least six months (4000 hrs) in a similar application. Vendor to furnish Proven Track Record in the offer for offered model indicting model nos. of items supplied, name of plant, name of client, type of application, month and year of supply and commissioning of the plant, name & address of the contact person.

2.0 APPLICABLE STANDARDS AND CODES

The design, construction, manufacturing, supply, testing and other general requirements of the USM should be strictly in accordance with the data sheets, applicable codes, and should comply fully with relevant National & International standards, Indian Electricity Act, Indian Electricity Rules, regulations of Insurance Association of India and Factories Act while carrying out work as per this specification.

The Vendor without any additional cost and delivery implications should carry out any modification suggested by the statutory bodies either during drawing approval or during inspection, if any.

The following codes and standards (versions/ revisions valid on the date of order) are referenced to & made part of specification. The following Codes and Standards shall be applied as a part of the requirements of this specification. For each code/standard the latest edition shall be applied.

ANSI/ASME	American National Standard Institutes/American society of Mechanical Engineers B 1.20.1 Pipe Threads B16.5 Steel pipe flanges and Flanged fittings B 16.20 Ring Joint Gaskets and Grooves for steel Pipe Flanges
ASME Sec VIII	Boiler & Pressure Vessel code rules for construction of Pressure Vessels

API MPMS	American Petroleum Institute Manual Petroleum Measurement Standards Chapter 1 Vocabulary Chapter 4 Proving Systems Chapter 5 Metering
AGA	American Gas Association Report No. 5 Fuel Gas Energy Metering Calculations Report No. 8 Compressibility of Natural Gas and other related Hydrocarbon Gases Report No.9 Measurement of Gas by Multipath Ultrasonic Meters
DIN 50049	Documents on Material Testing
IEC 79	Electrical Apparatus for Explosive Gas atmosphere
IEC 529	Degree of Protection Provided by Enclosures
IS 2147	Degree of Protection Provided by Enclosures for Low Voltage Switch Gear and Control Gear
IEC 801	Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment.
IS 2148	Flameproof Enclosures for Electrical Apparatus

Any other Codes & Standards mentioned elsewhere or which has required to be complied with as per the prevailing Government of India regulations shall also be followed. All Electrical devices shall meet the requirement for the area classification specified in the documents.

3.0 TECHNICAL SPECIFICATION FOR ULTRASONIC FLOWMETER

1. Ultrasonic flow meter shall be multi path type of minimum 4 path & above for natural gas custody transfer flow metering application and the design, construction and operation shall conform to AGA Report 9 (latest version) for multi-path. The meter shall be approved by NMI/ PTB/ NPL or equivalent body for custody transfer application.

2. The principle of operation used shall be simple in design and shall avoid analytical complexity associated with development of information, which is extraneous to the application. The over-all uncertainty (including lab uncertainties) of the supplied system shall be equal to or better than +/-0.3%.

3. The design used shall provide maximum reliability, maximum on-line performance and minimum maintenance having on-line diagnostic features. Instrument shall be field proven. No prototype instrument shall be supplied. Technique of measurement used shall be interference free. It shall be immune to other impurities in the fluid stream.

4. Internal surface roughness of 250 Ra or less (smoother) is required for the meter tube (including upstream & down stream straight runs). Meter tube shall be honed for achieving the

same and a certificate from TPI shall be submitted to MECON/CLIENT before flow calibration.

5. Wet calibration of Ultrasonic meters with natural gas shall be conducted with Upstream & down stream meter runs along with flow profiler.

6. The Accuracy specified in the tender documents for USM shall be Overall accuracy (inclusive of all lab uncertainty) and it is in percentage of reading. The OEM of Ultrasonic Gas flow meter shall certify that the overall accuracy will be met with the proposed installation-piping configuration (as per proposed P&ID and GAD) of the complete skid.

7. The flow meter shall be direct path type with minimum 4 path ultrasonic transducers. The transducers shall be energized by the integral electronics to transmit and receive ultrasonic waves. Vendor shall size all the ultrasonic flow meters for the given process conditions as per AGA 9. Sizing shall be done considering maximum flow capacity at minimum inlet operating pressure & gas composition and other process conditions.

8. The turndown ratio of each flow meter shall be minimum 1:40. Repeatability shall be better than 0.1% for qt<qi<qmax & ±0.2% for qmin<qi<qt and resolution better than 0.001 m/s. Accordingly vendor shall select the no. of paths (minimum 4 paths or more than 4 paths) to meet accuracy requirement and indicate the same in calculations / back-up literature.

9. The meter shall be provided with pressure tap to measure the static pressure in the meter.

10. The meter body shall be made as per data sheets. All flanges shall be weld neck, raised face and shall meet ANSI B 16.5. The ultrasonic metering system shall be provided with full diagnostics and customer user interface.

11. It shall be possible to replace or relocate transducers without a change in meter performance. After an exchange of transducers and a possible change of the associated software constants, the resulting shift in the meter's performance should not be more than the allowable repeatability of the meter. In addition, the maximum error and the maximum peak-to-peak error as detailed in AGA-9 shall not be exceeded. Retraction tool is not required.

12. The vendor shall comprehensively advise the impact of transducer failure on the performance and accuracy of the USM. Vendor shall confirm that the measurement will not degrade by more than ± 0.05% in case of loss of one path.

13. The meter design shall have the facility to remove / replace the transducers in situ under line operating condition. Failure or removal of one pair of transducers shall not cause the meter to lose all measurement function. Failure of any path shall generate an alarm identifying the affected path. Also transducers ports shall be designed in a way to reduce the possibility of liquid or solid accumulation.

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

15. Overall pressure drops across the meter assembly including meter runs shall be kept minimum. Pressure drop calculation across the meter shall be furnished. Ultrasonic meters shall be rated for the maximum design pressure as indicated in the data sheets.

16. Ultrasonic flow meter spool inside diameter to meet the specified I.D as per AGA. Internal surface roughness shall be as specified elsewhere.

17. All ultrasonic flow meters shall be supplied with upstream meter run with flow conditioner/profiler (min.10D before flow profiler, 10 D between flow profiler and US meter) and downstream meter runs (min.5D).

18. The Meter body length and bore has to be specified by the US Meter Manufacturer. The USM bore and the adjacent upstream pipe along with flanges should have the same inside diameter to within 1% of each other. Vendor has to provide document to justify the same duly certified by third party internationally recognized certifying agencies.

19. External meter body shall be blast cleaned to near white metal as per international standard and primed with inorganic zinc primer (two coats each of 40 micron minimum dry film thickness) and the final coat of epoxy paint of 40-micron dry film thickness.

3.1 METER ELECTRONICS:

a) Meter electronics shall include all associated transmitters, pre-amplifiers etc.

b) The transmitter unit shall be microprocessor-based electronics suitable for installation in the field under the ambient condition specified. Meter electronics shall be Weather proof to IP 65/ NEMA 4 and flameproof certified suitable to install in area classification IEC Zone-1, Gas Gr. IIA & IIB, Temp. Class T3 by a statutory body such as FM, UL, CENELEC, BASEEFA, PTB etc.

c) The electronics unit shall preferably be mounted integral on the meter.

d) The transmitter shall have extensive diagnostic capability. Self-diagnostic feature should include monitoring the health of the transducers and signal quality.

e) Meter parameters and factors set into the meter electronics shall be retained in non- volatile memory and shall be secured with password such that un-authorised changes are prohibited.

f) Configuration software and firmware shall be provided for each skid. The license shall be in the name of CLIENT.

g) Meter output signals from the meter electronics shall be without flying leads. All the signals from the meter electronics shall be terminated in a junction box (JB) supplied by the meter vendor and shall be mounted on skid. JB shall be weather proof (WP) to IP 65/NEMA 4 and flameproof certified suitable for the specified area classification.

h) The cable entry sizes between meter electronics and transducers shall be decided by vendor and the WP & flameproof cable glands to be supplied accordingly. Cable entry sizes shall be as per NPT standards.

i) The maximum velocity through the ultrasonic meter shall be less than 20 m/sec.

j) Meter electronics shall be capable of multiple output signals as follows:

k) Pulse outputs to flow computers configurable for flow rate signals.

l) RS-485/422 communication port with MODBUS protocol for communicating with the control systems i.e. control room mounted flow computer for meter diagnostics, test and health data.

m) Vendor shall supply the RS 485/422 cables interconnecting serial link cables which shall be armoured along with suitable connectors and converters against each item/ instrument/ tag for communication between flow meter in field and flow computers mounted on metering control panel located at respective control room.

n) The USM shall be connected to the flow computer serially for digital communication and also for frequency pulse signal shall be connected to flow computer for custody transfer flow indication.

o) Facility of any error correction in USM as permitted for custody transfer application shall be provided.

3.2 ON LINE FIELD VERIFICATION:

Speed of Sound comparison should be done in the stream flow computer for the speed of sound measured value from the USM and the speed of sound calculation based on the GC component data which is a part of AGA 8. If the difference between the SOS between the actual and the calculated one is more than the permissible limit then the flow computer shall generate a alarm

Separately, Licensed software shall be provided in name of CLIENT for Speed of Sound calculation which is a part of AGA 8.

3.3 VERIFICATION FOR CUSTODY TRANSFER AND CALIBRATION

Each USM meter shall have calibration certificate, duly signed by approved laboratories of weights and measures authority of country of origin. The Vendor shall furnish the regulations of the certifying authority considered by him for custody transfer applications. If other instruments are also needed to be certified as per the regulations the same shall be complied.

a. Certification for US meters: The vendor shall provide certification from Calibrating agency/ Laboratory / OEM of Ultrasonic Gas Flow meter confirming that the meter being calibrated shall work with specified accuracy/ repeatability with the actual gas composition mentioned in the tender documents. Further the OEM of Ultrasonic Gas Flow meter shall certify that with the P&ID and GAD of skid being proposed / supplied by the bidder the performance, accuracy, repeatability etc. of the offered Ultrasonic gas flow meter shall be within the mentioned specifications.

b. Each meter shall be “zero calibrated” (“dry calibrated”) with nitrogen. Test results shall be furnished. In the dry calibration set up, the gas velocity observed on all the acoustic paths shall be zero. The speed of sound of the individual acoustic path in the dry calibration set up shall not exceed ±0.2% of the mean velocity of all the paths

c. Flow calibration with high pressure Natural gas shall be performed for at least seven points (at 2.5%, 5%, 10%, 25%, 50%, 75% and 100% of Qmax.) and error curve shall be obtained. Flow Verification for at least two points shall be done after adjustment/ incorporation of factors obtained through calibration and the same to be recorded in the calibration report, as per AGA-9.

d. Vendor shall carryout performance test and certify the meter in combination with its companion electronics. A recognized test facility with traceable reference measurements shall

be used. Flow test data covering the minimum to the maximum flow rate shall be obtained for ascertaining the meter linearity and repeatability with in the specified limits.

e. The Ultrasonic meters shall be 'flow calibrated' with natural gas and shall have calibration certificate duly signed by laboratories approved by weights and measures authority of its country of origin or recognized international Institutes like NMI, PTB, Pigsar, Trans Canada Calibrations(TCC) Canada, Measurement Canada, Colorado Engineering Experiment Station Inc.(CEESI) USA, GAIL Hazira, etc. Accuracy with wet flow calibration shall be demonstrated within ±0.3% for multi path type under flow conditions in the turndown ratio of 1:10. The meter proving system to be used by vendor shall be traceable to international standards and uncertainty of meter proving system shall be furnished. Gas metering system integration, testing, validation and including third party "wet' calibrations (for the ultrasonic meters with its associated upstream / downstream meter runs & flow profiler) should be done in flow labs as detailed above

4.0 CALIBRATION REPORT:

The results of flow calibration shall be documented in a written report to be supplied to MECON/CLIENT. For each meter, the report shall include at a minimum the following:

a) Name of Meter Manufacturer
b) Model and Serial No. of Meter
c) Name and Address of the Calibration facility.
d) SPU Firmware revision number
e) Date(s) of calibration
f) Name and Designation/ Title of the person(s) conducting calibration
g) Description of calibration procedure
h) Upstream and Down-stream piping configuration including flow profiler, meter runs.
i) Serial nos. of all piping and flow profiler
j) Diagnostic report of the software configuration parameters at the time of calibration
k) All calibration data including Flow rates, Pressure, Temperature, Velocities, errors and gas composition
l) A statement of uncertainty for the facility with reference to the method used and date of last verification of traceability to the recognized national/ International standard.
m) An Identification of Adjustment method applied and adjustment factors used
n) No. of pages in the calibration document
o) Typed name below signature(s) of all the people who sign the calibration document.

5.0 NAME PLATE & TAGGING

5.1 A nameplate containing the following information shall be affixed to the meter body:

- The manufacturer, model number, serial number and month and year manufactured
- Maximum and minimum storage temperatures
- Maximum operating pressure and temperature range
- Maximum and minimum actual (at flowing conditions) flow rate per hour
- Purchase order number, shop order number and/or user tag number.

5.2 Each transducer port should be permanently marked with a unique designation for easy reference. If markings are stamped on the meter body, low-stress stamps that produce a rounded bottom impression should be used.

6.0 PACKAGING:

The USM shall be packaged to withstand rough handling during ocean shipment and in-land journey. It shall be vendor's responsibility to make good any deterioration that occurs during shipment. Sling points shall be clearly indicated on crates.

7.0 DATA AND DRAWING DETAIL

Vendor shall furnish all the documents as per "Vendor Data Requirements" enclosed with Requisition. All the other documents as per Technical specification and the documents required for better understanding and execution of the job to be supplied by the Vendor.

Certificates from statutory authorities confirming suitability of design / construction of all electrical and electronic items for use in hazardous area classification. In case of foreign supply, the Vendor should get all certificates endorsed by office of Chief Controller of Explosives (CCOE), Govt. of India within one month of delivery of USM at site.

Along with the bid the following information is to be provided by the Vendor:

In addition to VDR following documents also required:

1. General arrangement drawing giving overall dimensions and erection / shipping weight. Duly filled data sheets of major instruments etc.
2. List of commissioning spares for USM (if required)
3. List of special tools & tackles required for installation & maintenance.
4. Factory test procedure. (Refer Fat procedure attached in the tender document)
5. Maintenance schedule along with list of Spares for O&M.

Vendor shall provide following documents along with supply.

1. Software (logic diagram) on CD-ROM with suitable communication Protocol for communication of USM with flow computers.

INSTRUMENTATION SECTION

TECHNICAL SPECIFICATION
FOR
TURBINE METER

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

MECON LIMITED
DELHI - 110 092

0	20.01.2010		Ritish	Vikas	Rakesh
Revision	Date	Description	Prepared by	Checked by	Approved by

TECHNICAL SPECIFICATION FOR TURBINE METER

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

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

3. Vendor shall furnish the sizing calculations to justify the selection of turbine meters considering the density/compressibility of the given composition of the gas. The sizing shall be done at the minimum operating pressure.

4. The maximum velocity through the Turbine meter shall be less than 20 m/sec.

5. Vendor shall select the proper type and material of bearing for the service conditions indicated.

6. The pulse generator shall be non-contact proximity switches mounted near turbine wheel and reference wheel or non-contact type pulse pick up unit. The unit shall be tropicalised hermetically sealed and shall be either intrinsically safe or explosion proof as per data sheet. Further it shall be weatherproof to NEMA 4.

7. Turbine meter shall have LOCAL INDEX HEAD WITH mechanical/ electronic 8-digit totaliser. Electronic totaliser (when supplied in the data sheets) shall have LCD indication and shall be complete with dry cell batteries for power lasting for one year.

8. The system shall be immune to RF/FM interferences in that area.

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

10. Vendor shall furnish pressure drop figures for each turbine meter, flow straightener at normal operating conditions and at maximum flow condition.

11. While selecting the meter, vendor to ensure that the fluid velocity in the turbine meter shall not exceed 20 m/s.

12. Turbine meter/ flow computer shall have a continuous monitoring feature for detecting missing blades or bearing problems and to give alarm in such situation.

13. The meters shall be certified by weights and measures, and shall be calibrated to an accuracy of +/-0.5% band. Vendor shall furnish the documentary proof in support of the above along with certified calibration curve.

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

15. The pulse pick-up and transmitters shall comply with the principles of ISO 6551 'Cabled transmission of electric and/or electronic pulse data'. At least security level B and the checking facility of type P as defined by ISO 6551 shall be provided.

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

Range ability : Range-ability of Turbine meter shall be 20 : 1 for Meter sizes above G 100 and for Turbine meters with size less than or equal to G 100 range-ability shall be 10:1

Accuracy: For flow rates between 5% and 20% (of Meter max) at operating pressure the calibration curve shall be within an envelope of +/- 1% and for flow rates between 20 % to 100% (of meter max.) at operating pressure the calibration curve (min. 7points) shall be within an envelope of +/- 0.5%.

Repeatability: The repeatability of meter shall be +/- 0.1 % from Qmin to Qmax.

17. The turbine meters shall have HF pulses on the meter head and shall be connected to the flow computer. For Turbine meter of size up to 3", one(1) HF pulse and one(1) LF pulse is also acceptable. However for Turbine meter of size 4" and above, two(2) nos. of HF pulse is required.

18. **CERTIFICATION FOR CUSTODY TRANSFER AND CALIBRATION**

18.1 Turbine meter shall have type approval certificates from weights and measures approved laboratories, such as NMI, PTB or other reputed National Standard laboratory such as Pigsar, Trans Canada Calibrations(TCC) Canada, Colorado Engineering Experiment Station Inc.(CEESI) USA ,South West Research Inc. (SWRI) USA., FCRI.

18.2 The Vendor shall furnish the regulations of the certifying authority considered by him for custody transfer applications. If other instruments are also needed to be certified as per the regulations the same shall be complied.

18.3 Flow calibration shall be performed for at least seven points and error curve shall be obtained. Test medium shall be Natural Gas.

18.4 Vendor shall carryout performance test and certify the meter in combination with its companion electronics. A recognized test facility with traceable reference measurements shall be used. Flow test data at 7 points covering the minimum to the maximum flow rate shall be obtained for ascertaining the meter linearity and repeatability with in the specified limits. Wet Calibration of Flow Meters shall be done at the following nominal flow rates: 0.025 qmax, 0.05 qmax, 0.1 qmax, 0.25 qmax, 0.5 qmax, 0.75 qmax, and qmax.

INSTRUMENTATION SECTION

TECHNICAL SPECIFICATION
FOR
SELF ACTUATED PRESSURE CONTROL VALVES AND SLAM SHUT VALVES

SPEC. No. : MEC/05 / E5 / TS/PCV_SDV-030

MECON LIMITED
DELHI - 110 092

0	20.01.10		Ritish	Vikas	Rakesh
Revision	**Date**	**Description**	**Prepared by**	**Checked by**	**Approved by**

TECHNICAL SPECIFICATION
FOR
PRESSURE CONTROL VALVES AND SLAM SHUT VALVES

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

2. The Gas pressure regulator and slam shut valves shall be provided in redundant pressure regulation stream as primary pressure regulating stream and secondary pressure regulating stream as per P & IDs. It is intended to provide slam shut valves on upstream of self actuated pressure control valves at gas receiving points for tight shut off at increasing pressure beyond a preset limit, to take care of self actuated pressure control valves failure. The slam shut valve of primary regulating stream shall close at its set pressure in case of failure of primary operating regulator & monitor and the secondary regulating stream shall come in operation. The automatic switchover shall be achieved with appropriate staggered setting of Pressure regulator/monitor and slam shut valves. Vendor shall select the appropriate set points such that the switch-over is smooth without affecting the safety of the system and gas supply to consumers is also not interrupted.

3. Each pressure regulator / monitor shall be designed for maximum gas flow rate at the minimum inlet arrival pressure. Gas pressure regulators shall be with very high range-ability since high fluctuations in flow demand are expected and also the inlet pressure may vary considerably.

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

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

6. Leakage class for pressure control valve & slum-shut valve shall be class-VI as per ANSI B16.10

7. Vendor to note that the noise level for each Regulator shall be less than 85 dBA at one meter away from the valves. Vendor shall provide noise treatment to limit the noise level and include silencers or expanders as required in their scope of supply. Vendor to provide Noise calculation giving full details and standards used and any assumptions considered in calculation (This calculation shall be submitted along with the bid).

8. Slam shut valve shall be self-contained type requiring external control line such that the line pressure acts directly on the diaphragm.

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

10. Slam shut valves shall be provided with position indicator and shall have separate limit switches for open and close positions. Limit switches shall be with DPDT, snap acting micro switch with contact rating 1 A @ 24 V DC. Limit switch enclosure shall be weather proof to IP 55 and flame proof (Ex'd') suitable and certified for area classification IEC Zone 1, Gr. IIA, IIB, T3. Cable entry shall be ½" NPT with out flying leads.

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

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

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

14. Any By-pass valve provided for the slam shut valve shall be spring closing type.

15. Velocity at pressure regulating valve may increase beyond 20 meter per second however in the downstream pipe it shall be within 20 meter per second. Actual velocity shall be indicated by vendor.

16. Vendor shall furnish the flow rate versus trim lift curve to justify the valve range-ability and valve regulation characteristics.

17. The PCV & SDV shall be designed in such a way the noise generated by these equipments shall not interfere with the performance of the meter.

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

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

INSTRUMENTATION SECTION

TECHNICAL SPECIFICATION

FOR

CONTROL PANEL & ACCESSORIES

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

MECON LIMITED

DELHI - 110 092

Revision	Date	Description	Prepared by	Checked by	Approved by
0	20.01.10				

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

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.

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.**

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

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

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

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	± 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

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

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

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**

CONTENTS

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.

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

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 sha11 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:

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 % CO_2
   IV. Mole % N_2
   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.

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 ±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 ± 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 deg. 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 ±0.2% for components (mole %) greater than 10 % and ±0.5 % for components (mole%) between 1 % to 10% and ±1.0% for components (mole%) below 1%. The calibration shall be traceable to NPL or

equivalent (the traceability certificate to be submitted) with 03 years stability. Gas volume per cylinder shall be approximately 2.13 M^3.

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 ± 10%, 50 Hz ± 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.

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

a) In general Gas Chromatograph and sampling systems shall be designed and constructed in accordance with API – MPMS (Relevant portions).
b) Process Stream sampling shall be continuous.
c) The Gas Chromatograph performance shall be within specifications when the supply voltage varies by $\pm$ 10% of specified value and supply frequency varies by $\pm$ 3 HZ of specified value.
d) Unless otherwise specified material of all components wetted by sample shall be ANSI – 316 SS.
e) 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.
f) Unless otherwise specified, the following shall govern :

i. Threaded connections shall be NPT to ANSI / ASME B 1.20.
ii. Flanged connection shall be as per ANSI / ASME B 16.5
iii. Grooves of ring type joint flanges shall be octagonal as per ANSI /ASME B 16.20.
iv. 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

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.

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 venders 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.

PIPING MATERIAL SPECIFICATION
(NORTH EAST GAS GRID PIPELINE PROJECT)

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

(PROCESS & PIPELINE DESIGN SECTION)

MECON LIMITED

DELHI - 110 092

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PREPARED BY:	CHECKED BY:	APPROVED BY:	DATE ISSUED:
KRISHNA PATEL MANAGER	HEMANT KUMAR MANAGER	AMIT GANGAL GM I/C	JUNE, 2020

1.0 **SCOPE**

This specification covers the requirements of various piping materials used in piping/ pipeline system handling Natural Gas / Regasified 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

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 and Table-2.

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.

7.6 Butt 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, nippolet 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 Butt welding ends of WN flanges shall conform to ANSI B 16.25.

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 ¼" to 1"	:	UNC-2B
Nuts for stud bolts dia $1^{1/8}$" to 3 ¼"	:	8UN-2B

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

Studs bolts dia ¼" to 1"	:	UNC-2A
Stud bolts dia $1^{1/8}$" to 3 ¼"	:	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.

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.

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.

TABLE-1

PIPE WALL THICKNESS DETAILS FOR MAINLINE

Sl. No.	Pipe Material Description	Size (NB)	Thickness (mm)	Length
1	API 5L Gr. X-70, PSL-2	24”	10.31	As per SOR Quantity
2	API 5L Gr. X-70, PSL-2	24”	12.7	As per SOR Quantity
3	API 5L Gr. X-70, PSL-2	24”	17.48	As per SOR Quantity

PIPE WALL THICKNESS DETAILS FOR SPURLINE

TABLE-2

Sl. No.	Pipe Material Description	Size (NB)	Thickness (mm)	Length
1	API 5L Gr. X-56, PSL-2	8”	7.04	As per SOR Quantity
2	API 5L Gr. X-56, PSL-2	8”	7.92	As per SOR Quantity

TABLE-3

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

ANSI CLASS: 600 #	CORROSION ALLOWANCE: 1.5 MM	TEMP °C	−29.0	38.0	50	100	150	200	250
		PRESS. KG/CM^{2}g	104.14	104.14	102.2	95.04	91.97	89.35	85.07
SERVICE : NATURAL GAS		BASE MATERIAL: CARBON STEEL (MATERIAL GROUP 1.1)							

NOTES: −

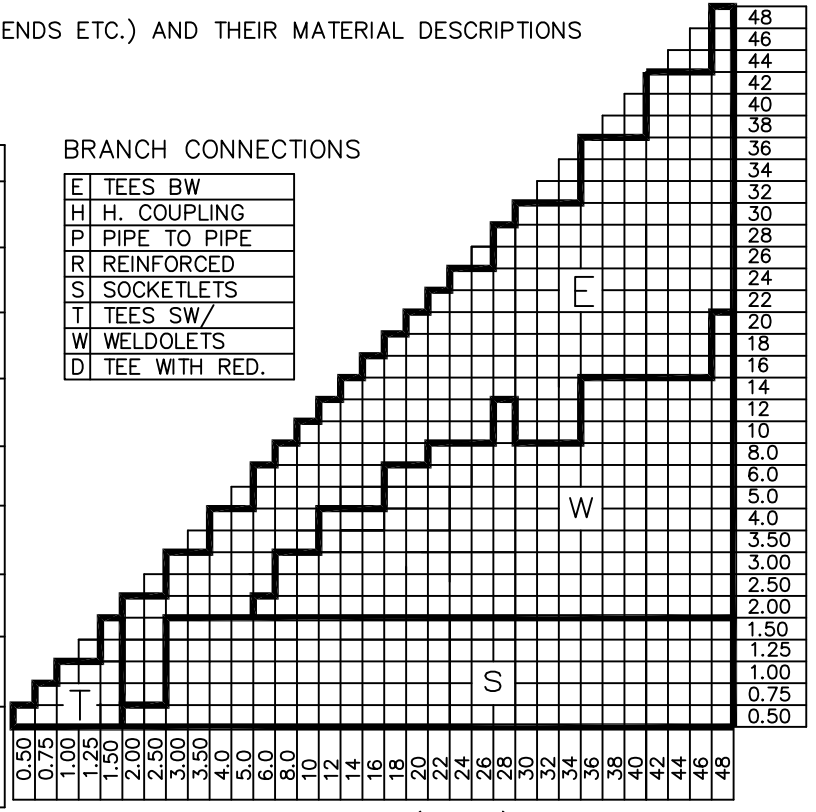
1. ALL VENTS & DRAIN SHALL BE PROVIDED WITH PLUG VALVE UNLESS MENTIONED OTHERWISE IN P&IDs.
2. FITTINGS SHALL BE OF SEAMLESS CONSTRUCTION UP TO 16" AND SHALL BE OF WELDED CONSTRUCTION 18" AND ABOVE.
3. WALL THICKNESS FOR LINEPIPE USED IN VARIOUS SECTIONS SHALL BE AS PER TABLE−1 OF PMS.
4. BALL VALVE 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. DESIGN PRESSURE & TEMP. FOR PIPELINE AND RELATED FACILITIES ARE 92 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" AND 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

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.



APPROVED A.GANGAL | DRWN | DSGN K.P. | CHKD H.K. | NAME | DATE | DATE

SECTION: OIL & GAS

REVISIONS: REV NO | DATE | ZONE | DESCRIPTIONS | BY | APPRD | REFERENCES | DRG. NO.

NATURAL GAS PIPELINE PROJECT

PIPING MATERIAL SPECIFICATIONS 600# (D1A)

APPENDIX−I

SCALE : N.T.S. (SH. 1 OF 2)

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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	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									B 16.47A									
BLIND FLANGE	MATERIAL AND GRADE	ASTM A 105				ASTM A 105 (CHARPY)														
	FLANGE FACING	RF 125AARH																		
	DIMENSION STD.	B16.5									B 16.47A									
BLANK	MATERIAL AND GRADE	ASTM A 105				ASTM A 105 (CHARPY)					ASTM A 516 GR.–70									
	FLANGE FACING	FF 125AARH																		
	DIMENSION STD.	B16.48									MNF' STD									
	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 600# , SP.WND SS316+GRAPHITE FILLED, B–16.20–ANSI B16.5,																		
ELBOW–90 ELBOW–45	MATERIAL	ASTM A 105				ASTM A 234 GR.WPB (CHARPY)					MSS–SP–75 GR.W PHY–52									
	END DETAIL	SW,6000#		SW,3000#		BW, 1.5D														
	DIMENSION STD.	B–16.11				B–16.9					MSS–SP–75									
T–EQUAL T–RED	MATERIAL	ASTM A 105				ASTM A 234 GR.WPB (CHARPY)					MSS–SP–75 GR.W PHY–52									
	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					BW									
	DIMENSION STD.	MSS–SP97				MSS–SP97					MSS–SP97									
	TYPE	SOCKOLET				WELDOLET					WELDOLET									

APPROVED A.GANGAL | DRWN | DSGN K.P. | CHKD H.K. | NAME | DATE

SECTION: OIL & GAS

REVISIONS | REV NO | DATE | ZONE | DESCRIPTIONS | BY | APPRD | REFERENCES | DRG. NO.

NATURAL GAS PIPELINE PROJECT

PIPING MATERIAL SPECIFICATIONS 600# (D1A)

SCALE : N.T.S.

APPENDIX–I (SH. 2 OF 2)

REV 0

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MECON LIMITED

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	
SERVICE : RLNG		BASE MATERIAL: CARBON STEEL (MATERIAL GROUP 1.3)							

NOTES: –

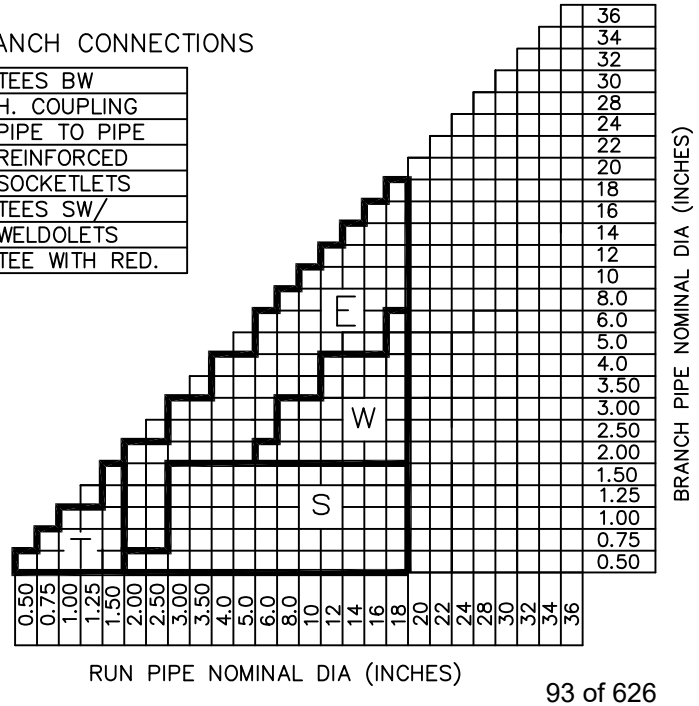
1. ALL VENTS & DRAIN SHALL BE PROVIDED WITH PLUG VALVE UNLESS MENTIONED OTHERWISE IN P&IDs.
2. FITTINGS SHALL BE OF SEAMLESS CONSTRUCTION UP TO 16" AND SHALL BE OF WELDED CONSTRUCTION 18" AND ABOVE.
3. WALL THICKNESS FOR LINEPIPE USED IN VARIOUS SECTIONS SHALL BE AS PER TABLE–1 OF PMS.
4. BALL VALVE 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. DESIGN PRESSURE & TEMP. FOR PIPELINE AND RELATED FACILITIES ARE 92 Kg/cm² g & (−45° 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" AND 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"	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.



APPROVED | A.GANGAL | DRWN | DSGN K.B. | CHKD S.K. | DATE

SECTION: OIL & GAS

REVISIONS: REV NO | DATE | ZONE | DESCRIPTIONS | BY | APPRD

REFERENCES

DRG. NO.

NATURAL GAS PIPELINE PROJECT

PIPING MATERIAL SPECIFICATIONS LOW TEMP SERVICE 600# (D4A)

SCALE : N.T.S. | APPENDIX–II | (SH. 1 OF 2) | REV 0

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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	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													

SECTION: OIL & GAS

APPROVED | DRWN | DSGN K.P. | NAME | DATE | CHKD H.K. | DATE

A.GANGAL

REVISIONS: REV NO | DATE | ZONE | DESCRIPTIONS | BY | APPRD

REFERENCES

DRG. NO.

NATURAL GAS PIPELINE PROJECT

PIPING MATERIAL SPECIFICATIONS LOW TEMP SERVICE 600# (D4A)

SCALE : N.T.S.

APPENDIX–II

(SH. 2 OF 2)

REV 0

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MECON LIMITED

ANSI CLASS: 300 #	CORROSION ALLOWANCE: 1.5 MM	TEMP °C	−29.0	38.0	50	100	150	200
		PRESS. KG/CM^{2}g	52.1	52.1	51.10	47.52	45.98	44.60
SERVICE : NATURAL GAS		BASE MATERIAL: CARBON STEEL (MATERIAL GROUP 1.1)						

NOTES: −

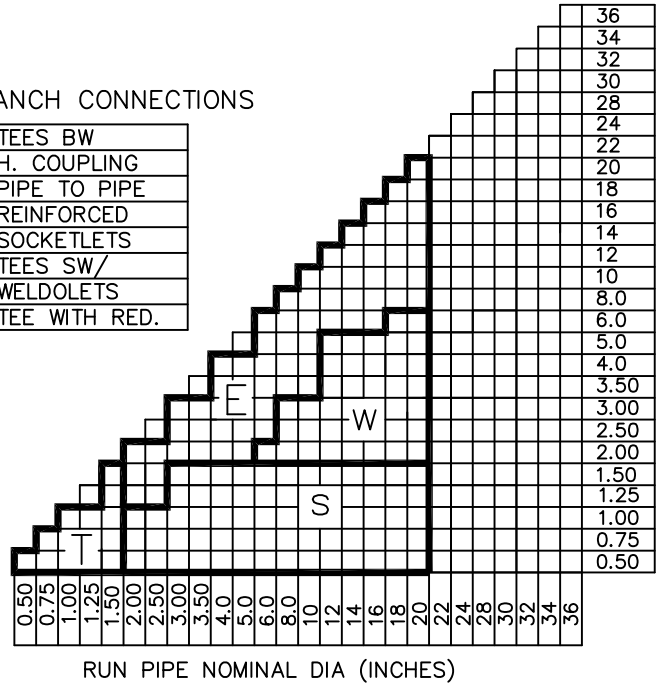
1. ALL VENTS & DRAIN SHALL BE PROVIDED WITH PLUG VALVE UNLESS MENTIONED OTHERWISE IN P&IDs.
2. FITTINGS SHALL BE OF SEAMLESS CONSTRUCTION UP TO 16" AND SHALL BE OF WELDED CONSTRUCTION 18" AND ABOVE.
3. WALL THICKNESS FOR LINEPIPE USED IN VARIOUS SECTIONS SHALL BE AS PER TABLE−1 OF PMS.
4. BALL VALVE 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. DESIGN PRESSURE & TEMP. FOR PIPELINE AND RELATED FACILITIES ARE 49 Kg/cm² 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

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.



APPROVED A.GANGAL | DRWN | DSGN K.P. | CHKD H.K. | NAME | DATE | DATE

SECTION: OIL & GAS

REVISIONS: REV NO | DATE | ZONE | DESCRIPTIONS | BY | APPRD | REFERENCES | DRG. NO.

NATURAL GAS PIPELINE PROJECT

PIPING MATERIAL SPECIFICATIONS 300# (B1A)

APPENDIX−III

SCALE : N.T.S. (SH. 1 OF 2)

REV 0

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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
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 ELBOW–45	MATERIAL	ASTM A 105				ASTM A 234 GR.WPB (CHARPY)										
	END DETAIL	SW,6000#		SW,3000#		BW, 1.5D										
	DIMENSION STD.	B–16.11				B–16.9										
T–EQUAL T–RED	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										
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										

APPROVED
DRWN
DSGN K.P.
A.GANGAL
NAME DATE CHKD H.K. DATE

SECTION: OIL & GAS

REV NO | DATE | ZONE | DESCRIPTIONS | BY | APPRD

REVISIONS

REFERENCES

DRG. NO.

NATURAL GAS PIPELINE PROJECT

PIPING MATERIAL SPECIFICATIONS 300# (B1A)

SCALE : N.T.S.

APPENDIX–III

(SH. 2 OF 2)

REV 0

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MECON LIMITED

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: –

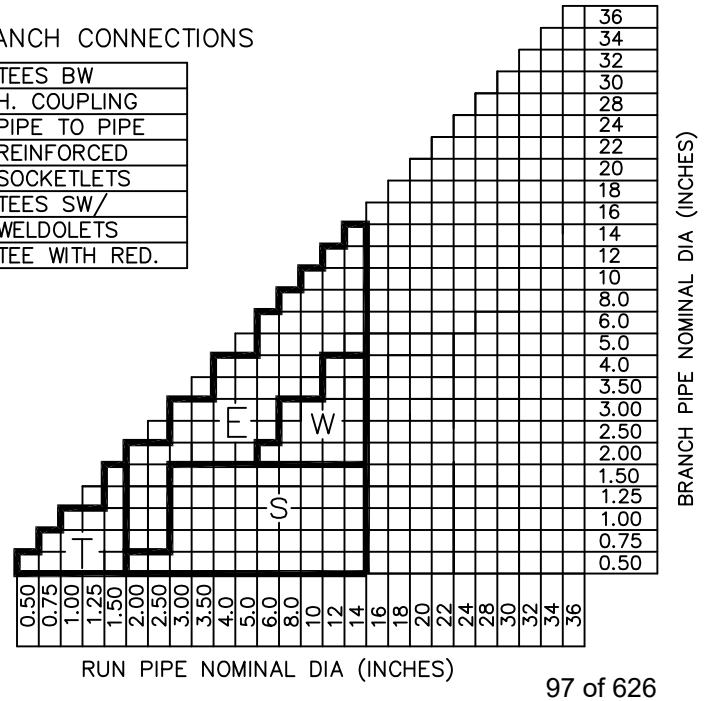
1. ALL VENTS & DRAIN SHALL BE PROVIDED WITH PLUG VALVE UNLESS MENTIONED OTHERWISE IN P&IDs.
2. FITTINGS SHALL BE OF SEAMLESS CONSTRUCTION UP TO 16" AND SHALL BE OF WELDED CONSTRUCTION 18" AND ABOVE.
3. WALL THICKNESS FOR LINEPIPE USED IN VARIOUS SECTIONS SHALL BE AS PER TABLE–1 OF PMS.
4. BALL VALVE 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/cm^{2}g &(−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.



APPROVED A.GANGAL | DRWN | DSGN K.P. | CHKD H.K. | NAME | DATE | DATE

SECTION: OIL & GAS

NATURAL GAS PIPELINE PROJECT

PIPING MATERIAL SPECIFICATIONS LOW TEMP SERVICE 300# (B4A)

SCALE : N.T.S. APPENDIX–IV (SH. 1 OF 2) REV 0

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REVISIONS: 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	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													

APPROVED
DRWN
DSGN K.P.
NAME DATE CHKD DATE
A.GANGAL H.K.

SECTION: OIL & GAS

REVISIONS: REV NO | DATE | ZONE | DESCRIPTIONS | BY | APPRD

REFERENCES

DRG. NO.

NATURAL GAS PIPELINE PROJECT

PIPING MATERIAL SPECIFICATIONS LOW TEMP SERVICE 300# (B4A)

SCALE : N.T.S.

APPENDIX–IV

(SH. 2 OF 2)

REV 0

MECON LIMITED

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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: −

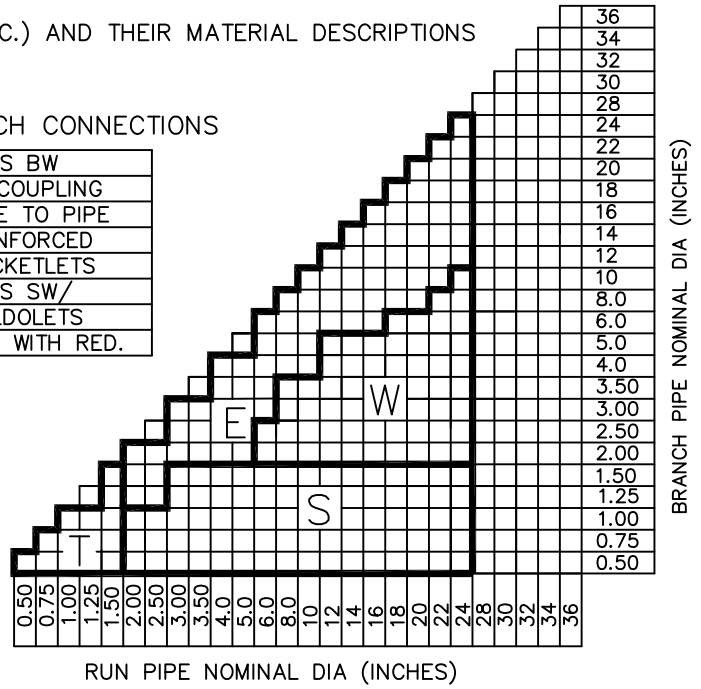
1. ALL VENTS & DRAIN SHALL BE PROVIDED WITH PLUG VALVE UNLESS MENTIONED OTHERWISE IN P&IDs.
2. FITTINGS SHALL BE OF SEAMLESS CONSTRUCTION UP TO 16" AND SHALL BE OF WELDED CONSTRUCTION 18" AND ABOVE.
3. WALL THICKNESS FOR LINEPIPE USED IN VARIOUS SECTIONS SHALL BE AS PER TABLE−1 OF PMS.
4. BALL VALVE 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. DESIGN PRESSURE & TEMP. FOR PIPELINE AND RELATED FACILITIES ARE 19 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" AND 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

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.



SECTION: OIL & GAS

APPROVED A.GANGAL

DRWN | DSGN K.P. | CHKD H.K. | NAME | DATE | DATE

NATURAL GAS PIPELINE PROJECT

PIPING MATERIAL SPECIFICATIONS 150# (A1A)

SCALE : N.T.S.

APPENDIX−V

(SH. 1 OF 2)

REV 0

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MECON LIMITED

REVISIONS | 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	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 ELBOW–45	MATERIAL	ASTM A 105				ASTM A 234 GR.WPB (CHARPY)							ASTM A 234 GR.WPB–W (CHARPY)						
	END DETAIL	SW,6000#		SW,3000#		BW, 1.5D													
	DIMENSION STD.	B–16.11				B–16.9													
T–EQUAL T–RED	MATERIAL	ASTM A 105				ASTM A 234 GR.WPB (CHARPY)							ASTM A 234 GR.WPB–W (CHARPY)						
	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)													
	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													

NATURAL GAS PIPELINE PROJECT

PIPING MATERIAL SPECIFICATIONS 150# (A1A)

SECTION: OIL & GAS

APPENDIX–V

SCALE : N.T.S.

(SH. 2 OF 2)

REV 0

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MECON LIMITED

APPROVED A.GANGAL

DSGN K.P.

DRWN

NAME DATE CHKD DATE

H.K.

REVISIONS

REV NO | DATE | ZONE | DESCRIPTIONS | BY | APPRD

REFERENCES

DRG. NO.

ANSI CLASS: 150#	CORROSION ALLOWANCE: 1.5MM	TEMP °C	−45	38	50	100	150	
		PRESS. KG/CM^{2}g	18.76	18.76	18.55	17.74	16.11	
SERVICE : RLNG		BASE MATERIAL: CARBON STEEL (MATERIAL GROUP 1.3)						

NOTES: –

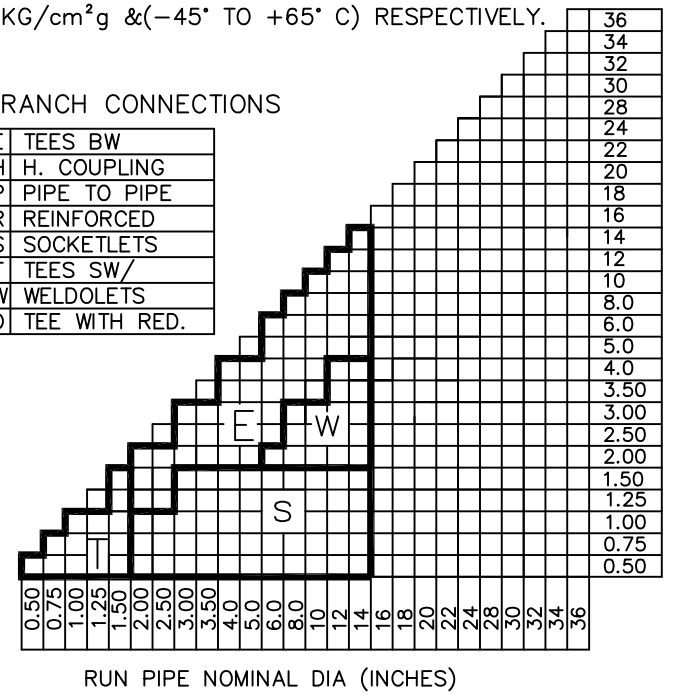
1. ALL VENTS & DRAIN SHALL BE PROVIDED WITH PLUG VALVE UNLESS MENTIONED OTHERWISE IN P&IDs.
2. FITTINGS SHALL BE OF SEAMLESS CONSTRUCTION UP TO 16" AND SHALL BE OF WELDED CONSTRUCTION 18" AND ABOVE.
3. WALL THICKNESS FOR LINEPIPE USED IN VARIOUS SECTIONS SHALL BE AS PER TABLE–1 OF PMS.
4. BALL VALVE 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" AND 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 19 KG/cm^{2}g &(−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.



SECTION: OIL & GAS

APPROVED | DRWN | DSGN K.P. | CHKD H.K. | NAME | DATE | A.GANGAL

REV NO | DATE | ZONE | DESCRIPTIONS | BY | APPRD — REVISIONS

REFERENCES

NATURAL GAS PIPELINE PROJECT

PIPING MATERIAL SPECIFICATIONS LOW TEMP SERVICE 150# (A4A)

SCALE : N.T.S. (SH. 1 OF 2)

APPENDIX–VI

REV 0

DRG. NO.

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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	
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								

APPROVED
DRWN
DSGN K.P.
A.GANGAL
NAME DATE CHKD DATE
H.K.

SECTION: OIL & GAS

REV NO DATE ZONE DESCRIPTIONS BY APPRD
REVISIONS

REFERENCES

DRG. NO.

NATURAL GAS PIPELINE PROJECT

PIPING MATERIAL SPECIFICATIONS LOW TEMP SERVICE 150# (A4A)

APPENDIX–VI

SCALE : N.T.S.

(SH. 2 OF 2)

REV 0

ISO 9001:2000 COMPANY

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MECON LIMITED

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
			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")**

REFERENCES	DRG. NO.
	MECON LIMITED
SCALE :	REV
DATA SHEET NO.: MEC/WINO/05/28/M/001/DS/BV/76	0