GAIL (India) Limited

(A Govt. of India Undertaking)
A Navratna Company
NEW DELHI, INDIA

KARANPUR-MORADABAD-KASHIPUR-RUDRAPUR NATURAL GAS PIPELINE PROJECT

BID DOCUMENT FOR PROCUREMENT OF

RTU FOR SCADA SYSTEM

UNDER OPEN INTERNATIONAL COMPETITIVE BIDDING

E-Tender no. 8000002002

BID DOC. NO. : 05/51/23 M4 /GAIL/094

VOLUME–II OF II
PREPARED AND ISSUED BY

MECON LIMITED
(A Govt. of India Undertaking)
Delhi, India

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SCADA SYSTEM FOR KMKRPL PROJECT

BID DOC. NO.: 05/51/23 M4 /GAIL/094 (RTU)

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{JS No.: MEC / 23M4 / 05 / E5 / I / PJS-094 (RTU) Rev 0}

GAIL (INDIA) LIMITED
New Delhi

KARANPUR-MORADABAD-KASHIPUR-RUDRAPUR PIPELINE PROJECT

MATERIAL REQUISITION

RTU FOR SCADA SYSTEM

MR NO.: MEC/S/05/E5/T/23M4/GAIL/094 (RTU)

BID DOC NO.: 05/51/23M4/GAIL/094

MECON LIMITED
DELHI – 110 092

MATERIAL REQUISITION

ITEM : RTU FOR SCADA SYSTEM
PROJECT : KARANPUR-MORADABAD-KASHIPUR RUDRAPUR NATURAL GAS PIPELINE
MR NO : MEC/S / 05/ E5/ T/ 23 M4 / GAIL / 094 (RTU)
BID Doc NO : 05/51/ 23 M4 / GAIL / 094

Sr. No.	D E S C R I P T I O N	Unit	Quantity
	Supply of RTU for SCADA system which including but not limited to, Project Management, Design, Engineering, Procurement of Materials, fabrications/ manufacturing, Inspection & Factory Acceptance Testing at works, Supply, Packaging, Shipping, Insurance, Port Handling, Custom Clearance, Inland Transportation to site, Storage & Safety, Installation along with necessary software, installation material, cables, connectors, RTU panels, cable trays, test instruments /equipments, Site Acceptance testing & Integration with BNPL SCADA system, Test Run, Commissioning, Integration Telecom System, BNPL APPS System, Training, Warranty, Mandatory & commissioning spares, Documentation etc and meet the requirements of the tender, its objectives, functional and specific requirements described in the specifications and taking care of complete requirements of P&IDs, Operation & Control philosophy and various attachments. The complete requirement as contained in the Bid Document shall be executed on turnkey indivisible works contract basis as per details scope of work, Technical Specification of RTU - Annexure I to PJS, & Job specification PJS No. MEC / 23M4 / 05 / E5 / I / PJS-094 (RTU) Rev 0 provided in the tender documents.		
Part A	**Part A : KARANPUR-MORADABAD-KASHIPUR PROJECT**		
A.1	**SUPPLY**		
A.1.1	Supply & all the work define above of Remote terminal units (RTU) with accessories as per the Technical Specification of RTU - Annexure I to PJS, & Job specification.		
a	For Despatch Station Karanpur (01 No.)	No.	1
b	For Intermediate pigging Station (01 No.)	No.	1
c	For SV Stations (03 Nos.)	Nos.	3
d	For Receiving Stations (05 Nos.)	Nos.	5
A.1.2	**Mandatory Spares:-**		
a	Analog Input Card	Nos.	02
b	Digital input card	Nos.	02
c	Digital output card	Nos.	02
d	Serial Interface Card (02 nos RS-232 & 2 nos RS-485)	Nos.	04
e	CPU card	Nos.	02
f	24 V DC Power supply module	Nos.	02
g	230V AC Power supply module	Nos.	02
h	GSM modem	No.	01
i	Spare fully wired RTU similar to Receiving Stations I/O configuration type with necessary accessories as required.	No.	1
A.1.3	PDT with all accessories including all cables & connectors	No.	01
A.1.4	**Test equipments as per specification**		
a	Portable Power Source cum Calibrator (Current & Voltage) as per specification	No.	01
b	4 ½ Digit Multi-meter as per specification	No.	01
c	RTU test unit with each type of RTU cards, power supply, CPU, communication, serial, AI,DI,AO,DO cards for simulating RTU test environment	No.	01
A.2	**SERVICE AND SITE WORK IN INDIA** Installation, Testing & commissioning and Interfacing with Instrumentation, Telecommunication, SCADA & APPS System, any other work for the completion/ hook-		

	up of KMKRPL SCADA to BNPL SCADA system complete in all respect as per TS of RTU and Job Specifications No MEC / 23M4 / 05 / E5 / I / PJS-094 (RTU) Rev 0 provided ion the tender.		
A.2.1	Installation Testing & commissioning of the RTUs with SCADA system Interface with all Hardware & Software as per TS of RTU and Job Specifications.		
a	For Despatch Station Karanpur (01 No.)	No.	1
b	For Intermediate pigging Station (01 No.)	No.	1
c	For SV Stations (03 Nos.)	Nos.	3
d	For Receiving Stations (05 Nos.)	Nos.	5
A.2.2	Interfacing of Flow Computers (FC) of consumer end (10 nos of consumers) to RTU of respected receiving station through GSM polling (GSM will be provided by the FC vendor) or polling on serial communication and all related work. Necessary software and hardware as required at respective RTU has to be supplied. (at 10 locations)	Nos	10
A.2.3	Training (as define in specifications) before the final acceptance of the SCADA system by the Client.	Lump -sum	1
PART B	**PART B : KASHIPUR – RUDRAPUR**		
B.1	**SUPPLY**		
B.1.1	System Design, Engineering & Supply of at RTU Remote terminal units with accessories as per the Technical Specification of RTU, Annexure I & Job specification PJS No. MEC / 23M4 / 05 / E5 / I / PJS-094 (RTU) Rev 0.		
a	For SV Stations (1 No.)	No	1
b	For Receiving Station at Rudrapur	No	1
B.2	**SERVICE AND SITE WORK IN INDIA** Installation, Testing & commissioning and Interfacing with Instrumentation, Telecommunication, SCADA & APPS System, all the work define above for the completion/ hook-up of KMKRPL SCADA to BNPL SCADA system complete in all respect.		
B.2.1	Installation Testing & commissioning of the RTUs with SCADA system Interface with all Hardware & Software as per TS of RTU and Job Specifications.		
a	For SV Stations (1 No.)	No.	1
b	For Receiving Station (1 No.)	No.	1
B.2.2	Interfacing of Flow Computers (FC) of consumer end (4 nos of consumers) to RTU of respected receiving station through GSM polling (GSM will be provided by the FC vendor) or polling on serial communication and all related work. Necessary software and hardware as required at respective RTU has to be supplied. (at 04 locations)	Nos.	4
B.2.3	All inclusive per month rates for maintaining the store (for the supplied material) during the extended period if required as define in the tender scope of work.	Nos	04

NOTES:

1. Bidder shall quote for all the items.
2. Bid offer will be evaluated package wise. However completion of total work as a TURNKEY work is Bidder's responsibility.
3. The KMKRPL pipeline will be executed in two Parts; Part A & Part B.
4. The work of Part A shall be completed within 6 months & Part B shall be completed within 12 months from the date of FOI as per schedule however GAIL /MECON may ask to complete the work before the schedule.
5. Bidder has to complete the work as per the schedule, however for Part B; if the site is not ready within the completion schedule of 12 months then bidder may compensate the expenditure of store (as per the rate available in the tender) till the readiness of the site. The payment will be made as per the actual certifications. In this situation, after intimation from GAIL, the site work has to be completed within the time stipulated for site work as per tender.

   However if the site is not ready for maximum 12 months from the date of handing over of material to GAIL's store (due to non availability of site) then the site work of that section will be treated as deleted from the scope of work of the bidder for contract closing purpose.
6. Detail list of the commissioning spares shall be furnished along with the offer.
7. The quantity and the location of the stations for both the parts A & B may change; bidder shall take prior approval for procurement and erection.

BIDDER QUALIFICATION CRITERIA (BQC) FORM
KMKRPL Project of GAIL

Bidder (quoted under clause 4.1.1 criteria of NIT)

A)	**Details of Bidder** 1. Name and address of Bidder Tel No, Fax No, E mail No. and website address, Works location and address 2. Bidder has proven facilities for design, engineering, integration, testing as per cl. 4.1.1 [yes/no] 3. Area of operation of Bidder 3.1 Vendor of RTU (Yes/No) 3.2 Own RTU offered (Yes/No) 3.3 If not OEM of RTU then OEM name with Address : 4. Letter from OEM for support for supplied RTU (if not OEM) (Yes/ No)	**Column to be filled by bidder**
B)	Details of SCADA / supply of RTU for SCADA projects as executed by the Bidder to ascertain fulfillment of tender conditions	

BIDDER QUALIFICATION CRITERIA (BQC) FORM PART – I (details for clause no. 4.1.1)		**Column to be filled for the implemented projects**
S.N	**Details**	**Project**
1.0	Project Name & Description	
1.1	Details of the application	
1.2	Details of pipe line & services	
1.3	No. of RTUs (Minimum 03)	
1.3.1	Name of RTU owner	
1.3.2	Make & model no of RTU	
1.4	Name & address of owner's contact person	
2.0	Telephone, FAX No, Email No. of owner's contact person	
2.1	a) Any system breakdowns b) Cause and duration of breakdown	
2.2	For above referred projects, the bidder as OEM has requisite experience in his own name(from same work location & address) and not in the name of its parent company located elsewhere (Yes/No)	
2.3	Weather the work executed in single (In same pipeline)	
3.0	Whether the RTU supplied had been successfully commissioned within last seven year from the bid due date (Completion certificate / satisfactory working certificate from end user) [yes/no]	
4.0	Scope of responsibility of the Bidder	
5.0	Project Management [yes/no]	
5.1	Design & Engineering [yes/no]	
5.2	Supply [yes/no]	

BIDDER QUALIFICATION CRITERIA (BQC) FORM PART – I		Column to be filled for the implemented projects
S.N	**Details**	**Project**
6.0	Installed [yes/no]	
6.1	Testing [yes/no]	
6.2	Integration [yes/no]	
6.3	SAT & Test run [yes/no]	
6.4	Commissioned [yes/no]	
6.5	Make/ Model No of RTUs proposed for this line	
6.6	a) Documents for fulfilling BEC furnished [yes/no] b) Reference List of similar job execution of SCADA/ supply of RTU with atleast the details of Purchase Order, Client name, Completion status etc furnished. [yes/no] c) Client's letter for sucssesfully completion with cross reference of PO (furnished)	
6.7	Whether the Supplied RTU integrated with a single SCADA system.	
6.8	Whether the supplied RTU can integrated with any IP based SCADA system	
6.9	Whether RTU offered for KMKRPL project is similar or higher in specification of this tender for implemented project. [Yes/No]	
6.10	Bidder has to provide commitment letter from OEM to extend complete technical support for the proposed make of RTU during the project tenure if the bidders is not a manufacturer.(Documents provided Yes/No)	
6.12	Bidder has to provide commitment letter from OEM to provide support for the SPARES for proposed make of RTU for as define in specification.(Documents provided Yes/No)	
C	Bidder's Office / Service center / Service associates to take care of post sales services, warranty and post warranty support: (Yes /No)	
1.1	Name & address of Office / Service Center / Service associate:	
1.2	Name of contact person	
1.3	Telephone, FAX No, Email No. of Contact person	
1.4	Having adequate trained manpower in India (Yes /No)	
1.5	a) Documents for fulfilling all the clause of (C) above furnished [yes/no]	

Bidder
Signature of the authorized signatory
Name of the authorized signatory
Stamp and Date

VENDOR DATA REQUIREMENTS

The table hereunder specifies the quantities and the nature of the documents to be submitted by the Vendor to the Client / Consultant for Approval / Record.

Any document, even when preliminary, shall be binding and therefore duly identified and signed by the Vendor. It shall bear the Project reference, the PO no. and the document identification number.

THE DOCUMENTS ARE FULLY PART OF THE SUPPLY WHICH SHALL BE COMPLETE ONLY IF AND WHEN THE DOCUMENTS COMPLYING FULLY WITH THE MATERIAL REQUISITION EQUIREMENTS ARE RECIVED BY THE CLIENT / CONSULTANT.

Sl. No.	Documents and Data	Quotes	Certified information required after Purchase Order			
			Soft Copy	Printed Matter	Date needed	Date Promised
1	I/O Assignment	-	4	4	6 weeks	-
2	Functional design Specification for RTU	1	4	4	6 weeks	-
3	RTU Cabinet Wiring diagram	-	4	4	6 weeks	-
4	SST, SOS & PCUR From (attached with the tender) duly filled and signed by the bidder	1	-	-	-	-
5	Bill of Material	1	4	4	6 weeks	-
6	List of Mandatory Spares	1	4	4	6 weeks	-
7	List of Commissioning Spares	1	4	4	6 weeks	-
8	Suggestive Control Room Layout for each station	-	4	4	8 weeks	-
9	Equipment Interconnection diagram including details of various interfaces, signal protocols etc.	-	4	4	8 weeks	-
10	RTU Specification, internal Layout including mounting arrangement, interconnection	1	4	4	8 weeks	-
11	Internal layout of SCADA cabinets, consoles, desks etc. including mounting arrangement, interconnection etc.	-	-	-	-	-
12	LAN interconnection diagram	-	-	-	-	-
13	I/O point database	-	4	4	8 weeks	-
14	HMI Graphics (Colour document)	-	-	-	-	-
15	Standard SCADA Manual for operation & maintenance	-	-	-	-	-
16	User guides, maintenance & configuration manuals for all supplied equipments / subsystems	-	4	4	-	W/S
17	Complier manuals including user guide, language reference, library reference etc.	-	4	4	-	W/S

18	API manuals including user guide, library reference manuals etc.	-	4	4	-	W/S
19	RTU Specification, operation, maintenance and configuration manual	-	4	4	-	W/S
20	RTU-IED interface manuals including manuals of special tools used for interfacing IEDs	-	4	4	-	W/S
21	Oracle interface manuals	-	-	-	-	-
22	Quality Assurance Plan	1	4	4	6 weeks	-
23	FAT Procedure	-	4	4	6 weeks	-
24	SAT Procedure	-	4	4	6 weeks	-
25	Test Run Procedure	-	4	4	6 weeks	-
26	IP address & protocol structure at each station	-	4	4	6 weeks	-
27	Datasheet of HMI Monitors, Laser jet printers, Color jet monitors, one routers etc	-	-	-	-	-
28	Station wise power consumption calculations of RTU	-	4	4	6 weeks	-
29	List of special Tools & Tackles	-	-	-	-	-
30	Project execution schedule	-	4	4	6 weeks	-
31	AS BUILT IO DETAILS AS PER GAIL's FORMAT	-	4	4	6 weeks	-

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
5. Final technical document file shall be supplied in hard copy as indicated and in electronic format (.pdf Acrobat files) on two (2 Nos.) CD-ROM
6. All these documents shall be submitted along with dispatch of the system to site
7. FAT procedure documents must include clause wise reference of tender specification for its compliance. This document shall be prepared in consultation with owner / owner's representative
8. The documents / information required with offer sheets to be furnished otherwise the offer shall be liable for rejection
9. During detail engineering stage, 3 sets of printed matter and 2 soft copy shall be submitted till the final approval of documents/drawings. After approval 4 sets has to submitted.
10. As Built documents : 6 sets Printed Matter, 6 sets Soft Copy.

VENDOR DRAWING/ DATA APPROVAL PROCEDURE

RTU FOR SCADA SYSTEM OF KMKRPL PROJECT
BID DOC. NO.: 05/51/23 M4 /GAIL/094 (RTU)

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.

DEVIATION FORM

Name of Bidder :

Schedule of Deviation :

Bidder shall; note that this is a **"NO DEVIATION TENDER"**

1. Bidder may given here a consolidated list of deviations/ clarifications/ comments of all sections of the bid package, which for an appropriate offer are considered unavoidable by him.

2. Deviations/ clarifications mentioned elsewhere in the offer shall not be bidding on the Client / Consultant and any such deviations if indicated elsewhere other than this form will render the offer non-responsive and shall liable to be rejected.

3. Bidder shall state the reasons for the deviations in the 'Remark' column.

4. All other clauses of the bid package shall be deemed to be fully complied by the Bidder.

5. **Only the deviations listed herein, in conjunction with the Bid package, shall constitute the contract requirements for the award of job to the Bidder.**

S.No.	Page No.	Clause No.	Requirement	Deviations as per Bid package	Clarification/ Comments by Bidder	Remarks
1						
2						
3						
4						
5						
6						
7						

Bidder

Signature of the authorized signatory

Name of the authorized signatory

Stamp and Date

(A Govt. of India Undertaking)
A Navratna Company
NEW DELHI, INDIA

KARANPUR-MORADABAD-KASHIPUR-RUDRAPUR NATURAL GAS PIPELINE PROJECT

PARTICULAR
JOB SPECIFICATION

RTU FOR SCADA SYSTEM

PJS No.: MEC / 23M4 / 05 / E5 / I / PJS-094 (RTU)
BID Doc No. : 05/51/23 M4 /GAIL/094 (RTU)

Prepared & Issued by

ELECTRICAL &
INSTRUMENTATION SECTION
MECON LIMITED
DELHI - 110 092

0	05.08.2010	Issued for Bid	Pooja /Abhay	Rakesh	Pankaj
Revision	Date	Description	Prepared by	Checked by	Approved by

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1.0 INTRODUCTION:

1.1. The purpose of this specification is to define the outline requirement of Remote Telemetery Unit (RTU) for Supervisory Control and Data Acquisition (SCADA) System for GAIL's Karanpur Moradabad Kashipur Rudrapur pipeline (referred as KMKRPL project) including all despatch terminal, Intermediate Pigging (IP) station, Sectionalising Valve (SV) stations, Receiving Terminals used for RLNG transporting services**.**

1.2. 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/ Supply / Engineering of the item. The decision of the purchaser shall be binding on the SCADA vendor

1.3. Vendor shall be responsible for selection of the correct system to meet the purchaser's specifications. In case of any modification / change in selected equipment model 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.

2.0 BRIEF PROJECT DETAIL

M/s GAIL (INDIA) LIMITED intended to lay 12" x 105 Km long Natural Gas pipeline from Dispatch cum tap off point GAIL's existing terminal at Karanpur to Kashipur with spurlines at Moradabad & Kashipur in Part-A & 58 Km (approx.) long Natural Gas pipeline in Part-B from Kashipur to Rudrapur to meet the gas demand of distribution to commercial & industrial consumers & city gas distribution projects in Moradabad , Kashipur & Rudrapur

The project will covers to lay a 12"x 105 km. long pipeline from Dispatch cum tap off point at Karanpur to Kashipur and 8" x 4.6 km long spurline to Siti Power in Moradabad & 8"/6"/4" x 25km spurlines from Kashipur with fourteen nos. of consumer's terminals. The pipeline is designed to transport 2.5 MMSCMD R-LNG.

1) Laying of Pipeline 12"x 105 km. pipeline from Dispatch cum tap off point at Karanpur to Kashipur .
2) SV's & IPS (IP with check metering facility) (03 SV's, 01 IP station)
3) Proposed Consumer Terminal at Siti Power (8"x 4.6 Km) at Moradabad , Pashupathi Acrylon (4"x3.0Km), Surya Roshni (6"x1.9Km), Shree Shyam paper (8"x 6.8Km), Savanti Power (12"x 2.0 Km) , Galwalia Ispat (6"x3.5Km), Maltiwal Paper (4"x1.0 Km) ,Indian Glycol (6"x 0.5 Km), Beta & Gama infratech , Naini tissue paper, Kashi Vishwanath steels & Siddharth paper mill at Kashipur

To facilitate the operation, monitoring, control and maintenance of the pipeline, dedicated telecommunication system/ network is proposed to be installed along the above-mentioned new pipeline.

Telecommunication system comprise of SDH based system on OFC network to facilitate voice & data communication for proper operational & management control of the pipeline. STM 16/STM4/STM1 along with CCTV, EPABX and associated system is to be set up to cater telecom & SCADA requirement The SDH NMS planned at Moradabad and integration with NMS at Noida also. Optical Fiber Cable 24 Fiber , 6 fibre as per ITU T G655 & Optical Fiber Cable 18 Fiber as per ITU T- 652 shall be laid by Blowing Technique in ϕ 40 mm PLB HDPE Telecom duct by other contractor.

To ensure effective and reliable Control, Management and Supervision of the pipeline, the pipeline is envisaged to be monitored and controlled from existing SCADA system having Master Control Stations (MSs) located at GAIL, Noida and Emergency Master Control Station (EMS) at Bhatinda as a extension of BNPL SCADA system. Normally the MS at GAIL, Noida shall be the Management Control Centre (MCC). The MS / EMS are interlinked with Remote Telemetry Units (RTUs) located along the pipeline by dedicated optical fiber communication system.

The tentative station wise I/O's indicated in tender. The major IED (Intelligent Electronic Devices) to be connected with the RTU's through RS 232 / RS 485 are Flow computers, Gas chromatograph, cathodic protection panel, UPS panel/ Battery chargers panel of Solar Power Supply or Grid power supply.

In addition, the system will facilitate running of Application Software (APPS- to be supplied by other contractor) package for reliable operation of the pipeline i.e. Leak Detection & location, supplementary modules.

3.0 SCOPE OF WORK RELATED TO SUPPLY & INTEGRATION OF RTU WITH EXISTING SCADA SYSTEM:

The Scope of work shall be supply of RTU for KARANPUR-MORADABAD-KASHIPUR-RUDRAPUR NATURAL GAS PIPELINE and to be integrated with existing Internet Protocol based BNPL SCADA system having SCADA Master Control Station (MS) at NOIDA and Emergency Master Station (EMS) at Bhatinda. The RTU procured and installed in this KMKRPL project shall be compatible to BNPL SCADA system. One Remote Workstations (RWS) at Kashipur of similar facilities as of BNPL RWS and approx. 11 Nos. of Remote Telemetry Units (RTU's) along the Karanpur- Moradabad Kashipur pipeline and 02 nos. of RTU for Kashipur - Rudrapur Gas Pipeline has been envisaged for KMKRPL project.

This tender is for the procurements of RTU for SCADA system of KMKRPL Part A & B including all the related activities including interfacing with existing BNPL SCADA system. However the interfacing work at existing MS & EMS for KMKRPL will be executed by other contractor. Any assistance required for hookup of RTU with existing BNPL SCADA System and commissioning of KMKRPL RTU will be in bidder's scope.

The Scope of work of this tender for bidder shall be supply of RTU for SCADA system which including but not limited to, Project Management, Design, Engineering, Procurement of Materials, fabrications/ manufacturing, Inspection & Factory Acceptance Testing at works, Supply, Packaging, Shipping, Insurance, Port Handling, Custom Clearance, Inland Transportation to site, Storage & Safety, Installation along with necessary accessories, cables, connectors, RTU panels, cable trays, test instruments /equipments, Site Acceptance testing and integration with BNPL SCADA system, Test Run, Commissioning, Integration Telecom System, BNPL APPS System, Training, Warranty, Mandatory & commissioning spares, Documentation etc and meet the requirements of the tender, its objectives, functional and specific requirements described in the specifications and taking care of complete requirements of P&IDs, Operation & Control philosophy and various attachments. The complete requirement as contained in the Bid Document shall be executed on turnkey indivisible works contract basis. The details scope of work is provided in the tender documents.

Bidder has to provide the commitment letter from the OEM for offered RTU along with bid documents. RTU Vendor shall provide all the required configuration data and necessary support /assistance during interfacing with Telecom system & SCADA system.

The complete requirement as contained in the Bid Document shall be executed on turnkey indivisible works contract basis and shall meet the tender requirement, its objectives, functional and specific requirements describe in the specification, taking care of complete P&ID requirement, operation & control philosophy. The details scope of work is provided in the tender documents. This specification shall be read in conjunction with scope of work, specification, drawings, documents and other requirements indicated in the tender documents.

4.0 COMPLETION PERIOD

Complete Scope for RTU of SCADA System at all the specified stations, shall be handed-over to the purchaser on turnkey basis after successful supply, installation, testing, commissioning, SAT and trail Run; as indicated below:

Part - A (KARANPUR-MORADABAD-KASHIPUR) :

Design, engineering, manufacturing, FAT respect :	4 months from the date of Supply complete in all FAX of Acceptance (FOA).
Installation, testing, trail run, commissioning:	6 months from the date of complete in all respect FAX of Acceptance (FOA).

Part - B (KASHIPUR-RUDRAPUR):

Design, engineering, manufacturing, FAT respect :	10 months from the date of Supply complete in all FAX of Acceptance (FOA).

Installation, testing, trail run, commissioning: 12 months from the date of complete in all respect FAX of Acceptance (FOA).

Bidder has to complete the Supply as per the schedule, however for Part B, if the site is not ready within the completion schedule of 12 months then bidder may compensate the expenditure of stores (as per the rate available in the tender) till the readiness of the site. The payment will be made as per the actual certifications. In this situation, after intimation of GAIL, the site work has to be completed within the time stipulated for site work as per tender.

5.0 BIDDER'S QUALIFICATION CRITERIA (BEC)- TECHNICAL:

This will be as define in the Vol - I of II of Bid documents. Bidder must fill the BQC provided at respective section without fail and provide all the necessary supporting documents along with offer.

5.1 EQUIPMENT QUALIFICATION CRITERIA (EQC)- TECHNICAL:

The RTU for SCADA System (Internet Protocal - IP based) proposed to be supplied shall be from the existing range and should have successfully tested for similar application. If bidder is not a manufacturer of RTU then bidder has to provide the commitment letter from the OEM for offered RTU along with bid documents. RTU Vendor shall provide all the required configuration data, necessary support /assistance for interfacing with Telecom system & SCADA system and the supports for spares for next 10 year to client. Format of logistic support duly signed by the bidder and the OEM has to be provided along with bid.

5.2 COMPATIBILITY TEST

The supplied RTU has to integrate with existing BNPL SCADA system; therefore, bidder's proposed RTUs shall meet the following requirements:

5.2.1 Before bidding, bidders have to carry out the compatibility test of proposed make & model of RTUs with existing BNPL SCADA supplier's works (YOKOGAWA India Limited, Bangalore). The proposed RTUs should be compatible with GAIL BNPL SCADA System (YOKOGAWA SCADA SYSTEM). **The certificate issued by YOKOGAWA India limited conforming compatibility of proposed RTUs with GAIL's BNPL SCADA System (YOKOGAWA SCADA SYSTEM) shall be submitted along with bid.**

Bidder proposes more then one make/model then the proposed make shall be qualified based on the compatibility test from YOKOGAWA India Limited, Bangalore. Cost implication if any is in the bidder's scope. The communication Protocal for RTU shall be standard DNP 3.0 (TCP/IP). For the compatibility testing bidder has to followed the test plan and procedure decided by the YOKOGAWA with GAIL's BNPL SCADA system. Letter issued by the YIL in their letter head with the details of the make and model no of the RTU has to attach along with bid.

The above qualification does not absolve the bidder to meet the technical RTU specification or any other requirement of the tender.

6.0 PROJECT REQUIREMENTS AND DETAIL SCOPE OF WORK:

6.1 The Bidder shall undertake full responsibility for providing RTU for SCADA system for **KMKRPL,** meeting the objectives, functional and specific requirements describe in the specification.

The material to be delivered and works performed shall be to meet the technical specifications and the requirements detailed in the Bid package.

6.2 GENERAL CONTROL AND FAILOVER PHILOSOPHY:

All the pipeline facility as define elsewhere for KMKRPL shall be supervised and controlled by the SCADA operators of BNPL Master Control station at Noida and backup at Emergency Master Control Station at

Bhatinda & also monitored at Remote Work Station Kashipur. All the despatch, IP Stations and Receiving station will be manned and all the SVs stations are unmanned. Local control system at these locations for various facilities communicated with SCADA system to allow remote monitoring and control from the Master Control Station and Emergency Master Control Station / RWS. The MS, RWS, EMS shall have dual redundant Ethernet LAN, distributed open system architecture having redundant processor, power supply and storage devices.

6.3 The system will be based on the concept of Open system Interconnect (OSI) architecture maximising the use of international standard interfaces. The SCADA system communicates shall communicate to individually IP addressed RTU / Device on dedicated OFC network and some of the RTU / device on GSM / leased line network. **Backup communication link between MS and EMS /RWS will be provided by Independent leased line provided by the independent service provider (arranged by the client).**

6.4 The material to be delivered and works performed shall be to meet the technical specifications and the requirements detailed in the tender.

6.5 One RTU shall be provided with redundant GSM Modem having capability for polling (read and write) to Flow Computer through either dialup / GPRS. The dial up RTU (any one from the supplied RTU) to be hooked up with the GSM Modem shall be conveyed during detailed engineering. All the necessary software/hardware and program for getting data through dial-up has to be supplied by the bidder. Also the bidder has to demonstrate the dialup functionality for one FC through redundant GSM/GPRS modem during FAT/SAT.

6.6 The proposed SCADA system shall be reliable, field proven and evolutionary state of the art. The RTU (appx 10 for Part A & 02 nos. for Part B with one spare) shall be provided at all SVs, IPs, Despatch and Receiving Terminals for remote monitoring and control as per the requirements. The each RTU shall have additionally 02 nos. of RS 485 and 02 nos. of RS 232 Serial ports for communication in future to the requirements indicated in I/O list enclosed with this tender separately. The requirements of internal communications between the RTU CPU module and RTU I/O modules is to be taken care separately while designing and sizing of RTU. The details of configuration of each port will be provided in detailed engineering.

6.7 Communication protocol between MS / EMS / RWS and RTUs shall confirm to OSI Communication model, DNP 3.0 (TCP/IP) and it will be standard protocol for all the station communications.

6.8 RTU Vendor shall ensure the completeness of the Bill of materials / Schedule of Rates (SOR) to meet the complete requirements of this tender as part of their responsibility and any change / modifications required for the same during detailed engineering to meet the requirements of the tender shall be done by the Vendor without any delivery & cost implications to the Client

6.9 The bidder shall carry out the activities related to project management, system design, engineering, integration, training & testing fully by themselves and the remaining activities may be sub-contracted to any other agency having experience in erection, cabling, installation of the SCADA system.

6.10 In the tender, the terms Owner, GAIL, Purchaser, Company and Client been used synonymously. The terms Contract document, Contract specifications, tender specification have been used synonymously.

6.11 The Bidder shall give an undertaking in line with PMR form enclosed as Annexure to PJS that system support for maintenance, up gradation and enhancement/expansion shall be **provided for 05 years** and spare part support shall be provided for the **period of 10 year** of the offered RTU from the expiry of the Warranty period. The ROC form as per Annexure of PJS and source of supply (SOS) as per Annexure of PJS has to be furnished with bid.

6.12 Bidder shall furnish all documentation, drawings, and other information required Operation and Maintenance Manuals, Handbook of inventory of all the equipment supplied and installed.

6.13 Bidder must coordination with Instrumentation / Telecommunication / Electrical / CP system contractor / BNPL SCADA vendor (YIL) during installation & commissioning for proper integration.

6.14 The electrical works associated with the installation and commissioning, earthing of RTU equipments at all sites, powering of equipments at all sites, termination of cables as required. Separate earth pits if required shall be provided by Client /other contractor.

6.15 Supply and laying of cables & connectors from TIC/ Instrumentation panel to RTU & interconnection between RTU with Telecom system.

6.16 Glanding, ferruling, termination of instrumentation signal cabling at RTU end and respective end at TIC/ Inst Panel end. The cabling from field devices up to TIC panel (including supply of panel & cables) will be carried out by Client /other contractor.

6.17 Training of Client's personnel (in the operation, maintenance, system internals and expansion/modification of the installed RTU) as define elsewhere in this PJS.

6.18 IEDs communication protocol details will be provided by Client during detail engineering.

6.19 The type of telecom connectivity shall be Ethernet based TCP/IP for each remote location; if any change, it will be communicated during engineering by Client.

6.20 At the RTU locations, UPS power at single point shall be provided by Client. Further lying of power cables, PDB and distribution to individual equipments is in the scope of bidder.

6.21 Scope regarding cables, glands and interconnection of cabling and accessories including cable routing between the following cabinets/ equipments are as follows:

Sl. No.	Type of Cabling	Location	From	To	RTU vendor
1.	Serial Interface cables (RS 232/RS 485)	RTU locations	RTUs.	IEDs (FC, GC, CP etc) at Remote locations	Complete interfacing requirements including supply of cables with connectors at IED end, modem end, and RS 232C / RS 485 intrinsically safe box (ISB) ends.
2.	Power cables	RWS / RTU locations	Power Distribution cabinet	RTU	Supply of cable including glanding, termination, ferruling, dressing etc. at RTU / RWS end.
3.	Telecom Interface Cable	RWS / RTU locations	Telecom panel / router / switch	Ethernet port of RTU / RWS / Lease line modem	Supply, Laying, routing, glanding termination both end.
5.	Instrumn. Cables	RTU Locations	TIC Panel	RTU	Glanding, ferruling, termination of instrumentation signal from TIC to RTU, both ends**.** The cabling from field devices up to TIC, Inst panel to TIC will be carried out by Client / Other Contractor.

6.22 **BATTERY LIMIT WITH OTHER CONTRACTORS**

SI. No.	Item	Scope of Pipe Laying Contractor or other contactor	Scope of RTU Vendor
1.	Cathodic Protection (CP)	Supply & laying of cable for hardwired signals (which shall be sent to RTU) from CP panel to Inst/ TIC panel including glanding, termination, ferruling, dressing etc. both end	Supply & laying of cable **for** hardwired signals / serial communication from CP / Inst /TIC panel to RTU including glanding, termination, ferruling, dressing etc. both end
2.	Fire & Gas Detection System	Supply & laying of cable for hardwired signals (which shall be sent to RTU) from Fire & Gas panel to TIC/INST panel including glanding, termination, ferruling, dressing etc. both end	Supply & laying of cable for hardwired signals from TIC/INST panel to RTU including glanding, termination, ferruling, dressing etc. both end

3.	Door Switches	Supply of Door switches & Supply & laying of cable for hardwired signals (which shall be sent to RTU) from Switches to TIC/INST panel including glanding, termination, ferruling, dressing etc. both end	Supply & laying of cable for hardwired signals from TIC/INST panel to RTU including glanding, termination, ferruling, dressing etc. both end.
4.	Corrosive Monitoring System	Supply & laying of cable for hardwired signals (which shall be sent to RTU) from CMS to TIC/INST panel including glanding, termination, ferruling, dressing etc. both end	Supply & laying of cable for hardwired signals from TIC/INST panel to RTU including glanding, termination, ferruling, dressing etc. both end.
5.	Hardwired Signal Cable for field instruments (field I/Os)	Supply of cable & laying of cables from field instruments to JB and JB to TIC/INST panel including & gas actuated valve & manual valves to TIC/INST panel including glanding, termination, ferruling, dressing etc. at Panel end.	None
6.	Soft Signals from TIC/ INST to RTU	Provide modbus details to RTU/SCADA vendor	Supply of communication cable with connectors at both ends from TIC/INST to RTU including glanding, termination, ferruling, dressing etc. at TIC/INST cabinet end and laying of the same cable up to RTU cabinet also Configuration at RTU end by RTU vendor
7	Solar System	Supply of solar system & provision for RS485 in Solar system for interfacing with RTU by Solar panel vendor also provide modbus details to RTU/SCADA vendor.	Supply of communication cable with connectors at both ends from Solar panel to RTU including Laying, glanding, termination, ferruling, dressing etc. at both ends.

Note:

(i) Distance between Telecom Panel and RTU equipment at stations and RWS shall be considered as 15 meters. However, these distances shall be firmed up during detail engineering.

(ii) Distance between IEDs/ TIC / CP /Solar and RTU Panel to be considered as 30 meters. However, these distances shall be firmed up during detail engineering.

6.23 Vendor shall note that inspection will be done by Client / MECON Personnel at Vendor's shop. For this inspection, labour, consumables, equipment and utilities as required shall be in vendor's scope or as define elsewhere in the tender documents.

6.24 Bidder shall provide the information / documents as per the Vendor data requirements along with their offer.

6.25 Bidder's offer, catalogues, drawings, instrument manuals etc. shall be in English.

6.26 The person deputes for erection and testing shall be competent for execute the work independently.

6.27 Portable Programmable Diagnostic Unit (PDT), 1 No. shall be provided as per the specification / with Latest configuration with minimum 1 USB & 1 RS232 port.

6.28 Test equipments as per specification with Latest configuration as per the SOR /MR.

6.29 Vendor shall provide Mandatory spares as per the SOR.

6.30 RTU Vendor shall provide all the required configuration data and necessary support /assistance during interfacing with Telecom system & SCADA system.

6.31 The test jigs RTUs of same make and model as Purposed RTU for testing purpose along with mounting cabinet of size 800 mm (W) x 800 mm (L) x 600 mm (H) shall be installed at RWS location (Karanpur) and shall be confirm during detailed engineering.

6.32 Vendor shall consider separate cable for each type of digital and analog signals. Over all & individually shield cable for analog signals and over all shielded for digital signals.

6.33 Supply of all the items / equipments including test equipments, software, installation materials, spares etc. required to execute the complete system in all respects. However, if any additional items are required to meet the functionality of the system as per this tender, vendor shall supply the same without any cost and time implication.

6.34 RTU panels testing shall be carried out as per the following stages.

A) Real data testing of all the serial interface signals from respective panel to RTU with SCADA.
B) Real data testing of hardwired signals from respective panel to RTU with SCADA.

6.35 RTU shall be interfaced with existing SCADA via telecom system on dual channel terminology and should support / compatible to DNP 3.0 (TCP/IOP) protocol.

6.36 Vendor to note that though DNP 3.00 (TCP/IP) is a standard protocol, in case any further details are required for integration or during design of RTUs with the existing SCADA system the same has to be obtained from the original supplier M/s Yokogawa India limited, Bangalore by the vendor as required.

6.37 RTU shall be interface with FC & GC through serial communication on Modbus.

6.38 All the signals from CP panel, door switches, CMS system and Fire & gas detection system shall connect with RTU through hardwired signal or serial communications as per the provisions available in the respective panels.

6.39 For telecom system vendor shall design the RTU which can support the IP base telecom system and provide IP port (two numbers, one act as primary and other as backup).

6.40 It is the prime responsibility of RTU vendor to establish communication between RTU, Telecom and SCADA. During interfacing stage if any extra item would require from RTU end which was not ascertained by RTU vendor during bidding stage shall make available with out any implication of extra cost to client.

6.41 Vendor shall provide all the RTU configuration details, communication Protocal details & assistance required for BNPL SCADA vendor (M/s YIL) during interfacing & commissioning.

6.42 The system shall meet the requirements of interoperability, portability and scalability as per the international standards (latest version).

6.43 The material to be delivered and works performed shall be to meet the technical specifications and the requirements detailed in the tender.

6.44 Performing all works required for designing, engineering, testing, supply, installation, interfacing with the communication channels, IEDs and instrumentation & electrical systems, etc, commissioning (with supply of commissioning spares including consumables), site testing, test run and putting into commercial operation of the system complete in all respects.

6.45 Furnishing all documentation, drawings, and other information required here-in including user, operation and maintenance manuals, handbook of inventory of all the equipment supplied and installed.

6.46 Furnishing as built documentation, drawings and CDs of the complete system. Documents and drawings shall be submitted as indicated in MR.

6.47 The civil works associated with the installation of supplied equipments at various stations. This includes restoration works various station and elsewhere as necessary.

6.48 The electrical works associated with the installation and commissioning of the equipments, earthing of equipments at all sites, powering of equipments at all sites, termination of cables as required.

6.49 Training to Owner's/Owner' Representative in the operation, maintenance, system internals and expansion/modification of the installed RTU system shall be provided.

6.50 RTU vendor shall prepare and submit final terminal details along with final IO list as per the FORMAT (to be provided by GAIL) before SAT.

6.51 **EXCLUSIONS**

Work such as civil work related to building, Electrical panel, Instrumentation panel, supply and erection of these panels in control room, Preparation of buried cable trenches and laying of multi-cables which is outside the vendor's scope. However vendor shall be responsible for supply and laying of cables from TIC/ instrumentation panel / other respective equipments to RTU, complete loop checking related to RTU/SCADA and final documents. The work for MS & EMS & RWS will be in other contractor scope. However any assistance required at KMKRPL site will be in bidder's scope for interfacing work.

7.0 GENERAL TECHNICAL REQUIREMENTS:

7.1 REFERENCES

7.1.1 Codes and Standards

The following standards shall be considered part of this specification insofar as they give definitions, describe requirements and provide tests that the equipment supplied shall meet. The Standards used shall be the latest revision in force, including any addenda, supplements or revisions thereto.

International Standards

API

- API 1113 Developing a Pipeline Supervisory Control Centre
- API 1130 Computational Pipeline Monitoring

ANSI

- ANSI/NFPA 75 Standard for the Protection of Electronic Computer Data Processing Equipment

NEMA

- NEMA ICS General Standards for Industrial Control and Systems
- NEMA ICS 2-230 Components for Solid-state Logic Systems
- NEMA ICS 3-304 Programmable Controllers
- NEEMA ICS-6 Enclosures for Industrial Controls and Systems

IEC

- IEC 61131 Programmable Controllers- ALL PARTS
- IEC 60870-5-101 Telecontrol equipment and systems – Part 5 – 101: Transmission Protocols – Companion standard for basic telecontrol tasks

ISA

- ISA S5.1 Instrumentation symbols and identification
- ISA S5.2 Binary Logic Diagrams for Process operation
- ISA- 5.3 – 1983 Graphic symbols for Distributed Control/ Shared Display Instrumentation, Logic, and Computer systems
- ISA S5.4 Instrument loop Diagrams
- ISA-5.5-1985 Graphic Symbols for Process Displays
- ISA S18.1 Alarm annunciation sequence and specification

- ISA-50.02 Fieldbus Standard for use in Industrial Control Systems Part : 2 Physical Layer Specification and Service Definition
- ISA RP55.1 Hardware testing of digital process computers
- ISA-RP60.3-1985 Human Engineering for Control centres
- ISA S71.04 Environmental conditions for process measurement and control System: Airborne contaminants
- ISA S72.1 LAN Industrial data highway
- EWICS-1998 Guidelines for the use of Programmable Logic Controllers in Safety – Related Systems
- EWICS-1997 Guidelines for Achieving Safety in Distributed Systems

Indian Standards

- IS 732-1989 Code of Practice for Electrical Wiring installations
- IS 3034-1993 Fire Safety of Industrial Buildings: Electrical, Generating and Distribution Stations- Code of Practice
- IS 3043 Code of Practice for Earthing
- IS 5572-1994 Classification of Hazardous Areas (other than mines) having Flammable Gases and vapors for Electrical Installation
- IS 5887-1916 Classification of Maximum Surface temperatures of Electrical Equipment for use in explosive Atmospheres

Other Standards

- API MPMS 12.2 Calculation of petroleum Quantity Using Dynamic Measurement Methods and Volume Correction Factors
- IEEE 472 Guide for surge Withstand Capability
- IEEE C37.1 Automatic and Supervisory Station Control and Data Acquisition
- IEEE 730 Software Quality Assurance Plan
- IEEE 830 Software Requirement Specification
- IEEE 802.3 Standard CSMA/CD Media Access Control (Ethernet)
- IEEE 829 Software Test Documentation
- ANSI MC8.1 Recommended Practice Hardware Testing of Digital Process computers
- ITU V.23 Modern VF Interference
- ITU V.24 DCE/DTE Interface
- BS 5345: Part 4:1977 UK Code of Practice for Intrinsic Safety
- BS 5501: Part 6:1977 Intrinsic Safety 'e'
- BS 1259: 1958 Intrinsic Safety Standard
- EIA-232 Interface between Data terminal equipment and data communication equipment employing serial binary data interchange
- EIA-422 Electrical characteristics of balanced voltage digital interface circuits
- EIA-485 Electrical Characteristic of generators and Receivers for use in Balanced Digital Multipoint Systems
- ISO/9001/02/03 Quality system for Design/Production and Installations/ Final Inspection and testing
- MIL-STD-461B Radio Frequency and Electro-magnetic Interference.

7.1.2 **Abbreviations**

AMS	Alarm Management System
CP	Cathodic Protection
DCS	Distributed Control System

DHCP	Dynamic Host Configuration Protocol
EPAX	Electronic Private Automatic Exchange
ESD	Emergency Shut Down
FEP	Front End Processor
FIFO	First In First Out
FMC	Field Marshalling Cabinet
GIS	Geographical Information System
GMS	Gas Management System
GOV	Gas Operated Valve
GPS	Global Positioning System
IS	Intrinsically Safe
LAN	Local Area Network
LDS	Leak Detection System
MS	Master Control Station
MIS	Management Information System
HMI	Human Machine Interface
MOV	Motor Operated Valve
MTBF	Mean Time between Failures
MTTR	Mean Time To Power
OPC	OLE for Process Control
P&ID	Piping and Instrument Diagram
PLC	Programmable logic Controller
RAID	Redundant Array of Independent Disks
RTU	Remote Terminal/ Telemetry Unit
RWS	Remote Work station
SCADA	Supervisory Control and Data Acquisition Unit
SCSI	Small Computer System Interface
EMS	Emergency Master Control Station
TSS	Training Simulation System
UPS	Uninterruptible Power Supply
WAN	Wide Area Network

7.2 GENERAL SITE INFORMATION:

All the equipment supplied under this contract shall be suitable for continuous operation under the environmental conditions prevailing at site. It shall be suitable for operation under the following site conditions:

Sand & Dust :

With a built up of dust on operational surface to a level such as may occur because of imperfections in the sealing of equipment, housing and conditions prevailing in sub-tropical dust conditions.

Tropicalisation : The equipment shall be fully tropicalised

Shock & vibration : The equipment shall withstand transportation and handling by air, sea and road under packed condition confirming to standards, confirming to MIL 810 B specification or commercial equivalent.

The equipment shall also be resistant to termite, fungus, rodents and salty environments.

7.3 ENVIRONMENTAL SPECIFICATION OF EQUIPMENT TO BE SUPPLIED

All the other RTUs at unmanned stations (at remote locations) shall be designed for storage and operation under the non air conditioned environment with the limits given below.

FOR	TEMPERATURE	HUMIDITY
Operation	0 to 55°C	10 to 95 % RH
Storage & transportation	0 to +60 °C	5 to 95 % RH

7.4 All equipment to be supplied shall withstand international standards of vibration for industrial application.

8.0 AREA AND ZONE CLASSIFICATION

The RTU installation and other Telemetering panel located in control room are specified as safe area.

9.0 POWER SUPPLY

9.1 Electrical power supply shall be provided at one point inside the battery limit as per the details provided below. If any other voltage levels are required, then all necessary conversions shall be in the scope of Vendor.

Vendor has to provide Station wise power consumption for the RTU for SCADA System along with the bid

Location	Power Source	Power Supply / Watts
RTU location	UPS (Grid+ Solar Panel)	24 V DC, 250 Watts; Non UPS 230 V AC for Utilities

9.2 RTU vendor shall furnish power consumption details with detailed break-up for each subsystem/equipments including inrush current and its duration during detailed engineering. Refer I/O list (Annexure – II) for details of station wise power supply.

9.3 Reliable and rugged SMPS power supply shall be supplied as required with equipment to generate isolated and stable voltage levels required for equipment operation.

9.4 **SURGE PROTECTION, TRANSIT SUPPRESSORS, RFI FILTERS**

All the equipment shall be designed with built-in safety to protect against the effects of monitor induced high voltages, effects of surges, transients (RF)

Necessary surge protection devise shall be provided as per the recommendation of the equipment supplier for all the power supply / signals.

10.0 EARTHING

10.1 Each supplied RTU cabinet shall be provided with earthing lugs with their frames. All these lugs/ strips shall be properly secured to the electrical earthing bus.

10.2 All the system ground of various cards and equipments, shields of instrument cables shall be connected to system ground bus which is electrically isolated from the AC mains earthing bus. The equipment shall provide

separate earthing strip for the same. The system ground bus shall be connected to independent ground buses through insulated wires.

10.3 Bidder shall note that for RTUs, separate earthing shall be provided by the Client for:-

a) System grounding (Earth resistance less than 2 ohm)

b) Frame and AC mains grounding (Earth resistance less than 5 ohm)

Accordingly the RTUs shall provide separate earthing strips as mentioned above and vendor shall also take care of onwards earthing connections from equipment to earthing strips provided separately in the respective rooms.

10.4 Following guideline shall be considered while doing the earthing work:

a) Panel metalwork- electrical AC mains supply earth – 2 off M10 brass studs per panel section. These brass studs shall be fitted with vibration proof nuts and washers.

b) Instrument “Clean” earth – electrically insulated copper bus bar 75 mm2 minimum separated from the panel metalwork by 25mm minimum. 2 off M10 brass earth studs to be provided at each end of the bars with associated shake proof nuts and washers.

c) An intrinsically earth bar similar in construction to the instrumentation clean bar shall be installed. This bar shall comply entirely with the requirements of IS 3043. The bar shall incorporate a removable section to facilitate earth continuity testing.

On intrinsically safe circuits the following shall be considered:

- Unused cores of the multicare cables nominated as spares shall be terminated to earth via dummy barriers. All other unused cores shall be taken directly to the I.S. earth bar.
- The earth connection via dual shake proof screws or clamps.
- Brass studs shall be incorporated on the I.S. earth bar for connection of dual I.S. earth cables.
- The I.S. earthing system shall be labeled “Safety earth-Do not disconnect”.

Similarly unused cores of Non- I.S. field cables and system cables shall be terminated and connected to the instrumentation “clean” earth. A minimum of 30 % spare capacity shall be provided within system cables and ELCO connectors.

11.0 SAFETY REQUIREMENTS

11.1 It is the intent of the Client that operational hazards be reduced to a minimum. The bidder shall use sound engineering judgment to complete an installation that will perform the required function without compromising this aim.

11.2 All controls shall be in fail-safe mode. a fail safe mode is defined as a plant equipment or system fail it shall be safe to the system

11.3 Provision shall be made to isolate all 230 V AC incoming signals to a cabinet (for utility socket on RTU) before gaining access to cabinet internals. Shrouding terminal with warning labels shall be provided with these terminals being segregated from other incoming terminals. Non UPS 230 V AC will be provided separately by client.

11.4 RTU vendor must ensure that the equipments will not be damaged due to blackouts / burnouts.

11.5 RTU vendor shall provide the start up procedure of the system. Further RTU vendor to indicate steps to be taken for fail safe operations of the system under following criterion

A) power failure

B) voltage variation more that ± 10%

C) frequency variation more than ± 3%

D) air conditioning failure

12.0 SYSTEM AVAILABILITY REQUIREMENTS

12.1 The vendor shall ensure the system availability shall be 99.98 %
12.2 The vendor shall ensure that the MTTR of RTU as 8 hrs and MS equipments as 2 hrs.
12.3 System Design covering future expansion takes calculation of availability in to account

13.0 ELECTROMAGNETIC COMPATIBILITY - EMC

13.1 The equipment shall be efficiently screened against EMI, RFI and conductive interference and shall not interfere with other equipment in the vicinity or installed in the same building.

13.2 The equipment shall be required to meet one of the relevant EMC standards (IEC, MIL, VDE, BS, IEEE etc.).

14.0 INSTALLATION MATERIALS

All installation materials such as ac and dc cables, telecom interface cables, serial interface cables, data cables, cable trays, relays, connectors, switches, fuses, terminations, distribution boxes and other items required but not mentioned herein shall be provided by the RTU vendor.

Vendor to note that detailed scope of cables including power cables with other accessories for interfacing with different equipments shall be supplied by the vendor.

The quality of materials used shall be of the highest order and shall conform to the international standards and safety standards as per relevant hazardous area classification.

15.0 FINISH

All the frame and the steel work of the cabinets shall be degreased then phosphate treated or coated with primer followed by at least two undercoats and a final coat of matte finished enamel paint of light admiralty grey color (IS 697) or as per RAL 7035. The finished of the equipments shall be of the finest quality and capable of long and unattended service. The inside of the cabinets shall be painted pale cream color (IS-352) or RAL 7035. Vendor shall take approval of the shade or other different shade during detailed engineering. Shade of the plinth shall be as per RAL 7022.

All the RTU cabinets shall have ‘Nameplates’ correlating with the type and location of the cabinet.

16.0 CALIBRATION

The calibration procedure along with periodicity required for ensuring the accuracy of test instruments supplied under this contract shall be taken care by the vendor. The vendor shall supply calibration charts from independent test laboratory for all input/output subsystems, during the warranty period.

17.0 MINOR CIVIL WORKS

For RTU locations, civil work shall consist of:

a) Civil works required for interconnecting cabling at control rooms between various systems & equipments [RTUs] with telecommunication system and the power supply unit along with cable routing and dressing. The cable trenching work will be done by other Contractor.

b) Associated grouting and fixing of equipment.

c) Providing and laying perforated trays etc. for point a) above if required

d) Any masonry work associated with entry and ingress of equipment inside the control rooms including making goods and finishing such masonry work.

18.0 ELECTRICAL WORKS:

Electrical work associated at all the stations shall be consisting of (but not limited to):

1. All the cable work including earthing up to the panel from the dedicated earthing point, system grounding for the supplied equipments.
2. Any temporary electrical works associated with the erection & commissioning of the system
3. Testing and certification of all the electrical works within the scope.
4. All power cabling (including supply of cables, glanding, ferruling, termination etc.) from the power distribution cabinet to the RTU shall be carried out by vendor

19.0 SPARES:

The vendor shall cover the various categories of spares included corresponding activity / services as listed below as part of Lump sum price:

a) Commissioning spares including consumables as part of commissioning activities.

b) Vendor must ensure availability of following commissioning spares as a minimum at site:
2 nos of CPU, 2 nos of each I/o's cards (AI, AO, DI, and DO) of RTU, one no of each type of communication card, Power cables and connectors

The mandatory spares (as per SOR) shall be supplied as per the contract. These spares can't be used during commissioning. Any mandatory spares utilized by the RTU vendor during Warranty period shall be replenished within 45 days.

20.0 TEST EQUIPMENTS:

20.1 Vendor shall include adequate test equipments & tools for testing, calibration as required for supplied items.

20.2 Vendor to supply two nos of licensed software needed for configuration and programming of RTU, Diagnostics software for RTU along with necessary cables/connectors, documentation and accessories. All the supplied software should be licensed to GAIL. One set of software to be installed in PDT and other to be installed at Server/Workstation in Noida. Software should have provision for remote configuration/download of configuration to RTU through RTU polling channels from MS.

20.3 Portable Programmable Diagnostic Test Unit (PDT Unit) shall be supplied with latest configuration. The PDT shall be latest Intel Pentium with active matrix display and fully configured and loaded with all the RTU configurations and diagnostic software. All the necessary cables and connectors shall be supplied with the PDTs.

MINIMUM SPEC FOR PORTABLE PROGRAMMABLE DIAGNOSTIC TEST UNIT (PDT UNIT):

The hardware shall be provided from proven sources (hand held service terminal equipment of Manufacture / Laptop computer from LENOVO /HP/DELL)

It shall be possible to use the PDT both locally and remotely to manage SCADA system. Provision for local accessibility at each equipment shall be provided along with all hardware /cable etc available at each station.

The PDU shall be provided as per the following minimum specification (For any discrepancy / conflict with specification, higher specification will prevail)

Make	: HP/ LENOVO/DELL
Processor	: Intel core 2 Duo, Min 2.6 Ghz integrated cache
Chipset	: Intel 845MP Chipset
RAM	: 4 GB, DDR SD RAM, 266 MHz
Keyboard	: 87 key or higher
Display	: 15" TFT active screen or higher Active color monitor
Mouse	:Touch point/Touch pad / Pin typet
Port	: 3 USB/ 1 parallel/1 serial / S Video out / Integrated wireless Blue Tooth/ External speaker/ External mic / Line in/ External monitor/ RJ-11& RJ-45
Slots	: One type II
Display	: AGP 4 x with min. 16MB RAM
HDD	: Minimum 160GB
Smart LAN /modem	:10/100Mbps Ethernet and 56.6Kbps Modem , wireless LAN, 820.11 b wireless Connection 10BASE- T/100BASE- TX Ethernet with RJ-45 interface
DVD – CD RW Drive (Swappable with FDD)	: 8 x min with auto disc cleaner and lens cleaning Cartridge
Weight	: less than 2.9 KG
Operating System	: Latest Window OS with Documentation & recovery mechanism, Office XP CD with license and media.
Manageability	: DMI /PC 2001 WI - FI certified state of art Management features
Anti-virus	: Latest Antivirus with license for virus definition free update till 3 years.
	: Latest MS Office suite
Accessories	: Leather carrying case, AC adaptor 240VAC 50Hz.
Battery	: Battery backup for M 3 Hours (Min)

20.4 Portable Power Source cum Calibrator (Voltage & Current):

Portable Power Source cum Calibrator (Voltage & Current) for simulating signal source and measurements function for current (min 4-20 m Amp) & voltage (1-5 Volt) make YOKOGAWA CA11E or equivalent.

The calibrator shall be operable on RTU power supply Voltage level (Both 24 V and 230 V AC). The calibrator shall be self contained and complete in all respects with power supply (230V AC chargeable adapter), cards termination/ connectors, interconnecting signal and power cables and connectors with carrying case. Calibration certificates shall be included

20.5 **4 ½ Digit Multi-meters:**

4 ½ Digit Multimeter with built-in signal level meters and with carrying case [to measure accurately and serve the function of measurements of DC voltage, AC voltage (True – RMS), resistance, conductance, frequency Test leads, probe holder, alligator clips, batteries, user manual and calibration certificate shall be included]. Preferred Make shall be Tektronix, Fluke, Agilent Technologies, Falcon.

21.0 DOCUMENTATION

The language used in all correspondence, documentation, literature, drawings, markings etc., shall be English.

Vendor shall furnish all relevant technical manuals, literature and other technical data as required at the various stages of the project indicated in tender.

All the drawings and documents shall be verified by the vendor before presenting the same for Client review.

All these documentation shall be furnished in hard cover loose ring folders in A4 size (210mm x 297 mm).

All documents shall also be supplied in "SOFT COPY" form.

All the drawings and documents shall be verified by the SCADA vendor before presenting the same for Client review. For initial submission 3 set hard & soft shall be submit till the approval. 6 sets of CD & prints of "As BUILT FINAL" documents shall be submitted.

RTU engineering documents (FAT, engineering manual, user's manual, engineering will be submitted for review/approval/records.

The contract document would be the Purchase order (after award of contract) and the same shall have higher precedence than all approved project documents.

Prior to submitting the following documents for Client's review/ records, the vendor shall review, duly sign & stamp all the documents and ensure compliance to the requirements of the contract.

22.0 FUNCTIONAL DESIGN SPECIFICATIONS (FDS)

Vendor has to note that this tender completely covers the operational and functional requirements of the RTU for SCADA system for GAIL's KMKRPL pipeline and associated network. The requirement of FDS shall be to focus on the implementation aspects of requirements specified elsewhere.

FDS shall be custom defined for this project and include the implementation aspects of tender requirements in the following sections.

FDS shall cover operational and functional requirements of SCADA implementation aspects within the scope of this tender [Complete details of systems configuration, control philosophy, Redundancy and backup aspects (system failovers & fail backs), alarms management covering implementation aspects of tender requirements, Interfacing, Integration and communication aspects between various subsystems including with Telecom system, communication protocol interfacing with Flow computers, GC, CP Panel and other IEDs, description of SCADA/ third party software interface, system resource sizing basis and performance parameters covering CPU, Hard disk and main memory utilisation, memory mapping, system timeouts, computers switchover timings, Display updates, Display Call-ups, poll time calculations etc.]

DRAWINGS:

Engineering drawings / documents –

This document shall cover the drawings / documents such as interconnection diagrams, supplied RTU cubicle typical layout and GA, RTU internal layout and interconnection drawings for each type of I/o's cards, PDB internal layout, Internal layout of RTU cabinets.

Construction drawings / documents:-

Documents such as Mounting arrangement of each cabinet, cable schedule, termination & wiring diagrams, grounding schemes / diagrams has to be submitted by the vendor.

Power Consumption and Utilisations Report (PUCR)

Vendor shall furnish power consumption details with detailed break-up for each subsystem/equipments including inrush current and its duration during detailed engineering. This document will be submitted at the earliest so that required power availability can be ascertained by GAIL in time.

Factory Acceptance Test (FAT) Plans and Procedure Documents:

FAT document for RTU shall contain test sections to test all the aspects of SCADA System as covered in relevant Purchase Requisition (PR), FDS documents.

Site Acceptance Test (SAT) Plans and Procedure Documents

SAT document for shall contain test sections to test all the aspects of integrated SCADA System, Test run & procedure documents has to be submitted.

Manuals

At least 30 days prior to the FAT, the proposed Operating and Maintenance Manuals and Final Drawings shall be submitted for review by the Owner.

Other Documentation

Bill of Material, Quality assurance plan, Billing procedure, Installation & Test procedure (which also includes the mounting arrangement of each cabinet), Site execution plan.

As-Built Manuals

The operating and maintenance manuals and drawings shall be updated with changes made to the equipment, configuration, and parameters or operating procedures during the installation and commissioning.

Final IO list along with cabling termination detail carried out between different panels by RTU vendor (in GAIL's format) has to be submitted along with the as-built

As-Built Operating and Maintenance Manuals shall be supplied prior to taking the Final Acceptance of the System.

22.1 RTU Vendor shall take care of project specific customizations for RTU system for meeting the project specific functionalities.

22.2 The review by OWNER'S/OWNER'S REPRESENTATIVE however does not absolve the RTU vendor of his responsibilities to satisfy' the requirements of contract document and install & commission the RTU system accordingly. RTU vendor is required to make necessary rectification in the RTU system to meet the requirements of the contract document at any stage of system implementation, without any implication of cost and schedule to the OWNER.

22.3 It is RTU vendor's responsibility to incorporate all the comments of the OWNER'S/OWNER'S REPRESENTATIVE in one revision itself. RTU vendor shall be responsible for incorporation of comments (comments not incorporated in the revised document without prior bringing to the notice of the OWNER'S/OWNER'S REPRESENTATIVE for acceptance) in the RTU system at any stage of the system implementation, without any implication of cost and schedule to the Owner.

22.4 RTU Vendor shall take care of the complete requirements of designing, generation and implementation of RTU displays for monitoring & control, RTU reports, RTU alarms/ events, RTU trending taking care of P&lDs and list of electrical parameters and covering the requirements outlined in this specification for RTU implementation.

22.5 The review code will be furnished by OWNER'S/OWNER'S REPRESENTATIVE only when the complete document is furnished by RTU vendor.

22.6 RTU vendor shall furnish the point wise response to OWNER'S/OWNER'S REPRESENTATIVE comments indicating the document section/clause/page no. reference where the same has been included in the revised document. The body of the document and corresponding pages will show the revision bars only at the places where the revision has been carried out. OWNER'S/OWNER'S REPRESENTATIVE will be required to check the revised document w.r.t. these changes only, while considering that rest of the document has remained unchanged.

23. TRAINING

Vendor shall provide training to technical, operator & maintenance personnel of the company in India. Company will bear the expenditure pertaining to air ticket, daily allowance, hotel expenditure and local conveyance for company's personnel for attending the training.

Training has to be provided at vendor's works having full training facilities for all the training specified in various clauses. Training documents contains all the details as specified have to be provided to all the trainee as per the schedule.

Training to be done at the integration centre where all the types of equipments supplied are simulated for practical training as defined elsewhere in the tender document.

RTU vendor shall train 4 man-weeks for OWNER's RTU engineers on internals and maintenance of the supplied system. The training shall include the following:

a) System internals.
b) Operate & maintain the system
c) Configuration /programming of RTU for integration of I/Os, IEDs, integration with SCADA software
d) Generation & modification Point database
e) Programming RTU to built logic, make program to poll IEDS with propriety protocol etc.
f) Precaution and safety aspect for RTU.

RTU vendor to note that all programming languages, commands, display languages etc. system shall be in ENGLISH language only.

24 WARRANTY

24.1 The system shall be guaranteed to give specified performance of 99.99% for a period of 24 months from the date of acceptance of the system by the owner. This warranty shall start from the date of acceptance of the system.

24.2 During the warranty, the vendor shall use his own instrument, spares, man-hour, communication facilities, hardware, software, materials, etc. for the rectification of any problem.

24.3 System Warranty including all services and spares including consumables for operation and maintenance of the system.

24.5 **Technical Support Service**

Technical Support Services that extends coverage for GAIL after handover of the system. This includes 24 x 7 (24 hours x 7 days a week) on line support. GAIL shall utilize this service by intimating the bidder in case of any contingency and Vendor in turn provide telephonic support. Depending upon the severity of the issue, engineer shall be sent by vendor to the site. All the costs for this support are in the scope of vendor.

25 QA / QC REQUIREMENTS

The Bidder shall operate a Quality System meeting the requirements of the relevant part of ISO 9002.
Bidder shall provide documents such as plans, procedures, instructions, etc. for the accomplishment of all works covered in this specification to provide the required quality.

Specific adherence to the guidelines set down in ISO 9002 series documentation shall be detailed out by the bidder and shall be subject to review and approval by the Company.

Vendor shall submit the quality management system meeting the requirements of ISO 9001 – 2000 which he proposes to operate while executing the job.

The system documents shall cover Quality Plan for this job, procedures, work instructions, inspection and test plans (ITP) and test results reporting format to provide an approach for achieving the required quality job. The quality system shall be reviewed and approved by the company.

Owner reserves the right to undertake such audit as deemed necessary to assess the effectiveness of the Bidder's quality system.

26 CERTIFICATE FOR LOGISTICS SUPPORT

Vendor shall provide backup engineering, maintenance support and spare part supports for a period of ten (10 years) for the RTU being supplied .Logistic support certificates as per format attached with the bid document.

27 SUPPLY AND STORAGE OF EQUIPMENT

For BNPL spur line the material has to be stored in GAIL's stored at the risk and cost of the bidder till the site readiness of the site. This shall include but not limited to supply and storage at GAIL's store of equipment and all other items required for installation and commissioning of the network including the following:

- Transportation of equipment and all other components from locations of manufacturing to the locations of installation or at GAIL's store.
- Storage during transit & storage at GAIL's store (as per terms & condition) as required till the readiness of owner's sites.
- Statutory clearances including clearances of Customs, Excise, Octroi and others, as required for all the supplied items.

28 SITE PREPARATION

This includes all electrical and civil works and site preparation activities as define above for installation and commissioning of the equipments.

ACCESSORIES / OTHER ASSOCIATED ITEMS

Supply & Installation of necessary equipment, cables trays, cables & accessories to meet the overall system requirements along Natural Gas Pipeline at respective sites, separate earthing & lighting protection of indoor equipment (not earth pit) at respective locations etc. Furniture as required for various systems, sub-systems, equipment etc shall be supplied by the Vendor.

System integration including requisite interfaces and accessories to realize the complete system shall be in bidder's scope.

The vendor shall extend the power from GAIL provided power point to the DCDB, to be installed in the equipment room using the armoured DC cable. For the same, the DCDB and armoured cable shall be supplied and installed by the vendor.

Any item of goods/services not specifically mentioned, but considered essential for completion of the work in all respects shall be deemed to be included in the scope of work of the successful Vendor.

29 ANNEXURE :

ANNEXURE I	-	SPECIFICATION OF REMOTE TELEMETRY UNIT (RTU)
ANNEXURE –II	-	I/O COUNT & POWER SUPPLY DETAILS FOR NEW RTUS
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ANNEXURE-VIII - SOURCE OF SUPPLY FORM (SOS) FORM
ANNEXURE-IX - POWER CONSUMPTION & UPS REQMT FORM (PUCR Form)
ANNEXURE-X - PIPELINE SCHEMATIC ROUTE DIAGRAM (KMKRPL)
ANNEXURE -XI - TYPICAL INTERFACING OF RTU WITH OTHER PANELS
ANNEXURE – XII - TECHNICAL CHECKLIST
ANNEXURE – XIII - LOGISTIC SUPPORT

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ANNEXURE - I
TECHNICAL SPECIFICATION FOR RTU

Rev. : 0

Edition : 1

SPECIFICATION

FOR
REMOTE TELEMETRY UNITS

SPECIFICATION NO.: MEC/S/05/E5/099

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

AMENDMENT STATUS

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)

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1.0 GENERAL

The RTU's shall be 32 bit microprocessor based programmable units with both erasable RAM and ROM memory. Each of the RTUs shall have its own processor, memory, battery backed power supply unit & communication processors confirming to communication protocol like DNP 3, Ethernet etc and I/O cards complete in all respects. The RTUs shall have TCP/IP port and serial port for polling from Master Station & Emergency Master Station.

All RTU shall be modular and from the same model product line with identical capabilities. The RTU I/O Modules shall be interchangeable without any interruption. RTU shall be reliable, field proven and evolutionary state of the art.

The I/O cards shall not be combined for the functionalities i.e. each card shall dedicated modules for Analog input, Analog output, digital Input, Digital output etc. The RTU's shall be designed to function such that no single point of failure or the inadvertent leaving of a printed circuit board out of the RTU shall cause a control mal-operation or result in any false operation or continuous communication transmission.

The complete RTUs shall be supplied with all its components including the cabinets. The cabinets should be weather proof and suitable for non-air-conditioned room. The actual layout of RTU along with its internal wiring, mounting arrangement etc. shall be carried out in detailed engineering. Proper illumination shall be provided inside the RTU cabinet.

2.0 Environmental

The equipment selected will operate in the following conditions:

- Ambient Temperature 55 ° C
- Humidity 05-95% RH.
- Non air-conditioned environments

3.0 Power Supply

RTU shall operate at 24 V DC power supply. The power supply available will be 24 V DC or 230 V AC $\pm$ 10%, 50 Hz $\pm$ 3% as indicated in the Tender elsewhere. The Vendor shall select the power supply module accordingly and furnish the power consumption of equipment in format enclosed with tender.

4.0 RTU SUBSYSTEMS

4.1 The RTUs shall comprise the following subsystems**:**

- Central processor with system software.
- Analog input
- Digital (contact) input
- Digital (contact) output
- Analog Output
- 2 Ethernet port for polling from MS and EMS through TCP/IP
- Serial ports/Ethernet port to connect Portable Diagnostic Test Unit (PDT)

- Serial ports for connecting IEDs e.g. Flow computers, Gas chromatograph.
- Battery backed power supply (SMPS).
- Diagnostic tools
- 2 Ethernet port for future polling of IEDS through TCP/IP
- Interposing Relays for Digital Output

The RTU's shall be configured such that interdependence of function is minimized and failure of any part of a RTU Module subsysterm except the common logic subsystem shall not directly affect the integrity of the unit, as a whole.

The RTU should be able to store alarm/ events in case of communication failure till the time of communication restoration.

4.2 The RTU system software shall provide the overall management of the supervision, monitoring and control function within the RTU and also manage the local Programmable Diagnostic Test Unit, communications, comprehensive diagnostic facilities and RTU start up procedures.

4.3 The RTU shall be programmable and shall have facilities for developing logic to interface with the IEDs as and when required. To this effect, all necessary tools, softwares and documentation shall be part of supply of the RTUs within the scope of this document.

5.0 DIGITAL INPUTS

Typical specification of Digital Input Modules to be supplied is as given below:

Input Type	:	Min. 16 nos. of Volt free contacts (2 wire isolated)
Contact Wetting	:	2-4 mA per input at 24V DC
Resistance recognized	:	Not exceeding 1 Kilo Ohms as a closed contact
Resistance recognized	:	Not less than 50 Kilo Ohms as an open contact
Isolation	:	Using optocouplers
Insulation Resistance	:	20 M ohms at 500 V Dc inputs
Debounce circuitry	:	10 m/sec
Indicators	:	Loop & State LEDs for each DI point
Voltage withstand Capacity	:	1.5 KV RMS
No/NC contacts	:	mixing of NO/NC contacts in the same card.

6.0 DIGITAL OUTPUTS

Typical specification of Digital Output Modules to be supplied is as given below:

Output Type	:	Min. 08 nos. of relay contacts
Indicators	:	LED indication for each DO point
Relay Type	:	Miniature power relay
Contact arrangement	:	1 NO + 1 NC relay contacts configuration to be provided up to the RTU terminal block
Contact Rating	:	Potential free contact rating of output interposing relay for each DO point (Contact rating 48 V DC, 2A; 230V AC, 5A)

(SCADA vendor to provide interposing relays for each digital output point)

Isolation	:	2KV RMS Contacts to Logic
DO command activation	:	Configurable Pulse duration (min 2 sec)
Security	:	Output contacts shall be monitored via Opto-isolators and must be short circuit proof and protected by suitable mechanism like fuse with suitable fuse blow indication provided.

7.0 ANALOG INPUTS

Typical specification of Analog Input Modules to be supplied is as given below:

Input Type	:	Min 08 isolated, Current Inputs
Ranges	:	4 - 20 mA, 0-5 V
Input impedance	:	Not less then 100 K for Voltage input Not more then 0.4 K for current Input
Multiplexer	:	By vendor
ADC type	:	12 bit binary, (exclusive of sign bit)
Series Mode Rejection	:	Greater than 30 db at 50 Hz
Common Mode rejection	:	Greater than 100 db at 50 Hz
Roll over error	:	1 bit
Temperature coefficient	:	0.005% per degree C
Accuracy	:	± 0.1% of range including drop in resistor

8.0 ANALOG OUTPUTS

Specifications of Analog Output modules to be supplied is as given below:

Output type	:	Min.4 Completely Isolated current (4-20 mA) outputs
DAC Type	:	12 bit binary (exclusive of sign bit)
DAC span	:	10 V or 5 V
Output Range	:	4-20 mA DC
Isolation	:	Each output shall be isolated from logic and others to 500 Volts
Loading	:	1K ohm for Current outputs
Differential Linearity	:	½ L.S.B.
Accuracy	:	± 0.1% of range
Temperature coefficient	:	0.01% per degree C of FSD
Update	:	within 10 msec.
Retentivity	:	Set-point value to be held by AO card till update by new set-point value from MS / EMS

9.0 COMMUNICATIONS

The RTU shall support both internal and external communications functions.

The communication network internal to the RTU shall be designed and implemented in such a way that the passing of data and commands between modules shall not be prevented by the failure of any module not directly involved in the communication exchange. In addition the internal network shall not become overloaded under the heaviest traffic possible in the RTU's ultimate expansion configuration.

The MS / EMS shall initiate communications with a selected RTU by IP addressing function. Each RTU shall recognize its own unique address and shall have the capability of being assigned any address within a range of possible addresses. It shall be possible to address all or selected number of RTUs from the MS/EMS in order that global or broadcast message may be sent.

The LED indication shall be provided in the RTU to check the health of RTU communication.

The RTU shall support both DNP 3.00 (TCP/IP) and IEC-60870-5-104 protocol for communicating with SCADA system at MS/EMS. This will be standard Protocal for all the station communications.

The RTU shall be polled through Ethernet port from MS/EMS.

10.0 RTU FEATURES

11.1 The RTU sub-system shall support the following:

a) Scanning of Input and Output
b) Fast scanning of selected I/O's points.
c) Field input initiated discrete control action.
Discrete control action corresponding to Remote Control Command reception.
d) Operator initiated discrete control action with check before execute and time out feature.
e) Operator initiated discrete control action with sequencing and interlocking.
Derivation of calculated digital points based on logical functions AND,OR,NOT etc from Digital and Analog input points.
f) Derivation of calculated analog points based on arithmetic functions +, -, /, *, sq, root etc. and driving external hardware. Calculation shall be performed in RTU in engineering units with 16 bit or higher floating point accuracy in case engineering conversion is being done at RTU level. (Calculations shall be performed in the SCADA server in case engineering conversion is being implemented in the SCADA server.)
g) Deviation of counter values using Integration of hardware and software generated analog points
h) IED (Flow computers, Gas Chromatographs), CP Panel, Solar system, UPS panel interfacing through RS232/ RS 485 ports for serial data.
i) Rate of change of alarm
j) RTU resident accumulator points driven by analog points.
k) Remote configurations of RTU from MS/EMS through PDT/ PC
l) Compatible with IP based telecom system

11.2 Automatic time synchronization of Remote Telemetry Units shall be implemented from MS / EMS & from various satiations along the pipeline with a resolution of 100 msec.

11.3 The RTUs shall have a self diagnostic feature and software watchdog timer devices to monitor & report the healthiness of CPU, memory, power supply, comm. interfaces and Input/Output modules at the local level. Further the RTUs shall support remote diagnostics from MS / EMS / various stations so that all these status shall be transmitted to MS / EMS and displayed in the RTU status graphic.

11.3.1 Analog input card and Analog output card shall be self calibrating type and event shall be sent to MS /EMS for out of calibration. Analog input card shall generate an event, if it is out of calibration, which shall be sent to MS/ EMS. Further if Analog output card is not self-calibrating type then all Analog outputs shall be wired back as along inputs and calculations performed on each channel to detect AO card out of calibration. This provision should be available in the SCADA system, however separate card (AO / DO) is not required. This out of calibration shall be available as part of RTU status graphics along with set point value displayed in the graphics, next to the corresponding controller symbol.

11.4 It shall scan and acquire parameters from process as per programmed scan cycles.

11.5 RTUs shall be intelligent in support of the following:

a) It shall process the analog data for high-low limit violations as per stored limit tables and communicate the same to MS along with time stamping.
b) Linear conversion to engineering units and input filtering, in case engineering unit conversion is being done at RTU level [conversion of raw data to normalized values (e.g. 0 to 1.0) for communication shall also be acceptable].
c) To support remote reconfiguration and downloading of parameters i.e. addition, deletion, modification and reassignment with different range, limits etc. from workstations to avoid local engineering at RTU level. The following requirements of RTU configuration form MS / EMS shall be fulfilled:

(i) The remote configuration wrt following parameters for the points defined in the RTUs shall be remotely done from active SCADA Server at MS / EMS, in case the features of Alarm generation, association of the alarm priority and engineering unit conversion are implemented at the RTU level.

- Analog alarm limits
- Analog scaling factor for engineering unit conversion
- Threshold value
- Filter time constant etc.

These shall be automatically updated to the standby SCADA Server also.

(ii) RTU vender shall include in scope of supply at MS / EMS/ various stations, PDT configuration unit (Monitor & Keyboard, hardware & software with cables & connectors) to create configuration file involving definition of:

- I/O modules attached to the RTUs
- Type of each I/O modules and time stamping requirements for points in each module.
- The mapping of RTUs data base to the DNP Protocal address space
- Software logic in RTUs

- Physical and software interfaces connected to the RTUs

(iii) The configuration file shall be able to be transferred online from MS / EMS / various stations using the existing data channels to the corresponding RTU.

(d) Time stamping of all exception reports.

[However, the SCADA vender has the option to implement the features of Alarm generation, association of the alarm priority and engineering unit conversion at the RTU level or SCADA server level].

11.6 RTU shall comply the following:

a) RTU shall be capable of updating process parameters data and configuration data in its own built-in memory. Time stamping of all field values at RTU end shall be required. In the event of failure or break of communication link, the RTU shall continue to scan all parameters and update its database. RTU shall retain in its database the complete analog and digital information of the field till it is completely and correctly read by MS / EMS / various stations in order to take care of no loss of data in case of failure of MS / EMS / various stations. The RTU shall scan the field and the memory buffer is to be sized to store all the changing data (i.e. new exception report for the data every poll time) and MS/EMS/various stations receive the same without any loss of data and alarms in the SCADA system to take care of channels SCADA server switchover times.

b) Further to take care of long term communication outage with MS/EMS the RTUs shall be designated to also scan the field and store in the memory up to 1000 field's exception reports during the period of communication outage for retrieval by MS subsequently.

c) The RTU system shall have the facility to attach to each digital event signal a time tag generated by the RTU local clock to enable the occurrence to be recorded and transferred with the resolution of 100 ms.

11.7 It shall be possible to have highest priority of alarms, in order for the same to be sent to MS/EMS. The SCADA vender has the option to implement the feature of association of the alarm priority at the RTU level or SCADA server level.

11.8 It shall provide 'Check before Execute' feature before execution of command.

11.9 Every control associated with the RTU shall report the status of the point after control execution. In case the status has not changed within fixed specified time it shall report to MS / EMS/ various stations for not having executed the control.

11.10 RTU shall not generate any false control signal due to power supply on-off conditions.

11.11 RTU shall support communication protocol supporting report by exception to prevent unnecessary data communication when the data is not changing.

11.12 It shall provide error detection and control feature for data communication with MS/EMS to ensure data integrity.

11.13 It shall have feature of connecting a pluggable Programmable Diagnostic Test unit (PDT) with keyboard & monitors diagnostic and programming aid to trouble shoot and configuration tool for RTU and I/O boards. It shall be possible to exercise all the functions of the RTU without disconnecting the RTU from process.

11.14 RTU shall have provision for applying filtering on the input signals and scaling for engineering units conversion.

11.15 From MS/EMS it shall be possible to off-scan complete RTU individually in addition to off-scan RTU points. In case of failure of complete RTU or off-scan of complete RTU only one alarm shall be generated and the RTU along & digital points shown in various graphics and printed in reports shall correspondingly have data integrity qualifier flag.

11.16 The RTU shall be able to store the configuration data and the process database upon power failure for at least one month. Upon restoration on the power, RTU shall resume the normal operation automatically.

11.17 The failed RTU once put online shall initiate service requirement to MS/EMS for re-initialization.

11.18 RTU shall operate power supply (230 V AC or 24 V DC as define elsewhere) as per power availability at site. Separate on/off power supply switch and fuse shall be supplied with each RTU. SCADA Vendor shall indicate power consumption for all the RTUs. Adequate isolation of input, output and power supply circuits shall be provided along with over voltage and short circuit protection.

Wherever 230V AC supply is provided for RTU, SCADA vendor shall carry out necessary conversion to covert the AC voltages to 24V DC for supply to field instrumentations and to RTU. The power to the field instrumentations is to be provided through barriers and all the digital output has to be driven through 3-5 A interposing relays. The necessary converter to covert the AC voltages to 24V DC, the barriers and the imposing relays shall form the integral part of the RTU.

Terminations for connections of power supply should be of standard industrial type.

11.19 All the field instrument connections for RTUs shall be terminated in the TIP (Telemetry interface panel). The I/O point wires shall not be directly terminated on the RTU I/O boards. Terminal blocks/panels is to be provided in the RTU cabinet. I/O termination blocks shall have both male and female portions so that to isolate the field wiring at RTU level, male/female termination block attached to be field wiring can be pulled out instead of removing the wiring. Printed tube type Cross ferruling shall be done.

11.20 The electronics in the RTU cabinet shall consist of plug-in PCB's or units with Gold plated edge connectors that utilize a wiping action for connection for PCB's to the back frame wiring. SCADA Vender shall detail the shelf and inter-shelf wiring and the termination of the wiring harness between the RTU and the terminal block area. Easy access cabinet wiring, for maintenance purposes is essential. The PCBs and RTU components shall be designed for high temp rating and low power consumption so that air exchange with the ambient environment will not be required.

11.21 The RTU shall be Immune to radio frequency interference generated by any nearby source meeting the latest international standards in this regard (MIL, VDE etc.)

11.22 The RTU equipment shall function continuously without requiring any preventive maintenance.

11.23 RTUs shall be multidropped on a pair of communication channels. Upon failure of primary channels, RTU shall respond to MS / EMS requests/ interrogation on secondary channel automatically without any loss of data & operation. System shall provide status on the availability of each of the channels.

11.24 It shall be possible to output any AI (Including serial data from IEDs) & DI point value available in real time database at MS / EMS, as AO (Including serial data from IEDs) & DO to any RTU respectively. The relay contact configuration shall be provided up to the RTU terminal block. The DO command contact closure duration shall be configurable. It shall be possible to configure DO contact duration open or close for a long duration as per the DI status. This provision should be available in the SCADA system, however separate card (AO / DO) is not required.

Within the scope of this document, SCADA vender shall down load Gas Chromatograph value to those Flow Computers, in whose locations Gas Chromatograph is not available, through the same serial link which is used for reading the Flow Computer values. Source Gas Chromatograph and target Flow Computers will be finalized during detail engineering.

11.25 Non availability of any one of the two communication channels should not hamper the functioning of the other RTUs multidropped on the pair of channels.

11.26 RTU vender to ensure that the open/close status of valves (open state first wired and thereafter close state) be wired consecutively in the RTUs.

Interlocking Logic

The means to minimize the risk of incorrect operation or incorrect sequence of operations can be included within the RTU as a logical interlocking function.

All the data shall be available in the engineering units in the RTU database. The RTU vendor has the option to implement the feature of engineering unit conversion at the RTU level.

11.27 It shall have feature of connecting a pluggable Programmable Diagnostic Test unit (PDT) with keyboard & monitors diagnostic and programming aid to trouble shoot and configuration tool for RTU and I/O boards. It shall be possible to exercise all the functions of the RTU without disconnecting the RTU from process.

11.28 RTU Vendor shall detail the shelf and inter-shelf wiring and the termination of the wiring harness between the RTU, the terminal block area and the field instrumentation. Easy access to cabinet wiring, for maintenance purposes is essential. The RTU components shall be designed for high temperature rating and low power consumption so that air exchange with the ambient environment will not be required.

11.29 Identification labels for RTUs, RTU card files, power distribution boards, terminations etc complete in all respects properly correlating with the drawings is to be ensured by the RTU vendor.

11.30 SCAN RATES

The local scan rate for the individual I/O modules shall be such that the time-tagging resolution and system performance requirements are achieved.

Vendor to provide minimum & maximum SCAN time.

The consideration of scan times shall include the acquisition of data, processing and updating of the RTU database. The overall RTU local scan shall be defined as the time required to acquire field data and update the RTU database and the same shall be much faster than RTU poll time by MS / EMS. It is expected that scan rate shall not exceed 100 msec for direct I/Os

11.31 DIGITAL OUTPUT (CONTACT) SUBSYSTEM

The contact output subsystem shall provide momentary closure of potential free contact relay output for the operation of valves. The subsystem shall fully support the functional requirement of control

The relay contact configuration shall be provided up to the RTU terminal block.

The DO command contact closure duration shall be configurable. It shall be possible to configure DO contact duration open or close for a long duration and all contacts shall be voltage free.

It shall not be possible for the RTU to energize an output that has not been selected for control.

A RTU restart, following an RTU power failure, shall not reset the output circuits, shall not generate false control signal and shall cancel any pending control selection.

Set point controls:

All analog output control functions shall utilize the select-check-operate control sequence associated with set point control.

11.32 Each I/O shall be protected against the reverse polarity of the power voltage to I/O.

11.33 **RTU Panels**

RTU Panels shall be free standing and conform to NEMA-4 (IP52) requirement. The panels shall have lockable front and rear doors and bottom cable entry and provided with gasket and fitting to keep out moisture, salt, dust, greases and corrosives. The panel shall be naturally cooled.

All doors, drawers, trays and other weight supporting parts shall be fabricated of metal and adequately reinforced to limit vibrations. All components and devices inside the panel shall be well highly and the panel shall have a tidy look.

The Vendor shall furnish details of the shelf and inter-shelf wiring and the termination of the wiring harness between the RTU and the terminal block area, the connections from PCB's to back frame wiring shall preferably be with gold plated edge connectors which utilize a wiping action. Easy access to cabinet wiring for maintenance purpose is essential. The I/O point wires shall not be terminated directly on the I/O boards. Termination panel is to be provided for this.

The RTU equipment cabinet (Rittal or equivalent) to be supplied shall be constructed to allow free airflow to dissipate heat generated. Construction shall be such that ventilation grills will not be obstructed when equipment is mounted in its installed position. In order to effectively remove dissipated heat from the cabinets, vent louvers backed by wire fly screen shall be provided. RTU vendor shall calculate the heat dissipation and where the calculations prove the necessity, then air flow ventilation shall be assisted by integral low power silent running air extraction fans and same shall be included in RTU vendor's scope. In let ventilation grills shall be filled with dust filters.

The Vendor shall guarantee satisfactory functioning of the system hardware mounted in the panels even in the event of failure of air-conditioning unit.

Each panel shall have provision for fully wired 25% (of IO requirement mentioned in Annexure II) spare additional I/O terminals for each type of I/Os (AI, DI, DO, AO) to take care of any additions in future. All the I/Os present in each cards installed in the RTUs (including spares) has to be wired till termination board. For DO card provision of relay has to be made for all the I/Os available in the DO cards installed.

Hardware mounted and wired panels of all systems included in the scope of the Vendor shall be subjected to burn-in operation for minimum 15 days before dispatch to site.

A typical panel Rack drawing is enclosed with this document for reference purpose. Vendor has to select the Rack as per dimension refer in enclosed drawing.

The RTU's cabinet shall be made of CRCA sheet enclosures frame minimum thickness shall be 1.5 mm and the cabinet size 2100 mm height x 1000 mm width and 800 mm depth and 100 mm base plate. Gland plat thickness shall be 3.0 mm.

Vendor shall supply necessary hardware's like DI, DO ,A1 and AO cards, complete with interning wiring upto the terminal blocks including spares I/Os.

The RTU cabinet shall be provided with 24V dc Power supply unit.

Non UPS power supply for Cooling fans, panel door switches, space heater, maintenance socket and Tube lights front & rear end.

Finish

i. All frame and steel work of the RTU cabinets shall be degreased, then phosphate treated or coated with primer, followed by at least two undercoats

ii. All the RTU cabinets shall have 'Nameplates' correlating with the type and location qf the cabinet.

11.34 Connection to Marshalling/ Instrument Control Panel/ Telecommunication System

All the instruments connections for RTU's shall be terminated in the Marshalling rack/ Control Cabinets (TIC panel) / Instrumentation panel to be supplied by other. The vendor shall include in the offer all necessary cables, materials and services required to install the RTU's and interconnect the I/O's with the Marshalling rack/ Inst Control Cabinet/ interface cabinets and RTU's along with interfacing with telecommunication system.

11.35 SERIAL LINK REQUIREMENT

a) The RTU shall be equipped with the RS 232 ports & RS 485 ports for polling the IEDs as specified in the document elsewhere. Additionally one more RS 232C or TCP/IP port shall be provided for connecting PDT for configuration of the RTU.

b) RTU vendor shall develop, configure and establish the communication for reading / writing of data from / to the flow computers / CP Panel / Gas Chromatograph or other IEDs. RTU vendor to configure RTUs for writing of GC data installed in one terminal(and connected one RTU) to flow-computers kept at other terminal(and connected to a different RTU) along the same pipeline. The client shall furnish to RTU vendor the make & model no., protocol details of these IEDs during detailed engineering or prior to FAT. RTU vendor shall simulate the above devices using protocol analyzers / PC /other means to demonstrate during FAT.

c) RTU vendor shall provide all the software tools and programs (source code) used to interface RTUs with Flow computer/ PLCs/ any other IEDs. It shall be possible for client to integrate other IEDs with the RTU in future. To achieve the same the RTUs shall have provision for integrating IEDs and all necessary software, compilers, tools etc. shall be supplied by the SCADA vendor. The alarms for power supply/ serial link failure/ flow computer & other IEDs malfunction through serial link shall be implemented. The integration of IED's (of any protocol not just modbus) with the RTUs shall be totally end user configurable.

d) The alarms for power supply / serial link failure / flow computer, CP panel & gas chromatograph malfunction through serial link shall be implemented.

e) The RTU memory sizing sizing shall be adequate for required nos. (as application) of flow computers / gas chromatographs serially connected with the RTU.

f) The Flow computer / Gas Chromatograph data shall be scanned by the RTU much faster than RTU poll time by MS / EMS.

g) All the RTU shall be user programmable for interfacing with any kind of IEDs FC /GC /CP panel / Solar panel /UPS panel / PLC etc.

11.36 Input/Output Points and serial ports for polling IEDs:

The RTU vendor shall supply the RTUs equipped with I/O cards, IP port & serial ports (for IED interfacing) as per the I/O count and serial ports requirement define elsewhere. The RTUs shall be user programmable for interfacings with any kind of IED

11.37 **Portable RTU Configuration and Diagnostic Test Unit**

RTU shall have feature of connecting a pluggable Programmable configuration and maintenance terminal along with all hardware and software necessary to interface to the RTU. This unit will function as a diagnostic and programming aid to trouble shoot and configure RTU and input/output boards. It shall be possible to exercise all the functions of RTU's without disconnecting the RTU from process. This unit shall be a note book PC with proper enclosure with key board and VDU. It shall operate on integral rechargeable battery which shall be able to supply power for a minimum of 12 hours before recharge.

The PDT along with Servers at MS to be installed with licensed RTU configurator software along with all the cables & connectors required for configuration of RTU. Also any additional software required for programming RTUs for dialup operation/ making logics etc needs to be provided by the vendor.

The PDT as diagnostic aid to RTU shall be a notebook (laptop) with proper enclosure and shall operate on integral battery which shall be rechargeable type. The battery shall be able to supply power as a minimum for 3 hours before requiring recharging operation. Also the PDT shall operate on 230 V AC power supply. Vendor shall provide all the necessary converter/adaptor along with PDT.

11.38 PACKAGING:

The RTU 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.

11.39 DATA AND DRAWING DETAIL

Vendor shall furnish all the documents as per "Vendor Data Requirements" enclosed with Material Requisition/ Job Specifications. 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.

A certificate from statutory authorities confirming suitability of design / construction of all electrical and electronic items for use in hazardous area classification has to be furnished.

11.40 RTU spare Support

Vendor to provide a certificate to client from OEM of RTU for RTU spare support for 10 years from completion of warranty.

ANNEXURE-1

TECHNICAL SCHEDULE TO BE FILLED BY THE TENDERER

The Vendor shall fill the following technical particulars and submit the same with the offer for selected Remote Telemetry Unit.

Item	Description	Particulars
	GENERAL	
1.	Make	
2.	Model no.	
3.	Degree of protection (IP No.)	
4.	Operating temperature range (degree centigrade)	
5.	Operating relative humidity range %	
6.	Maximum number of I/O modules per subrack Main subrack Extension subrack	
7.	Maximum number of communication modules per subrack	
8.	Selectable communication speed range	
09.	Resolution of time tagging	
10.	High/low limit checking yes/no	
11.	Whether RTU supports self-checkback-execute and time out feature yes/no	
12.	Interfacing with flow computers of different makes (Instromet/Spectra Tek, etc.) yes/no	
13.	Remote configuration and downloading of parameters from Master Station supported yes/no	
14.	Self diagnostic of RTU and reporting it to Master Station yes/no	
15.	Number of serial ports supported in addition to redundant communication links with Master Station (minimum 4 nos.)	
16.	Whether RTU supports connection of portable maintenance diagnostic test unit yes/no	
17.	Whether hardware for 25 % spare installed I/O's for RTU included yes/no	
18.	MTBF for a fully equipped RTU h	
19.	Equipment availability %	
20.	MTTR for a fully equipped RTU h	
21.	Power requirement for a fully equipped RTU W	
22.	Maximum number of I/O modules per RTU (separately for each type to be given)	
23.	Spare capacity for each type of I/O	

Item	Description	Particulars
24.	Rack dimensions	
25.	**Main Processing Module** Module designation	
26.	Microprocessor type	
27.	Word length	
28.	Basic clocking rate	
29.	Engineering unit conversion yes/no	
30.	Arithmatic processor facility with floating point capability yes/no	
31.	Programe location (i.e. EPROM,RAM)	
32.	EPROM k bytes	
33.	RAM k bytes	
34.	RAM battery back up for one month yes/no	
35.	Type of data bus available for communication among the I/O modules (serial/parallel)	
36.	MTBF h	
37.	Equipment availability %	
	Response Times	
38.	Time taken to access and display information requested by the user from the Master Station	
39.	Time taken to write one modified entry to the data base from Master Station	
40.	Time taken to write one modified entry to the data base from RTU maintenance facility	
41.	Time taken to validate a complete database following an instruction from the Master Station	
	Compliance with CCITT recommendations	
42	Physical interface	

Item	Description	Particulars
	ANALOG INPUT MODULE	
1.	Module designation	
2.	Microcontroller/microprocessor type	
3.	No. of inputs per module	
4.	Type of ADC	
5.	Scanning resolution bits	
6.	Whether AI module of self calibrating type and event reporting to Master Station if out of calibration yes/no	
7.	Accuracy %	
8.	Conversion time ms	
9.	Type of Analog multiplexer	
10.	Method of isolation	

11.	Surge withstand capability (as per IEEE Standards)	
12.	MTBF h	
13.	Equipment availability %	
14.	Power requirement W	
15.	Signal support: 4-20 mA and 0-5 V(Yes/No)	
	DIGITAL INPUT MODULE	
15.	Module designation	
16.	Microcontroller/microprocessor type	
17.	No. of inputs per module	
18.	Is input module type configurable as a) Status and alarms b) Sequence of events c) Parallel input d) Pulse accumulator e) Any combination of these	
19.	Contact bounce protection yes/no	
20.	Optical isolation yes/no	
21.	Scan time ms	
22.	Noise rejection yes/no	
23.	Surge withstand capability (as per IEEE standard)	
24.	MTBF h	
25.	Equipment availability %	
26.	Power requirement W	

	DIGITAL OUTPUT MODULE	
27.	Module designation	
28.	Microcontroller/microprocessor type	
29.	No. of outputs per module	
30.	Maximum output current mA	
31.	Maximum switched output voltage V	
32.	MTBF h	
33.	Equipment availability %	
34.	Power requirement W	
	ANALOG OUTPUT MODULE	
35.	Module designation	
36.	Microcontroller/microprocessor type	
37.	No. of outputs per module Max. no. of voltage outputs Max. no. of current outputs	
38.	Type of output interface (DAC)	
39.	DAC resolution bits	

40.	Overall accuracy	
41.	Type of isolation	
42.	Whether module of self calibrating type and event reporting to Master Station if out of calibration yes/no	
43.	MTBF h	
44.	Equipment availability %	
45.	Power requirement W	
	COMMUNICATION MODULE	
46.	Module designation	
47.	Microcontroller/microprocessor type	
48.	No. of communication channels	
49.	Type of communications interfaces supported	
50.	Designation of communication protocol	
51.	Type of protection	
52.	Type of isolation	
53.	MTBF h	
54.	Equipment availability %	
55.	Power requirement W	
56.	The standards to which modem conforms to	

	POWER SUPPLY MODULE	
57.	Module designation	
58.	Nominal input voltage V	
59.	Operating voltage range %	
60.	Output voltage range V	
61.	Input voltage protection kV	
62.	Output voltage protection kV	
63.	MTBF h	
64.	Equipment availability %	
65.	Power requirement for a fully equipped RTU W	

ANNEXURE – II

I/O COUNT & POWER SUPPLY DETAILS FOR NEW RTUS

I/O COUNTS & POWER SUPPLY DETAILS FOR NEW RTUs OF KMKRPL PROJECT

Sl. No.	RTU No.	Station	AI*	AI#	TOTAL AI	DI*	DI#	TOTAL DI	DO*	DO#	TOTAL DO	AO*	AO#	TOTAL AO	Serial Ports (NOTE -6)	Power Source	Power Supply	Maximum allowable load (watts)
	----	Noida (existing) (Master Station)	----	----	---	---	---	---	---	---	---	---	---	---	---	(UPS) Grid	-	-
PART - A																		
1	RTU-1	Dispatch Terminal at Karanpur	10	4	14	12	10	22	4	---	4	---	---	---	3	UPS (Grid)	24VDC	250 W
2	RTU-2	12" SV 1 Station	4	15	19	3	12	15	2	1	3	---	---	---	1	UPS (Grid+ Solar)	24VDC	250 W
3	RTU-3	IP-1 (Intermediate Pigging Station-1)	10	13	23	14	21	35	4	1	5	1	---	1	3	UPS (Grid)	24VDC	400 W
4	RTU-4	Siti Energy at Moradabad	8	4	12	4	10	14	---	---	---	1	---	1	3	UPS (Grid)	24VDC	250 W
5	RTU-5	12" SV 2 Station	4	15	19	3	12	15	2	1	3	---	---	---	1	UPS (Grid + Solar)	24VDC	250 W
6	RTU-6	12" SV 3 Station	4	15	19	3	12	15	2	1	3	---	---	---	1	UPS (Grid + Solar)	24VDC	250 W
7	RTU-7	Receiving Terminal at Savanti Power	8	4	12	4	10	14	---	---	---	1	---	1	4	UPS (Grid)	24VDC	250 W

Sl. No.	RTU No.	Station	AI*	AI#	TOTAL AI	DI*	DI#	TOTAL DI	DO*	DO#	TOTAL DO	AO*	AO#	TOTAL AO	Serial Ports (NOTE -6)	Power Source	Power Supply	Maximum allowable load (watts)
8	RTU-8	Receiving Terminal at Kashipur . (RWS)	18	8	26	13	20	33	4	---	4	2	---	2	4	UPS (Grid)	230VAC 24VDC	1000W 300W
9	RTU-9	Receiving Terminal at Beta	8	4	12	4	10	14	---	---	---	1	---	1	3	UPS (Grid)	24VDC	250 W
10	RTU-10	Receiving Terminal at Gama	8	4	12	4	10	14	---	---	---	1	---	1	3	UPS (Grid)	24VDC	250 W
PART – B																		
11	RTU-11	SV station-2	4	15	19	3	12	15	2	1	3	---	---	----	1	UPS (Grid+ Solar)	24VDC	250W
12	RTU-12	Receiving station at Rudrapur	10	4	14	12	10	22	4	---	4	---	---	---	3	UPS (Grid)	24VDC	300W

NOTES:

1. **In addition to above quantities; 25% Spare I/Os shall be provided for each station.**
2. **The I/Os marked (" * ") are the tentative I/Os as per P & ID.**
3. **The I/Os marked (" # ") are the tentative I/Os typically has to be considered for other IED's (Such as power supply, LEL Detectors, solar panels, Fire & Safety, CP system etc.)**
4. **The counts of I/Os will be finalized during detail engineering.**
5. **Bidder shall provide station wise maximum power consumption details.**
6. **Minimum 2 nos. of Spare serial RS-232/RS485 ports shall be provided to all RTU's in addition to above indicated quantity as per clause no 6.6 of PJS.**
7. **For RTU-8 (at Kashipur) 10 nos. & for RTU-12 (at Rudrapur) 4 nos. of extra spare serial RS-232/RS485 ports shall be provided in addition to above indicated quantity.**

ANNEXURE – III

INSPECTION AND TESTING

ANNEXURE-III to PJS

INSPECTION AND TESTING

1.0 INSPECTION

All equipment and components of the system shall be subjected to inspection and testing both during and upon completion of manufacturing and at site. Bidder shall provide full details of all type tests carried out on boards and modules and tests normally carried out in their works including to what standards these are carried out. These test preferably in accordance with International / National Standards.

1.1 All factory tests will be witnessed by Client / Consultant.

1.2 Client / Consultant shall have free entry and access at all phases of the project to all parts of Bidder's facilities associated with manufacturing and testing of system.

1.3 Bidder shall invite Client / Consultant well in advance with minimum 2 months notice of the date at which the system is ready for testing.

1.4 The equipment will not be shipped before they have been officially released in the form of release notes by Client / Consultant.

1.5 Bidder shall provide Client / Consultant with all reasonable facilities necessary to determine compliance to the system specification.

1.6 Bidder to note that acceptance of the equipments and the system of inspection and testing shall in no way absolve the bidder of his responsibility to deliver the equipment meeting all the requirements specified in the specification. Bidder shall be responsible till the completion of the warranty, for any corrections/modifications including supply and implementation of hardware & software to fulfil the requirements of the contract. If after acceptance of the system certain changes are required such as debugging of the software supplied or any other related issues which cannot be ascertained during the final handover of the system, these changes shall be carried out by the vendor at their cost

1.7 Bidder personnel shall be actively involved during factory acceptance and site acceptance testing.

2.0 TESTING

Testing shall concern SCADA equipments at all stations including RTUs and application software system. The test shall consist of:

a) Pre-Factory Acceptance Test (Pre-FAT)
b) Factory Acceptance Testing (FAT)
c) Pre-Site Acceptance Test (Pre-SAT)
d) Site Acceptance Test (SAT)
e) Test Run

Bidder shall submit to Client / Consultant detailed test plans and procedures, three months prior to all actual testing for factory and site acceptance test and run over review.

2.1 **PRE-FAT**

During the PRE-FAT testing phase, the Bidder is to ensure that system performs in compliance to specifications of the tender, FDS prior to offering the system for FAT by Client / Consultant.

PRE-FAT shall be conducted based on the approved FAT documentation signed by system engineering group of the bidder and On successful clearance of PRE-FAT, the Bidder shall make available to the Client / Consultant, the PRE-FAT signed and approved reports and thereafter clearance for conducting the FAT by Client / Consultant shall be given as above.

2.2 **FACTORY ACCEPTANCE TESTING (FAT)**

2.2.1 The Bidder shall prepare FAT documentation covering all hardware, software including SCADA software and system functionalities including system expansion requirements and submit it 3 months in advance for Client / Consultant review and approval. Factory acceptance test will be done based on the stipulations in the approved FAT document, which shall completely fulfil the contract requirements and approved SCADA/RTU FDS documents.

2.2.2 FAT shall be carried out in SCADA/ RTU vendor's premises. FAT shall cover the testing & Integrated SCADA/RTU System with RTUs

Testing shall systematically, fully and functionally test all the hardware and software in the presence of Client / Consultant inspectors to ascertain compliance with the contract document and approved FDS documents. Test Bed shall be prepared with all the equipments (SCADA Servers, HMI, RWSs, RTUs, Routers, and Peripherals etc) interconnected to actual configuration to perform the testing of integrated SCADA system. All the workstation desks, cabinets with mounting, wiring, interconnection of the equipments shall be available for this testing.

The equipment to be supplied shall be type-tested for electromagnetic Compatibility.

2.2.3 The SCADA system / RTU testing shall cover the following aspects as a minimum:

a) Visual and mechanical testing to ensure correct, proper, good and neat workmanship.

b) Demonstration of the complete system functionalities, hardware & software compliances wit all the equipments including RTUs.

c) Checking of complcte database definitions for the proper system configuration.

d) Testing of system passwords and security features.

e) Testing the synchronization of clock between the nodes of each MS and the RTUs as per the specification.

f) Checking of various Tog formats, reports, archiving functions.

g) Checking of system loading w.r.t CPU, memory, disk, as per the requirements.

h) Checking of system diagnostics for all the equipments as per the requirements, power failure and system restarts.

i) Redundancy check for dual communication channel.

j) 10 & Serial communication checking by simulation

k) System building procedures and verifications.

l) Pipeline shutdown and various sequences and interlocks as per pipeline Operation and Control Philosophy.

2.2.4 On line testing, Commissioning

2.2.4.1 Prior to SAT, all RTUs shall be tested online by RTU vendor when all the dispatched, SV, IP, receiving station hardware & software w.r.t RTU system have been successfully tested, with regard to correctness of complete database using plant simulator, remote diagnostics, proper representation of all RTUs data on graphics, alarms, trending, reports etc., checking of operation of various control commands i.e. valves open/close, pipeline shutdown and permissive etc., complete checking and testing of signals from Inst panels to RTU & RTU to Inst panel checking of field values, field device status, controls of field devices commands and set points from MS / EMS. Complete checking and testing of signals and RTU I/o's database points from Inst panel cabinets to RTUs, testing of serial interfaces with Inst panel & Solar panel shall be included in the on-line testing of RTUs.

2.2.4.2 Prior to SAT, the activities of installation, RTUs on-line testing and commissioning shall be performed by RTU vendor by following their Company standard & established practices & procedures to ensure that good techniques and best engineering practices had been followed, while ensuring correctness & completeness of the same.

2.2.4.3 SAT shall be conducted by the RTU vendor after successful integration & commissioning of the complete system and after all actual field signals have been interfaced with the RTU system including the successful completion of on-line testing of all the RTUs.

3.0 SITE ACCEPTANCE TESTING (SAT)

3.1 The Bidder shall prepare SAT test plans and procedures document for integrated system & submit it 1 month in advance of Client / Consultant review and approval.

3.2 SAT shall involve integrated testing of complete RTU / SCADA system. Site Acceptance Testing will be done based on the stipulations in the approved SAT document. Once the test is successfully performed, then the system would be ready for commencement of test run.

3.3 SAT shall be done inline with FAT, wherein simulated signals shall be replaced by actual field signal and integration with Telecom system has been carried out.

3.4 SAT shall be conducted by the experienced system engineering group of the vendor (having experience and involved in system design, engineering, integration & FAT.)

4.0 TEST RUN

Test for continuous functional operation of the system with the required system reliability and availability. This test aims at keeping the complete integrated system operation for a period of 30 days for all the 24 hours a day.

In case of failure, the test will be restarted till the system operates without failure of any system functionality for 30 days. Failure of test shall be limited to such system failures which will affect system availability and reliability and shall not be dependent upon established failure of third party supplied items. Client / Consultant shall have the right to reject the complete system or part there of in the event of two successive failures of test run.

The 'Test Run' will be carried out after the commissioning of complete pipeline duly witnessed by Client / Consultant. After the successful completion of Test run, Warranty phase will start and system taking over certificate will be issued by the Client / Consultant.

4.1 **TEST REPORTS**

The observations, exceptions and test result obtained during the various test shall be documented and produced in the form of a report by the Bidder within 15 days of completion of Test Run which shall be subsequently reviewed / approved by Client /Consultant within 10 days of submission of repost. The warranty phase will start only after the approval of documents / acceptance of the system.

5.0 FAILURE OF COMPONENTS

A log of all failed hardware and software modules shall be maintained which shall give date and time of failure, description of the failed components & cards/software along with designation, effect of failure on the system, cause of failure and number of ours of operation of the part before it failed.

Upon failure of the components/cards/modules, the same shall be replaced by better graded components/cards. And the test shall be restarted from the beginning or the previous logical points as the case may be. If after this one replacement the unit of sub-system still fails to meet the specifications, the Bidder shall replace the complete unit or sub-system with one that meets the requirements and restarts the test all over again.

6.0 Bidder shall depute one experienced software & one hardware engineer fully conversant with the system at MS /EMS during the test run, and they will coordinator for APPS system integration with APPS sub-vendor engineer during the test run.

7.0 All the tests will be necessary in connection with the execution of works as per approved document shall be carried out at the Bidder's premise, testing laboratory and work site of the Client / Consultant at Bidder's cost. The Bidder shall provide assistance; instruments, labour and materials

as are normally required for the examining, measuring and testing any workmanship as may be selected and required.

8.0 Factory Acceptance Test shall be carried out at Bidder's factory. These tests will encompass all the material and equipment delivered and software pertaining to RTU/ SCADA system including the equipment and software supplied by Bidder and sub-vendor. Pre-FAT report duly witnessed and accepted by the SCADA vendor shall be available for reference during FAT.

9.0 Various observations and test results obtained during the various test shall be documented and produced in the form of a report by the Bidder. Each report shall contain:

a) Purpose.

b) Method.

c) Deviation from procedures described in previously submitted test plans, if any, with cause for the same.

d) Result of test compared with expected results as per the test plan.

e) Exceptions and action plan.

10.0 If a unit or sub-system has failed during the test and is not repaired and made successfully operational or not replaced within four hours of active repair time after the failure, the test shall be suspended and restarted all over again only after the Bidder has placed the device back in to acceptable operation. The Client / Consultant's approval shall be obtained for any allowable logistic time required to replace the failed component/system shall be to Bidder's account.

11.0 The Client / Consultant shall be free to request any specific test on any equipment and the system considered necessary by him, although not listed in the testing documents to verify the compliance with the specifications.

12.0 Any statutory test/inspection certificate, as may be required, under any law or directive issued by Govt. or any competent authority, shall be furnished to the Client / Consultant.

13.0 For operational software tests, the plans shall include summery of the method, a list of typical test cases, the sequence of execution and expected results.

For hardware tests, the plans shall include purpose of the test, definition of test inputs, specifications of test procedures and definition of results to be obtained.

14.0 It shall be Bidder's responsibility to modify the operational and diagnostics software in case of any mal-operation is revealed during online operation of the system after commissioning with in the guarantee period.

15.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PROGRAM/RECORDS

The Bidder shall ensure the quality of all equipment and software delivered, installed and commissioning and all works performed under this Contract according to a Quality Policy and a Quality Assurance Programme submitted along with his Bid.

The Bidder shall submit:

a) Quality Control Plans showing the activities to be examined by Quality Control group of Bidder along with the documentation which shall be maintained and submitted to the Client / Consultant.

b) Quality Control & Quality Assurance organisation set up proposed to be deployed by the Bidder.

c) Procedure for Tests, Calibration, Maintenance of software, Instruments and Equipments.

A log shall also be maintained by the Bidder during the time the system remains at Bidder's works from the time of purchase/putting the system for the purpose until system is cleared to dispatch the India. This log shall be sent along with the system to the Client / Consultant.

ANNEXURE – IV

INSTALLATION & COMMISSIONING

ANNEXURE-IV to PJS

RTU FOR SCADA SYSTEM

INSTALLATION & COMMISSIONING

1.0 The installation and commissioning of all the equipment at various sites including the activities of instrumentation signal interconnections, electrical and civil works with power supply distribution and grounding works and other necessary facilities is the responsibility of the Bidder.

2.0 a) All supply and interconnection of cabling and accessories including cable routing between the following cabinets/equipments are also included in Bidder's scope, and to be carried out by the Bidder. The activities of signal identification at site, cable termination, ferruling, glanding, dressing at TIC end, RTU end, telecom rack end etc. are in Bidders scope for all sites.

(i) Between RTUs & Telemetry interface cabinets.
(ii) Between RTUs & Telecommunication equipments.
(iii) Between SCADA (CCUs, WAN routers) & Telecommunication equipments.
(iv) Between Remote workstations & Telecommunication equipments.
(v) Between RTUs and flow computers serial interfacing as required.

b) All cables between TICs and RTUs shall be PVC insulated, single pair (1.5 mm2), multi pair (0.5 mm2), twisted in pair individually, individual pair shielded and overall shielded with aluminium mylar tape. Separate cables for analog and digital cables to be used. The distance between TIC and RTU for each SV, and IP station shall be approx. 15 meters. The cables have to be included accordingly.

Each cable pair shall be identifiable by pair/core no of colour code. The cable shall have multi strand copper conductor. 20% spare pairs shall be provided in all the cables from Telemetry interface cabinet to RTU.

c) The Ethernet cable from RTU to Telecom rack shall be 50 feet long at each station, complete with connectors at each end. However distances shall be firmed up during detail engineering or prior to FAT.

d) RTU/ SCADA vendor shall be responsible for proper selection of the RS 232 C or any other cable for ensuring good communication with telecommunications.

3.0 All the erection work shall be carried out as per the established recommended practices and best workmanship.

4.0 Bidder shall bring all installation aids, test equipments and qualified and experienced personnel, in order to carry out the job successfully. A list of the same shall be submitted to the Client / Consultant for the review.

On completion of erection and installation of all equipment and software, and before start-up, each item of the system shall be jointly inspected by the Client / Consultant and Bidder for correctness & completeness of the installation and acceptability of start-up leading of commissioning tests at site.

5.0 The list of commissioning test to be performed shall be mutually agreed upon and included in the Bidder's Quality assurance programmes. Bidder's commissioning engineers shall carry out these tests. After the commissioning tests are over, the system shall be put for SAT.

6.0 All technical personnel assigned to the site by Bidder must be fully conversant with the specific system and its software packages. The Bidder's field personnel shall have both hardware & software capability to bring the system online quickly and efficiently and with the minimum of interference with other concurrent construction and commissioning activity.

7.0 The commissioning spares for all the items/equipments shall be included along with commissioning services as required to commission the complete system. The consumable required during commissioning of system shall be included as part of commissioning spares.

Commissioning spares including consumables as part of commissioning activities. Vendor must ensure availability of following commissioning spares as a minimum at site:

a. 2 nos. of CPU and 2 nos. of each type of I/O card (AI, AO, DI, DO, Serial cards) of RTU

b. One no. Router

Mandatory spares as per MR

RTU/ SCADA Vendor to note that the mandatory spares are the inventory of the spares to be kept by the Client and the same shall not be utilised by the RTU/SCADA Vendor at any stage of the project till completion of warranty, without Client's prior concurrence. Any mandatory spares utilized by the RTU/SCADA vendor during Warranty period shall be replenished within 45 days.

8.0 To the extent that the Standard of the works has not been specified in the Contract, the Bidder shall use good quality materials, techniques and standards and execute the Contract with the care, skill and diligence required in accordance with best engineering practice.

9.0 Bidder shall at his own expense supply and provide all the equipment, tools, temporary works material both for temporary and for permanent works, labour, supervisors, engineers and specialist, movement of the supplied equipment at the site, required for installation, commissioning, execution and completion of the works. The Bidder shall make his own arrangements at his own cost for the transport where necessary of his staff and labour to and from the site of the works.

10.0 The Bidder shall provide and maintain an office at the Site, during Installation, Testing & Commissioning phase, for his staff, and such office shall be open at all reasonable hours to receive instructions, notice or other communications as per the advice of the Client / Consultant.

11.0 Appropriate storage of the materials to be supplied in this contract will be arranged at the site by the Bidder at the various stations after the materials have been delivered by the Bidder. The Bidder shall be responsible for the storage, security and safety of all other materials, tools etc. brought by the Bidder for the installation and commissioning of the system at the site.

12.0 The Bidder's responsibility at site shall include all the activities necessary to be performed to complete the entire job as per the contract requirements including the following as a minimum.

a) Receipt of hardware, software and checking the adequacy and completeness of supply.

b) Storage, safety, security of the equipments & other materials including software at site.

c) Installation of the complete system including power supply, earthing, cable terminations, calibration, civil and electrical works.

d) Checking of equipment installation.

e) Checking of interconnection and overall system functionality.

f) On line/Offline debugging of the system.

g) Coordination /interfacing (including obtaining relevant details) with Instrumentation, APPS sub-vendor, CP system & Electrical contractor, Telecom sub-vendor directly or through client for any disputes.

h) On line testing and commissioning of SCADA system and testing of APPS system with sub-vendor.

13.0 For installation, RTUs online testing and commissioning as per the specification of RTU supplier recommendation. After these test, the SCADA system shall be put for SAT.

14.0 RTU / SCADA vendor to note that there could be minor database changes, graphics, report logic changes during site commissioning phase as required by the client / consultant. The same shall be treated as part of the scope of SCADA vendor. This activity will be carried out by other vendor.

ANNEXURE - V
P & ID DRAWINGS
FOR DESPATCH, SV / IP
& RECEIVING STATIONS

DRG. NO. MEC/23M4/05/21/M/000/1002

SYMBOLS & ABBREVIATIONS

SYMBOLS

- VP–PLUG VALVE (WELDED END)
- VP–PLUG VALVE (FLANGED END)
- VB–BALL VALVE (WELDED END)
- VB–BALL VALVE (FLANGED END)
- GATE VALVE (FLANGED END)
- GV–GLOBE VALVE (FLANGED END)
- CRV–CREEP RELIEF VALVE (WELDED END)
- PRESSURE RELIEF OR SAFETY VALVE (PSV)
- PRESSURE REGULATING VALVE (PCV) (SELF ACTUATING TYPE)
- NON RETURN VALVE (FLANGED END)
- CONTROL VALVE WITH SLAM SHUT–OFF VALVE
- SOLENOID VALVE
- ACTUATED ISOLATION VALVE
- ACTUATED ISOLATION VALVE WITH HANDWHEEL
- REDUCER / EXPANDER
- FLANGE
- FLAME ARRESTOR (FA)
- REMOTE TERMINAL UNIT (RTU)
- DIAPHRAM
- AUTO RECIRCULATION VALVE

SYMBOLS

- PD METER
- TURBINE METER
- INSULATION JOINT (IJ)
- FLOW TEE (FWT)
- FIELD MOUNTED INSTRUMENT
- CONTROL PANEL MOUNTED INSTRUMENT
- ULTRASONIC METER
- SCADA INDICATOR, CONTROLLER OR OTHER DEVICES WITH OPERATOR ACCESS TO ADJUSTMENT.
- PROGRAMMABLE LOGIC CONTROLLER FOR MONITORING & CONTROL ACCESSIBLE TO OPERATOR
- PIG LAUNCHER / RECEIVER
- FLOW STRAIGHTNER
- ROTA METER
- PIG SIGNALLER (XXLS)
- VENT
- SPECTACLE BLIND

ABBREVIATIONS

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

ABBREVIATIONS

TT	TEMP TRANSMITTER
FR	FLOW RECORDER
PIR	PRESSURE IND.RECORDER
TIR	TEMP. IND. RECORDER
PSH	PRESSURE SWITCH HIGH
PSL	PRESSURE SWITCH LOW
LSH	LEVEL SWITCH HIGH
LSL	LEVEL SWITCH LOW
LAH	LEVEL ALARM HIGH
LAL	LEVEL ALARM LOW
A1A/B1A	150#/300# RATING
C1A/D1A	400#/600# RATING
LX/PX	PNEUMATIC/ ELECTRIC SIGNAL TRANSMITTER
FB	FULL BORE
S	SAMPLING
CP	CORROSION PROBE
CC	CORROSION COUPON
AV	ACTUATED VALVE
SDV	SHUT DOWN VALVE
LV	LEVEL CONTROL VALVE
PV/PCV	PRESSURE CONTROL VALVE
BD	BLOW DOWN
H	HOLD
ARV	AUTO RECIRCULATION VALVE

SIZE"–FLUID–00–00–A1A/B1A/C1A/D1A/D4A

- SIZE"–FLUID–00–00–A1A/B1A/C1A/D1A/D4A — MATERIAL SPEC.
- SIZE"–FLUID–00–00–A1A/B1A/C1A/D1A/D4A — LINE NO.
- SIZE"–FLUID–00–00–A1A/B1A/C1A/D1A/D4A — UNIT NO.
- SIZE"–FLUID–00–00–A1A/B1A/C1A/D1A/D4A — NATURAL GAS
- SIZE"–FLUID–00–00–A1A/B1A/C1A/D1A/D4A — LINE SIZE (NOMINAL)

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MECON LIMITED

REV	DESCRIPTION	BY	VERIFIED
	REVISION		

REFERENCES | DRG.NO.

SECTION	OIL & GAS
LOCATION	NEW DELHI
DESIGNED	
DRAWN	SUNNY
CHECKED AND VERIFIED	TKM
APPROVED	SIG (BND)
DATE	20.07.2009

KAPANPUR–MORADABAD–KASHIPUR–RUDRAPUR GAS PIPELINE PROJECT.

LEGEND / DRAWING SYMBOLS

SCALE : NTS | SHEET 1 OF 2 | REV D

DRG. NO. MEC/23M4/05/21/M/000/1002

REV / SEC | INST. | CONCURRED BY

SYMBOLS & ABBREVIATIONS

SYMBOLS

- CONTINIUOUS-ACTION VALVE
- RIGHT-ANGLE SHUT-OFF VALVE, GENERAL
- THREE-WAY VALVE, GENERAL
- FOUR-WAY VALVE, GENERAL
- NEEDLE VALVE
- PUSHBUTTON VALVE
- BUTTERFLY VALVE
- CONTINUOUSLY VARIABLE BORE BUTTERFLY VALVE
- SEPERATOR GENERAL
- 2 STAGE SEPERATOR
- CYCLONE SEPERATOR
- SIGHT GLASS. GENRAL
- CAP
- FLANGE CONNECTION

SYMBOLS

- SPRING-OPERATED ACTUATOR
- AUTOMATICALLY OPERATED ACTUATOR, GENERAL
- ELECTRIC MOTOR-OPERATED ACTUATOR, GENERAL
- VALVE CLOSED ON FAILURE OF ACTUATING ENERGY
- VALVE OPENED ON FAILURE OF ACTUATING ENERGY
- VALVE RETAINS POSITION ON FAILURE OF ACTUATING ENERGY
- TURBINE, GENERAL
- COMPRESSOR, GENERAL
- BLIND PLATE
- "FIGURE 8" PLATE, BLIND PLATE IN FUNCTION
- "FIGURE 8" PLATE, GOGGLE PLATE IN FUNCTION
- ORIFICE PLATE
- FILTER, GENERAL
- GAS FILTER, GENERAL

SYMBOLS

- BASKET FILTER
- GAS SORPTION FILTER
- LIQUID FILTER, GENERAL
- "T" TYPE STRAINER
- "Y" TYPE STRAINER
- PRESSURE REDUCING VALVE, IN AUXILIARY AND CONTRAL FACILITIES
- PRESSURE CONTROL VALVE, GENERAL
- PROCESS PRIMARY LINE
- PROCESS SECONDARY LINE
- ELECTRIC LINE
- PNEUMATIC LINE
- CAPILLARY LINE
- SOFTWARE SIGNAL
- JACKETED LINE
- JACKETED & HEATED LINE
- CENTRIFUGAL PUMP
- IN / OUT RECIPROCATING PUMP
- CP CORROSION PROBE
- CC CORROSION COUPON

ABBREVIATIONS

ESD	EMERGRNCY SHUT-DOWN
EW	DRAIN
FB	FAIL-BLOCKED
GCV	GAS-OPERATED CONTROL VALVE
GOV	GAS-OVER OIL OPERATED VALVE
HOV	HYDRAULIC-OPERATED VALVE
LC	LOCKED CLOSED
LO	LOCKED OPEN
LP	LOCKED POSITION
LPT	LOW POINT
MCV	MOTOR CONTRAL VALVE
MH	MANHOLE
MOV	MOTOR-OPERATED VALVE
SV	SOLENOID VALVE
PSV	PRESSURE SAFETY VALVE
PCV/PV	PRESSURE CONTROL VALVE
SSV	SAFETY SHUT-OFF VALVE
PRV	PRESSURE RELIFE VALVE
SP	SET POINT
TW	THERMOWELL
NRV	NON-RETURN VALVE
CV	CHECK VALVE
FCV	FLOW CONTROL VALVE
PGS	POWER GAS SUPPLY
IAS	INTRUMENT AIR SUPPLY
NC	NORMAL CLOSED
NO	NORMAL OPEN

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REV / SEC	INST.	CONCURRED BY

REV.NO	DATE	ZONE	DESCRIPTION	BY	VERIFIED
			REVISION		

REFERENCES DRG.NO.

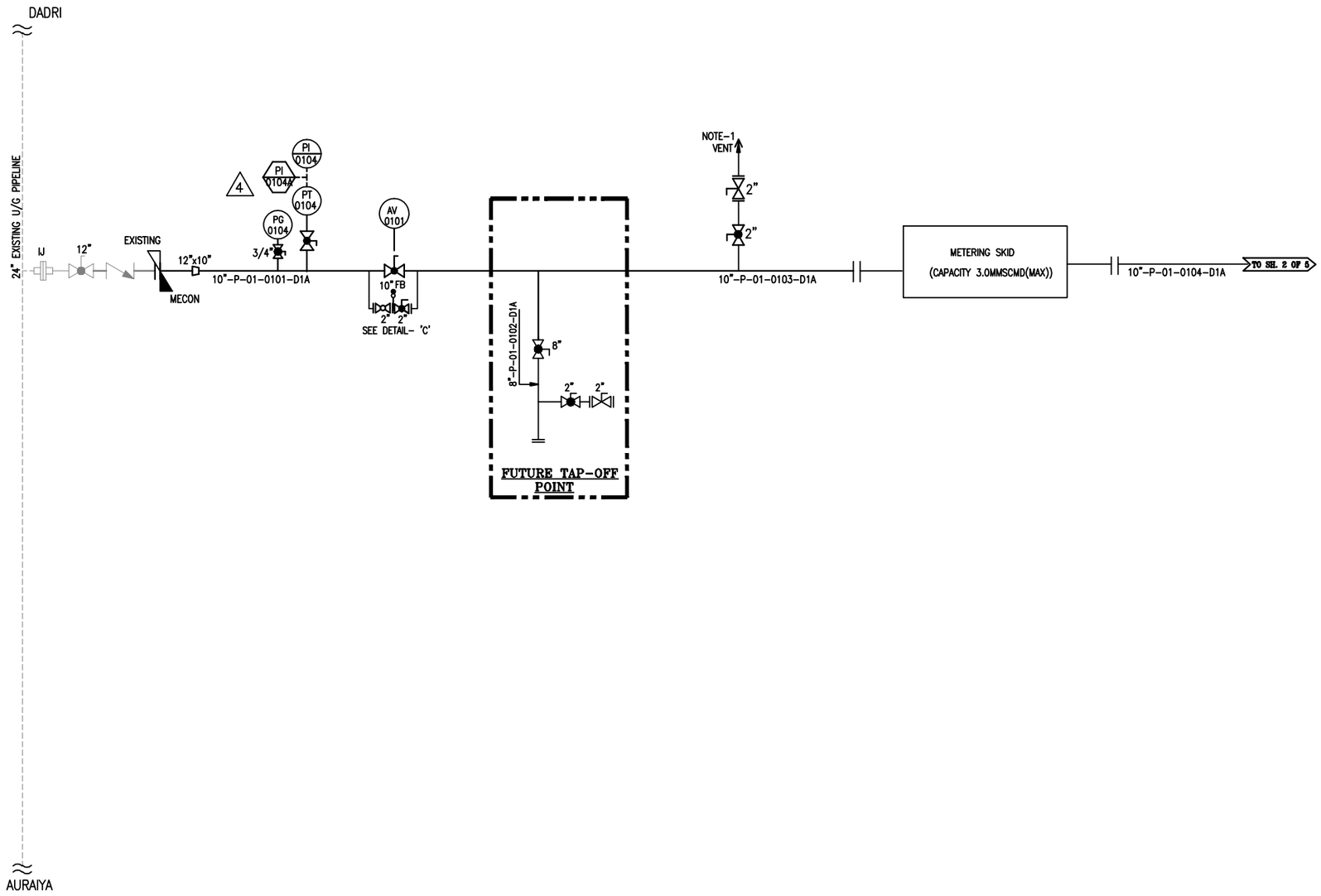
SECTION	OIL & GAS
LOCATION	NEW DELHI
DESIGNED	
DRAWN	SUNNY
CHECKED AND VERIFIED	TKM
APPROVED	SIG (BND)
	DATE 20.07.2009

KAPANPUR-MORADABAD-KASHIPUR-RUDRAPUR GAS PIPELINE PROJECT.

LEGEND / DRAWING SYMBOLS

SCALE : NTS	SHEET	REV
DRG. NO. MEC/23M4/05/21/M/000/1002	2 OF 2	D

DRG. NO. MEC/23M4/05/21/M/001/0001



NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. METERING SHALL BE DONE BY ULTRASONIC FLOW METER WITH CONTROL PANEL MOUNTED FLOW COMPUTER. INSTALLATION SHALL BE AS PER AGA9 LATEST EDITION. HOWEVER THERE SHALL BE TWO STREAMS OF METERING (1W+1S).
3. ENVIRONMENTAL ENCLOSURE REQUIRED FOR METERING INSTRUMENTS. INSULATION OF USM METER RUN & IMPLUSE LINES OF METERING INSTRUMENT IS REQUIRED.
4. PROVISION SHALL BE KEPT TO HOOK UP INLET & OUTLET PR. & TEMP., FLOW PERAMETERS, STATUS OF GAS ACTUATED VALVES, WITH SCADA.
5. ALL BALL VALVES ABOVE 2" SHALL BE TRUNION MOUNTED ONLY.
6. ALL BALL VALVES 2" AND BELOW 2" SHALL BE FULL BORE ONLY.
7. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.

PROCESS DATA

FLUID : NATURAL GAS/RLNG
FLOW :
NORMAL : 2.5 MMSCMD
MAXIMUM : 3.0 MMSCMD (4)

PRESSURE
BEFORE PCV : 66-73 Kg/Cm^2 (g)
AFTER PCV : 40-60 Kg/Cm^2 (g)
DESIGN : 92 Kg/Cm^2(g)

TEMPERATURE
WORKING : 5°-50° C
DESIGN : -29 TO 65°C

DESIGN CLASS : 600#

LINE LEGEND

EXISTING LINE
PROPOSED LINE ABOVE GROUND(A/G)
PROPOSED LINE UNDER GROUND(U/G)

10"-P-01-0101-D1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (NG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE FLANGE END.

FOR TENDER PURPOSE ONLY

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REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
4	17.07.2010		GAIL'S COMMENTS INCORPORATED	SR	BND
3	02.02.2010		GAIL'S COMMENTS INCORPORATED	SR	BND
2	24.12.09		GAIL'S COMMENTS INCORPORATED	SR	BND
1	25.11.09		GAIL'S COMMENTS INCORPORATED	SR	BND

REVISION

REFERENCES | DRG.NO.

SECTION	OIL & GAS (LDP)
LOCATION	DELHI
DESIGNED	SR
DRAWN	ANKIT
CHECKED AND VERIFIED	B.N. DAS
APPROVED	SIG
DATE	07.01.2009

KARANPUR-MURADABAD-KASHIPUR GAS PIPELINE. PHASE-I (12"x102 KM.)

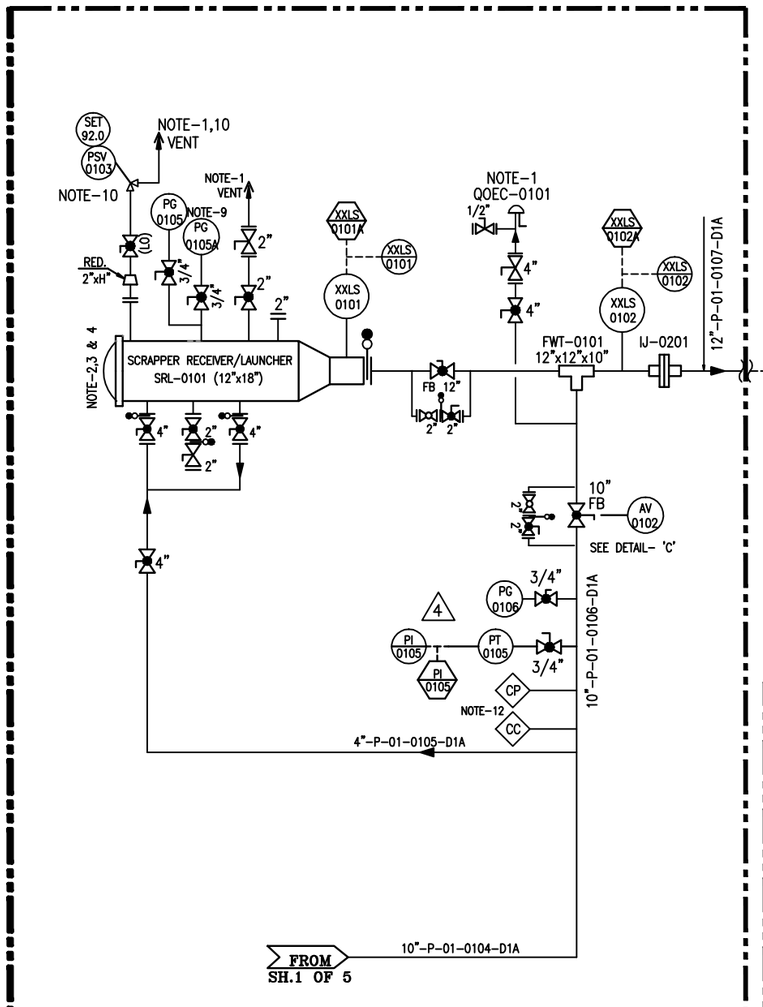
P & ID FOR METERING TERMINAL AT KARANPUR

SCALE : NTS | SHEET | REV

DRG. NO. MEC/23M4/05/21/M/001/0001 | 1 OF 5 | 4

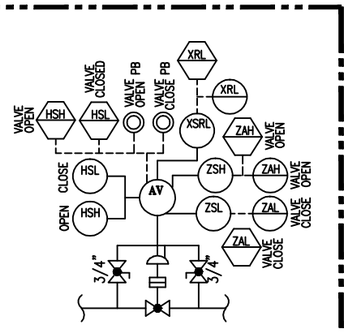
REV / SEC | INST. | CONCURRED BY

DRG. NO. MEC/23M4/05/21/M/001/0001

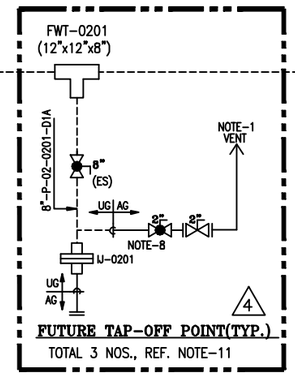


DESPATCH TERMINAL AT KARANPUR
CH. 0 Km. (APPROX.)

12"x52 KM UPTO MORADABAD.
Gr. X-65 U/G P/L



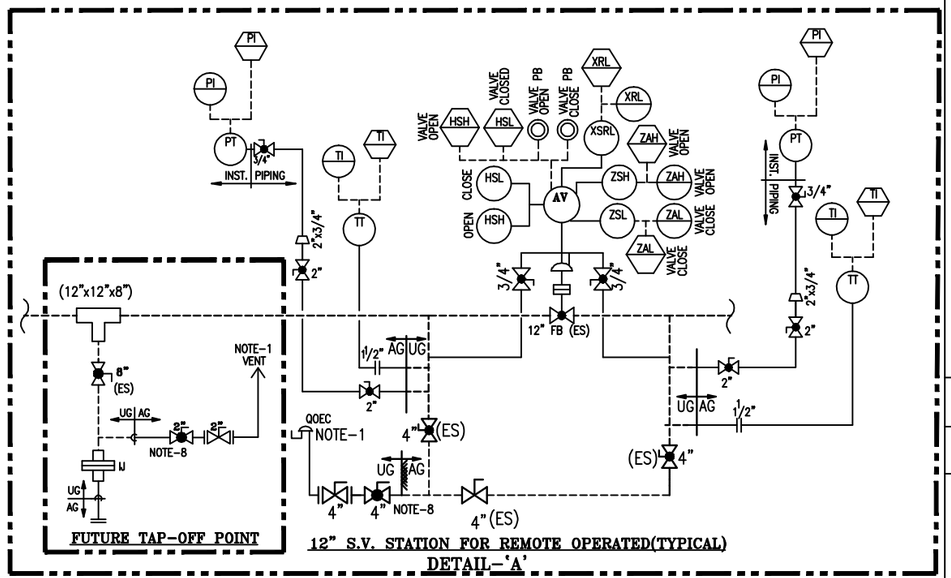
A.V. TYPICAL
DETAIL- 'C'



FUTURE TAP-OFF POINT(TYP.)
TOTAL 3 NOS., REF. NOTE-11

SV-1
12",FB
CH. 27 K.M.
NOTE-5
SEE DETAIL-'A'

TO SH. 3 OF 5



FUTURE TAP-OFF POINT

12" S.V. STATION FOR REMOTE OPERATED(TYPICAL)
DETAIL-'A'

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST LEVEL.
2. SCRAPPER LAUNCHER/RECEIVER SHALL HAVE SCRAPPER HANDLING FACILITY COMPIRING OF A JIB CRANE & A TROLLY AND SHALL HAVE A QUICK OPPENING CLOSURE.
3. SCRAPPER LAUNCHER/RECEIVER SHALL BE SUITABLE FOR HANDLING INTELLIGENT PIGS.
4. DOUBLE INTERLOCK SHALL BE PROVIDED FOR PIG LAUNCHER/ RECEIVER DOOR.
5. ALL SV EXTENDED STEM BW, FULL BORE VALVE.
6. ALL BALL VALVES 2" AND ABOVE 2" SHALL BE TRUNION MOUNTED ONLY.
7. ALL BALL VALVES 2" AND BELOW 2" SHALL BE FULL BORE ONLY.
8. PROVIDE ELECTRICAL ISOLATION FOR SUPPORT AND ANY OTHER CONNECTIONS
9. PG-0105A SHALL HAVE A RANGE OF 0-1 Kg/cm (g) WITH A GAUGE SAVER. PG-0105 WILL ALSO HAVE GAUGE SAVER. △4
10. NO. OF RELIEF VALVAES AND CLASS TO BE DECIDED DURING DETAIL ENGINEERING.
11. THREE NOS. OF FUTURE TAP OFF POINT SHALL BE CONSIDERED AT CHAINAGE 13.54 KM, 61.63 KM, 71.5 KM RESPECTIVELY.
12. ONLINE RETRIEVAL TYPE CORROSION MONITORING COUPON & CORROSION PROBE SHALL BE PROVIDED.

PROCESS DATA

FLUID : NATURAL GAS/RLNG
FLOW :
NORMAL : 2.5 MMSCMD
MAXIMUM : 3.0 MMSCMD △4

PRESSURE
BEFORE PCV : 66-73 Kg/Cm^2(g)
AFTER PCV : 40-60 Kg/Cm^2(g)
DESIGN : 92 Kg/Cm^2(g)

TEMPERATURE
WORKING : 5°-50° C
DESIGN : -29 TO 65°C
DESIGN CLASS : 600#

LINE LEGEND
- EXISTING LINE
- PROPOSED LINE ABOVE GROUND(A/G)
- PROPOSED LINE UNDER GROUND(U/G)

12"-P-01-0101-D1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (NG)
- LINE SIZE (NOMINAL)

VALVE LEGEND
- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1 1/2" SW END.
- PLUG VALVE BW END/UPTO 1 1/2" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE FLANGE END

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REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
			REVISION		
4	17.07.2010		GAIL'S COMMENTS INCORPORATED	SR	BND
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REFERENCES | DRG.NO.

REV / SEC	INST.	CONCURRED BY

SECTION	OIL & GAS (LDP)
LOCATION	DELHI
DESIGNED	SR
DRAWN	ANKIT
CHECKED AND VERIFIED	B.N.DAS
APPROVED	SIG
DATE	01.11.2009

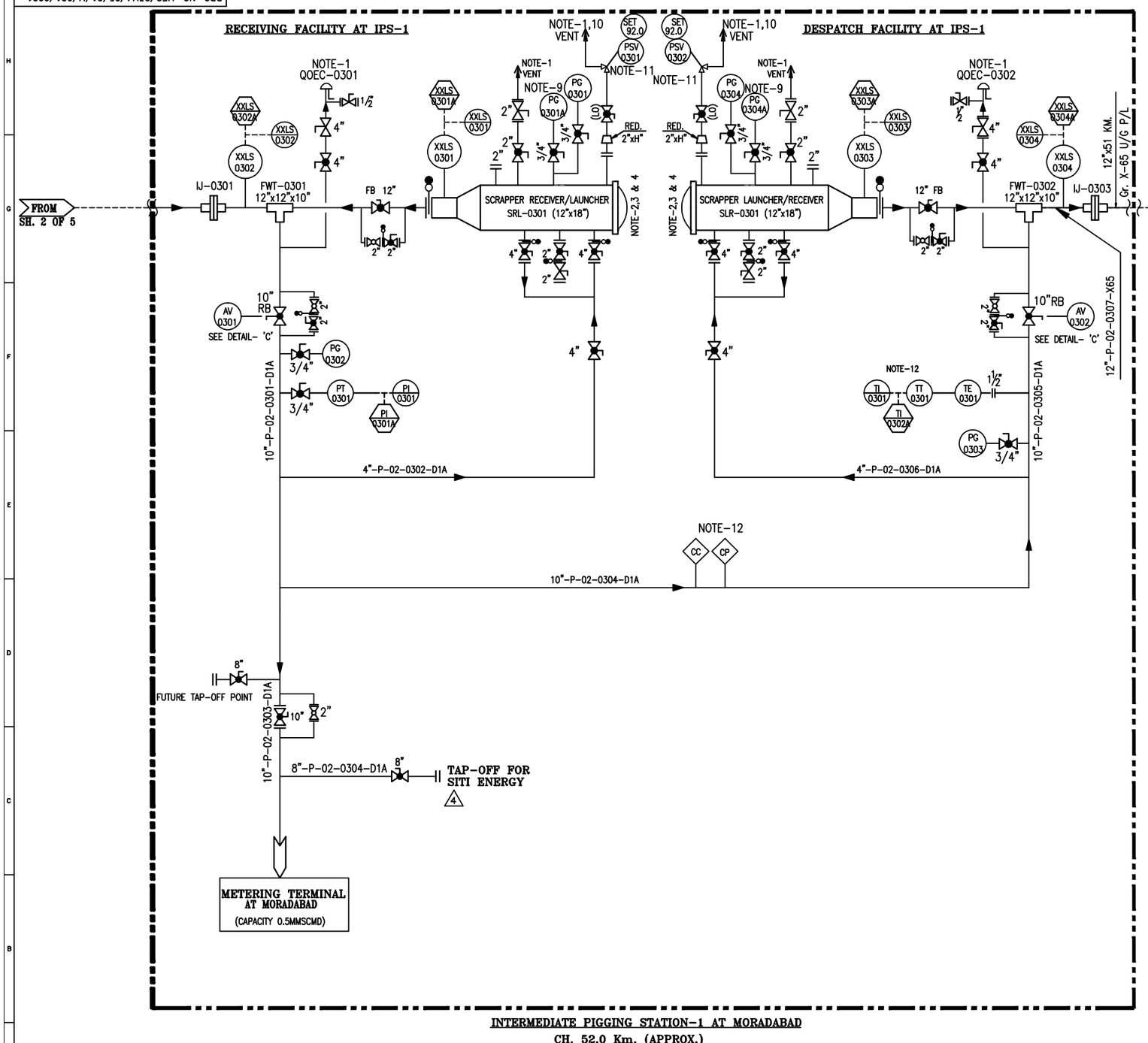
KARANPUR-MURADABAD-KASHIPUR GAS PIPELINE. PHASE-I (12"x102 KM.)

P & ID FOR DESPATCH TERMINAL AT KARANPUR CH. 0 Km.

SCALE : NTS | SHEET 2 OF 5 | REV 4

DRG. NO. MEC/23M4/05/21/M/001/0001

DRG. NO. MEC/23M4/05/21/M/001/0001



INTERMEDIATE PIGGING STATION-1 AT MORADABAD
CH. 52.0 Km. (APPROX.)

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST LEVEL.
2. SCRAPPER LAUNCHER/RECEIVER SHALL HAVE SCRAPPER HANDLING FACILITY COMPIRING OF A JIB CRANE & A TROLLY AND SHALL HAVE A QUICK OPPENING CLOSURE.
3. SCRAPPER LAUNCHER/RECEIVER SHALL BE SUITABLE FOR HANDLING INTELLIGENT PIGS.
4. DOUBLE INTERLOCK SHALL BE PROVIDED FOR PIG LAUNCHER/ RECEIVER DOOR.
5. ALL BALL VALVES 2" AND ABOVE 2" SHALL BE TRUNION MOUNTED ONLY.
6. ALL BALL VALVES 2" AND BELOW 2" SHALL BE FULL BORE ONLY.
7. ALL SV EXTENDED STEM BW, FULL BORE VALVE.
8. PROVIDE ELECTRICAL ISOLATION FOR SUPPORT AND ANY OTHER CONNECTIONS
9. PG-0301 & PG-0304 SHALL HAVE A RANGE OF 0-1 Kg/cm (g) WITH A GAUGE SAVER. (4)
10. PG-0301A & PG-0304A SHALL HAVE A RANGE OF 0-1 Kg/cm (g) WITH A GAUGE SAVER.
11. NO. OF RELIEF VALVAES AND CLASS TO BE DECIDED DURING DETAIL ENGINEERING.
12. ONLINE RETRIEVAL TYPE CORROSION MONITORING COUPON & CORROSION PROBE SHALL BE PROVIDED.

PROCESS DATA

FLUID : NATURAL GAS/RLNG

FLOW :
NORMAL : 2.5 MMSCMD
MAXIMUM : 3.0 MMSCMD (4)

PRESSURE : 66-73 Kg/Cm^2(g)

DESIGN : 92 Kg/Cm^2(g)

TEMPERATURE
WORKING : 5'-50' C
DESIGN : -29 TO 65'C

DESIGN CLASS : 600#

LINE LEGEND

EXISTING LINE
PROPOSED LINE ABOVE GROUND(A/G)
PROPOSED LINE UNDER GROUND(U/G)

12"-P-02-0301-D1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (NG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

BALL VALVE FLANGE END
BALL VALVE BW END/UPTO 1 1/2" SW END.
PLUG VALVE BW END/UPTO 1 1/2" SW END.
PLUG VALVE FLANGE END
GLOBE VALVE FLANGE END

FOR TENDER PURPOSE ONLY

GAIL (INDIA) LIMITED

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MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
4	17.07.2010		GAIL'S COMMENTS INCORPORATED	SR	BND
3	02.02.2010		GAIL'S COMMENTS INCORPORATED	SR	BND
2	24.12.09		GAIL'S COMMENTS INCORPORATED	SR	BND
1	25.11.09		GAIL'S COMMENTS INCORPORATED	SR	BND

REVISION

REFERENCES | DRG.NO.

REV / SEC | INST. | CONCURRED BY

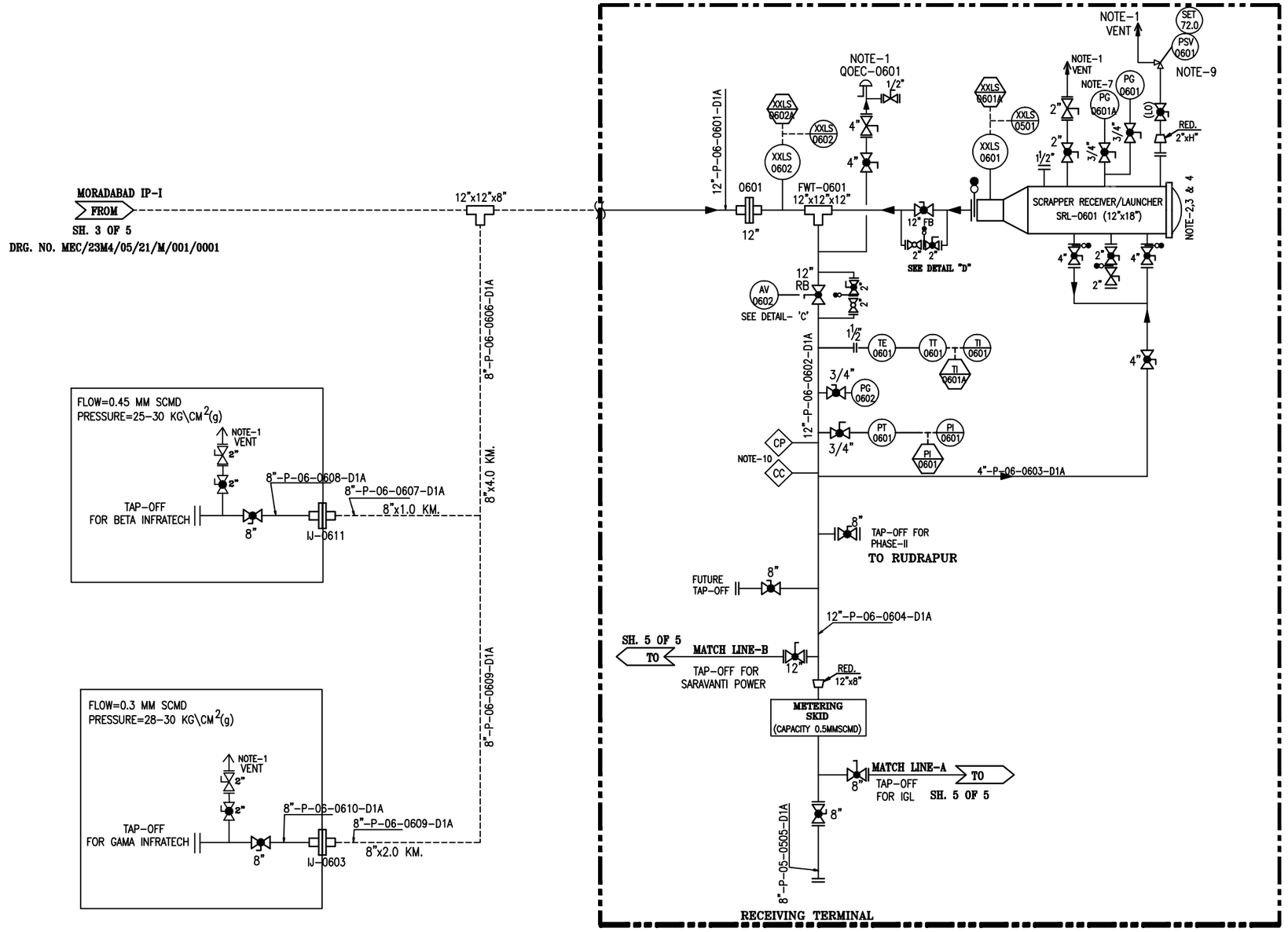
SECTION	OIL & GAS (LDP)
LOCATION	DELHI
DESIGNED	SR
DRAWN	ANKIT
CHECKED AND VERIFIED	B.N.DAS
APPROVED	SIG
DATE	07.11.2009

KARANPUR-MURADABAD-KASHIPUR GAS PIPELINE. PHASE-I (12"x102 KM.)

P & ID FOR INTERMEDIATE PIGGING STATION-1 & SECTIONALISING VALVE STATION WITH FUTURE TAP-OFF POINT AT CHAINGAGE OF 52 KM.

SCALE : NTS | SHEET | REV

DRG. NO. MEC/23M4/05/21/M/001/0001 | 3 OF 5 | 4



RECEIVING TERMINAL AT KASHIPUR IGL TAP-OFF POINT
CH. 102.0 Km.

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST LEVEL.
2. SCRAPPER LAUNCHER/RECEIVER SHALL HAVE SCRAPPER HANDLING FACILITY COMPIRING OF A JIB CRANE & A TROLLY AND SHALL HAVE A QUICK OPPENING CLOSURE.
3. SCRAPPER LAUNCHER/RECEIVER SHALL BE SUITABLE FOR HANDLING INTELLIGENT PIGS.
4. DOUBLE INTERLOCK SHALL BE PROVIDED FOR PIG LAUNCHER/ RECEIVER DOOR.
5. ALL BALL VALVES 2" AND ABOVE 2" SHALL BE TRUNION MOUNTED ONLY.
6. ALL BALL VALVES 2" AND BELOW 2" SHALL BE FULL BORE ONLY.
7. PG-0501A SHALL HAVE A RANGE OF 0-1 Kg/cm (g) WITH A GAUGE SAVER. PG-0501 WILL ALSO HAVE GAUGE SAVER. (4)
8. PROVIDE ELECTRICAL ISOLATION FOR SUPPORT AND ANY OTHER CONNECTIONS
9. NO. OF RELIEF VALVAES AND CLASS TO BE DECIDED DURING DETAIL ENGINEERING.
10. ONLINE RETRIEVAL TYPE CORROSION MONITORING COUPON & CORROSION PROBE SHALL BE PROVIDED.
11. ALL CONSUMER PRESSURES SHOWN ARE AT OUTLETS OF METERING SKIDS.
12. ALL DISTANCE SHOWN HERE ARE TENTATIVE.

PROCESS DATA

FLUID : NATURAL GAS/RLNG

FLOW :
NORMAL : 2.5 MMSCMD
MAXIMUM : 3.0 MMSCMD (4)

PRESSURE : 30-40 Kg/Cm^2(g)

DESIGN : 92 Kg/Cm^2(g)

TEMPERATURE
WORKING : 5'-50' C
DESIGN : -29 TO 65'C

DESIGN CLASS : 600#

LINE LEGEND

EXISTING LINE
PROPOSED LINE ABOVE GROUND(A/G)
PROPOSED LINE UNDER GROUND(U/G)

12"-P-06-0501-D1A
- 12" — LINE SIZE (NOMINAL)
- P — PROCESS FLUID (NG)
- 06 — UNIT NO.
- 0501 — LINE NO.
- D1A — MATERIAL SPEC.

VALVE LEGEND

BALL VALVE FLANGE END
BALL VALVE BW END/UPTO 1 1/2" SW END.
PLUG VALVE BW END/UPTO 1 1/2" SW END.
PLUG VALVE FLANGE END
GLOBE VALVE FLANGE END

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MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
4	22.06.2010		GAIL'S COMMENTS INCORPORATED	SR	BND
3	02.02.2010		GAIL'S COMMENTS INCORPORATED	SR	BND
2	24.12.09		GAIL'S COMMENTS INCORPORATED	SR	BND
1	25.11.09		GAIL'S COMMENTS INCORPORATED	SR	BND
			REVISION		

REFERENCES | DRG.NO.

SECTION	OIL & GAS (LDP)
LOCATION	DELHI
DESIGNED	SR
DRAWN	ANKIT
CHECKED AND VERIFIED	T.K. MONDAL
APPROVED	SIG
DATE	07.11.2009

KARANPUR-MURADABAD-KASHIPUR GAS PIPELINE. PHASE-I (12"x102 KM.)

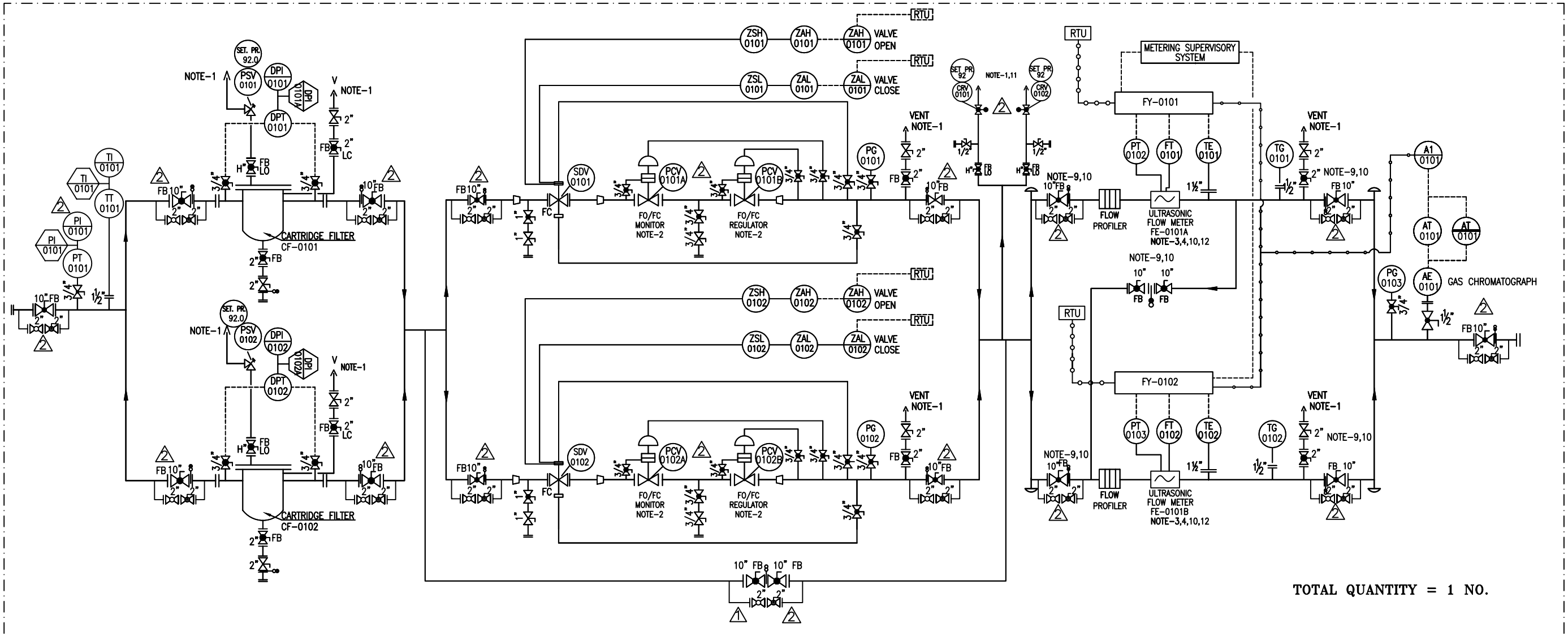
P & ID FOR RECEIVING TERMINAL AT KASHIPUR AT CHAINGAGE OF 102 KM.

SCALE : NTS | SHEET | REV

DRG. NO. MEC/23M4/05/21/M/001/0001 | 4 OF 5 | 4

REV / SEC | INST. | CONCURRED BY

DRG. NO. MEC/23M4/05/21/M/001/0002



METERING SKID

CAPACITY 2.5 MMSCMD

TOTAL QUANTITY = 1 NO.

PROCESS DATA			
FLUID	: NATURAL GAS	TEMPERATURE	
FLOW		WORKING	: 5–45°C
MINIMUM	: 0.3 MMSCMD	DESIGN	: (–)29°C–65°C
NORMAL	: 2.5 MMSCMD	DESIGN CLASS	: 600#
MAXIMUM	: 3.0 MMSCMD		
PRESSURE :			
BEFORE PCV:	66–73 KG/CM^{2}G		
AFTER PCV :	40–60 KG/CM^{2}G		
DESIGN	: 92 KG/CM^{2}G		

NOTES :–

1. ALL VENTS SHALL BE LOCATED AT A MIN. HEIGHT OF 3M ABOVE THE HIGHEST OPERATING PLATFORM OR SHALL BE AT LEAST 1.0 M ABOVE MAN HEIGHT FROM OPERATING LEVEL. ALL VENTS SHALL BE PROVIDED WITH FLAP CAPS.
2. SDV SHALL BE OF SLAM SHUT VALVE & SHALL BE CLOSED IN EVENT OF HIGH PRESSURE DISCHARGE FROM PRESSURE CONTROL VALVE. PCV SHALL BE PILOT–OPERATED TYPE.
3. FLOW MEASUREMENT SHALL BE ULTRASONIC FLOW METER TYPE WITH PANEL–MOUNTED FLOW COMPUTER.
4. METER RUNS SHALL BE IN CONFORMATION WITH AGA9 (LATEST EDITION). UPSTREAM & DOWNSTREAM PIPE LENGTHS SHALL BE PROVIDED ACCORDINGLY & TRANSPORTED LOOSE.
5. ALL BALL VALVES OF SIZES ⩾ 2" (FOR 600# RATING) & OF SIZES ⩾ 6" (FOR 300# RATING) SHALL BE OF TRUNNION MOUNTED TYPE. OTHER VALVES SHALL BE FLOATING TYPE.
6. EACH VENT LINE SHALL BE PROVIDED WITH A BALL VALVE & A PLUG VALVE.
7. MAXIMUM PRESSURE DROP ACROSS THE METERING SKID 3.0 Kg/cm2 (g).
8. MAX. VELOCITY SHALL BE 20M/S FOR ULTRASONIC FLOW METERS.
9. THESE BALL VALVES ARE TO BE SUPPLIED WITH LIMIT SWITCHES.
10. THE PIPING ARRANGEMENT INCLUDING Z CONFIGURATION TO BE APPROVED BY ULTRASONIC METER MANUFACTURER.
11. NUMBER & RATING OF PSVs, CRVs TO BE DECIDED DURING DETAILED ENGENEERING.
12. THE UMS BASED SKIDS SHALL HAVE CONFIGURATION (10D + 10D + METER + 5D). THE SIZE OF METER SHALL BE SAME AS METERING INLET BALL VALVE SIZE

LINE LEGEND

10"–P–01–0101–D1A
- D1A — MATERIAL SPEC.
- 0101 — LINE NO.
- 01 — UNIT NO.
- P — PROCESS FLUID (NG)
- 10" — LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END
- PLUG VALVE BW END/UPTO 1½" SW END
- PLUG VALVE FLANGE END
- GLOBE VALVE.
- CHECK VALVE.

FB – FULL BORE
FC – FAIL CLOSE
FO – FAIL OPEN

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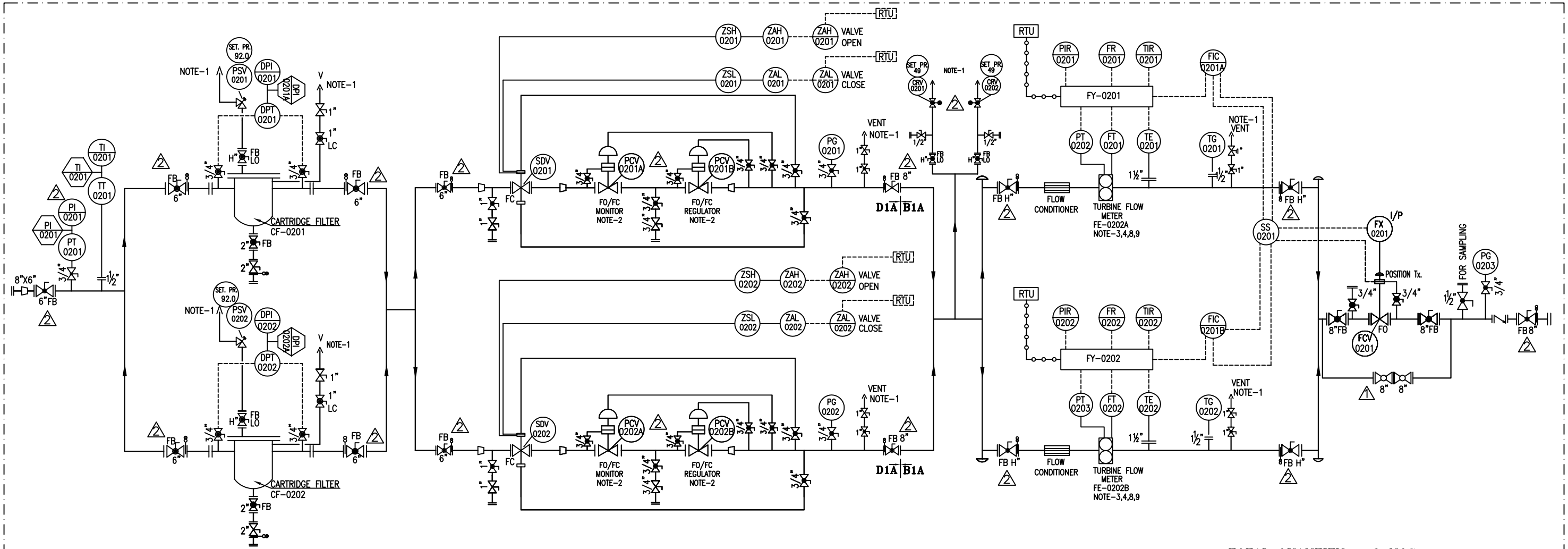
REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
2	29–01–10		AS PER M/s GAIL COMMENTS DATED 28/01/10		
1	21–01–10		PCV BY PASS LINE ADDED AS COMMENTED BY M/s GAIL		
0					
REV / SEC	INST.		CONCURRED BY		

REVISION

REFERENCES — DRG. NO.

SECTION	OIL & GAS	KAPANPUR–MORADABAD–KASHIPUR–RUDRAPUR GAS PIPELINE PHASE–I(12" X 52 KM.)
LOCATION	DELHI	
DESIGNED	SR	
DRAWN	SUNNY	P & ID FOR METERING SKID AT KARANPUR
CHECKED AND VERIFIED	T.K.M	
APPROVED	SIG (B.N.DAS)	SCALE : NTS — SHEET 1 OF 6 — REV 2
	DATE 09.01.10	DRG. NO. MEC/23M4/05/21/M/001/0002



TOTAL QUANTITY = 3 NOS.

METERING SKID
CAPACITY 0.5 MMSCMD

PROCESS DATA			
FLUID	: NATURAL GAS	TEMPERATURE	
FLOW		WORKING	: 5–45°C
MINIMUM	: 0.05 MMSCMD	DESIGN	: (–)29°C–65°C
NORMAL	: 0.5 MMSCMD	DESIGN CLASS	: 600# / 300#
MAXIMUM	: 0.6 MMSCMD		
PRESSURE	:		
BEFORE PCV:	42–54 KG/CM^{2}G		
AFTER PCV	: 18–27 KG/CM^{2}G		
DESIGN	: 92/49 KG/CM^{2}G		

NOTES :–

1. ALL VENTS SHALL BE LOCATED AT A MIN. HEIGHT OF 3M ABOVE THE HIGHEST OPERATING PLATFORM OR SHALL BE AT LEAST 1.0 M ABOVE MAN HEIGHT FROM OPERATING LEVEL. ALL VENTS SHALL BE PROVIDED WITH FLAP CAPS.
2. SDV SHALL BE OF SLAM SHUT VALVE & SHALL BE CLOSED IN EVENT OF HIGH PRESSURE DISCHARGE FROM PRESSURE CONTROL VALVE. PCV SHALL BE PILOT–OPERATED TYPE.
3. FLOW MEASUREMENT SHALL BE TURBINE METER TYPE WITH PANEL–MOUNTED FLOW COMPUTER.
4. METERING TUBE SHALL BE IN CONFORMATION WITH AGA7 LATEST EDITION. UPSTREAM & DOWN STREAM PIPE LENGTH SHALL BE MAINTAINED AS PER AGA GUIDELINES.
5. ALL BALL VALVES OF SIZES ⩾ 2" (FOR 600# RATING) & OF SIZES ⩾ 6" (FOR 300# RATING) SHALL BE OF TRUNNION MOUNTED TYPE. OTHER VALVES SHALL BE FLOATING TYPE.
6. EACH VENT LINE SHALL BE PROVIDED WITH A BALL VALVE & A PLUG VALVE.
7. NUMBER & RATING OF PSVs, CRVs TO BE DECIDED DURING DETAILED ENGENEERING.
8. THE TURBINE METER BASED SKIDS SHALL HAVE CONFIGURATION (10D + METER + 5D). THE SIZE OF METER SHALL BE SAME AS METERING INLET BALL VALVE SIZE.
9. MAX. VELOCITY SHALL BE 22 M/S FOR TURBINE FLOW METERS.

LINE LEGEND

8"–P–02–0202–D1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (NG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END
- PLUG VALVE BW END/UPTO 1½" SW END
- PLUG VALVE FLANGE END
- GLOBE VALVE.
- CHECK VALVE.

FB – FULL BORE
FC – FAIL CLOSE
FO – FAIL OPEN

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REV	DATE	ZONE	DESCRIPTION / REVISION	BY	VERIFIED
2	29–01–10		AS PER M/s GAIL COMMENTS DATED 28/01/10		
1	21–01–10		FCV ADDED AS COMMENTED BY M/s GAIL		
0	INST.		CONCURRED BY		

REFERENCES | DRG. NO.

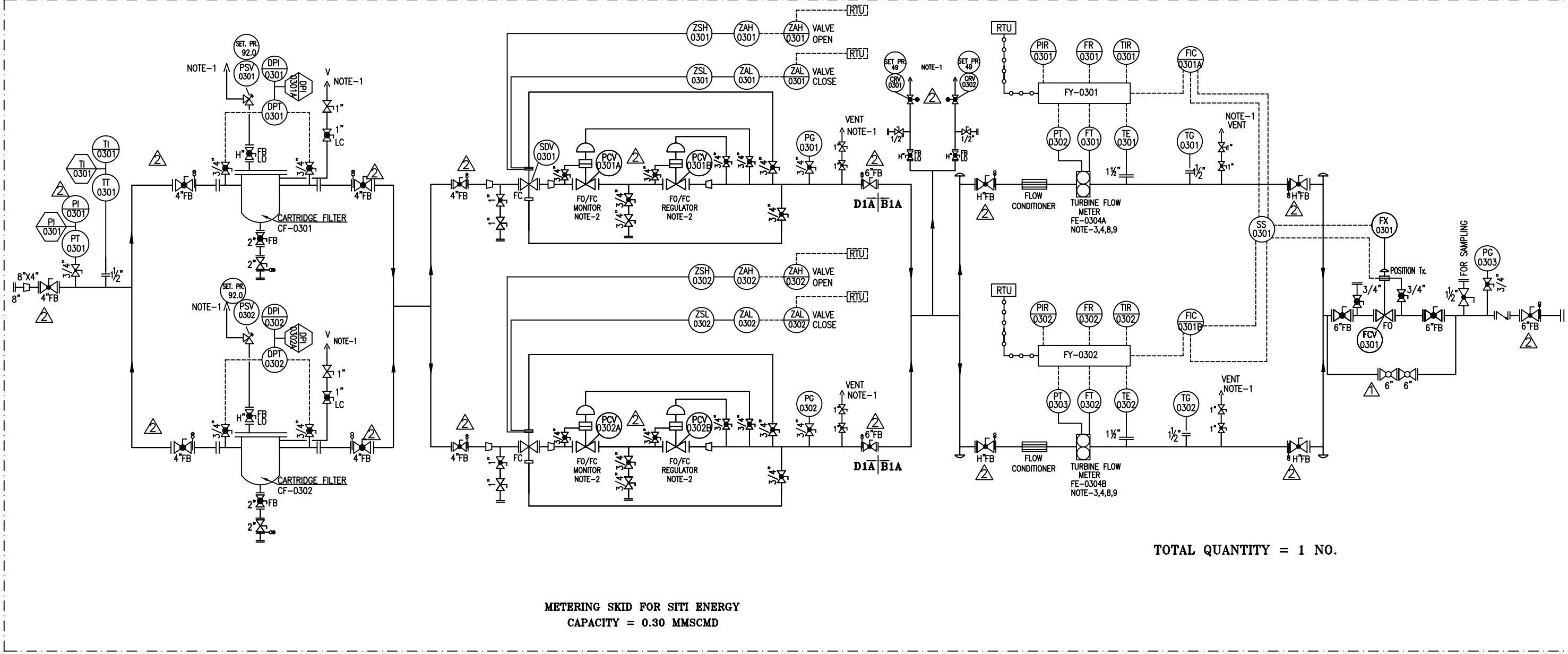
SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	SR
DRAWN	SUNNY
CHECKED AND VERIFIED	T.K.M
APPROVED	SIG (B.N.DAS)
	DATE 09.01.10

KAPANPUR–MORADABAD–KASHIPUR–RUDRAPUR GAS PIPELINE PHASE–I(12"X 52 KM.)

P & ID FOR METERING SKID MORADABAD, KASHIPUR & KASHIPUR IGL

SCALE : NTS | SHEET 2 OF 6 | REV 2

DRG. NO. MEC/23M4/05/21/M/001/0002



TOTAL QUANTITY = 1 NO.

METERING SKID FOR SITI ENERGY
CAPACITY = 0.30 MMSCMD

PROCESS DATA			
FLUID	: NATURAL GAS	TEMPERATURE	
FLOW		WORKING	: 5–45°C
MINIMUM	: 0.1 MMSCMD	DESIGN	: (–)29°C–65°C
NORMAL	: 0.3 MMSCMD	DESIGN CLASS	: 600#/300#
MAXIMUM	: 0.4 MMSCMD		
PRESSURE :			
BEFORE PCV:	44–60 KG/CM^{2}G		
AFTER PCV	: 18–27 KG/CM^{2}G		
DESIGN	: 92/49 KG/CM^{2}G		

NOTES :–

1. ALL VENTS SHALL BE LOCATED AT A MIN. HEIGHT OF 3M ABOVE THE HIGHEST OPERATING PLATFORM OR SHALL BE AT LEAST 1.0 M ABOVE MAN HEIGHT FROM OPERATING LEVEL. ALL VENTS SHALL BE PROVIDED WITH FLAP CAPS.
2. SDV SHALL BE OF SLAM SHUT VALVE & SHALL BE CLOSED IN EVENT OF HIGH PRESSURE DISCHARGE FROM PRESSURE CONTROL VALVE. PCV SHALL BE PILOT–OPERATED TYPE.
3. FLOW MEASUREMENT SHALL BE TURBINE METER TYPE WITH PANEL MOUNTED FLOW COMPUTER.
4. METERING TUBE SHALL BE IN CONFORMATION WITH AGA7 LATEST EDITION. UPSTREAM & DOWNSTREAM PIPE LENGTH SHALL BE MAINTAINED AS PER AGA GUIDELINES.
5. ALL BALL VALVES OF SIZES ⩾ 2" (FOR 600# RATING) & OF SIZES ⩾ 6" (FOR 300# RATING) SHALL BE OF TRUNNION MOUNTED TYPE. OTHER VALVES SHALL BE FLOATING TYPE.
6. EACH VENT LINE SHALL BE PROVIDED WITH A BALL VALVE & A PLUG VALVE.
7. NUMBER & RATING OF PSVs, CRVs TO BE DECIDED DURING DETAILED ENGENEERING.
8. THE TURBINE METER BASED SKIDS SHALL HAVE CONFIGURATION (10D + METER + 5D). THE SIZE OF METER SHALL BE SAME AS METERING INLET BALL VALVE SIZE.
9. MAX. VELOCITY SHALL BE 22 M/S FOR TURBINE FLOW METERS.

LINE LEGEND

4"–P–04–0301–D1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (NG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END
- PLUG VALVE BW END/UPTO 1½" SW END
- PLUG VALVE FLANGE END
- GLOBE VALVE.
- CHECK VALVE.

FB – FULL BORE
FC – FAIL CLOSE
FO – FAIL OPEN

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REV	REV. NO.	DATE	ZONE	DESCRIPTION / REVISION	BY	VERIFIED
0	⚠	29–01–10		AS PER M/s GAIL COMMENTS DATED 28/01/10		
	⚠	21–01–10		FCV ADDED AS COMMENTED BY M/s GAIL		

REFERENCES | DRG. NO.

REV / SEC	INST.	CONCURRED BY
0		

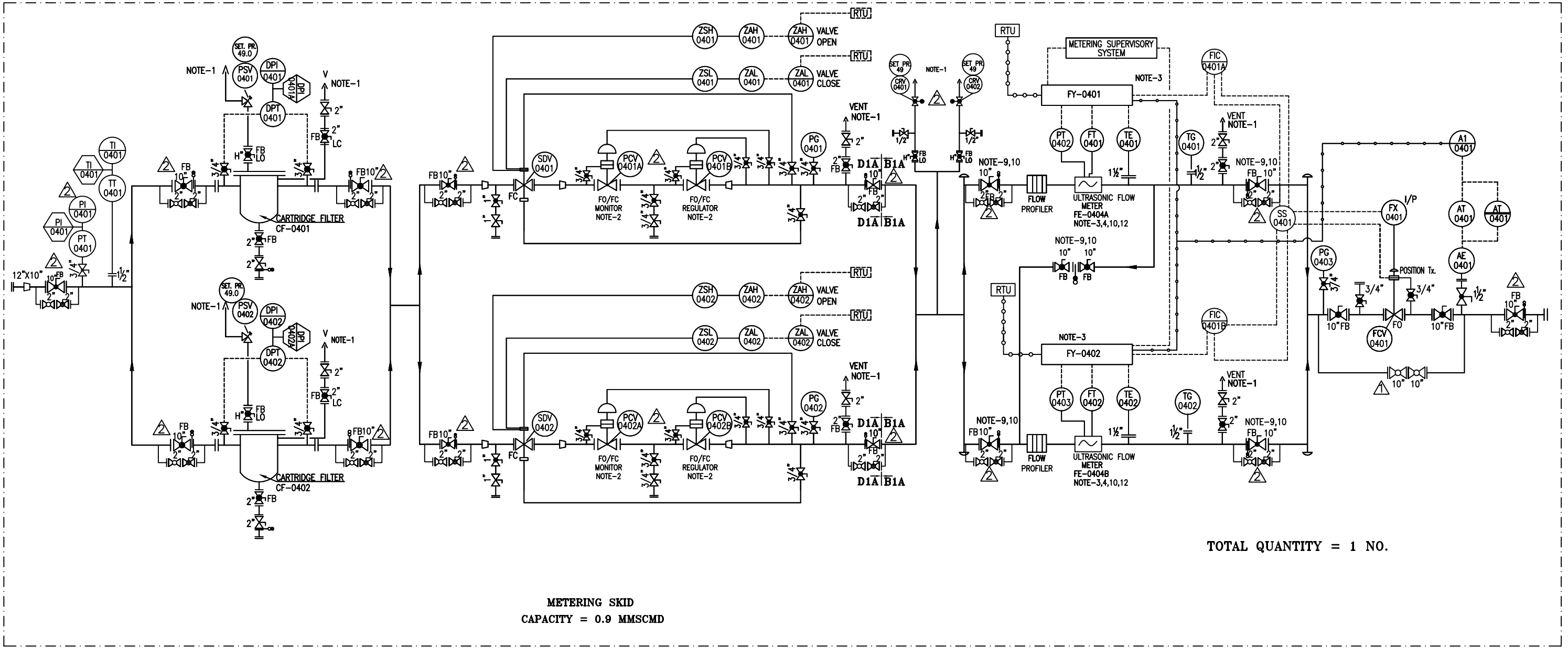
SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	SR
DRAWN	SUNNY
CHECKED AND VERIFIED	T.K.M
APPROVED	SIG (B.N.DAS)
	DATE 09.01.10

KAPANPUR–MORADABAD–KASHIPUR–RUDRAPUR GAS PIPELINE PHASE–II(8" 54 KM.)

P & ID FOR METERING SKID FOR SITI ENERGY AT MORADABAD

SCALE : NTS | SHEET 3 OF 6 | REV 2

DRG. NO. MEC/23M4/05/21/M/001/0002



TOTAL QUANTITY = 1 NO.

METERING SKID
CAPACITY = 0.9 MMSCMD

PROCESS DATA

FLUID	: NATURAL GAS	TEMPERATURE	
FLOW		WORKING	: 5–45°C
NORMAL	: 0.9 MMSCMD	DESIGN	: (–)29°C–65°C
MAXIMUM	: 1.0 MMSCMD	DESIGN CLASS	: 600#/300#
PRESSURE :			
BEFORE PCV:	23–60 KG/CM^{2}G		
OUTLET OF SKID:	19–30 KG/CM^{2}G		
DESIGN	: 92/49 KG/CM^{2}G		

NOTES :–

1. ALL VENTS SHALL BE LOCATED AT A MIN. HEIGHT OF 3M ABOVE THE HIGHEST OPERATING PLATFORM OR SHALL BE AT LEAST 1.0 M ABOVE MAN HEIGHT FROM OPERATING LEVEL. ALL VENTS SHALL BE PROVIDED WITH FLAP CAPS.
2. SDV SHALL BE OF SLAM SHUT VALVE & SHALL BE CLOSED IN EVENT OF HIGH PRESSURE DISCHARGE FROM PRESSURE CONTROL VALVE. PCV SHALL BE PILOT–OPERATED TYPE.
3. FLOW MEASUREMENT SHALL BE ULTRASONIC FLOW METER TYPE WITH PANEL–MOUNTED FLOW COMPUTER.
4. METER RUNS SHALL BE IN CONFORMATION WITH AGA9 (LATEST EDITION). UPSTREAM & DOWNSTREAM PIPE LENGTHS SHALL BE PROVIDED ACCORDINGLY & TRANSPORTED LOOSE.
5. ALL BALL VALVES OF SIZES ⩾ 2" (FOR 600# RATING) & OF SIZES ⩾ 6" (FOR 300# RATING) SHALL BE OF TRUNNION MOUNTED TYPE. OTHER VALVES SHALL BE FLOATING TYPE.
6. EACH VENT LINE SHALL BE PROVIDED WITH A BALL VALVE & A PLUG VALVE.
7. MAXIMUM PRESSURE DROP ACROSS THE METERING SKID 3.0 Kg/cm2 (g).
8. MAX. VELOCITY SHALL BE 20M/S FOR ULTRASONIC FLOW METERS.
9. THESE BALL VALVES ARE TO BE SUPPLIED WITH LIMIT SWITCHES.
10. THE PIPING ARRANGEMENT INCLUDING Z CONFIGURATION TO BE APPROVED BY ULTRASONIC METER MANUFACTURER.
11. NUMBER & RATING OF PSVs, CRVs TO BE DECIDED DURING DETAILED ENGENEERING.
12. THE UMS BASED SKIDS SHALL HAVE CONFIGURATION (10D + 10D + METER + 5D). THE SIZE OF METER SHALL BE SAME AS METERING INLET BALL VALVE SIZE.

LINE LEGEND

10"–P–04–0404–B1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (NG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END
- PLUG VALVE BW END/UPTO 1½" SW END
- PLUG VALVE FLANGE END
- GLOBE VALVE.
- CHECK VALVE.

FB – FULL BORE
FC – FAIL CLOSE
FO – FAIL OPEN

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MECON LIMITED

REV. NO.	DATE	ZONE	DESCRIPTION	BY	VERIFIED
			REVISION		
2	29–01–10		AS PER M/s GAIL COMMENTS DATED 28/01/10		
1	21–01–10		FCV ADDED AS COMMENTED BY M/s GAIL		
0					

REFERENCES | DRG. NO.

REV / SEC	INST.	CONCURRED BY
0		

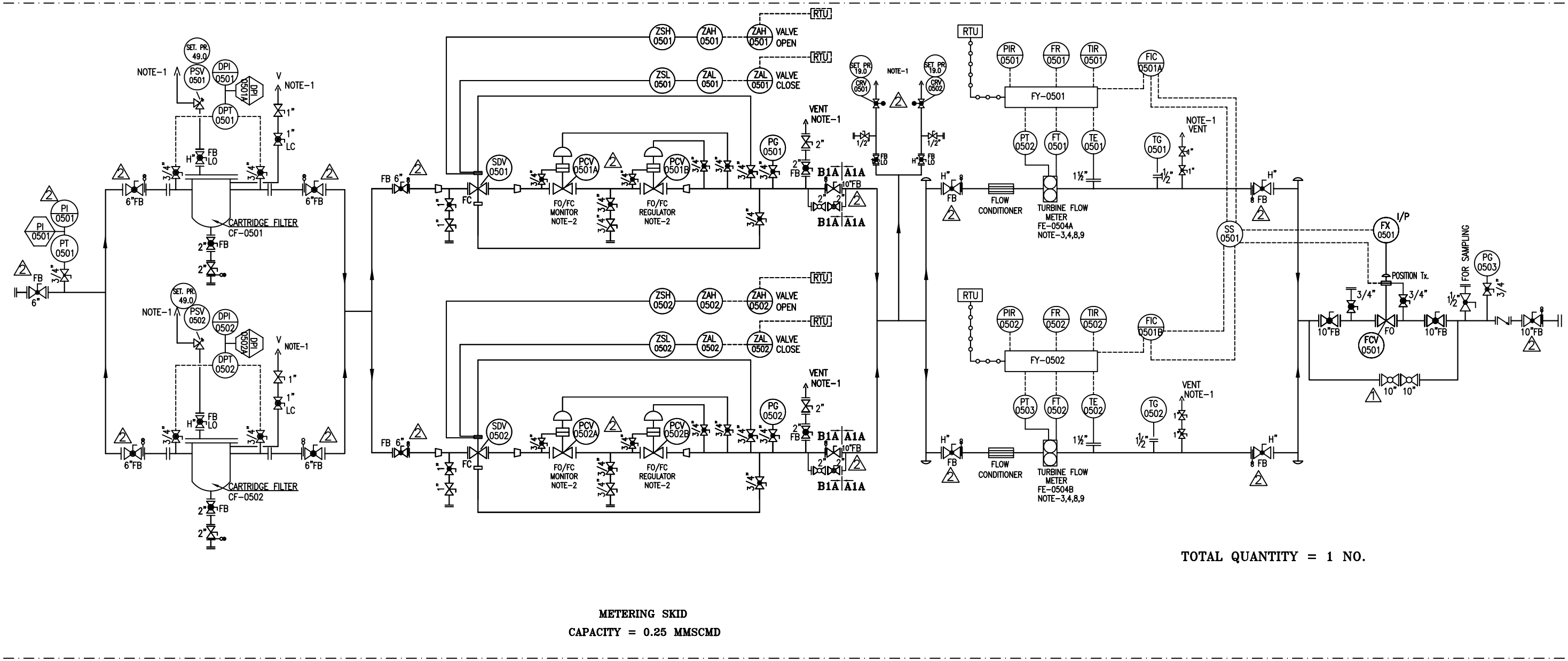
SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	SR
DRAWN	SUNNY
CHECKED AND VERIFIED	T.K.M
APPROVED	SIG (B.N.DAS)
	DATE 09.01.10

KAPANPUR–MORADABAD–KASHIPUR–RUDRAPUR GAS PIPELINE PHASE–I(12"X" 52 KM.)

P & ID FOR METERING SKID FOR SRAVANTHI ENERGY AT KASHIPUR.

SCALE : NTS | SHEET 4 OF 6 | REV 2

DRG. NO. MEC/23M4/05/21/M/001/0002



TOTAL QUANTITY = 1 NO.

METERING SKID
CAPACITY = 0.25 MMSCMD

PROCESS DATA			
FLUID	: NATURAL GAS	TEMPERATURE	
FLOW		WORKING	: 5–45°C
NORMAL	: 0.25 MMSCMD	DESIGN	: (–)29°C–65°C
PRESSURE :		DESIGN CLASS	: 300#/150#
BEFORE PCV:	18–27 KG/CM^{2}G		
AFTER PCV :	3–5 KG/CM^{2}G		
DESIGN	: 49/19 KG/CM^{2}G		

NOTES :–

1. ALL VENTS SHALL BE LOCATED AT A MIN. HEIGHT OF 3M ABOVE THE HIGHEST OPERATING PLATFORM OR SHALL BE AT LEAST 1.0 M ABOVE MAN HEIGHT FROM OPERATING LEVEL. ALL VENTS SHALL BE PROVIDED WITH FLAP CAPS.
2. SDV SHALL BE OF SLAM SHUT VALVE & SHALL BE CLOSED IN EVENT OF HIGH PRESSURE DISCHARGE FROM PRESSURE CONTROL VALVE. PCV SHALL BE PILOT–OPERATED TYPE.
3. FLOW MEASUREMENT SHALL BE TURBINE METER TYPE WITH SOLAR–PANEL BASED FIELD–MOUNTED FLOW COMPUTER WITH GSM.
4. METERING TUBE SHALL BE IN CONFORMATION WITH AGA7 LATEST EDITION. UPSTREAM & DOWN STREAM PIPE LENGTH SHALL BE MAINTAINED AS PER AGA GUIDELINES.
5. ALL BALL VALVES OF SIZES ⩾ 6" (FOR 300# RATING) & OF SIZES ⩾ 10" (FOR 150# RATING) SHALL BE OF TRUNNION MOUNTED TYPE. OTHER VALVES SHALL BE FLOATING TYPE.
6. EACH VENT LINE SHALL BE PROVIDED WITH A BALL VALVE & A PLUG VALVE.
7. NUMBER & RATING OF PSVs, CRVs TO BE DECIDED DURING DETAILED ENGENEERING.
8. THE TURBINE METER BASED SKIDS SHALL HAVE CONFIGURATION (10D + METER + 5D). THE SIZE OF METER SHALL BE SAME AS METERING INLET BALL VALVE SIZE.
9. MAX. VELOCITY SHALL BE 22 M/S FOR TURBINE FLOW METERS.

LINE LEGEND

6"–P–04–0504–B1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (NG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END
- PLUG VALVE BW END/UPTO 1½" SW END
- PLUG VALVE FLANGE END
- GLOBE VALVE.
- CHECK VALVE.

FB – FULL BORE
FC – FAIL CLOSE
FO – FAIL OPEN

FOR TENDER PURPOSE ONLY

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
0					
1	29–01–10		AS PER M/s GAIL COMMENTS DATED 28/01/10		
2	21–01–10		FCV ADDED AS COMMENTED BY M/s GAIL		

REVISION

REFERENCES — DRG. NO.

REV / SEC | INST. | CONCURRED BY

GAIL (INDIA) LIMITED
मेकॉन लिमिटेड
MECON LIMITED

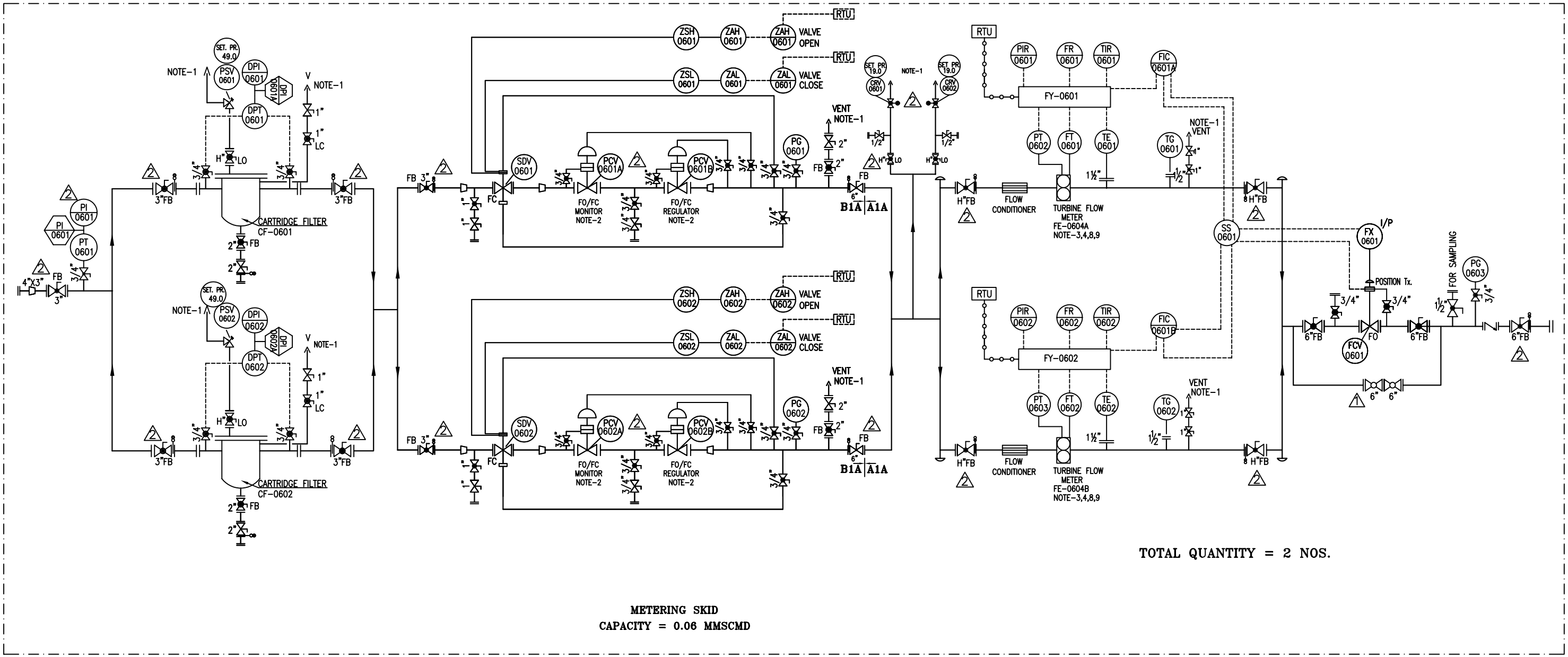
SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	SR
DRAWN	SUNNY
CHECKED AND VERIFIED	T.K.M
APPROVED	SIG (B.N.DAS)
	DATE 09.01.10

KAPANPUR–MORADABAD–KASHIPUR–RUDRAPUR GAS PIPELINE PHASE–I(12"X52 KM.)

P & ID FOR METERING SKID FOR INDIAN GLYCOL AT KASHIPUR.

SCALE : NTS | SHEET 5 OF 6 | REV 2

DRG. NO. MEC/23M4/05/21/M/001/0002



TOTAL QUANTITY = 2 NOS.

METERING SKID
CAPACITY = 0.06 MMSCMD

PROCESS DATA

FLUID	: NATURAL GAS	TEMPERATURE	
FLOW		WORKING	: 5–45°C
MINIMUM	: 0.01 MMSCMD	DESIGN	: (–)29°C–65°C
NORMAL	: 0.06 MMSCMD	DESIGN CLASS	: 300#/150#
PRESSURE :			
BEFORE PCV:	18–27 KG/CM^{2}G		
AFTER PCV :	3–5 KG/CM^{2}G		
DESIGN	: 49/19 KG/CM^{2}G		

NOTES :–

1. ALL VENTS SHALL BE LOCATED AT A MIN. HEIGHT OF 3M ABOVE THE HIGHEST OPERATING PLATFORM OR SHALL BE AT LEAST 1.0 M ABOVE MAN HEIGHT FROM OPERATING LEVEL. ALL VENTS SHALL BE PROVIDED WITH FLAP CAPS.
2. SDV SHALL BE OF SLAM SHUT VALVE & SHALL BE CLOSED IN EVENT OF HIGH PRESSURE DISCHARGE FROM PRESSURE CONTROL VALVE. PCV SHALL BE PILOT–OPERATED TYPE.
3. FLOW MEASUREMENT SHALL BE TURBINE METER TYPE WITH SOLAR–PANEL BASED FIELD–MOUNTED FLOW COMPUTER WITH GSM.
4. METERING TUBE SHALL BE IN CONFORMATION WITH AGA7 LATEST EDITION. UPSTREAM & DOWN STREAM PIPE LENGTH SHALL BE MAINTAINED AS PER AGA GUIDELINES.
5. ALL BALL VALVES OF SIZES ⩾ 6" (FOR 300# RATING) & OF SIZES ⩾ 4" (FOR 150# RATING) SHALL BE OF TRUNNION MOUNTED TYPE. OTHER VALVES SHALL BE FLOATING TYPE.
6. EACH VENT LINE SHALL BE PROVIDED WITH A BALL VALVE & A PLUG VALVE.
7. NUMBER & RATING OF PSVs, CRVs TO BE DECIDED DURING DETAILED ENGENEERING.
8. THE TURBINE METER BASED SKIDS SHALL HAVE CONFIGURATION (10D + METER + 5D). THE SIZE OF METER SHALL BE SAME AS METERING INLET BALL VALVE SIZE.
9. MAX. VELOCITY SHALL BE 22 M/S FOR TURBINE FLOW METERS.

LINE LEGEND

4"–P–04–0604–B1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (NG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END
- PLUG VALVE BW END/UPTO 1½" SW END
- PLUG VALVE FLANGE END
- GLOBE VALVE.
- CHECK VALVE.

FB – FULL BORE
FC – FAIL CLOSE
FO – FAIL OPEN

FOR TENDER PURPOSE ONLY

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MECON LIMITED

REV	INST.	CONCURRED BY
0		

REV. NO.	DATE	ZONE	DESCRIPTION / REVISION	BY	VERIFIED
2	29–01–10		AS PER M/s GAIL COMMENTS DATED 28/01/10		
1	21–01–10		FCV ADDED AS COMMENTED BY M/s GAIL		

REFERENCES | DRG. NO.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	SR
DRAWN	SUNNY
CHECKED AND VERIFIED	T.K.M
APPROVED	SIG (B.N.DAS)
	DATE 09.01.10

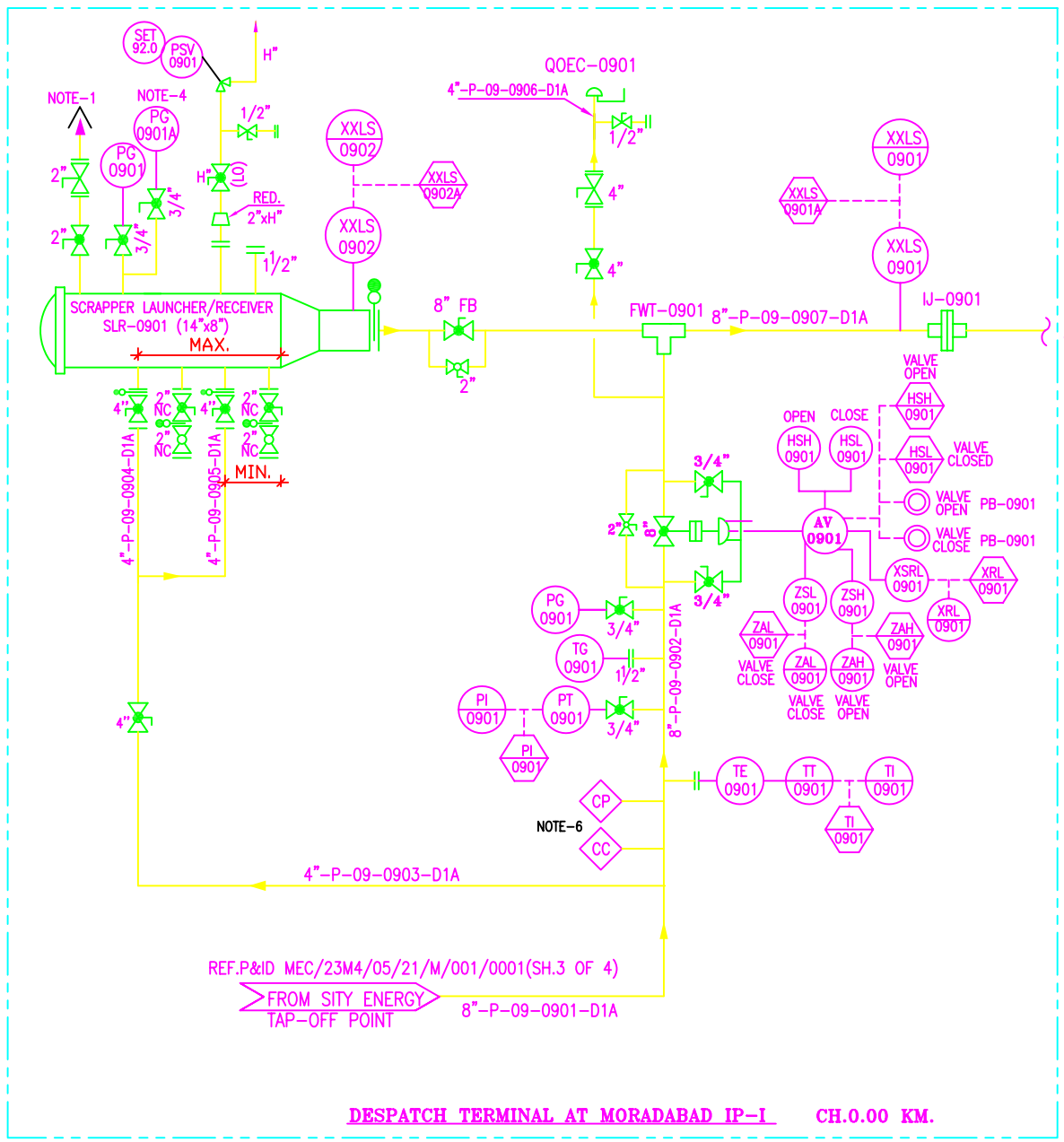
KAPANPUR–MORADABAD–KASHIPUR–RUDRAPUR GAS PIPELINE PHASE–I(12"X 52 KM.)

P & ID FOR METERING SKID FOR PASHUPATHI ACRYLON & SURYA ROSHINI

SCALE : NTS | SHEET 6 OF 6 | REV 2

DRG. NO. MEC/23M4/05/21/M/001/0002

DRG. NO. MEC/23M4/05/21/M/001/0002



NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST LEVEL.
2. PROVISION SHALL BE KEPT TO HOOK UP INLET & OUTLET PR. & TEMP., FLOW PERAMETERS, STATUS OF GAS ACTUATED VALVES, WITH SCADA. SCADA & TELEMETRY SCHEME SHALL BE PROVIDED BY GAIL.
3. ALL VENTS SHALL BE CONNECTED WITH EXISTING VENT SYSTEM. IF AVAILABLE.
4. PG-0901A SHALL HAVE A RANGE OF 0-1 Kg/cm (g) WITH A GAUGE SAVER.
5. SCRAPPER TRAP SHALL HAVE FEATURE FOR WORKING AS LAUNCHER AS WELL AS RECEIVER i.e., BI-DIRECTOR AND IT SHALL BE SUITABLE.
6. ONLINE RETRIEVAL TYPE CORROSION MONITORING COUPON & CORROSION PROBE SHALL BE PROVIDED.
7. ALL SV EXTENDED STEM BW, FULL BORE VALVE.

PROCESS DATA

FLUID	:	NATURAL GAS	
FLOW			
MINIMUM	:	0.1 MMSCMD	
NORMAL	:	1.1 MMSCMD	
MAXIMUM	:	1.2 MMSCMD	
PRESSURE			
WORKING	:	52-62 KG/CM^{2}G	TEMPERATURE
DESIGN	:	92 KG/CM^{2}G	WORKING : 5-45° C
			DESIGN : (-)29°C-65° C
			DESIGN CLASS : 600#

NOTE: FLOW :NORMAL-1.92 & MAXIMUM-2.56 MMSCMD AT 73.5 KG/CM2(g) AT KARANPUR TAP-OFF POINT.

LINE LEGEND

8"-P-09-0901-D1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (NG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

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

GAIL (INDIA) LIMITED

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MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
△					
REV.NO			REVISION		

REFERENCES | DRG.NO.

SECTION	OIL & GAS (PROCESS)
LOCATION	DELHI
DESIGNED	SR
DRAWN	SUNNY
CHECKED AND VERIFIED	B.N.DAS
APPROVED	SIG (B.N.DASI)
	DATE 23.06.2010

KARANPUR-MORADABAD-KASHIPUR-RUDRAPUR NATURAL GAS PIPELINE PHASE-I

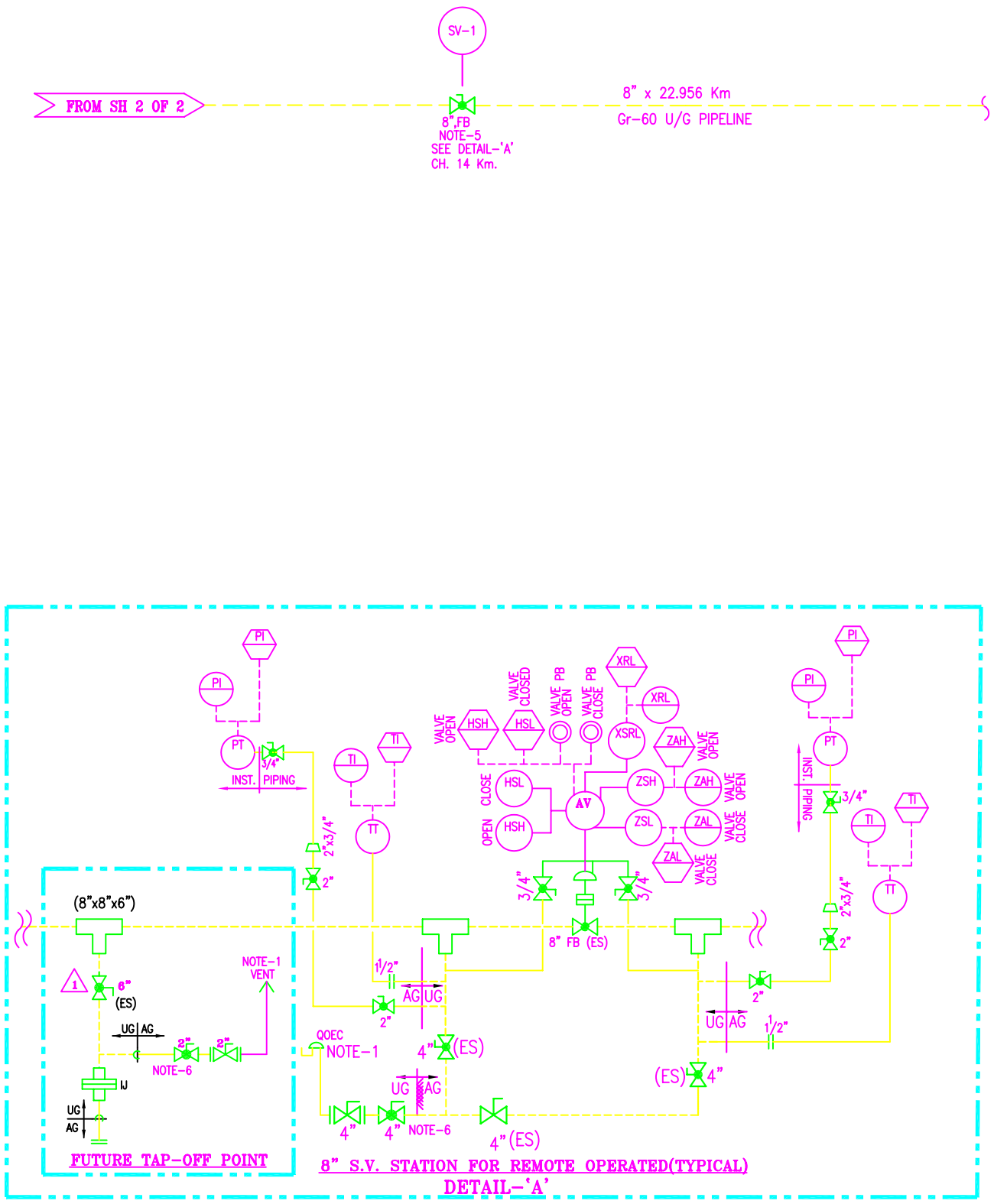
P & ID FOR DESPATCH TERMINAL AT MORADABAD

SCALE : NTS | SHEET | REV

DRG. NO. MEC/23M4/05/21/M/001/0002 | 1 OF 2 | 0

REV / SEC | INST. | CONCURRED BY

DRG. NO. MEC/23M4/05/21/M/001/0002



RECEIVING TERMINAL AT SITI ENERGY MORADABAD CH.22.956KM.

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST LEVEL.
2. PROVISION SHALL BE KEPT TO HOOK UP INLET & OUTLET PR. & TEMP., FLOW PERAMETERS, STATUS OF GAS ACTUATED VALVES, WITH SCADA. SCADA & TELEMETRY SCHEME SHALL BE PROVIDED BY GAIL.
3. PG-1001A SHALL HAVE A RANGE OF 0-1 Kg/cm^2(g) WITH A GAUGE SAVER.
4. ONLINE RETRIEVAL TYPE CORROSION MONITORING COUPON & CORROSION PROBE SHALL BE PROVIDED.
5. ALL SV EXTENDED STEM BW, FULL BORE VALVE.
6. PROVIDE ELECTRICAL ISOLATION FOR SUPPORT AND ANY OTHER CONNECTIONS

PROCESS DATA

FLUID	:	NATURAL GAS
FLOW		
MINIMUM	:	0.1 MMSCMD
NORMAL	:	1.1 MMSCMD
MAXIMUM	:	1.2 MMSCMD
PRESSURE		
WORKING	:	30-45 KG/CM^{2}G
DESIGN	:	92 KG/CM^{2}G

TEMPERATURE		
WORKING	:	5-45° C
DESIGN	:	(-)29°C-65° C
DESIGN CLASS	:	600#

NOTE: FLOW :NORMAL-1.92 & MAXIMUM-2.56 MMSCMD AT 73.5 KG/CM2(g) AT KARANPUR TAP-OFF POINT.

LINE LEGEND

8"-P-10-1001-D1A
- D1A — MATERIAL SPEC.
- 1001 — LINE NO.
- 10 — UNIT NO.
- P — PROCESS FLUID (NG)
- 8" — LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

GAIL (INDIA) LIMITED

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MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
1	26.07.09		GAIL'S COMMENTS INCORPORATED	SR	BND
REV.NO			REVISION		

REFERENCES DRG.NO.

SECTION	OIL & GAS (PROCESS)
LOCATION	DELHI
DESIGNED	SR
DRAWN	SUNNY
CHECKED AND VERIFIED	B.N.DAS
APPROVED	SIG (B.N.DAS)
DATE	23.06.2010

KARANPUR-MORADABAD-KASHIPUR-RUDRAPUR NATURAL GAS PIPELINE PHASE-I

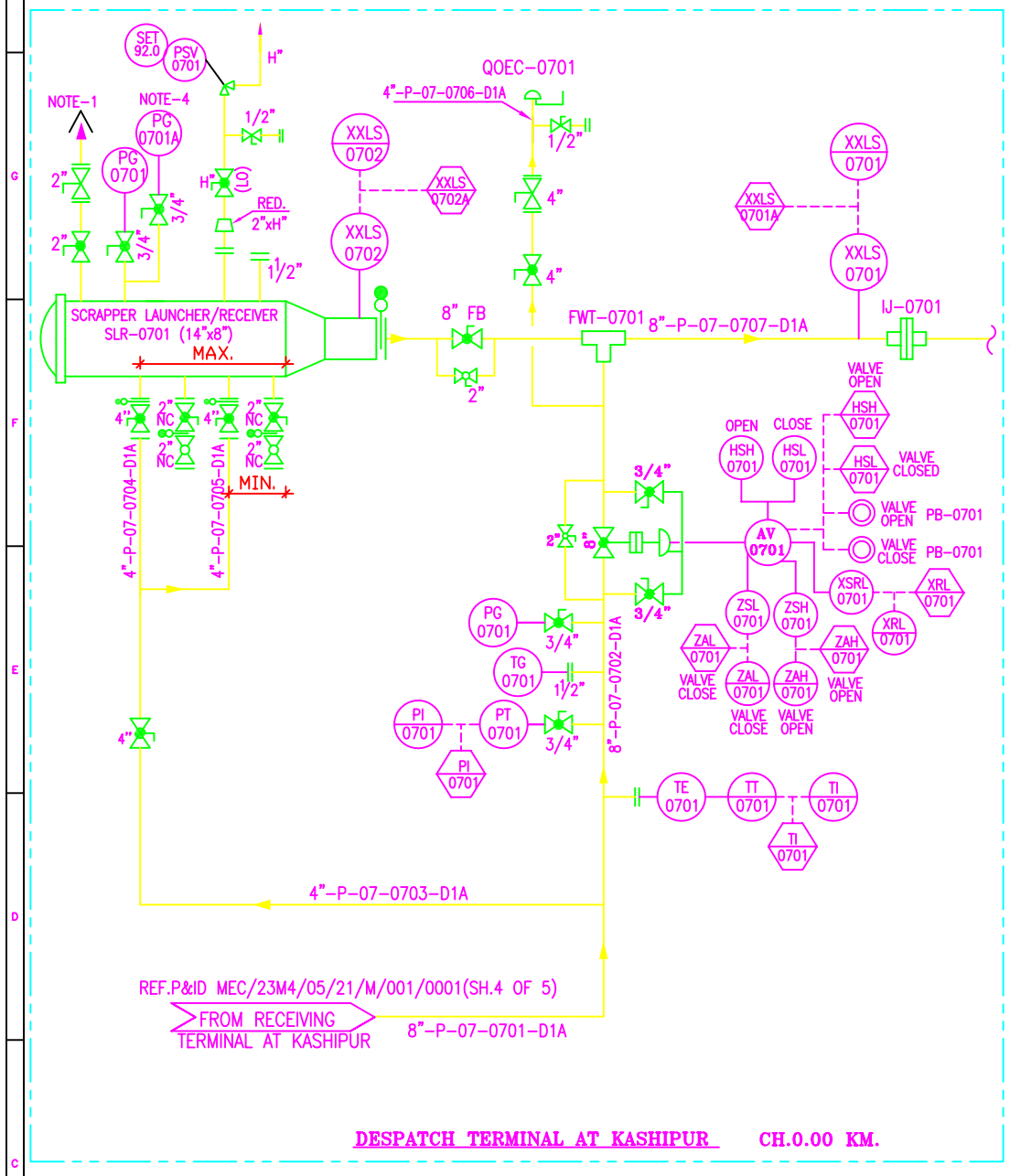
P & ID FOR RECEIVING TERMINAL AT SITI ENERGY, MORADABAD

SCALE : NTS | SHEET 2 of 2 | REV 1

DRG. NO. MEC/23M4/05/21/M/001/0002

REV / SEC: INST. — CONCURRED BY

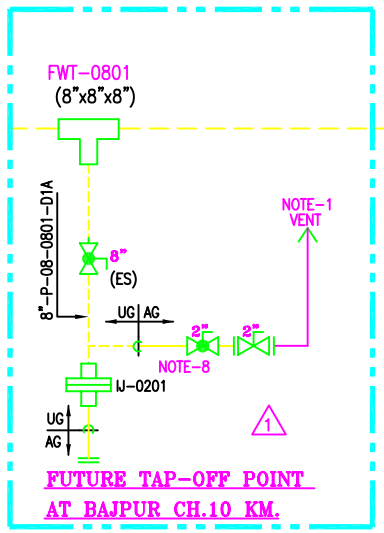
DRG. NO. MEC/23M8/05/21/M/001/0001



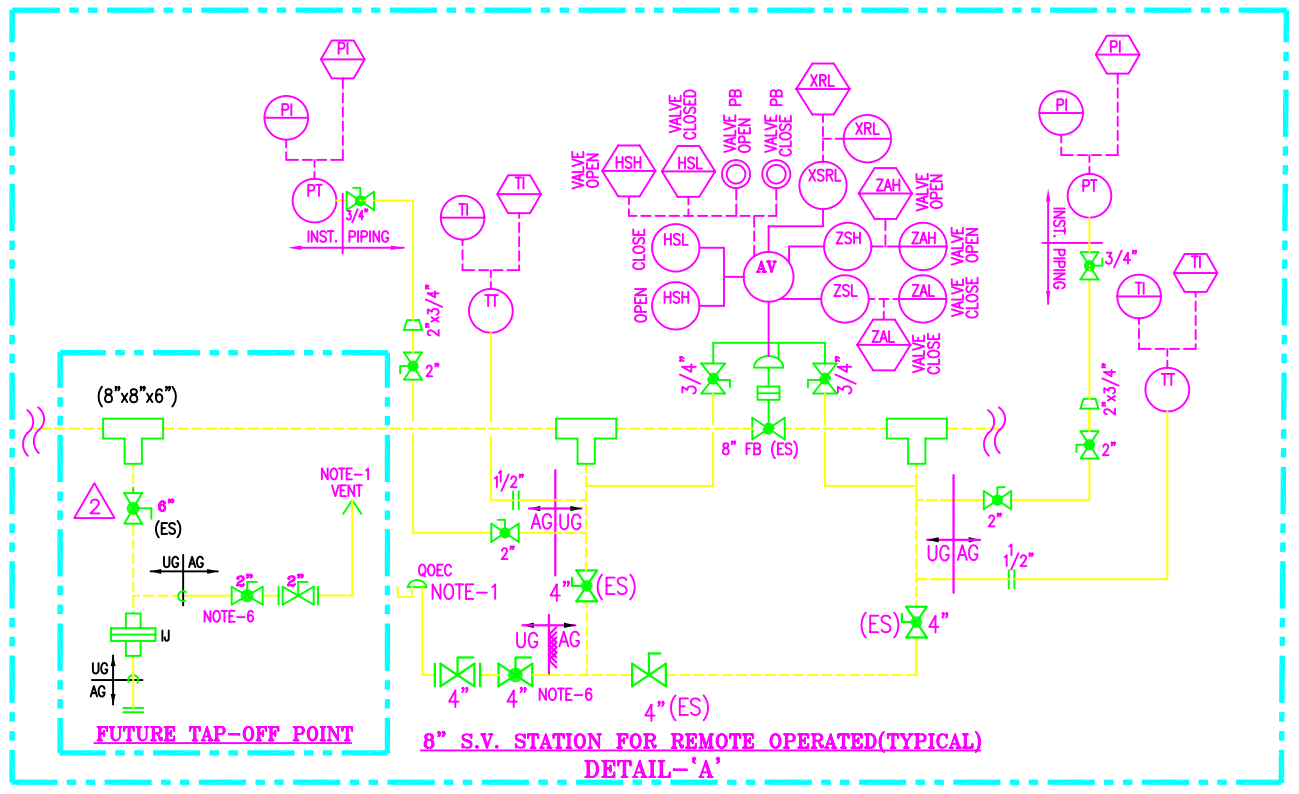
DESPATCH TERMINAL AT KASHIPUR CH.0.00 KM.

8" X 46.23 Km
Gr-60 U/G PIPELINE

SV-1
8",FB
NOTE-5
SEE DETAIL-'A'
DOWN STREAM
OF KOSI RIVER
CH.(Around 6-8 km.)



TO SH 2 OF 2



NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST LEVEL.
2. PROVISION SHALL BE KEPT TO HOOK UP INLET & OUTLET PR. & TEMP., FLOW PERAMETERS, STATUS OF GAS ACTUATED VALVES, WITH SCADA. SCADA & TELEMETRY SCHEME SHALL BE PROVIDED BY GAIL.
3. ALL VENTS SHALL BE CONNECTED WITH EXISTING VENT SYSTEM. IF AVAILABLE.
4. PG-0701A SHALL HAVE A RANGE OF 0-1 Kg/cm^2(g) WITH A GAUGE SAVER.
5. SCRAPPER TRAP SHALL HAVE FEATURE FOR WORKING AS LAUNCHER AS WELL AS RECEIVER i.e., BI-DIRECTOR AND IT SHALL BE SUITABLE.

PROCESS DATA

FLUID	:	NATURAL GAS
FLOW		
MINIMUM	:	0.1 MMSCMD
NORMAL	:	0.21 MMSCMD
MAXIMUM	:	0.38 MMSCMD
PRESSURE		
WORKING	:	38-56 KG/CM^{2}G
DESIGN	:	92 KG/CM^{2}G

TEMPERATURE		
WORKING	:	5-45° C
DESIGN	:	(-)29°C-65° C
DESIGN CLASS	:	600#

NOTE: FLOW :NORMAL-1.92 & MAXIMUM-2.56 MMSCMD AT 73.5 KG/CM2(g) AT KARANPUR TAP-OFF POINT.

LINE LEGEND

8"-P-07-0701-D1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (NG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

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

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MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
2	26.07.09		GAIL'S COMMENTS INCORPORATED	SR	BND
1	19.07.09		GAIL'S COMMENTS INCORPORATED	SR	BND

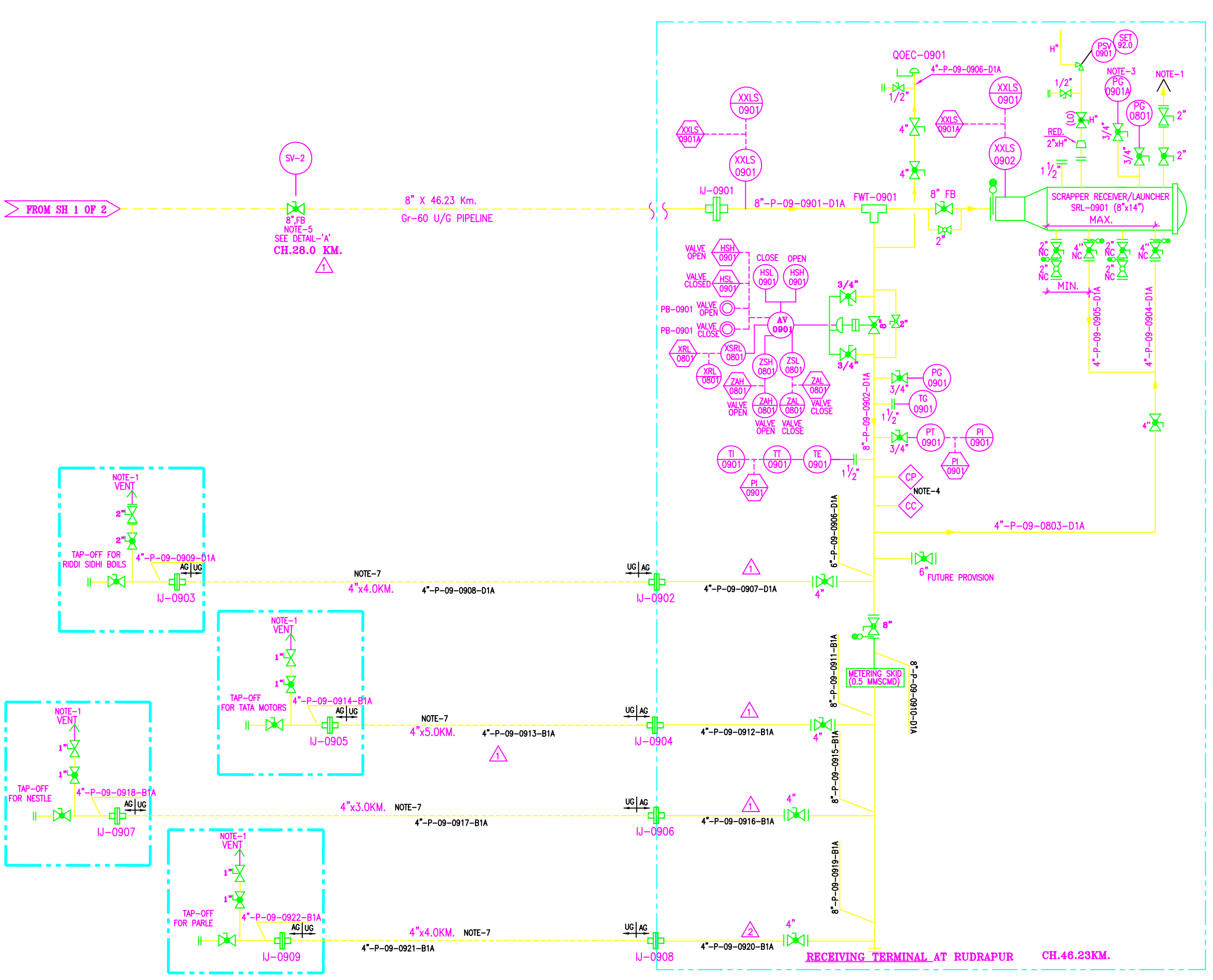
REVISION

REFERENCES | DRG.NO.

SECTION	OIL & GAS (PROCESS)	KARANPUR-MORADABAD-KASHIPUR-RUDRAPUR NATURAL GAS PIPELINE PHASE-II(8"X46.23Km.)
LOCATION	DELHI	
DESIGNED	SR	
DRAWN	SUNNY	P & ID FOR DESPATCH TERMINAL AT KASHIPUR
CHECKED AND VERIFIED	B.N.DAS	
APPROVED	SIG (B.N.DAS)	SCALE : NTS
	DATE 28.06.2010	DRG. NO. MEC/23M8/05/21/M/002/0001

SHEET 1 OF 2 | REV 2

REV | INST. | CONCURRED BY | SEC



NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST LEVEL.
2. PROVISION SHALL BE KEPT TO HOOK UP INLET & OUTLET PR. & TEMP., FLOW PERAMETERS, STATUS OF GAS ACTUATED VALVES, WITH SCADA. SCADA & TELEMETRY SCHEME SHALL BE PROVIDED BY GAIL.
3. PG-0901A SHALL HAVE A RANGE OF 0-1 $Kg/cm^2(g)$ WITH A GAUGE SAVER.
4. ONLINE RETRIEVAL TYPE CORROSION MONITORING COUPON & CORROSION PROBE SHALL BE PROVIDED.
5. ALL SV EXTENDED STEM BW, FULL BORE VALVE.
6. PROVIDE ELECTRICAL ISOLATION FOR SUPPORT AND ANY OTHER CONNECTIONS
7. ALL DISTANCE SHOWN HERE ARE TENTATIVE.

PROCESS DATA

FLUID	: NATURAL GAS	TEMPERATURE	
FLOW		WORKING	: 5-45° C
MINIMUM	: 0.1 MMSCMD	DESIGN	: (-)29°C-65° C
NORMAL	: 0.21 MMSCMD	DESIGN CLASS	: 600#
MAXIMUM	: 0.38 MMSCMD		
PRESSURE			
WORKING	: 35-55 KG/CM^2G		
DESIGN	: 92 KG/CM^2G		

NOTE: FLOW :NORMAL-1.92 & MAXIMUM-2.56 MMSCMD AT 73.5 KG/CM2(g) AT KARANPUR TAP-OFF POINT.

LINE LEGEND

8"-P-09-0901-D1A
- 8" — NOMINAL PIPE SIZE
- P — PROCESS FLUID (NG)
- 09 — UNIT NO.
- 0901 — LINE NO.
- D1A — MATERIAL SPEC.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE FLANGE END.

GAIL (INDIA) LIMITED

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MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
2	26.07.09		GAIL'S COMMENTS INCORPORATED	SR	BND
1	19.07.09		GAIL'S COMMENTS INCORPORATED	SR	BND

REVISION

REFERENCES | DRG.NO.

SECTION	OIL & GAS (PROCESS)
LOCATION	DELHI
DESIGNED	SR
DRAWN	SUNNY
CHECKED AND VERIFIED	B.N.DAS
APPROVED	SIG (B.N.DAS)
	DATE 28.06.2010

KARANPUR-MORADABAD-KASHIPUR-RUDRAPUR NATURAL GAS PIPELINE PHASE-II(8"X46.23Km.)

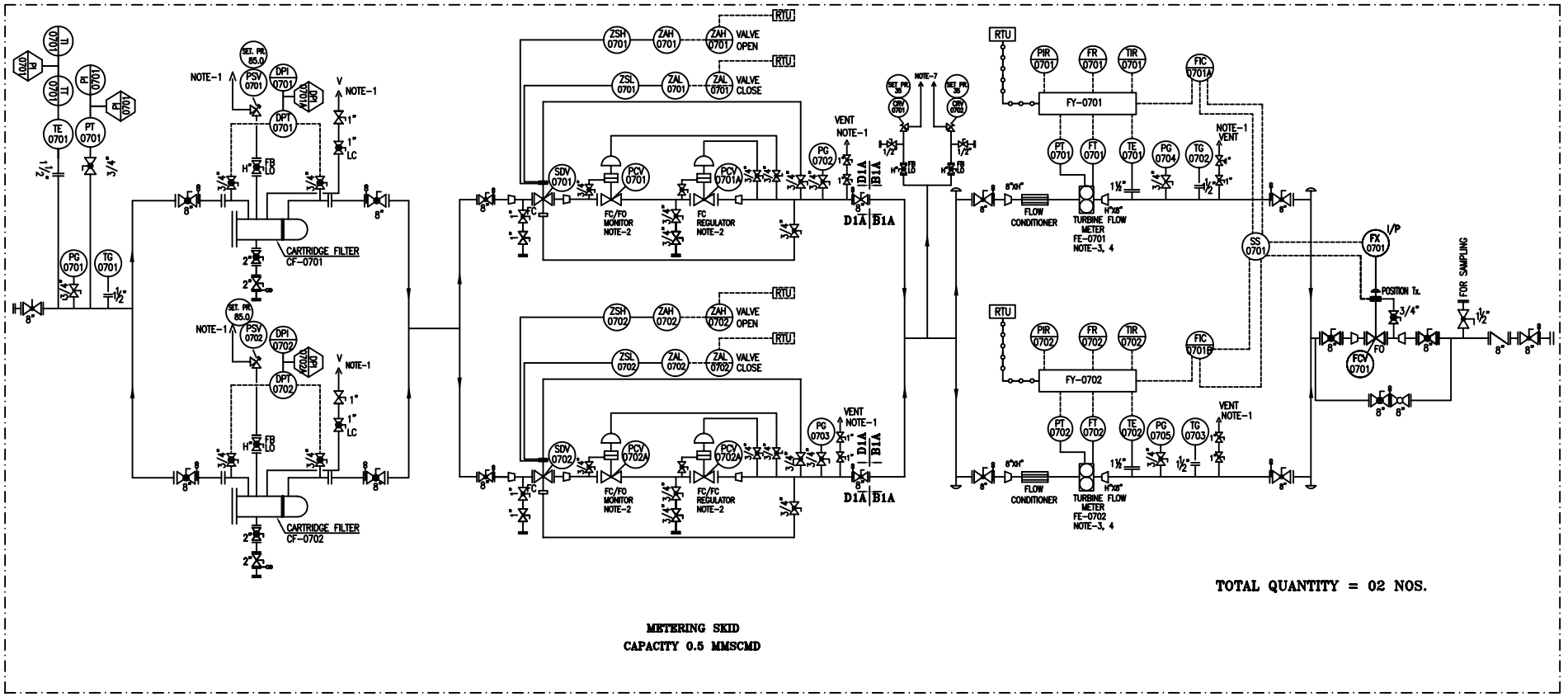
P & ID FOR RECEIVING TERMINAL AT RUDRAPUR

SCALE : NTS | SHEET 2 of 2 | REV 2

DRG. NO. MEC/23M8/05/21/M/002/0001

REV / SEC | INST. | CONCURRED BY

DRG. NO. MEC/23MB/05/21/M/001/0003



METERING SKID
CAPACITY 0.5 MMSCMD

TOTAL QUANTITY = 02 NOS.

PROCESS DATA

FLUID	: NATURAL GAS	TEMPERATURE	
FLOW		WORKING :	5–45°C
MINIMUM	: 0.1 MMSCMD	DESIGN :	(–)29°C–65°C
NORMAL	: 0.4 MMSCMD	DESIGN CLASS	: 600#/300#
MAXIMUM	: 0.6 MMSCMD		
PRESSURE :			
BEFORE PCV:	22–56 KG/CM^{2}G		
AFTER PCV :	18–30 KG/CM^{2}G		
DESIGN :	92/49 KG/CM^{2}G		

NOTES :–

1. ALL VENTS SHALL BE LOCATED AT A MIN. HEIGHT OF 3M ABOVE THE HIGHEST OPERATING PLATFORM OR SHALL BE AT LEAST 1.0 M ABOVE MAN HEIGHT FROM OPERATING LEVEL. ALL VENTS SHALL BE PROVIDED WITH FLAP CAPS.
2. SDV SHALL BE OF SLAM SHUT VALVE & SHALL BE CLOSED IN EVENT OF HIGH PRESSURE DISCHARGE FROM PRESSURE CONTROL VALVE. PCV SHALL BE PILOT–OPERATED TYPE.
3. FLOW MEASUREMENT SHALL BE TURBINE METER TYPE WITH PANEL–MOUNTED FLOW COMPUTER.
4. METERING TUBE SHALL BE IN CONFORMATION WITH AGA7 LATEST EDITION. UPSTREAM & DOWN STREAM PIPE LENGTH SHALL BE MAINTAINED AS PER AGA GUIDELINES.
5. ALL BALL VALVES OF SIZES ≥ 2" (FOR 600# RATING) & OF SIZES ≥ 6" (FOR 300# RATING) SHALL BE OF TRUNNION MOUNTED TYPE. OTHER VALVES SHALL BE FLOATING TYPE.
6. EACH VENT LINE SHALL BE PROVIDED WITH A BALL VALVE & A PLUG VALVE.
7. SIZE,NUMBER & RATING OF SAFETY VALVES TO BE DECIDED DURING DETAILED ENGENEERING.
8. ALL VALES ARE FULL BORE ONLY.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END
- PLUG VALVE BW END/UPTO 1½" SW END
- PLUG VALVE FLANGE END
- GLOBE VALVE.
- CHECK VALVE.

FB – FULL BORE
FC – FAIL CLOSE
FO – FAIL OPEN

FOR TENDER PURPOSE ONLY

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MECON LIMITED

REV	INST.	CONCURRED BY
0		

REV. NO.	DATE	ZONE	DESCRIPTION	BY	VERIFIED
			REVISION		

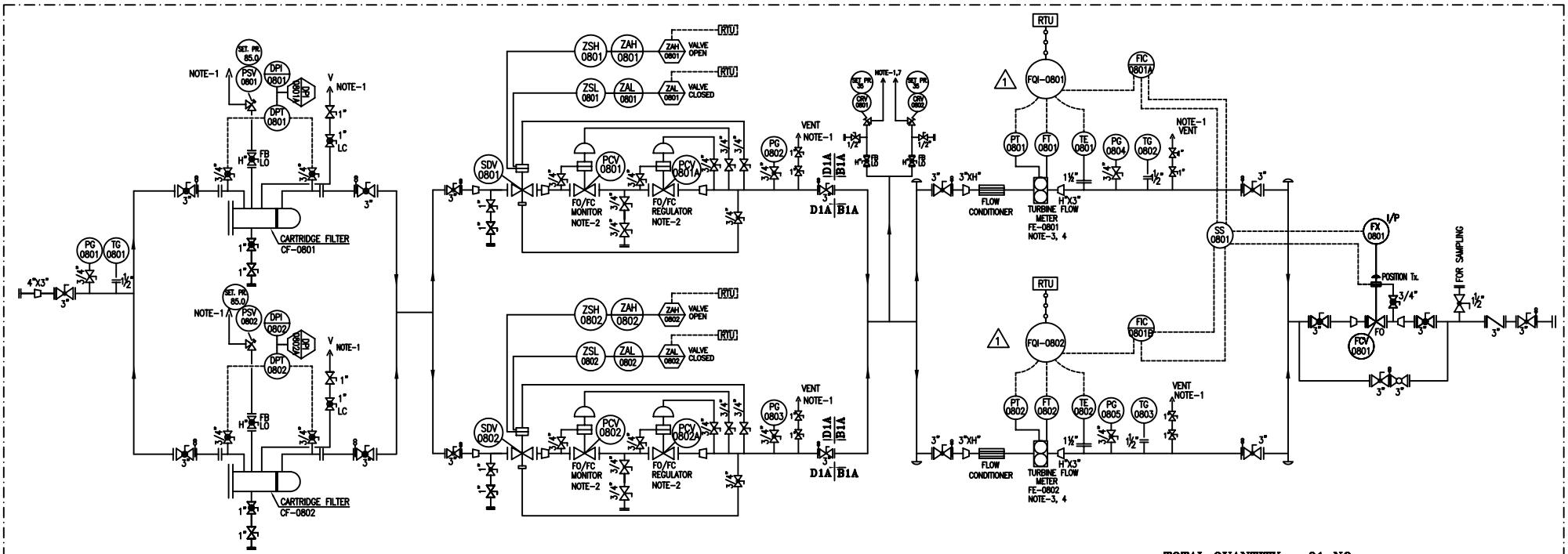
REFERENCES | DRG. NO.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	SR
DRAWN	SUNNY
CHECKED AND VERIFIED	T.K.MONDAL
APPROVED	SIG
DATE	10.08.10

KAPANPUR–MORADABAD–KASHIPUR–RUDRAPUR GAS PIPELINE .

P & ID FOR METERING SKID FOR BETA & GAMA INFRATECH

SCALE : NTS	SHEET	REV
DRG. NO. MEC/23MB/05/21/M/001/0003	1 OF 6	0



METERING SKID
CAPACITY = 0.1 MMSCMD

TOTAL QUANTITY = 01 NO.

PROCESS DATA

FLUID	: NATURAL GAS	TEMPERATURE	
FLOW		WORKING	: 5–45°C
MINIMUM	: 0.05 MMSCMD	DESIGN	: (–)29°C–65°C
NORMAL	: 0.1 MMSCMD	DESIGN CLASS	: 600#/300#
MAXIMUM	: 0.12 MMSCMD		
PRESSURE	:		
BEFORE PCV:	22–56 KG/CM^{2}G		
AFTER PCV	: 18–30 KG/CM^{2}G		
DESIGN	: 92/49 KG/CM^{2}G		

NOTES :–

1. ALL VENTS SHALL BE LOCATED AT A MIN. HEIGHT OF 3M ABOVE THE HIGHEST OPERATING PLATFORM OR SHALL BE AT LEAST 1.0 M ABOVE MAN HEIGHT FROM OPERATING LEVEL. ALL VENTS SHALL BE PROVIDED WITH FLAP CAPS.
2. SDV SHALL BE OF SLAM SHUT VALVE & SHALL BE CLOSED IN EVENT OF HIGH PRESSURE DISCHARGE FROM PRESSURE CONTROL VALVE. PCV SHALL BE PILOT–OPERATED TYPE.
3. FLOW MEASUREMENT SHALL BE TURBINE METER TYPE WITH SOLAR–PANEL BASED FIELD–MOUNTED FLOW COMPUTER WITH GSM. ⚠1
4. METERING TUBE SHALL BE IN CONFORMATION WITH AGA7 LATEST EDITION. UPSTREAM & DOWN STREAM PIPE LENGTH SHALL BE MAINTAINED AS PER AGA GUIDELINES.
5. ALL BALL VALVES OF SIZES ≥ 2" (FOR 600# RATING) & OF SIZES ≥ 6" (FOR 300# RATING) SHALL BE OF TRUNNION MOUNTED TYPE. OTHER VALVES SHALL BE FLOATING TYPE.
6. EACH VENT LINE SHALL BE PROVIDED WITH A BALL VALVE & A PLUG VALVE.
7. SIZE NUMBER & RATING OF SAFETY VALVES TO BE DECIDED DURING DETAILED ENGENEERING.
8. ALL VALVES ARE FULL BORE ONLY.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END
- PLUG VALVE BW END/UPTO 1½" SW END
- PLUG VALVE FLANGE END
- GLOBE VALVE FLANGE END.
- CHECK VALVE FLANGE END.

FB – FULL BORE
FC – FAIL CLOSE
FO – FAIL OPEN

FOR TENDER PURPOSE ONLY

GAIL (INDIA) LIMITED
मेकॉन लिमिटेड
MECON LIMITED

REV	INST.	CONCURRED BY
0		
SEC		

REV. NO.	DATE	ZONE	DESCRIPTION	BY	VERIFIED
⚠1	21.07.09		GAIL'S COMMENTS INCORPORATED	SR	BND

REVISION

REFERENCES — DRG. NO.

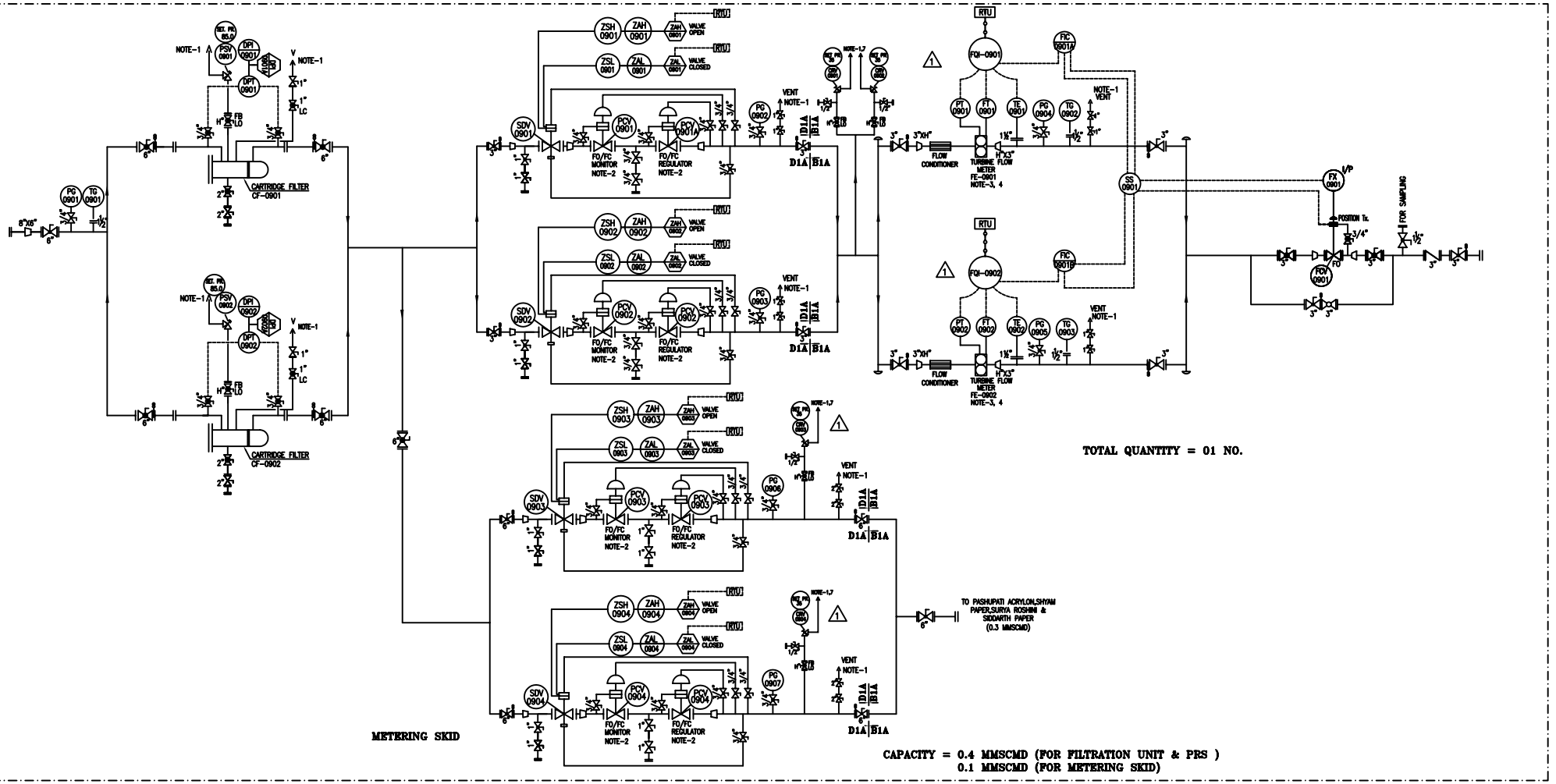
SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	SR
DRAWN	SUNNY
CHECKED AND VERIFIED	T.K.MONDAL
APPROVED	SIG
DATE	08.07.10

KAPANPUR–MORADABAD–KASHIPUR–RUDRAPUR GAS PIPELINE .

P & ID FOR METERING SKID FOR NAINI PAPER MILLS

SCALE : NTS	SHEET	REV
DRG. NO. MEC/23MB/05/21/M/001/0003	2 OF 6	1

DRG. NO. MEC/23MB/05/21/M/001/0003



PROCESS DATA

FLUID	: NATURAL GAS
FLOW	
FILTRATION UNIT & PRS	: 0.4 MMSCMD
METERING SKID	: 0.1 MMSCMD
MINIMUM	: 0.06 MMSCMD
NORMAL	: 0.1 MMSCMD
MAXIMUM	: 0.12 MMSCMD
PRESSURE :	
BEFORE PCV:	22–56 KG/CM^{2}G
AFTER PCV :	18–30 KG/CM^{2}G
DESIGN	: 92/49 KG/CM^{2}G
TEMPERATURE	
WORKING	: 5–45°C
DESIGN	: (–)29°C–65°C
DESIGN CLASS	: 600#/300#

NOTES :-

1. ALL VENTS SHALL BE LOCATED AT A MIN. HEIGHT OF 3M ABOVE THE HIGHEST OPERATING PLATFORM OR SHALL BE AT LEAST 1.0 M ABOVE MAN HEIGHT FROM OPERATING LEVEL. ALL VENTS SHALL BE PROVIDED WITH FLAP CAPS.
2. SDV SHALL BE OF SLAM SHUT VALVE & SHALL BE CLOSED IN EVENT OF HIGH PRESSURE DISCHARGE FROM PRESSURE CONTROL VALVE. PCV SHALL BE PILOT–OPERATED TYPE.
3. FLOW MEASUREMENT SHALL BE TURBINE METER TYPE WITH SOLAR–PANEL BASED FIELD–MOUNTED FLOW COMPUTER WITH GSM. ⚠1
4. METERING TUBE SHALL BE IN CONFORMATION IN WITH AGA7 LATEST EDITION. UPSTREAM & DOWN STREAM PIPE LENGTH SHALL BE MAINTAINED AS PER AGA GUIDELINES.
5. ALL BALL VALVES OF SIZES ≥ 2" (FOR 600# RATING) & OF SIZES ≥ 6" (FOR 300# RATING) SHALL BE OF TRUNNION MOUNTED TYPE. OTHER VALVES SHALL BE FLOATING TYPE.
6. EACH VENT LINE SHALL BE PROVIDED WITH A BALL VALVE & A PLUG VALVE.
7. SIZE, NUMBER & CLASS RATING OF SAFETY VALVES TO BE DECIDED DURING DETAILED ENGENEERING.
8. ALL VALVES ARE FULL BORE ONLY.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END
- PLUG VALVE BW END/UPTO 1½" SW END
- PLUG VALVE FLANGE END
- GLOBE VALVE.
- CHECK VALVE.

FB – FULL BORE
FC – FAIL CLOSE
FO – FAIL OPEN

FOR TENDER PURPOSE ONLY

GAIL (INDIA) LIMITED
मेकॉन लिमिटेड
MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
0	21.07.09		GAIL'S COMMENTS INCORPORATED	SR	END

REVISION

REFERENCES — DRG. NO.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	SR
DRAWN	SUNNY
CHECKED AND VERIFIED	T.K.MONDAL
APPROVED	SIG
DATE	08.07.10

KAPANPUR–MORADABAD–KASHIPUR–RUDRAPUR GAS PIPELINE

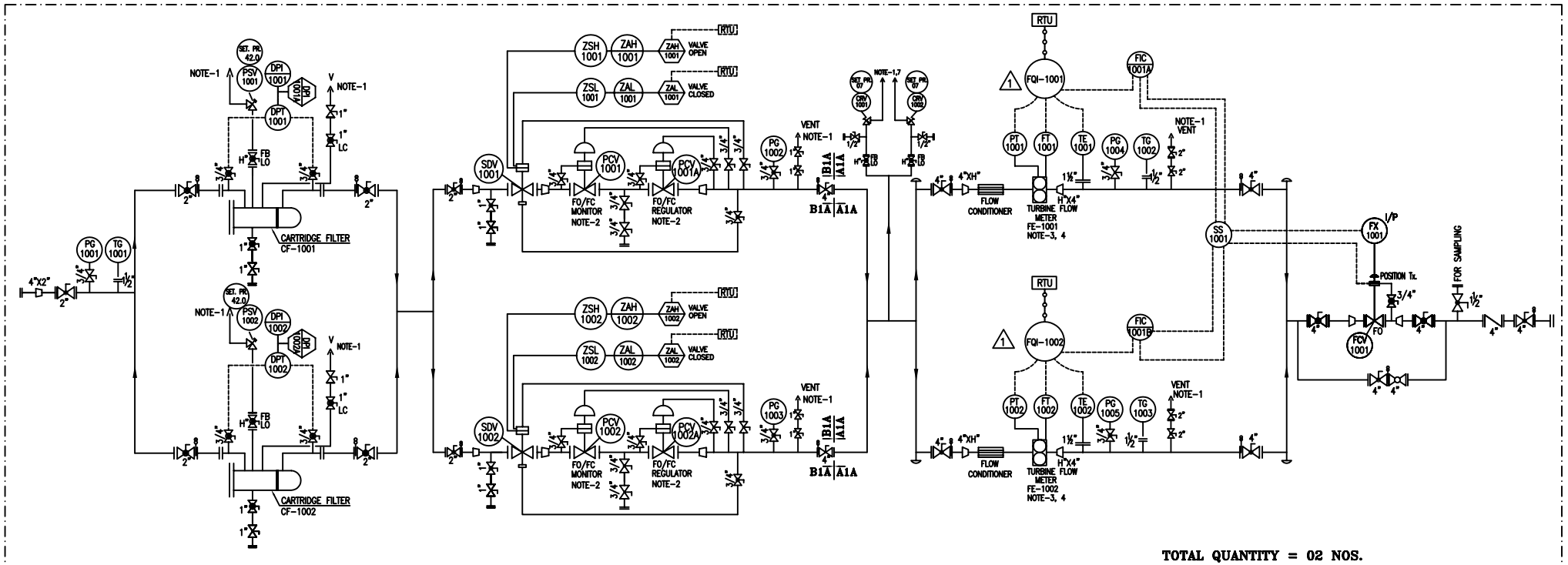
P & ID FOR METERING SKID FOR NAINI TISSUE PAPER MILLS

SCALE : NTS | SHEET 3 OF 6 | REV 1

DRG. NO. MEC/23MB/05/21/M/001/0003

REV / SEC | INST. | CONCURRED BY

DRG. NO. MEC/23M8/05/21/M/001/0003



TOTAL QUANTITY = 02 NOS.

METERING SKID
CAPACITY = 0.02 MMSCMD

PROCESS DATA			
FLUID	: NATURAL GAS	TEMPERATURE	
FLOW		WORKING	: 5-45°C
MINIMUM	: 0.01 MMSCMD	DESIGN	: (-)29°C-65°C
NORMAL	: 0.02 MMSCMD	DESIGN CLASS	: 300#/150#
MAXIMUM	: 0.04 MMSCMD		
PRESSURE	:		
BEFORE PCV:	19-27 KG/CM^{2}G		
AFTER PCV	: 3-5 KG/CM^{2}G		
DESIGN	: 49/19 KG/CM^{2}G		

NOTES :-

1. ALL VENTS SHALL BE LOCATED AT A MIN. HEIGHT OF 3M ABOVE THE HIGHEST OPERATING PLATFORM OR SHALL BE AT LEAST 1.0 M ABOVE MAN HEIGHT FROM OPERATING LEVEL. ALL VENTS SHALL BE PROVIDED WITH FLAP CAPS.
2. SDV SHALL BE OF SLAM SHUT VALVE & SHALL BE CLOSED IN EVENT OF HIGH PRESSURE DISCHARGE FROM PRESSURE CONTROL VALVE. PCV SHALL BE PILOT-OPERATED TYPE.
3. FLOW MEASUREMENT SHALL BE TURBINE METER TYPE WITH SOLAR-PANEL BASED FIELD-MOUNTED FLOW COMPUTER WITH GSM. 1
4. METERING TUBE SHALL BE IN CONFORMATION WITH AGA7 LATEST EDITION. UPSTREAM & DOWN STREAM PIPE LENGTH SHALL BE MAINTAINED AS PER AGA GUIDELINES.
5. ALL BALL VALVES OF SIZES ≥ 6" (FOR 300# RATING) & OF SIZES ≥ 10" (FOR 150# RATING) SHALL BE OF TRUNNION MOUNTED TYPE. OTHER VALVES SHALL BE FLOATING TYPE.
6. EACH VENT LINE SHALL BE PROVIDED WITH A BALL VALVE & A PLUG VALVE.
7. SIZE, NUMBER & CLASS RATING OF SAFETY VALVES TO BE DECIDED DURING DETAILED ENGENEERING.
8. ALL VALVES ARE FULL BORE ONLY.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END
- PLUG VALVE BW END/UPTO 1½" SW END
- PLUG VALVE FLANGE END
- GLOBE VALVE FLANGE END.
- CHECK VALVE FLANGE END.

FB – FULL BORE
FC – FAIL CLOSE
FO – FAIL OPEN

FOR TENDER PURPOSE ONLY

GAIL (INDIA) LIMITED
मेकॉन लिमिटेड
MECON LIMITED

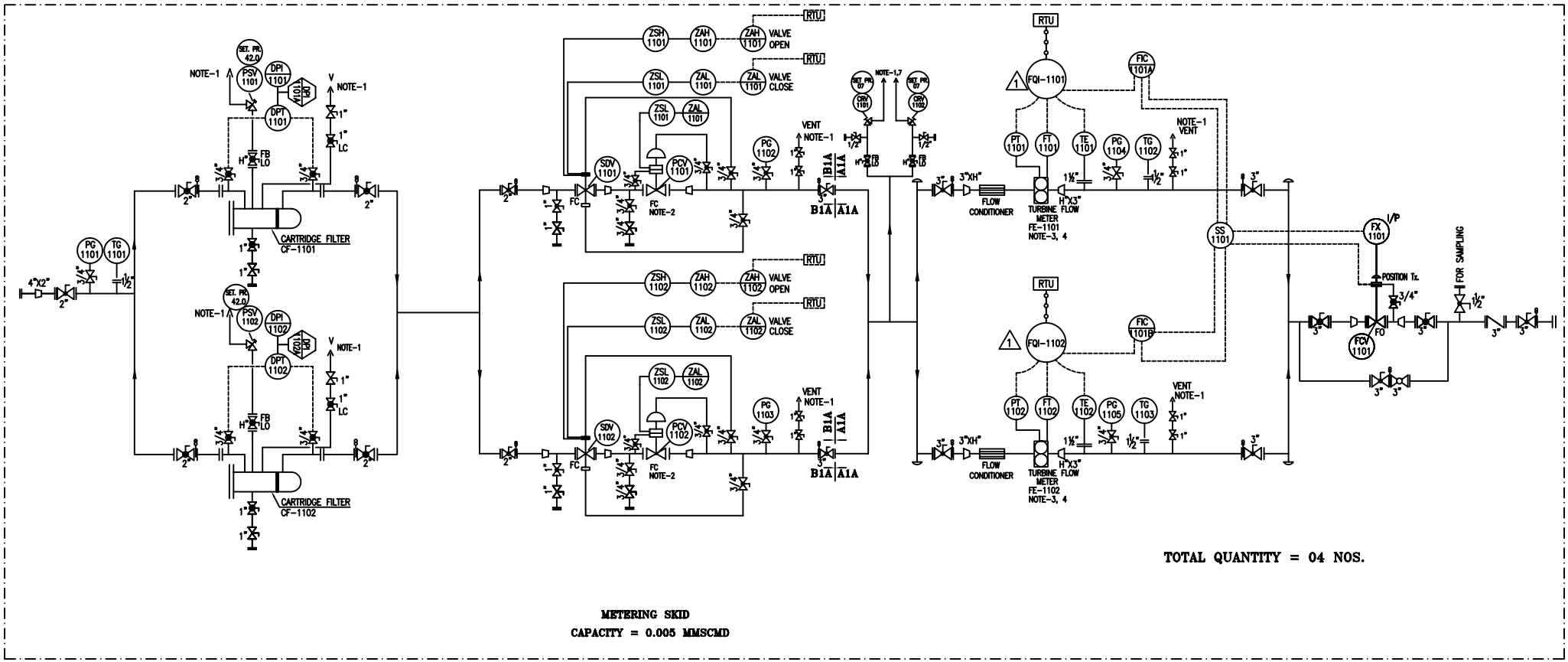
REV	SEC	INST.	CONCURRED BY
0			

REV. NO.	DATE	ZONE	DESCRIPTION	BY	VERIFIED
1	21.07.09		GAIL'S COMMENTS INCORPORATED	SR	BND

REVISION

REFERENCES | DRG. NO.

SECTION	OIL & GAS	KAPANPUR-MORADABAD-KASHIPUR-RUDRAPUR GAS PIPELINE	
LOCATION	DELHI		
DESIGNED	SR	P & ID FOR METERING SKID FOR KASHI VISHWANATH STEELS & GALWALIA STEELS LTD.	
DRAWN	SUNNY		
CHECKED AND VERIFIED	B.N.DAS		
APPROVED	SIG	SCALE : NTS	SHEET 4 OF 6 / REV 1
DATE	10.06.10	DRG. NO. MEC/23M8/05/21/M/001/0003	



METERING SKID
CAPACITY = 0.005 MMSCMD

TOTAL QUANTITY = 04 NOS.

PROCESS DATA

FLUID	: NATURAL GAS	TEMPERATURE	
FLOW		WORKING	: 5–45°C
MINIMUM	: 0.0009 MMSCMD	DESIGN	: (–)29°C–65°C
NORMAL	: 0.005 MMSCMD	DESIGN CLASS	: 300#/150#
MAXIMUM	: 0.02 MMSCMD		
PRESSURE :			
BEFORE PCV:	19–27 KG/CM^{2}G		
AFTER PCV :	3–5 KG/CM^{2}G		
DESIGN :	49/19 KG/CM^{2}G		

NOTES :-

1. ALL VENTS SHALL BE LOCATED AT A MIN. HEIGHT OF 3M ABOVE THE HIGHEST OPERATING PLATFORM OR SHALL BE AT LEAST 1.0 M ABOVE MAN HEIGHT FROM OPERATING LEVEL. ALL VENTS SHALL BE PROVIDED WITH FLAP CAPS.
2. SDV SHALL BE OF SLAM SHUT VALVE & SHALL BE CLOSED IN EVENT OF HIGH PRESSURE DISCHARGE FROM PRESSURE CONTROL VALVE. PCV SHALL BE PILOT–OPERATED TYPE.
3. FLOW MEASUREMENT SHALL BE TURBINE METER TYPE WITH SOLAR–PANEL BASED FIELD–MOUNTED FLOW COMPUTER WITH GSM. △1
4. METERING TUBE SHALL BE IN CONFORMATION WITH AGA7 LATEST EDITION. UPSTREAM & DOWN STREAM PIPE LENGTH SHALL BE MAINTAINED AS PER AGA GUIDELINES.
5. ALL BALL VALVES OF SIZES ⩾ 6" (FOR 300# RATING) & OF SIZES ⩾ 10" (FOR 150# RATING) SHALL BE OF TRUNNION MOUNTED TYPE. OTHER VALVES SHALL BE FLOATING TYPE.
6. EACH VENT LINE SHALL BE PROVIDED WITH A BALL VALVE & A PLUG VALVE.
7. SIZE, NUMBER & CLASS RATING OF SAFETY VALVES TO BE DECIDED DURING DETAILED ENGENEERING.
8. ALL VALVES ARE FULL BORE ONLY.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END
- PLUG VALVE BW END/UPTO 1½" SW END
- PLUG VALVE FLANGE END
- GLOBE VALVE FLANGE END.
- CHECK VALVE FLANGE END.

FB – FULL BORE
FC – FAIL CLOSE
FO – FAIL OPEN

FOR TENDER PURPOSE ONLY

GAIL (INDIA) LIMITED
मेकॉन लिमिटेड
MECON LIMITED

REV	INST.	CONCURRED BY
0		

REV. NO.	DATE	ZONE	DESCRIPTION / REVISION	BY	VERIFIED
△1	21.07.09		GAIL'S COMMENTS INCORPORATED	SR	BND

REFERENCES — DRG. NO.

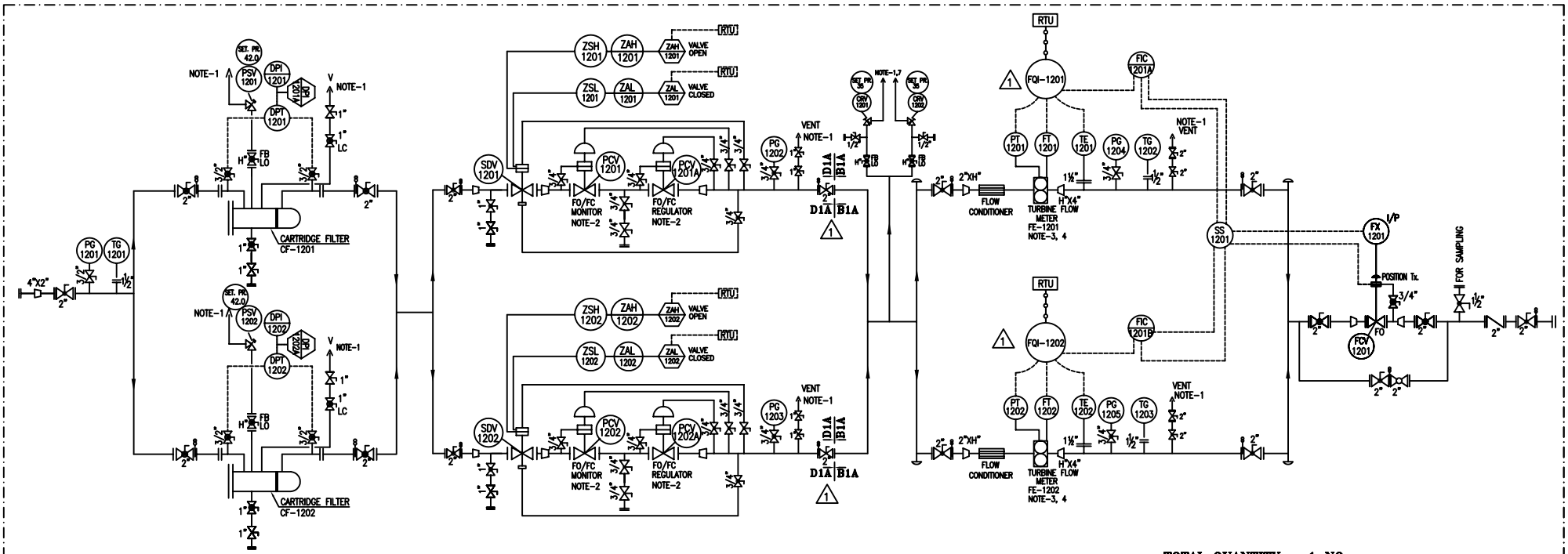
SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	SR
DRAWN	SUNNY
CHECKED AND VERIFIED	B.N.DAS
APPROVED	SIG
DATE	10.08.10

KAPANPUR–MORADABAD–KASHIPUR–RUDRAPUR GAS PIPELINE

P & ID FOR METERING SKID FOR SIDDARTH PAPER MILLS, TATA MOTORS, NESTLE& PARLE.

SCALE : NTS | SHEET 6 OF 6 | REV 1

DRG. NO. MEC/23MB/05/21/M/001/0003



METERING SKID
CAPACITY = 0.03 MMSCMD

TOTAL QUANTITY = 1 NO.

PROCESS DATA

FLUID	: NATURAL GAS	TEMPERATURE	
FLOW		WORKING	: 5–45°C
MINIMUM	: 0.005 MMSCMD	DESIGN	: (–)29°C–65°C
NORMAL	: 0.03 MMSCMD	DESIGN CLASS	: 600#/300# 1
MAXIMUM	: 0.05 MMSCMD		
PRESSURE :			
BEFORE PCV:	20–52 KG/CM²G		
AFTER PCV	: 20–28 KG/CM²G		
DESIGN	: 92/49 KG/CM²G 1		

NOTES :–

1. ALL VENTS SHALL BE LOCATED AT A MIN. HEIGHT OF 3M ABOVE THE HIGHEST OPERATING PLATFORM OR SHALL BE AT LEAST 1.0 M ABOVE MAN HEIGHT FROM OPERATING LEVEL. ALL VENTS SHALL BE PROVIDED WITH FLAP CAPS.
2. SDV SHALL BE OF SLAM SHUT VALVE & SHALL BE CLOSED IN EVENT OF HIGH PRESSURE DISCHARGE FROM PRESSURE CONTROL VALVE. PCV SHALL BE PILOT–OPERATED TYPE.
3. FLOW MEASUREMENT SHALL BE TURBINE METER TYPE WITH SOLAR–PANEL BASED FIELD–MOUNTED FLOW COMPUTER WITH GSM. 1
4. METERING TUBE SHALL BE IN CONFORMATION WITH AGA7 LATEST EDITION. UPSTREAM & DOWN STREAM PIPE LENGTH SHALL BE MAINTAINED AS PER AGA GUIDELINES.
5. ALL BALL VALVES OF SIZES ⩾ 2" (FOR 600# RATING) & OF SIZES ⩾ 6" (FOR 300# RATING) SHALL BE OF TRUNNION MOUNTED TYPE. OTHER VALVES SHALL BE FLOATING TYPE.
6. EACH VENT LINE SHALL BE PROVIDED WITH A BALL VALVE & A PLUG VALVE.
7. SIZE NUMBER & RATING OF SAFETY VALVES TO BE DECIDED DURING DETAILED ENGENEERING.
8. ALL VALVES ARE FULL BORE ONLY.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END
- PLUG VALVE BW END/UPTO 1½" SW END
- PLUG VALVE FLANGE END
- GLOBE VALVE FLANGE END.
- CHECK VALVE FLANGE END.

FB – FULL BORE
FC – FAIL CLOSE
FO – FAIL OPEN

FOR TENDER PURPOSE ONLY

GAIL (INDIA) LIMITED
मेकॉन लिमिटेड
MECON LIMITED

REV	INST.	CONCURRED BY
0		
SEC		

REV. NO.	DATE	ZONE	DESCRIPTION	BY	VERIFIED
1	21.07.09		GAIL'S COMMENTS INCORPORATED	SR	BND

REVISION

REFERENCES — DRG. NO.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	SR
DRAWN	SUNNY
CHECKED AND VERIFIED	T.K.MONDAL
APPROVED	SIG
DATE	08.07.10

KAPANPUR–MORADABAD–KASHIPUR–RUDRAPUR GAS PIPELINE

P & ID FOR METERING SKID FOR RIDHI SHIDDHI GLUCO BOILS

SCALE : NTS | SHEET 6 OF 6 | REV 1

DRG. NO. MEC/23MB/05/21/M/001/0003

ANNEXURE – VI

PROJECT MANAGEMENT AND RESPONSIBILITY (PMR) FORM

PROJECT MANAGEMENT AND RESPONSIBILITY (PMR) FORM

Name of RTU Bidder :
RTU Vendor works & address :
Name of the sub-vendor/Service Associates :
Sub-vendor works & Address :

Activity/project Responsibility	Performed by Bidder [yes/no]	Performed by Sub-vendor / Service associate	Manufacturing facilities/ location
Single source responsibility with performance guarantee for the successful execution of the project			
Project management			
Project basic engineering activities including design			
Supply of RTU			
Development & implementation SCADA DATA			
Detailed System Engineering			
Logistic Support			
Integration of RTU and SCADA software (SCADA Supplied by other)			
Documentation 1) For RTU 2) Detailed engineering drawing and documents 3) For FAT 4) For Construction drawings & documents 5) For SAT			
Factory Acceptance Testing 1 For MS /EMS with RTUs 2 For integrated SCADA system			
Installation and commissioning of RTU at various location			
Site acceptance testing and test run			
Warranty			
Training			

Signature of the authorized signatory
Name of the authorized signatory
Stamp and Date

Note: If the activity is performed by the Bidder, and sub vendor, same shall be differentiated by letter 'P' against the party who is primarily responsible for the same activity.

ANNEXURE – VII

RESPONSIVE OFFER CRITERIA (ROC) FORM

RESPONSIVE OFFER CRITERIA (ROC) FORM

			Column to be filled
A	1	Scope of supply and works complied with as per the Bid package [yes/no]	
	2	RTU specifications & configuration as per the Bid specifications [yes/no]	
B	1.	Bidder must categorically state compliance that all deviations/comments from all sections of Bid package are only listed in deviation form and all remaining clauses are deemed to be fully complied by the Bidder	
	2.	All the forms are duly filled, stamped and signed by authorized representatives at the required places [yes/no]	
	3.	Bidders proposal as per bid outline requirements [yes/no]	

Signature of the authorized signatory

Name of the authorized signatory

Stamp and Date

ANNEXURE – VIII

SOURCE OF SUPPLY FORM (SOS) FORM

ANNEXURE VIII to PJS
RTU FOR SCADA System

SOURCE OF SUPPLY (SOS) FORM

This form shall be duly filled and signed by bidder and it shall be submitted along with bid. All the points shall be unambiguously responded, if anything is kept blank by the bidder, it shall be considered as non-compliance of the tender and the bid shall be liable for rejection.

1. Remote Terminal Unit (RTU)

Sr. No.	Items	As per Tender	Bidder Compliance	Remark
I	Approved Make	-		
2	Model	-		
3	RTU feature	RTU should have its own processor, memory, power supply unit, dedicated I/o's cards & communication ports also self diagnostic feature and software watch dog timer device to monitor & report the healthiness of CPU, I/o Cards, Power supply, Communication unit etc and same reporting to MS/EMS. Software Logic implementation, data storage capacity.		
4	Processor	32 bit Microprocessor based.		
5	Communication speed	19.2 1Kbps		
6	RAM	Min l6 MB (Note)		
7	Support to Communication protocols with MS	DNP3.0		
8	Analog Input	Min 08 Channel per card		
9	Analog Output	Min 04 Channel per card		
10	Digital Input	Min 16 Channel per Card		
11	Digital Output	Min 08 Channel per card		
12	Communication Ports			
12.1	RS232	Required as per specification		
12.2	RS485	As per PTs RTU		
13	Data Time Stamping	At RTU Level		
14	Battery Back	RTU should have mm 2 year internal battery back up for CPU Memory.		
15	Quantity	As per BOM / SOR		

2. **Portable Diagnostic Test Unit / Laptop (Any conflict between the minimum requirements of spec, the higher spec will prevail)**

Sr. No.	Items	As per Tender	Bidder Compliance	Remark
I	Make	HP/DELL/IBM		
2	Model	-		
3	CPU	Intel Pentium 4, core 2 Duo, mm 2.0 0Hz		
4	RAM	Min2GB		
5	Hard Disk	Min 250 GB SATA		
6	CD ROM	dual Layer		
7	Display	Min 14" TFT		
8	Operating system	Latest Windows(Compatible to RTU Diagnostic Software)		
9	Serial Interface	Required		
10	Ports	4 USB / 1 parallel / S Video out / Infrared port /External speaker / External Mic / Line in / External monitor/ RJ-45/blue tooth		
11	Application software	RTU system configuration, simulation & Diagnostic software.		
12	Quantity	As per BOM		

3. RTU cabinet Specification:

Sr. No.	Items	As per Tender	Bidder	Make & Model	Remark
I	Approved Make	Rittal /ICA/ Pyrotech			
2	Anti vibration Pad provided	All system cabinets/ panels will have anti vibration pads with minimum 15mm thickness.			
3	Cabinet size	The cabinets [around 2100 mm height (around 2000 mm height + 100 mm plinth), 800 rum width max. and 800 mm depth max)			
4	Color frame colour	RAL 7035 for exterior and interior			
5	Base/Plinth	Black colour			
6	Cable entry	bottom			
7	Provision for separate ground connections for signals and power supply.	Required			

8	MCBs and IBs	20 % spare MCBs and 20% spare TBs will be provided			
9	Doors	Double doors at back and single door at front with neoprene gaskets at every 1.5 m at back & front			
10	Fans in the system cabinets	As required for cooling and ventilation			
11	Terminal blocks	All the terminals block for Dl, Al, AC and DO shall be provided with fuses with adequate rating for protection and isolation purpose. The metallic portion shall be coated against rust/corrosion.			
12	Lifting eye bolt	Removable type required			
I3	Indicating Lamps	RED color Power ON			
14	Space heater and Thermostat	Required			

Note:

In the event of failure or break of communication link, the RTU shall continue to scan all parameters and update its database. RTU shall retain in its database the complete analog & digital information of the field till it is completely and correctly read by MS / EMS in order to take care of no loss of data in case of failure of MS / EMS.

The RTU shall scan the field and the memory buffer is to be sized to store all the changing data (i.e. new exception report for the data every poll time) and MS/EMS receive the same without any loss of data and alarms in the SCADA system to take care of channel, SCADA server switchover times.

RTU vender shall size CPU memory as per tender requirement to meet the above functionality.

ANNEXURE – IX

POWER CONSUMPTION & UPS REQMT FORM (PUCR Form)

ANNEXURE IX to PJS
RTU FOR SCADA System

POWER CONSUMPTION REQUIREMENTS (PCR) FORM

This form shall be duly filled ***and*** signed by bidder and it shall be submitted along with bid.

A. RTUs DC Load Requirements

S.No.	RTUs name	All RTU cards		Max. power consumption		Complete RTUs DC power requirements (waifs)
		TYPE	QUANTITY	Unit consumption (waifs)	Total consumption (waifs)	
I		Al				
2		AO				
3		Dl				
4		DO				
5		Serial				
6		CPU, communication, memory, power supply unit				
7		Any item/s not included above				

NOTE:

a) All RTU cards (including CPU, communication cards, Al, AO, Dl, DO, Serial cards along with power supply unit) are included for power consumption.

b) The digital output cards power consumption (waifs) shall also include the power requirements for interposing relays.

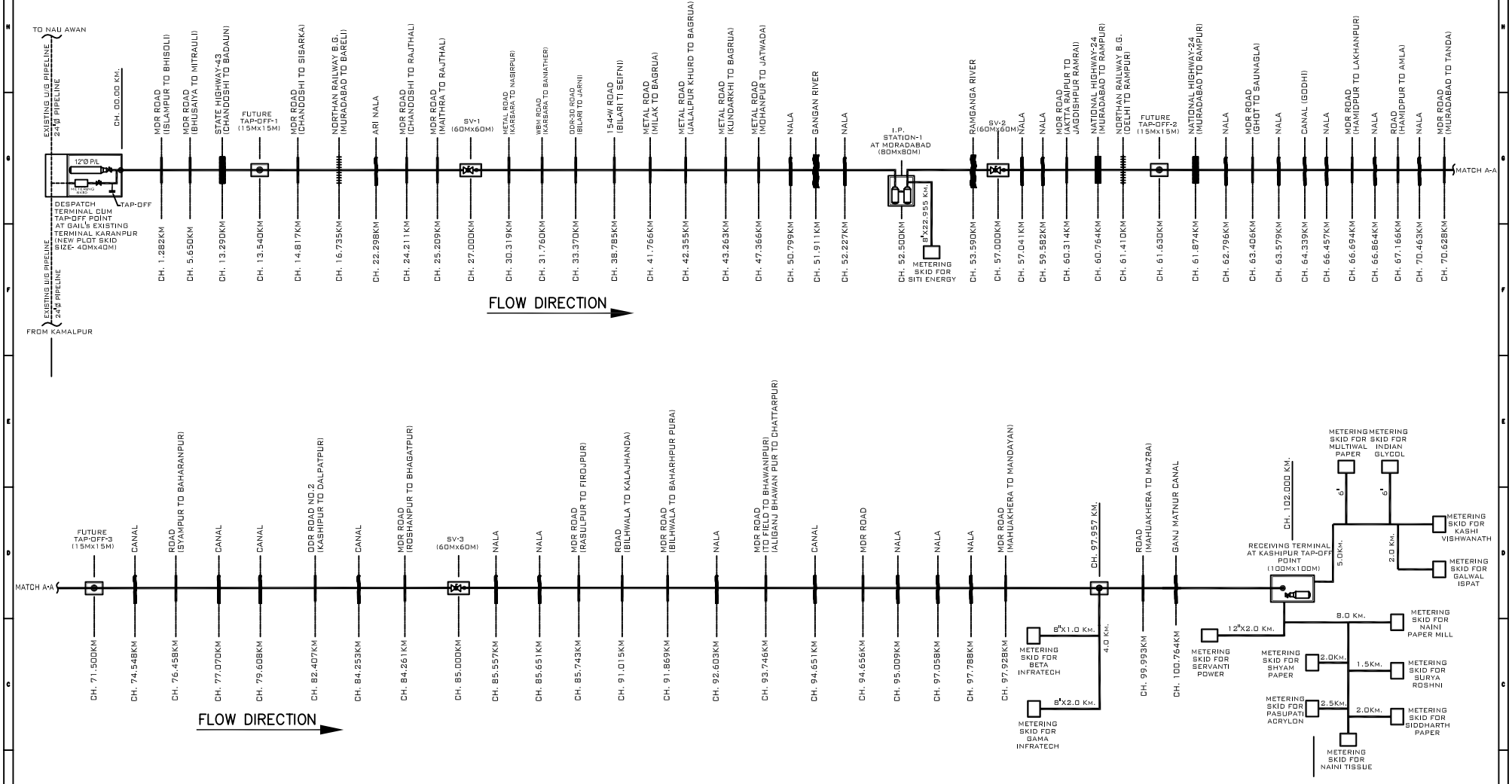
c) The above table shall be filled for all the RTUs being supplied.

ANNEXURE – X

PIPELINE SCHEMATIC ROUTE DIAGRAM (KMKRPL)

DRG. NO. MEC/2344/05/21/M/000/1021

KARANPUR-MORADABAD-KASHIPUR (PHASE-I) SCHEMATIC ROUTE DIAGRAM



DETAIL OF CROSSING

S.No.	SYMBOL OF X-ING	TYPE OF X-ING	SECTION-1 Nos.	SECTION-2 Nos.
1.		RIVER	02	01
2.		NALA/CANAL	03	20
3.		RAILWAY	01	01
4.		ROAD/MDR/METAL ROAD	30	25
5.		MAJOR ROAD (NH/SH)	01	02

LEGEND:
- 12"Ø PIPELINE
- 8"Ø PIPELINE
- 6"Ø PIPELINE
- 4"Ø PIPELINE

TENTATIVE NOs. OF STATION

DESPATCH STATION	- 01 NO.
RECEIVING STATION	- 01 NO.
INTERMEDIATE PIGGING STATION	- 01 NO.
SV WITH TAP-OFF POINT	- 03 NOS.
FUTURE TAP-OFF POINT	- 03 NOS.

NOTES :-

1. ABOVE PIPELINE SCHEMATIC ROUTE DIAGRAM PREPARED BASED ON SURVEY DOCUMENT & DRAWING RECEIVED FROM CLIENT.
2. ONLY MAIN CROSSING ALONG THE ROUTE HAVE BEEN SHOWN.

REV. NO.	DATE	ZONE	DESCRIPTION / REMARKS	BY	VERIFIED
1	14.05.10		(1) P/L LENGTH TO SITI ENERGY CHANGED 4.8 TO 22.955 (2) CHANGE OF R/T CHANGE AND CONSUMERS NETWORK REVISED	S.S.	S.K.

REFERENCES — DRG. NO.

CONCURRED BY

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	POOJA
DRAWN	SUNIL
CHECKED AND VERIFIED	SUNIL KUMAR
APPROVED	(U.K.NARANG)
DATE	30/07/2010

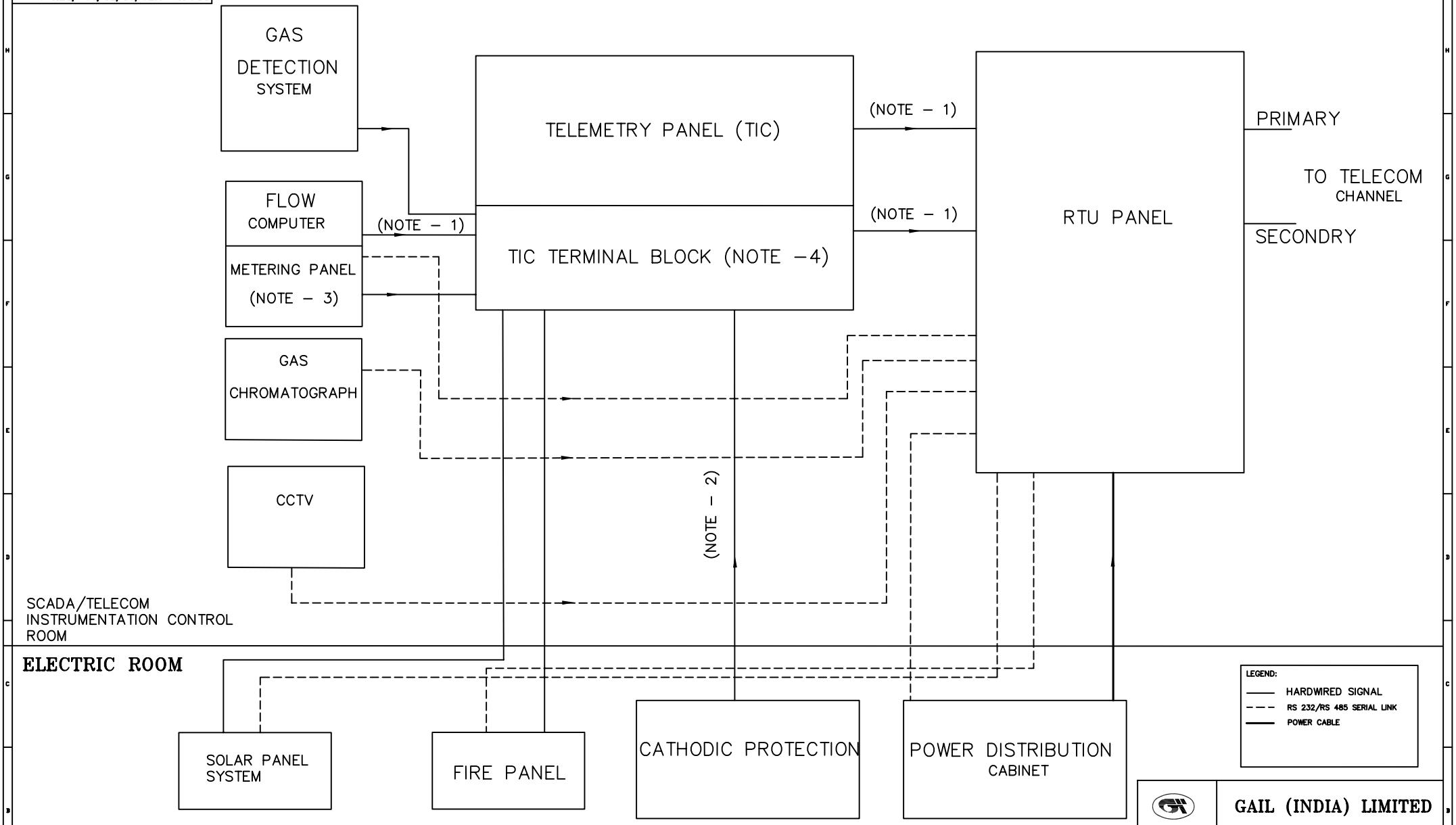
KARANPUR–MORADABAD–KASHIPUR (PHASE–I) PIPELINE PROJECT

PIPELINE SCHEMATIC ROUTE DIAGRAM

SCALE : NTS (SH 1 OF 1) REV

DRG. NO. MEC/2344/05/21/M/000/1021 1

ANNEXURE - XI
TYPICAL INTERFACING OF RTU WITH OTHER PANELS



NOTES:–1. IN ADDITION TO SERIAL DATA, FLOW RATE, PRESSERE & TEMPERATURE SHALL BE HARDWIRED SIGNAL FROM FLOW COMPTER TO RTU.
2. PSP VALUE, IMPRESSED VOLTAGE & IMPRESSED CURRENT SHALL BE HARDWIRED SIGNAL FROM CATHODIC PROTECTION PANEL TO RTU.
3. SEPERATE METERING PANELS SHALL BE PROVIDED BY METERING VENDOR IN WHICH FLOW COMPUTER, GC CONTROLLER SHALL BE INSTALLED.
4. HADWIRED SIGNALS FROM FIRE & GAS DETECTION PANEL, METERING PANEL, SOLAR PANEL, PDC & CATHODIC PROTECTION PANEL SHALL BE TERMINATED INSIDE TIC CABINET FROM WHERE THESE SIGNALS SHALL BE TAKEN TO RTU THROUGH HARDWIRED LINK
5. SEPERATE HARDWIRED CABLES SHALL BE USED FOR AI, AO, DI, DO SIGNALS. MIXING OF DIFFERENT TYPES OF SIGNALS SHALL NOT BE ACCEPTABLE.
6. SCOPE CF INTERFACING CABLES SHALL BE AS PER RESPECTIVE CLAUSE OF PJS

REV / SEC | CONCURRED BY

REV.NO	DATE	ZONE	GENERAL REVESION DESCRIPTION REVISION	BY	VERIFIED	REFERENCES DRG.NO.

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

SECTION LOCATION	INSTRUMETATION NEW DELHI
DESIGNED	
DRAWN	
CHECKED AND VERIFIED	
APPROVED	SIG
	DATE

TYPICAL INTERFACING OF RTU WITH OTHER PANEL

SCALE : NTS (SH. 1 OF 1) REV

DRG.NO. MEC/05/E5/094/RTU-01 1

ANNEXURE – XII

TECHNICAL CHECKLIST FOR SCADA SYSTEM (KMKRPL)

ANNEXURE-XII to PJS
RTU FOR SCADA System

TECHNICAL CHECKLISTS

Name of Bidder :
Bidder / Vendor works & address :
Name of Sub Vendor (as applicable) :

This Technical Check list shall be dully filled in and submitted along with un-priced 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.

Sl. No	Checklist point	Yes / No
	Have you filled up the following formats, which form a part of technical checklist	
1.	Submit Un-priced SOR with indicated "Quoted" in price part	
2.	ANNEXURE VI Project Management & Responsibility (PMR) Form	
3.	ANNEXURE-VII Responsive Offer Criteria (ROC) Form	
4.	ANNEXURE-VIII Source Of Supply (SOS) Form	
5.	ANNEXURE – IX Power Consumption & Ups Reqmt Form (PUCR Form)	
6.	Bill of Material (Supply) for RTU- submitted (Yes /No)	
7.	Submit Data Sheets/Technical Specifications RTU (Yes / No)	
8.	RTU Configuration Drawing Submitted (Yes/No)	
9.	Submit signed & stamped tender documents	
10.	Submit Clause wise technical compliance of PJS with Annexure	
11.	Have you filled up 'NO DEVIATION FORM' and submitted the same?	
12.	Have you provided list of spares for operation and maintenance along with unit rates?	
13.	Have you provided list of commissioning spares?	
14.	Have you enclosed the catalogs/literature in ENGLISH language including model decoding details, drawing etc necessary for evaluation of your offer?	
15.	Have you confirmed that documents required as per vendor data requirement will be supplied after placement of order?	
16.	Have you furnished System Architecture for RTU	
17.	Have you furnished and 'PERFORMANCE GUARANTEE CERTIFICATE'?	
18.	Have you furnished 'Vendor Data Requirement' with all necessary documents	
19.	You quoted as OEM or System Integrator	
20.	You have 24 hr service support for O&M	
21.	Indicate deviation / discrepancy with supporting documents / reasons etc.	

Sl. No	**Compliance to**	**Noted (Yes / No)**
1.	Quoted for all the items	
2.	Time Schedule.	
3.	Furnished documents supporting BEC	
4.	Tender MR requirements and scope as per Job Specification	
5.	Payment Terms as per tender	
6.	Training as per tender	

Signature of the Bidder authorized signatory

Name of the Bidder authorized signatory

Stamp and Date

ANNEXURE – XIII

CERTIFICATE FOR LOGISTIC SUPPORT

ANNEXURE- XIII to PJS
RTU for SCADA System

CERTIFICATE FOR LOGISTICS SUPPORT

1.0 LOGISTIC SUPPORT CERTIFICATE

1.1 Vendor must furnish Certificate for providing necessary support services in favour of the Owner (M/s GAIL) for RTU committing them to provide logistic to purchaser in the format furnished along with.

1.2 In case of bought-out items, this certificate must be furnished for each of the Sub vendors clearly indicating type, model no. etc.

1.3 The Certificates must be furnished from each manufacturer in case more than one manufacturer is proposed for an item. However it is expected that the vendor proposes Only one approved manufacturer for an item.

1.4.1 The Certificate must be signed with seal by the official signatory on the company's letterhead.

CERTIFICATE FOR LOGISTICS SUPPORT

(**To be signed by Manufacturer's corporate level signatory on company's letterhead)**

I, on behalf of M/s_____ confirm that the Item _____ Model No._____ for quoted by M/s_____ for M/s GAIL against Bid Doc No. 05/51/23 M4 / GAIL / 094; respective Particular Job Specification for RTU for SCADA system No. MEC / 23 M4 / 05 / E5 / I / PJS-094 shall continue to be supported by us for a period of minimum 05 years. The quoted system shall not be withdrawn from Indian market as a matter of our corporate policy.

I further confirm that in case of placement of order by GAIL on us, we shall continue to Support GAIL by spare part support for a period of 10 years from the date of placement of order.

Signature of the Bidder authorized signatory

Name of the Bidder authorized signatory

Stamp and Date