TECHNICAL BID DOCUMENT

TERMINAL AUTOMATION SYSTEM AT BPCL , BARAUNI TOP

BHARAT PETROLEUM CORPORATION LIMITED

BHARAT BHAVAN , PLOT NO. 31 KIT SCHEME NO .118 , PRINCE GULAM Md. SHAH ROAD , GOLF GREEN KOLKATA - 700095

BARAUNI TOP

Preamble :

The town situated at the bank of the holy river Ganges is connected by a Railway-cum-Road bridge over connecting North Bihar and South Bihar known as Rajendra Setu officially but as Mokama bridge in common parlance.

Railways

Barauni Junction is one of the important stations in Bihar. It is a junction and is connected to all the four metropolis New Delhi, Kolkata, Mumbai and Chennai through important Broad Gauge Routes. It takes around 15 hours to reach Barauni from New Delhi through train. It is the gateway for the North-East states, it connects the whole country with the North-East States.

Roads

National Highway 28 (India) start at Barauni and National Highway 31 (India) passes through this town. Both national highway having junction here. Bus,Jeep,Taxi,Rickshaw,Auto used for local transportation.

Air

The nearest airport to Barauni is Lok Nayak Jayaprakash Airport, Patna 102 kilometres (63 miles)

Address of Barauni TOP

BHARAT PETROLEUM CORPORATION LIMITED
BARAUNI TOP PAPROUR, DISTRICT BEGUSARAI
BARAUNI -- 851114
CONTACT PERSON :MANAGER OPERATIONS (RETAIL)
MR. POU KHOHO
CONTACT DETAILS :: 06243-242047 Extn : 25 , 06243-243818
MOBILE NO. +91 9199415951

FACILITY DETAILS ::

A. TLF GANTRY PRODUCT FILLING CONFIGURATION : Existing TLF Flowmeters will be utilized . Please refer Bill of Quantity .

TLFG CONFIGURATION PLAN OF BARAUNI TOP																			
BAY-1		BAY-2		BAY-3		BAY-4		BAY-5		BAY-6		BAY-7		BAY-8		BAY-9		BAY-10	
ARM-1	ARM-2	ARM-1	ARM-2	ARM-1	ARM-2	ARM-1	ARM-2	ARM-1	ARM-2	ARM-1	ARM-2	ARM-1	ARM-2	ARM-1	ARM-2	ARM-1	ARM-2	ARM-1	ARM-2
HSD	HI-SPEED	HSD	HSD	HSD	HSD	MS	HSD	HSD	HSD	SKO	SKO	SKO	SKO	SKO	SKO	MS	HSD	SPEED	MS

B. TANKAGE DETAILS :

ABOVE GROUND : Existing Servo Level gauges will be utilized .

SL NO.	PRODUCT	DIA (M)	HT(M)	CAPACITY (KL)	CAPACITY SAFE (KL)
T1	HSD	24	15	6800	6460
T2	HSD	24	15	6800	6460
T3	HSD	24	15	6800	6460
T4	MS	11	14.4	1365	1297
T5	MS	11	14.4	1365	1297
T6	SKO	14	15	2316	2200
T7	SKO	14	15	2316	2200

UNDER GROUND :

SL NO.	PRODUCT	DIA (M)	LENGTH(M)	CAPACITY
T 8	MS SPEED	2.36	10	45
T9	DIESEL HI SPEED	3.2	12.6	100
T10	SKO	2.36	10	45
T11	ETHANOL	2.75	8.25	45
T12	HSD	2.01	6.75	20

C. PRODUCT PUMP DETAILS :

TANK LORRY FILLING :

PRODUCT	CAPACITY (KL/HR)	MAIN	SATNDBY
HSD	200	2 NOS	1 NO.
SKO	100	2 NOS	NIL
MS	100	2 NOS	1 NO.
MS	60 VT PUMP	1 NO	NIL

D . FIRE ENGINE :

CAPACITY : 615 M3/HR : 2 NOS (MAIN) + 1 NO. (STANDBY)

GENERAL NOTE : THE 'SCOPE OF WORK' & 'TECHNICAL SPECIFICATIONS' ARE TO BE READ IN CONJUNCTION WITH P&IDs & SYSTEM ARCHITECTURE DRAWING SPECIFIED BELOW.

A. System Architecture Drawing [E&P:INST/AP11/TAS-SA/1(REV.2)]

1. SCOPE OF WORK

1.1 BIDDER'S SCOPE OF WORK FOR THE JOB SHALL BROADLY COMPRISE OF THE FOLLOWING :

1.1.1 Design and system engineering of complete Automation System including interfacing with the ISC Computer.

1.1.2 The TAS system shall be designed such that the LRCs and the PLCs shall not be loaded more than 60% of the capacity. This shall be witnessed and verified by BPCL during the FAT. Vendor has to make arrangement during FAT to verify the above requirement of BPCL. Processor loading for PLCs, LRC and Networking loading as per tender requirement will be verified during FAT/SAT.

1.1.3 Dynamic & static graphic representation of the all the operating facilities in installation on the basis of P& IDs as well as site survey/study by vendor is required at Operator Interface Consoles .

1.1.4 Vendor to submit the following calculation along with technical bid**.**

- Processor loading for PLCs
- Processor loading for LRCs.
- Network loading.
- I/O requirement vis-à-vis provision in the selected PLC
- Heat load calculation.
- Actual UPS Capacity based on full load condition.

1.1.5 Vendors are required to furnish complete model listing for offered devices/equipments backed up by model selection guide as part of technical offer.

1.1.6 Manufacture, Supply, Installation, Cabling, Field Testing, Commissioning, Trial Run, Site Acceptance and Stabilization of the complete system of complete Terminal Automation System (hardware and software) consisting of following sub – systems **:**

1.1.6.1 Loading Rack control sub- system

1.1.6.2 Tank truck entry sub- system

1.1.6.3 SAP-TAS interface sub-system

1.1.6.4 Access control sub – system

1.1.6.5 Emergency shutdown sub-system [based on SIL2 certified Programmable Logic controller]

1.1.6.6 Programmable Logic controller sub- system [For Normal plant operations/ controls)]

1.1.6.7 Flow Measurement & control sub-system

1.1.6.8 Pressure/ Temp/ Flow (DP/ Turbine/ Coriollis type) Transmitters

1.1.6.9 Pressure/ DP/ Temp. Gauges

1.1.6.10 Pressure Switches

1.1.6.11 Meter Proving System

1.1.6.12 Pressure safety relief valve

1.1.6.13 Tank Farm Management system (Field & control Room instrumentation)

1.1.6.14 Uninterrupted Power Supply System

1.1.7 Installation, Cabling (supply/ laying), Field Testing, Commissioning, Integration (hardwiring/ digital interface with PLC), Site Acceptance Test of following instrumentation/ sub-systems [to be provided by BPCL as Free issue items; protocol details (open/ proprietary) wherever applicable, will be provided by BPCL], with the proposed Terminal Automation System including development & successful implementation of serial interface as well as supply/ laying/ termination of signal/ communication cables .

1.1.7.1 ROSOVs (Remote Operated Shut-Off Valves) – to be hardwired with safety PLC

1.1.7.2 Hydrocarbon Detectors / Transmitters - to be hardwired with safety PLC

1.1.7.3 Rim Seal Protection system (tanks) - to be hardwired / serial interfaced with safety PLC

1.1.7.4 Fire Fighting system (Pr .switches/ MCPs/ FW pumps / MCC starter panels)- to be hardwired with safety PLC

1.1.7.5 MOVs – to be hardwired / to be serially interfaced (2-wire control system) with PLC as applicable.

1.1.7.6 On-line Blending systems [serial interfaced through its PLC/ VFD/ Flow Meters / Ratio Controllers]

1.1.7.7 Product Pumps (through MCC panels / VFD control panels) - including modification at MCC panels required for interface with TAS. The MCC s are to be modified for provision of dedicated input ports (potential free contacts) for receiving the closure command either from conventional PLC (Normal operation) Or closure command from Safety PLC (ESD operation).

NOTE: Protocol details for proprietary/open protocols will be arranged by BPCL. However software drivers (LRC resident) are to be developed by T.A. Vendor

1.1.8 Packing, forwarding, transportation, custom clearance, insurance, octroi, storage etc. complete of the system.

1.1.9 Supply, laying (overhead/underground) & termination of power / control / signal cables for all Instruments / equipment along with erection hardware required for the complete job.

1.1.10 System Documentation, Training, AMC & Warranty etc.

1.1.11 Supply of special tools, test equipments and spares required for testing, calibration, commissioning and maintenance of the system.

1.1.12 Any other instrument/ equipment/ service which are not explicitly mentioned in the tender but deemed necessary for the successful operation of the system complete in all respects, shall be in bidder’s scope.

1.2 DETAILED SCOPE OF WORK WILL INCLUDE FOLLOWING:

1.2.1 Loading Rack computers including Field Automations sub-system, communication networks, Operator interface consoles, ISC Computer with all peripheral units including VDU, Printers, etc. associated hardware and software to meet complete functional specifications including necessary computer consoles / furniture.

1.2.2 Tank lorry Entry System including all peripheral devices such as VDU's & printers etc. associated hardware & software to meet complete functional specifications.

1.2.3 Necessary hardware and software for interfacing with ISC Computer system on TCP/IP, complete with cabling etc complete.

1.2.4 Radio Frequency interface (RFI) & Electro Magnetic Interference (EMI) requirements in line with IEC 61000-4 shall be strictly followed.

1.2.5 Transient & Surge Protection – The entire automation system needs to be protected against system errors & hardware damage caused by -

1.2.5.1 Electrical Transients on power wiring.

1.2.5.2 Electrical Transients on signal wiring

1.2.6 All the Networking devices (Control Room) connected with field instrumentation are to be provided with surge protection devices for protection against electric transients.

1.2.7 Transient Voltage Surge Suppressors (TVSS) are to be provided at the UPS (power supply inlet ports) to protect control room & field instrumentation from Electric transients.

1.2.8 Programmable Logic Controller (PLC) (for normal plant operations / controls) as per actual I/Os quantity including spares based on functional requirements of all MOVs, Batch controllers, Barrier Gates, Pumps, Field instruments etc. Complete, Tank farm instrumentation**.** This will include simulation of all the Interlocks.

1.2.9 SIL2 certified Programmable Logic Controller (PLC) [for Emergency shutdown operations /safety Interlocks] as per actual I/Os quantity including spares based on functional requirements of all MOVs , HC detectors, ROSOVs , Hi-Hi Level switches, Batch controllers Barrier Gates, Pumps, Fire fighting equipments, Field instruments etc. complete**.** This will include simulation of all the interlocks.

1.2.10 The PLC systems shall have surge withstanding capability for their input/output modules as per IEEE 472 standard. The PLC system shall be capable of preventing noise arising caused by solenoids, relays & contactors carrying heavy currents.

1.2.11 Earthing - Each cabinet shall have segregated earthing system as detailed below-

1.2.11.1 Instrument Earth (NIS Earth) – Non IS signal cable shields are to be connected to the 'Instrument signal ground earth bar'

1.2.11.2 Intrinsic safe grounding (IS earth) - The IS instrument signal cable shields are to be connected to 'intrinsic safe earth bar'.

1.2.11.3 Electrical safety & cabinet steel earth (Dirty earth) - The grounding from all racks, doors, gland plates & other metallic objects are to be connected to 'safety earth bar'.

All the above specified earth systems in cabinets shall have isolated copper bar (25 mm X 25mm or more) properly drilled & tapped for connecting earthing lugs.

1.2.12 Flow Measurement & Control sub-system for each bay will consist of –

- Two Positive Displacement type flow meters with pulse transmitters OR Two Mass Flow Meters (as applicable at TLF gantry)
- Two Air Eliminators (Dead volume capacity - 10% volume of product accumulated in 1 minute at max. rated flow rate of the PD Meter)
- Two strainers
- Two Set stop valves (option2 is mandatory for FO service)

  [*<u>Option-1:</u> Hydraulically powered type, if available line pressure is 1.5 Kg/cm2g as a minimum;*

  <u>Option-2</u> : Pneumatically powered type (along with air compressor, refrigerated air drier & GI piping /copper tubing required for pneumatic/air supply at individual loading points) , if available line pressure is less than 1.5 Kg/cm2g & it is not practically feasible by the Operations / E&P to raise it more than 1.5 Kg/cm2g]

- Two RTD type Temperature sensor
- Two Remote interacting terminals
- Two Single Channel Batch controllers

- One card Reader (Proximity type)
- One Earthing Relay
- FLP Junction Boxes (Power/control/signal)

1.2.13 Each product header running between TLF pump house & TLF Gantry will be provided with pressure gauges, pressure safety valve, Meter proving system, Pressure transmitter & Bulk Air Eliminator (Dead volume capacity -10% volume of the product accumulated in 1 minute at combined max. rated flow rate of all the TLF pumps of the specified product).

1.2.14 Pressure / Temp. Gauges, Pressure safety valves, Pressure / Temp / Flow Transmitters along with isolation valves, fittings, impulse piping (SS 304) wherever indicated / as applicable are to be provided & integrated with TAS.

1.2.15 Hardwired Level Alarm contacts (to be provided by TFMS vendor in control room) are to be interfaced with PLC by TAS vendor.

1.2.16 BPCL will provide in its MCC control room following power tap-off points-

- One no. 230 VAC (+/- 10%), 50Hz (+/- 1%), Single phase, power supply point for non-UPS loads.
- One no. 440 VAC (+/- 10%), 50Hz (+/- 1%), Three phase, power supply point for UPS system.
- One no. 440 VAC (+/- 10%), 50Hz (+/- 1%), Three phase, power supply point for Power Distribution cabinet of MOVs.

Any further power distribution including supply & laying of proper size power cable /signal cable from MCC room to Automation control room alongwith provision of Power distribution cabinets (UPS & Non UPS Power supply) required for Power supply requirement of control room instrumentation & Field Instrumentation is in vendor's scope of work. Vendor should also consider a power distribution panel with one incoming feeder and minimum four outgoing feeder with proper size of Switch fuse unit/MCCBs.

The Power distribution cabinet referred above shall have individual MCBs for all discrete instruments/ equipments pertaining to control room & field instrumentation (either supplied by vendor or the free issue instrumentation supplied by BPCL & integrated by TAS vendor).

Dedicated power distribution cabinets with individual MCBs is to be provided for powering of field MOVs.

1.2.17 The following philosophy will be applicable for power cabling for the field instrumentation:

- In general, 20% spare cores in cables & 20% spare terminals in JBs & Marshalling cabinets / system cabinets are to be provided.
- For each bay, 36C X 1.5 sq mm copper conductor, armoured, FRLS PVC cable is to be laid from control Room (Power distribution cabinet) up to bay specific FLP Junction box.
- From the above FLP Junction box, 3C X 1.5 sq mm copper conductor, armoured, FRLS PVC cables, are to be provided / laid to the following instruments of a bay -
    - Four Solenoid Valves of the two Set stop valves
    - Two Remote interacting terminals
    - Two single channel Batch controller
    - One card Reader(Proximity type)
    - One Earthing Relay
- For the field transmitters (4-wire transmitters) instruments, (12/24/36) C X 1.5 sq mm multicore copper conductor, armoured, FRLS PVC cables are to be provided upto Field Junction Box (Power). From this JB 3C X 1.5 sq mm branch cable is to be laid up to Tx.

Note: During design stage, in case of long distances, if voltage drop between Power supply source & receiving instrument exceeds more than 5%, then 2.5 sq mm copper conductors are to be considered instead of 1.5 sq mm as specified above.

1.2.18 The following philosophy will be applicable for signal cabling for the field instrumentation.

- In general, 20% spare cores in cables & 20% spare terminals in JBs & Marshalling cabinets/system cabinets are to be provided
- Batch Controllers-

- Four batch controllers are to be multi dropped in such a manner that the two redundant serial communication ports of batch controller gets connected to the two redundant Terminal Servers by using -
    - Multipair [2-pair (twisted), 1.5 sq mm copper conductor PVC, shielded], overall shielded, armoured, FRLS PVC signal cable between a batch controller & field junction box.
    - Two no. multipair [12-pair (twisted), 1.5 sq mm copper conductor, PVC , shielded], overall shielded, armoured, FRLS PVC cable between field JB & Marshalling/system cabinet(control room) in such a manner that the signal from the two redundant serial communication ports of the batch controllers get routed up to the two Terminal servers through Marshalling/system cabinet (control room) by using the two multicore cables.

- Card Readers-
    - Card Readers need not be multi dropped. Card Readers directly connected with Batch controllers are preferred.
    - Single pair [1pair (twisted), 1.5 sq mm copper conductor, PVC, shielded], overall shielded, armoured, FRLS PVC cable between a Card reader & field JB.
    - Multipair [12-pair (twisted), 1.5 sq mm copper conductor, PVC, shielded], overall shielded, armoured, FRLS PVC cable between field JB & Marshalling/system cabinet (control room).
- 2-wire /4-wire transmitters-
    - Single pair [1pair (twisted), 1.5 sq mm copper conductor, PVC, shielded], overall shielded, armoured, FRLS PVC cable between a Transmitter & field JB.
    - Multipair [12-pair (twisted), 1.5 sq mm copper conductor, PVC, shielded], overall shielded, armoured, FRLS PVC cable between field JB & Marshalling/PLC cabinet (control room).

1.2.19 The following philosophy will be applicable for control cabling for the field instrumentation.

- In general, 20% spare cores in cables & 20% spare terminals in JBs & Marshalling cabinets/system cabinets are to be provided

- Pressure/ Level /Temp Switches-
    - Control cable [2 core, 1.5 sq mm copper conductor, PVC, armoured, FRLS PVC] between a Switch & field JB.
    - One no. multi core control cable [24 core, 1.5 sq mm copper conductor, PVC, overall shielded, armoured, FRLS PVC] between field JB & Marshalling/PLC cabinet (control room).
- Open/ Close status-Limit switches (ROSOVs/ MOVs/ Barrier Gates/ Dyke Drain valve)
    - Control cable [2 core, 1.5 sq mm copper conductor, PVC, armoured, FRLS PVC] between a Switch & field JB.
    - One no. multi core control cable [24 core, 1.5 sq mm copper conductor, PVC, overall shielded, armoured, FRLS PVC] between field JB & Marshalling/PLC cabinet (control room).

1.2.20 Field instrumentation /scope of work will include following

- Installation (along with supply / fabrication of impulse piping manifold & its hydro testing, including supply of SS isolation valves / fittings & ¾" dia SS 316 impulse tubing), cabling, loop checking, commissioning of field instrumentation (as applicable) in general as well as specified in 'Schedule Of Quantities'.
- All instrument installation materials as well as cable laying material such as instrument supports (2" pipe yokes), MS angles/flats, Field Junction boxes, trays, ducts, compression fittings, cable glands, aluminium saddles, lead markers, sand, bricks, cement, etc. as required for the system.
- All field equipment shall be weatherproof to IP65 /NEMA-4/IS-2147 or equal unless otherwise specified. They shall also be intrinsically safe or explosive proof (NEMA-7 / IS-2148) suitable for area classification Zone 1 & 2, Gr., IIA & IIB as per IEC / CENELEC/ IS as a minimum. Intrinsically safe equipment is preferred and shall be used as the first option. Also all the field instruments shall be approved by Chief controller of Explosives/PESO.
- Supply and laying of all cables including ferruling, dressing, glanding and termination etc. as per Plant layout & finalized cable routes.
- Civil/ Mechanical/ Electrical works including the casting of foundation as per requirements for instruments support where paved surfaces do not exist.

- Minor civil works like chipping of pavement and grouting on the pavements for the instruments panels/supports stand, and chipping and refilling of the pavement for conduits.
- Sealing of cables/tube/pipe entries into the control room after laying and testing of all boxes, cables etc. by installing Multi cable transit (MCT) blocks. All works relating to the sizing, designing and installation of MCT blocks is within the scope of the vendor.
- Installation of main control panels, marshalling cabinets and system cabinets in control room.
- Supplying & providing supports for installation of equipments are included in the scope of the vendor.
- All the pipeline works for installation of all field instrumentation, Density meter, Pressure Transmitter and other instruments are also included in the scope of the vendor.
- Pipes, Bends, Isolation Valves & Flanges only below 80 mm size required in this regard will be supplied/ by the vendor.
- All the structural & other materials are to be supplied by the vendor.
- Laying and termination at both ends of instruments earth buses provided in control panels to instrument earth pit.
- Complete earthing of control room equipment, TLF equipment & FLP equipment in the field.
- Painting of all structural supports for trays, panels, junction boxes, instruments, ducts etc.
- Drilling holes on all panels, shut down cabinets, power supply cabinets, control panels, etc. for cables/ glands/ grommets.
- No hot work in the TLF, Tank Farm area, only fabricated clamps are to be used for installing cable trays, equipment erection etc.
- Grounding of shielded cables to respective instrument earth bus.
- Supply of all types of consumables required for erection of the job.
- Completion of drawings/documents as per the execution of work at site and submission to BPCL.

- Preparation and submission of as built drawings as required and submission to BPCL.
- The bought out items shall be supplied from BPCL approved vendors/SOS Form as per vendor list enclosed.
- All the instruments/ equipments/ subsystem supplied shall be from original manufacturers and make/model offered shall have sufficient successful proven operational track record at the time of the bid.
- All FLP glands shall be made of SS316.

1.2.21 Control room instrumentation will be as per System Architecture drawing & will include following -

- Open table top type control desk for LRC / OIC / TFM / TTES / ISC / Terminal Manager / Territory Manager PC.
- Marshalling racks, power supply distribution cabinets/ boxes, power pack units, intrinsic safe barriers/ isolators, other auxiliary cabinets etc. as per specifications.
- Front end software with suitable hardware with lorry allocation validation at each step of filling activity and managing the proper functioning of all firmware.
- P/L Receipt screens, Tank farm receipt, to indicate all field instruments with real time values.
- Inter tank transfer screens to be provided.
- Gantry overview screen to be provided.
- Tank farm overview with MOV open/close status and Pump house overview with MOV open/close status to be given based on P & IDs provided by BPCL.
- RIT status screen to be provided on the graphics of LRC/OIC. Flashing status / sequence should mirror the field status of the RIT.
- All tanks level, gross vol., net vol. etc to be given.
- Adequate help screens to be provided.
- Dual redundant load rack computers / TAS Servers in hot standby configuration as per functional specifications. These will receive dynamic parameter updates through front-end dedicated fully redundant communication or terminal servers from field equipment like flow meters/ batch controller and density meters/ temperature sensors & tank farm system. LRC computer will be interfaced to the

ISC computer on dual redundant TCP/IP communication. The connectivity between ISC and LRC (including cable laying) will be the vendor's responsibility

- One no. operator interface console will be provided in the Installation/ Territory Manager's room.
- Two no. TTES computer shall be located in the Invoice Room/ Planning room.
- ONE No. SAP-TAS computer will be provided in the Invoice/Planning room.
- One No Work station for ISC
- Two nos. LRCs in main control room along with two operator interface consoles & two printers.
- 30 Cards for Terminal use with customized logo sign of BPCL & photo ID compatible to the access control system offered shall be supplied by the vendor for main control room.
- 300 Cards for Terminal use with customized logo sign of BPCL compatible to the access control system offered shall be supplied by the vendor.
- One PLC Controllers as per requirement in rack to rack hot standby configuration as per specification for Remote operation of MOVs, Barrier Gates, Pumps, ESD, Smart transmitters and density meters. etc. The PLC/DCS with accessories shall be housed in panels as per the specification enclosed.
- Dedicated network printers with print servers as shown in system architecture diagram enclosed.

1.2.22 Emergency Shutdown System Field cabling Philosophy – Field instrumentation specified for integration with ESD –PLC system shall be provided with dedicated FRLS cabling (signal/ power/ control) & FLP Junction Boxes (signal/ power/ control) .

1.3 DETAILS OF EXISTING INSTALLATION (TO BE PROVIDED BY REGIONAL E&P) ON THE BASIS OF WHICH 'SCOPE OF WORK' WILL BE DEFINED/ QUANTIFIED

- Specify no. of product storage tanks (cone roof, floating roof & horizontal tanks) along with tank height / dia & product allocation
- Specify no. of MOVs along with its service/tag no.
- Specify Product pumps along with product type/ application/ max. Flow & max. Pressure

- Specify no. of bays /loading points per bay/ product allocation per loading point/ Operating Pressure / flow (min/max) at each loading point.
- Details of existing instrumentation
- Details of MCCs to be interfaced with TAS
- Specify no. of Fire water tanks along with tank height, details of existing tank instruments & details of Fire water pump house /fire fighting system.
- Details of Power supply –single phase & 3-phase
- Installation details can be given in following format

Pump Max. Flow Capacity (Kl/Hr.)	Pump Max. Discharge head (MLC)	No. of Bays & No. of TLF Loading points at each bay for the product	Existing Flow Rate & Pressure at Loading points during TLF operation	Product Pressure at the extreme end of TLF header at gantry when all loading points are operational (Pl. check by using Pressure Gauge)	No. of product storage tanks with storage capacity /height/ type of each tank	Details of existing Tank Farm Automation if any	Details of Blending facilities provided/to be provided at installation	Details of any other facility	Remarks

1.3.1 SPECIAL CONDITIONS :

i. Vendor shall indicate the load requirement for all types of power supplies. Break-up for power requirement of each equipment is to be furnished along with the offer at bid stage.

ii. Vendor shall be required to furnish ventilation and air-conditioning requirement in the control room during detail engineering.

iii. Vendor is required to specify the total pressure drop across complete metering assembly. Maximum allowable pressure drop is 1 kg/cm2 across metering system i.e. strainer, air eliminator, PD meter & DCV.

iv. Vendor is required to submit a detailed scheme for proving system offered by them as per specifications detailed in "Functional specification".

v. Vendor to ensure that the equipment shall not be damaged due to black-outs / brown-outs and indicate following :

Steps to be taken for fail safe operation of the system under following conditions:

a. Power failure.

b. Voltage variation upto +/- 10 %

c. Frequency variation +/- 3%

d. Air conditioning failure.

e. Start – up procedure of the system.

2 FUNCTIONAL DESIGN SPECIFICATION (FDS) :

2.1 The objective of FDS is to present all aspects of Terminal Automation System with various subsystem such as LRC subsystem, Field Automation subsystem, Flow Metering subsystem, Tank Farm Management system, ESD System, PLC, ESD-PLC subsystem, etc. It is expected that FDS shall be used by all levels of operating personnel i.e. system engineers, maintenance engineers, operators, supervisors etc. who should get complete insight and understanding of the following aspects about Terminal Automation system.

- System design aspects.
- Operational & Functional requirements.
- Complete details of systems configuration, all hardware, software & equipments offered for this project to fulfill the obligation of the contract document.
- Redundancy and backup aspects (system fail over)
- Configuration and engineering aspects. (Database preparation, Alarm/Event presentation, System maintenance and engg. Function).
- System diagnostics.
- System expansion capacity and up gradation methodologies.
- Operator's MMI.
- Interfacing integration and communication aspects between various subsystems.
- System performance parameters covering CPU, Disk and main memory utilization, memory mapping, system time outs, LRC computers switch over timings, Display updates, Display call ups etc.
- System testing and evaluation criteria.

2.2 System should have redundancy for critical communication links like batch controllers to LRC interface ; TFMS CIU to LRC interface ; PLC/ESD-PLC to LRC/TAS Servers interface ; MOV's Master station to PLC interface & PLC Processor to PLC I/O racks to ensure full operational capacity at all times as per detailed specifications the tender.

2.3 The operational requirements as specified in this tender might undergo revisions during detail design and engineering. Vendor must ensure that the offered system software packages have the capacity and flexibility to take care of these revisions e.g. product changed, bays changed, product codes etc.

2.4 The capacity of offered software should be with 20 % spares with respect to nos. of data base points/ tags after calculating requirements of the total system. The offered software should have in-built capability/provision to take care for future expansion to the extent of addition of minimum Five type of existing/new products for loading in the gantry, up to five new product tanks. System should be flexible from the point of view of up-gradation. These shall be verified during FAT.

2.5 Vendor is required to submit/ offer system network configuration as per details provided in “Functional Specifications”.

2.6 The offered software should be of proven technology & latest version; with copyright or trademark registration. The offered software has to be from principal manufacturer/ as per norms of vendor registration/ acceptance for BPCL empanelment for terminal projects as specified in the tender.

2.7 The original copy of the license certificate for the operating system, RDBMS & OS (10 user license – 2 No. For redundant LRC/ TAS server & client stations), SCADA/DCS software and LRC / TAS server software each needs to be provided to BPCL from the principal collaborator from the country of origin clearly mentioning the details like project name, end user name, name & version of the offered software for each of above, data base sizing as a minimum. The original copy of the license certificate in name of BPCL supported with unpriced shipping import documents shall be provided to BPCL for effecting payment to the vendor. In the absence of the above documents payment shall be held back by BPCL. The prime bidder / system integrator with collaborator backup shall confirm availability of the source code for the custom code programmed RWL Filling Operation application software with them.

2.8 In case the prime bidder has an MOU / Joint venture with the principal who is the technology supplier or the vendor is a 100% subsidiary of the principal a letter shall be submitted by the prime bidder on the principals letter head from the country of origin declaring qualified technical support for the offered application software for the next 10 years as a minimum.

2.9 All software licenses shall be from the principal software manufacturer and not from the resellers.

2.10 For each server (LRC / TAS Server) running memory resident applications like Operating system + SCADA / DCS software, RDBMS + code programmed application for Tank lorry filling operations, development (engineering) + runtime + network license is to be provided from principal supplier. Each operator / client station shall be provided with Runtime + Network license with no. of licenses being equal to the no. of client /

operator stations and these shall be submitted to BPCL. In addition, for LRC to be used as OIC, two nos. additional R+N licenses shall be provided.

2.11 R+N licenses (MMI /GIU/HMI) shall be provided on all servers/client stations /operator interface

2.12 Stations including TTES & where ever Visual Basic Document Forms / equivalent are employed to achieve TAS functionality, they should open in MMI/GUI/HMI background only i.e. embedded using ACTIVE X /equivalent technology on MMI /GUI/HMI. Interoperability within all client stations should be available i.e. it should be possible to view OIC graphics in TTES machine & vice versa".

2.13 Vendors are required to produce following documentary evidence to BPCL before integrated FAT for offered system :-

i) Site License for Operating System for each of the LRC & client stations and shall be equivalent to Full pack of Windows 2008 Server.

ii) Site License for SCADA / MMI / LRC

iii) Site License for RDBMS.

iv) Site License of PLC loader software

v) Site License of TFMS software

2.14 Each LRC server shall have memory resident Development + Runtime + Network license & each client station /operator interface console shall have Runtime + Network License as minimum. For example, for a redundant LRC station + three client (operator) station configuration, minimum 2 nos. of D+R+N & 3 nos. of R+N station licenses shall be provided. The original copy of Operating System license, RDBMS license (total 2 nos. one each for each LRC server with necessary user license as specified) + SCADA or MMI & LRC license shall be provided to BPCL. The licenses shall be with a unique hardware / software key as applicable & certificate from principal supplier which provides details like end user name, name & version of offered software, details like nos. of D+R+N & nos. of R+N licenses offered as part of site license, backed up by support letter from principal supplier that offered software version is latest with technical support for next ten years. The offered software site license /software shall meet all LRC performance criteria as specified in the tender. The vendor shall need to provide a written guarantee on Rs. 100 /- judicial stamp paper to BPCL that source code for truck logic application is available with prime bidder & /or in case of lead bidder using BPCL approved vendor for LRC software, same written guarantee shall be provided by lead bidder accompanied by MOU on a judicial stamp paper between lead

bidder & principal supplier of LRC software clearly defining terms of agreement, logistic support, scope of site support, life cycle support plan for ten years. The vendors shall also be required to submit to BPCL copy of un-priced PO copies accompanied by un-priced invoice along with import shipping documents (Bill of Entry at Customs - Un priced) to BPCL for verification. BPCL shall make itself available for FAT after full satisfaction / verification of all above clauses.

2.15 Configuration of Software loaded on various terminals shall be as per following Table.

SOFTWARE	LRC1	LRC2	OIC1	OIC2	OIC3	TTES1	TTES2	ISC
OPERATING SYSTEM *	Y	Y	Y	Y	Y	Y	Y	Y
RDBMS	Y	Y	N	N	N	N	N	N
LRC APPLICATION SOFTWARE (FOR SERVER)	Y	Y	N	N	N	N	N	N
LRC APPLICATION SOFTWARE INCUDING HMI/ SCADA** (FOR CLIENT)	N	N	Y	Y	Y	Y	Y	N
OPC CLIENT (OLE FOR PROCESS CONTROL)	Y	Y	N	N	N	N	N	N
ODBC (OPEN DATA BASE CONNECTIVITY	Y	Y	N	N	N	N	N	N
NET DDE (NETWORKED DYNAMIC DATA EXCHANGE)	Y	Y	N	N	N	N	N	N

Note:

* Operating System shall be Windows 2008 Server for LRC / ISC and Windows 7 for the Client Stations.

** HMI / SCADA shall be either of the following only, as per the tender:

- CS3000
- ADVANT / T-MAC
- EXPERION PKS R400 – HONEYWELL
- SMART TERMINAL MANAGER (Latest Version)
- SIMATIC Win CC
- WONDERWARE
- INTELLUTIONS

The offered software should be of the latest version

The 2 sets of original copy of the license certificate of the operating system, RDBMS(min. 5 user license) and TA application software for redundant LRC/ TAS server needs to be provided clearly mentioning the details like project name, end user name, name & version of the offered software for each of above, data base sizing as a minimum. Each operator / client station shall be provided with Runtime + Network license with no. of licenses being equal to the no. of client / operator stations.

2.15.1 Following SCADA / DCS LRC software are acceptable

a) Experion PKS SCADA R 400 - Honeywell

b) Smart Terminal Manager – Latest version

c) INDUSTRIAL IT (T-MAC) – ABB Germany or latest version.

d) Advant – ABB Norway or latest version.

e) Invensys FOX I/A Invensys USA or latest version.

f) Yokogawa EXATAS + Centum CS 3000 – Yokogawa Japan

g) LNTAS with iFIX latest version.

h) Freelance 2000 – ABB Germany

2.15.2 Following are the approved Operating Systems and RDBMS.

Operating Systems (10 CAL license)

a) Microsoft Windows 2008 Server Standard Edition – SERVER

b) Microsoft Windows 7 Professional - CLIENT

RDBMS (10 user license)

a) Microsoft SQL Server 2010

b) Oracle 11 g or latest

2.16 Vendor should also submit operation flow chart & functional specifications for the system offered during detail engineering.

2.17 Customization of software will have to be carried out by the vendor to suit the system requirement.

2.18 Vendor shall have to give a guarantee on a non-judicial stamp paper / company's letter head for availability of spares and back-up engineering for maintenance of this system for a post warranty period of 10 years.

2.19 The site should be free from all scrap and other material/ equipment after completion of job.

2.20 Confirmation from the sub-vendor regarding sustained supply of spares and service in the BPCL format for the following major items as a minimum shall be provided during detailed engineering :-

a) Batch Controller

b) PD meter Assembly

c) Mass Flow Meter

d) Digital Control valve

e) Earthing Relay

f) PLC

g) Software

h) Servers/Workstations

This shall be submitted during detailed engineering before procurement.

2.21 Bidders shall quote strictly as per the approved vendor list of BPCL as attached with the tender. No deviations to the same shall be acceptable and the offer may be liable for rejection. Bidders shall in their offer fill up the enclosed SOS format clearly indicating the make, model and country of origin for both 1st and 2nd choice. Technical literature for all the items needs to be submitted with the bid offer.

3 DRAWINGS TO BE SUBMITTED DURING DETAILED ENGG:

3.1 Dimensional plan and layout drawing showing equipment layout inside control room and inside Truck loading shed.

3.2 Routing and details of entire cable installation complete with JUNCTION BOX details and cable trays.

3.3 General arrangement drawing and installation drawing of all the equipment viz. Control room mounted and field mounted.

3.4 Dimensional/Installation drawing for metering skid in the TLG clearly indicating the end to end distance for offered skid.

3.5 Power supply distribution panels / Power cable/control cable/ signal cable drawing inside control room and in the field.

3.6 Detailed proposed system architecture diagram showing all interconnection complying to the functional specifications.

3.7 Detailed software block diagram showing various functional modules & tasks for the offered software & their interconnection.

3.8 Detailed PLC system architecture & interface to LRC / TAS servers.

On completion of work, the vendor shall supply one set of as built drawings in CDROM and two sets of prints of all as-built drawings incorporating all changes that might have been affected during execution of contract. Vendor shall also submit minimum two sets of equipment Operation and Maintenance manuals.

Vendor shall also arrange & submit softcopy of as built drawings & Operation & Maintenance manuals

4 VERIFICATION OF DOCUMENTS :

In case BPCL so desires the vendors may be required to bring the original of the following documents for verification at BPCL. Bidders are required to submit attested copies of these documents along with their techno-commercial offers.

4.1 Documents in support of tenderers or its collaborator's having executed work of similar nature during any of the last three financial years for qualifying for this work as given in tender notice.

4.2 Latest income tax clearance certificate.

4.3 P.F. registration certificate.

4.4 Legal collaboration agreement with foreign collaborator.

5 OPERATING PHILOSPHY AND SYSTEM CHARACTERISTICS.

5.1 AUTOMATED TANK LORRY SYSTEM- OPERATION PHILOSPHY

i. The ISC will sort the truck nos. based on first come first serve basis for each of the owners /contractors like, BPCL, IOCL, HPCL & others. The sorted list (first in –first out) shall be available as a menu driven GUI interface at the TTES screen.

ii. The TTES operator will pre-select tank trucks for each of the category for loading in the Tank lorry planning room.

iii. The LRC will first display the 4 Truck nos. For pre-selected trucks on the display terminal located in the TT parking Area at one time & only those tank trucks whose nos. are displayed on the display terminal will report the ISC terminal at the Tank lorry planning room. Subsequent Truck nos. will be scrolled onto the display terminal by the LRC at user configurable scrolling times.

iv. If a displayed truck nos. does not report to the ISC within a user configured time set; the truck nos. will be directed / displayed at the wait list display line of the display terminal for a user configurable preset time before being deleted from the display terminal.

v. ISC operation is carried out in following order.

The commercial verification including checking of the amount, party particulars, load requirements, credit balance of the party, Quota of the party and details of T/T are verified.

Planning Officer Decides:

i. Destination: (automatically decided by the system from the list of available indents and other selection criterion, However the operator may decide/change the destination, in case of exigencies with Exception logging and approval from authorized system administrator)
    - Product allocation –compartment wise.
    - Quantity allocation-compartment wise.
    - Abloy lock System / other sealing system

vi. The above scheduled pre-load data from ISC downloads the information pertaining to particular T/T to Loading rack computer system (LRCS) which in turn downloads this data to tank tuck entry system (TTES).

vii. TTES allocates bay no, based on total no of T/T inside and 1+2 criteria for TLF bay. TTES can over ride LRCS in bay allocation, if required. TTES enters seal number on TTES screen. Card reader at TTES validates Lorry Card (Proximity type) ID. Main computer will pass the information to all checkpoints and filling bay. FAN (filling advice note) is printed by TTES operator and handed over to the driver along with seal. Validity of card & expiry of FAN shall be user programmable.

viii. T/T enters through main Gate, reports at TLF entry gate Barrier.

ix. Driver shows the card into barrier gate card reader. Gate opens on command from PLC based on clearance from main computer of control room and the T/T enter the licensed premises. Traffic signal lights are provided at the entry barrier gate to provide visual feedback.

x. T/T is driven to allocated bay and Queued up near the bay for loading. Once bay is cleared, TT is parked in the allocated Bay. The “Red” lamp is on in the RIT. at particular TLF bay. T/T driver shows the card at the card reader provided at the loading bay. LRC checks its validity, downloads the loading information to batch controller and lights up the Amber lamp at the RIT.

xi. T/T driver inserts loading arm in the first compartment of T/T i.e. starting from T/T cabin side.

xii. Driver connects earthing to the T/T.

xiii. Driver prepares for loading and acknowledges by pressing amber push button on RIT.

xiv. Green lamp on RIT is ON.

xv. Driver presses green PB for actual start of loading operation. Flow of product should not start unless all the mandatory permissive checks are complied with.

xvi. (Steps x to xii are repeated till the loading is completed for all compartments of T/T.)

xvii. FLP Green Lamps; located at each bay; are to be turned “ON”, when the corresponding truck is completely loaded. The successful completion of loading operation shall be indicated in the control room by LRC.

xviii. After the TT filling, the Driver drives the Truck to the Sealing platform where the Abloy lock shall be provided. The Bay Officer then enters the Abloy lock numbers into TAS through a combination of card reader and Alphanumeric Display & key Pad.

xix. Batch controller uploads all loading information along with T/T status to the LRCS.LRC compiles all the data such as TT no., Product name, filled quantity compartment-wise, temperature, density and seal nos. etc. for one batch load. LRC communicates back with the above post load data pocket to TTES computer through ISC system for preparing delivery documents.

xx. The T/T driver after sealing proceeds to the Automatic gate barrier. The driver then proceeds to security room. The driver submits the card to the security officer at the planning room. The officer shows card in the “exit” card reader. Once exit access is validated, the ISC system prepares delivery receipt (Invoice) and driver collects Invoice reports.

xxi. T/T driver shows his card to the card reader at the barrier gate exit point.

xxii. LRCS checks up in its database, whether the challan for the particular truck has already been printed from the Tank lorry planning room and if yes, all clear-signal is sent to PLC via LRC for operating of the exit barrier gate at the TLF. Traffic Signal Lights are provided at the exit gate.

xxiii. T/T comes out of licensed premises, goes to security gate. Meanwhile, T/T driver hands over card and gate pass copy of challan to security gate and drives out of premises. After passing of each truck, the barrier gate closes automatically.

xxiv. Entire system will work on real time mode and will register entry, filling and exit time of each Tank truck. The system should be able to take care of RTKM (round trip kilometer) of all the customers and their turnaround time. No tank truck should be accepted if it reports before the minimum stipulated time.

xxv. In the event of LRC failure, all the batch controllers shall fall back to the stand alone mode of operation; each batch controller shall display the prompt “ENTER P.I.N. NO. ; each bay supervisor will be having unique PIN no., which can be entered at Batch Controller to facilitate/locally load the TT for any given quantity after setting Qty. In batch controller. Seal entry prompts for each compartment for a given particular tank truck should be facilitated at the end of loading all compartments. All historical data pertaining to such type of fillings will be recorded in the batch controller & downloaded to the LRC when the system comes online.

5.2 OPERATION CONCEPT AND SALIENT FEATURE

a) TLF BAY ALLOCATION :

Automatic through LRC

b) PUMP SEQUENCING FOR TLF P/H

Auto sequencing of Pumps for each product shall be done based on the no. of Loading arms in operation and the same shall be performed in the PLC. The pumps are to be operated through a suitable PLC so that only optimum desired nos. of pumps are in operation till such time the flow requirement of the system does not overshoot a specified range, as soon as the flow requirement shoots beyond that, the second pump should come into operation Similarly, other pumps should also come into operation, sequentially, as soon as the flow requirements shoots beyond specified higher ranges.

However, when the total flow requirements drops down below given range (which is very low), the supervisory computer should send an alarm as well suitable control signal to the PLC, similar alarm should also be actuated in pressure rises above 8.0 Kg per Sq.cm. or when pressure falls below 1.0 Kg. per Sq. cm.

Starting of 1st pump and switching off of the last pump shall be done from control room.

All the pumps should start in sequence. Sequence should change automatically after certain running hrs of particular a pump. Provision should be there for interchangeability of pump, in logic of PLC.

Pump to shut off automatically once level in Tank is low-low.

Interrupted Loading sequence:

During the normal loading, the loading operation may be stopped or interrupted in a number of ways including

i. Safety permissive interlock failure.
ii. BC Alarm condition.
iii. Local stop from RIT.
iv. Emergency stop.
v. Stop command from control room operator.

Pump demand contacts from the batch controller shall be hardwired to the PLC/DCS

c) AUTOMATION OF TANK FARM

TFMS system will be supplied, installed & commissioned independently by its OEM or by TAS Vendor (as applicable).

Interfacing of the TFMS system to achieve fully automated & remote manual control of Tank farm instrumentation [(MOVs, ROSOVS) & pump house (auto start /stop of pumps & status (Run/Stop)] is in Automation vendor's scope. Moreover Dynamic graphics of tank farm area, pump house etc. which is in Automation vendor's scope, will require following:

i. The tank farm management System shall be interfaced with TAS through TFMS computer over redundant Ethernet LAN.

ii. All the hardwired alarm contacts (from eg. Radar Level Tx./ Servo Level Tx./ Hi-Hi Level Switch etc;) shall be interfaced with safety PLC DI modules.

iii. The analog outputs of the level transmitters (4-20 mA) shall be interfaced through AI modules of conventional PLC.

iv. Start-Stop command & open-close status of MOVs / ROSOVs shall be made functional in following manner:

    a. by way of hard wiring MOV / ROSOV with PLC
    b. by way of interfacing serial communication ports of PLC with 2-wire control system of MOVs (if applicable)

Following Data from tank farm automation (as a minimum) will be made available to Automation vendor:

a. Tank no., product , tank capacity
b. Product Level in Tank
c. Water Bottom Level
d. Hi-Hi Level Alarm (Measured by Hi-Hi Level Switch)
e. H,HH,L,LL levels (HH&LL alarms hardwired to PLC)
f. Product temperature.
g. Product Density.
h. Net , gross & standard volume

Tank Valves:

All the automated valves provided at Tank Inlet / Outlet for Tanks (i.e. MOVs & ROSOVs) are to be hard wired or serially interfaced with conventional PLC / Safety PLC. These MOVs / ROSOVs will be controlled automatically by PLCs as per operational / Safety requirement.

5.3 RECEIPT OF PRODUCTS

5.3.1 Valves in the pipeline receipt manifold are made with operating control at control room.

5.3.2 To record all batch numbers and quantities of receipt of product on real time.

5.3.3 To send signals for printing of MIS at pre-decided intervals.

5.3.4 To send signals for auto shut-off of valves depending on H or HH levels attained in the tanks.

5.3.5 Tank body receipt valves / MOVs / ROSOVs should automatically close/open depending on high-high/low-low levels in the tanks.

5.3.6 Detailed logic for receipt of product & MOV (Tank) operation shall be discussed during detailed engg.

5.3.7 During PLT Tank MOV should not be closed first.

5.4 PUMP HOUSE MANIFOLD

Valves operation inside P.H. manifold is required to be motorised on discharge side with remote control from control room. Also NRV will be provided by BPCL on discharge side of each PPU.

6 TERMINAL AUTOMATION SYSTEM (TAS) INTERFACING WITH SAP AT AUTOMATED LOCATIONS.

6.1 INTRODUCTION

In SAP environment all the documents at the locations are generated using a central server installed at Mumbai. The central server transfers the shipment data thru FTP to a local Win2K server and similarly the necessary data required for generating documents will be picked up from the local server. This local Win2K server, called as Integrated Supervisory Computer (ISC), communicates with TAS server or LRC (Loading Rack Computer) to transfer the data files between the local servers using the interface programs provided by the TAS vendor. These interface programs are executed thru Visual FoxPro based package SAPTAS installed on the ISC and this package also generates the filling slips with bay number. The objective for interfacing the ISC with LRC is to transfer the necessary data between these two systems to avoid the re-entering of data so as to ensure the consistency of the data in both the systems. The interfacing between LRC and ISC will be based on the following.

ISC will be initiating requests with files as parameters thru programs of SAPTAS to get the necessary data from LRC. The reply files from LRC will be written onto the ISC system in pre-designed SDF formats under specified directories.

The ISC and LRC will be connected through Ethernet with TCP/IP suite loaded on both the servers.

All the programs required for various pre-defined data requests will be developed by the suppliers of automation software and hardware and all the source programs will be made available on ISC and LRC.

The connectivity between ISC and LRC (including cable laying) will be the vendor's responsibility and the connectivity between ISC and all PCs, which are required to be connected to ISC, will be provided by BPCL.

SAPTAS package and the vendor interfaces loaded on ISC will be executed from the planning room PCs by mapping the ISC drive to PCs. At the same time, the SAPTAS package and the interfaces if loaded on planning room PCs should also work as backup to ISC.

6.2 SEQUENCE OF OPERATIONS AT AUTOMATED LOCATIONS

6.2.1 Truck Registration

In the morning, at the start of operations, the truck driver reports to the planning office adjacent to the security cabin. The planning officer will check the lorry data in the lorry master file (MF) at the ISC terminal. He will then issue a card to the driver after swiping the same at the card reader. He will also store the card number in the Lorry MF against the record of the lorry for which the card is issued. Similarly the planning officer registers all the lorries as and when they report to him. It is also

possible that some of the vehicles are issued the cards permanently. In this case, as and when the drivers swipe the cards at the card reader, their reporting should be registered in LRC.

6.2.2 Filling Advice Note (FAN) printing

The planning officer will have a set of indents. By the truck registration process as enumerated above, he will also know the number of lorries reported. He then assigns a lorry for a shipment in SAP. At the time of saving the shipment after compartment planning a data file in ASCII format will be created and a shell script will be executed to transfer this data file into local NT server thru FTP. By using these data files and also assigning the card number, if not assigned earlier, in SAPTAS package, the entire lorry data is now transferred to LRC. The LRC does the bay allocation and intimates the bay allocation details back to the ISC.

The FAN is then printed at the planning office by the ISC terminal (i.e. PC on which ISC drive is mapped).

The planning officer will hand over the FAN to the lorry driver.

6.2.3 Filling of Lorry

The lorry enters the gantry area after swiping the card at the card reader near the entry gate. He drives to the allocated bay. He again uses the card for subsequent filling operations. All checks will be done by the Batch Controller like bay no, earthing, product, compartment no. etc. prior to filling.

6.2.4 Sealing of Lorry

After filling, the lorry comes to the sealing platform located approx.30m from the gantry exit. The lorry driver again swipes the card at a card reader located at the sealing platform. The seal/lock numbers along with the vehicle number captured during the generation of the FAN will be displayed for confirmation by the operator. After the sealing the driver proceeds to the exit gate and swipes the card at the card reader near the exit gate.

6.2.5 Invoice printing:

Before the invoice is printed in SAP, the user at the location can confirm thru ISC that the lorry is filled and sealed. The filled quantities can be transferred to SAP from ISC if the invoice is required to be generated with the filled quantities only.

6.3 TRUCK LOADING INTERFACE

6.3.1 Truck Arrival Recording.

The arrival of a tank truck will be recorded in LRC after the magnetic card is read at the Planning office. The card number will also be stored in the Tank Lorry master file of SAPTAS in ISC to link the TL number with the card number. The recorded TL

data in LRC will be transferred to ISC on request from ISC. Necessary controls to be included to avoid repetitive downloading of same data.

6.3.2 Bay Allocation.

The loading information for a tank truck will be provided by the ISC to LRC for the allocation of filling bay by the LRC and to print the same on the Filling Advice Note (FAN) by ISC. This request by ISC will be made through a function call and the reply file from LRC will be put in a pre-defined directory of ISC.

6.3.3 Transfer of Loading Data.

The ISC will initiate a request for post loading data from LRC for a filled lorry so as to generate documents like Cash memo, Invoice, PDN etc. This data will be transferred to ISC from LRC in a pre-defined directory. This data is transferred in two files, one with load data and the other with Seals data.

6.3.4 Lorry Exit Recording.

At the time of exit of a lorry from the exit gate, LRC records the data. This data will be transferred to the ISC on receiving the request from ISC.

6.3.5 Cancellation of Truck authorized earlier by the ISC.

In case it is required to cancel the trucks that have been already authorized for filling but not checked in at a filling bay, this request will be made by ISC and LRC will reply with appropriate code indicating that the filling authorization is cancelled or not.

6.3.6 Bay wise truck Queue.

The ISC will initiate a request for the number of trucks in a queue for each bay. This information will be uploaded to ISC from LRC.

6.4 TANK FARM AUTOMATION SYSTEM INTERFACE

6.4.1 Tank Data

The required data in the specified format will be downloaded on to the ISC from LRC. In case a tank is not in storage mode, the latest measured values for last time a tank was in storage mode will be downloaded.

6.5 REQUEST SPECIFICATIONS FOR DATA TRANSFER BETWEEN ISC AND LRC

The requests that are required to interface the ISC with LRC are given below. These requests will be made by the RUN/! Command from SAPTAS on ISC. The called request may be a compiled

'C' program residing on ISC with a provision to generate appropriate error flags in case proper data is not generated by LRC as reply to the requests received from ISC within the time out period.

A maximum response time of 500 milliseconds is expected for all data transfers for generation of the reply data files, to enable smooth operation of SAPTAS package.

The time out settings for various requests will be finalized after the system has been put into operation and the response time and possible delays are identified.

NOTE:
For sending the location specific Process Data (e.g. Tank product Level/ volume/ temp. etc.) as per M. B. Lal Committee, web service is already developed by BPCL. Vendors need to develop the application to consume the webservice to be provided by BPCL - ERPCC.

7 FUNCTIONAL SPECIFICATIONS.

This specification defines the minimum requirements of terminal Automation System designed for reliable, effective and optimum control & monitoring of a Marketing terminal Operations.

The vendor shall not deviate from this specification without prior written approval from the purchaser. The Terminal Automation System, hereafter called the system or “TAS”, shall be capable of terminal wide automation. All functions defined in this specification shall be performed in an integrated cohesive manner. The architecture of the system shall accommodate both functional and geographical distribution of the hardware, software, and database over the terminal while allowing system wide access to the distributed data. The TAS shall utilize a modular architecture to permit wide range of system configurations and facilitate system flexibility and expendability. It shall include real-time control at the field instrumentation level, supervisory control, centralized order allocation, transaction processing, and product inventory tracking at terminal level and comprehensive product movement accounting and reporting at the management level.

7.1 GENERAL

- The system shall be designed fault avoidance as a minimum by selecting high grade components of proven quality and proper design of system electronics. Redundancy shall be provided, where ever specified; as per this specification to improve the system availability and reliability.
- The terminal automation system software (Latest version) shall be governed by the operating system running in a real time mode and shall be able to meet all functional requirements as specified minimum.
- The system architecture shall be open, providing data movement horizontally and vertically throughout the operations structure.
- The Terminal Automation system (Latest version), proposed shall consist of the following subsystem :
    a. Automation sub-system including loading rack computers.
    b. Flow Metering and loading sub-system.
    c. Tank Farm Management sub-system.
    d. Plant control sub-system using Conventional PLC and Safety PLC.
    e. Data Management (ISC) system. etc.
    f. Barrier gate. etc.

- Isolation shall be provided for all field signals by use of active barriers where ever applicable. Isolation shall also be provided between Engineering/Operator Console/ PLC programming terminal and related sub-systems connected to it, if there is any possibility of high voltage from CRTs being transmitted to the sub-system.
- On Line replacement of any module shall be possible in a way that removal and addition of a module can be accomplished without de-energising the system. Further, there should not be any interruption in the system while replacing a faulty module wherever redundant modules are provided.
- The system shall have an extensive set of self diagnostic routines which shall locate and identify the system failure at least upto module level including redundant components. Failure of a module in a sub-system shall appear on the Operator Consoles irrespective of the display selected.
- The system shall be internally protected against system errors and hardware damage resulting from electrical transients on power wiring and signal wiring which may be generated by switching large electrical loads or by power line faults and connecting & disconnecting devices or removing or inserting printed circuit boards in the system.

7.2 EXPANDABILITY

- The system design shall permit the on-line addition of new system/ subsystems with no disruption to either the operation or system communications for future expansion. The capacity of offered software (Latest version) should be with 20 % spares with respect to nos. of data base points /tags after calculating requirements of the total system.

7.3 UPGRADABILITY

The system architecture shall provide a logical planned implementation of evolving technologies and provision for up-gradation of existing equipment.

7.4 SYSTEM COMMUNICATIONS

- General :

Automation system communications shall be based on the ISO Open system Interconnect (OSI) reference model to provide a migration path to evolving communication standards. The communication networking shall be selected with optimal loading and higher throughput. Maximum network loading shall not exceed 60 % of the total offered capacity as per functional specifications.

7.5 NETWORK REQUIREMENTS:

- The automation system communication shall be on the high-speed modern local area network (LAN) confirming to IEEE 802.3 standards and utilize industry standard protocols with **minimum 100 Mbps bandwidth.**
- To ensure maximum reliability, communications shall be dual redundant. The communications system shall be capable of sustaining loss of one media channel without loss of data or performance degradation.
- **Ethernet Switches with auto sensing for 10/100 MBPS port selection & Simple Network Management Protocol support** are to be used for establishing LAN inter-connectivity in dual redundant configuration. All the STP/ UTP/Co-axial cabling within Ethernet network should have 100% redundancy or better.
- **20 % spare ports are to be provided on each of the Ethernet Switches.**
- Loss of communications shall not cause loss of control at the local subsystem.
- The communication software should employ a peer to peer communications (master less) protocol between all sub-systems where-ever applicable.
- The automation system shall be able to integrate terminal wide network data into common Terminal Automation Software functions such as user displays, historical recording and reports.
- Loss of a subsystem or module shall not disrupt communications to other subsystems or result in performance de-gradation. Loss of a subsystem or module shall cause automatic isolation by pass of the failed subsystem without disrupting communications & without performance degradation; **loss of a subsystem or module or module channel shall generate a diagnostic message to be displayed at the operator stations and logged; identifying location /type of fault.**
- **Dedicated Front End Communication Processors /Terminal Server / LAN Server are to be offered with 100 % redundancy in hardware with 20 % spare ports capacity. Critical communication channels / physical links from devices such as batch controllers; communication interface unit (TFMS); PLCs shall be connected in dual redundant configuration to serial ports of the primary & secondary (redundant) Terminal Server / Communication Processor. Maximum 16 port Terminal Servers are acceptable.**
- Interfacing of field serial communication links directly to adapters / interface cards residing within the LRC EISA/ISA/PCI slots & using LRC CPU clock cycles shall

not be acceptable. **Interfacing of redundant serial links from field equipment to a single front-end terminal or communication server shall not be acceptable.**

- The LAN connectivity between the main control room & the Terminal Manager Computer shall be established using dual redundant (two physical runs) 4-core armored fiber optic cabling with necessary fiber optic transceivers as per specifications & run in GI conduits.

7.6 OPERATOR/ ENGINEER INTERFACE: -

- Access to Operator/Engineering Station functions shall be provided by a multi-level password system.

7.7 ENGINEERING FEATURES: -

- The software shall provide extensive user-friendly tools for creation of dynamic displays and total system configuration. All the Engineering tools shall be initiated within the system.

7.8 INTEGRATED SUPERVISORY COMPUTER (ISC) SYSTEM:

- The ISC Computer system shall be supplied by Vendor and the same shall be connected with Terminal Automation system for real time Data transfer for Integrated Terminal Operation by the Bidder.
- The bidder shall provide Dual redundant Ethernet interface along with all necessary application software for interface with the ISC using TCP/IP and shall supply necessary dual redundant cabling; as specified upto the ISC computer .
- Complete responsibility for the system integration between LRC & ISC system is in the scope of the bidder.

7.9 LOADING RACK COMPUTER (LRC) SYSTEM :

The LRC system shall be configured as a distributed real time computing Environment consisting of dual LRC computers working in **dual hot stan**dby mode and shall oversee the loading operation.

- In the hot standby mode, LRC computer-1 shall be running the entire Terminal Automation Software in primary mode and LRC computer-2 will be hot standby to LRC computer-1. The complete system data base consisting of real time values, equipment status and configuration related data base files shall reside in primary computer and the same shall be dynamically updated in the stand by computer as to take care of the entire terminal operation bumplessly on failure of primary

computer. On restoration, the failed computer shall automatically become hot standby and should function in synchronized pair with complete updating of files and database automatically. LRC servers shall be provided / configured for RAID Level 5(five).

- The LRC software (Latest version) for TAS should be offered complete with standard third party interface software functional modules like Open data base connectivity (ODBC); Microsoft Excel Data Exchange Interchange; to enable the LRC system to be integrated with BPCL SAP system.
- Vendor has to confirm each point as per table given below :

SR. NO.	**LRC SOFTWARE FEATURES**	**BPCL REQUIREMENTS**	**VENDOR'S CONFIRMATION.**
A.	**REDUNDANCY**		
1.	Server fail over alarm announced Audibly & Visually.	**YES,** For both primary & secondary server.	
2.	Ethernet fail over alarm announced Audibly & Visually.	**YES,** For both primary & secondary LAN.	
3.	LRC Server fails over time.	Maximum 30 seconds that includes real time Database as well as RDBMS.	
4.	Operator / Client station connection to Redundant Server.	Operator / Client station should always connect to Primary Server.	
5.	Time taken by operator stations / client stations to connect/ upload data from active primary server.	Maximum 30 seconds for all operator/client stations.	
6.	RAID 5 DIAGNOSTICS.	Hard disk fail over should be annunciated Audibly & Visually.	
7.	Electronic preset communication	Communication channel fail over	

SR. NO.	LRC SOFTWARE FEATURES	BPCL REQUIREMENTS	VENDOR'S CONFIRMATION.
	channel fail over.	should be Audibly & Visually annunciated.	
8.	PLC (Conventional / Safety) Fail over alarm announced Audibly & Visually.	YES; For both primary & secondary PLC.	
9.	PLC (Conventional / Safety) Scan Time	100 m sec for interlock logic (DI / DO)	
10.	PLC (Conventional / Safety) Interrogation Bulk Power Supply	Redundant Power Supply Required	
11.	Each PLC (Conventional / Safety) Processor Rack to Host System Communication Redundancy	Redundancy Required by use of two dedicated communication processor modules in each PLC CPU Rack	
12.	PLC (Conventional / Safety) DO Module	DO Module to be provided with in-built fuse blow protection, maximum I/O module density 8/16 points.	
13.	PLC (Conventional / Safety) I/O Modules Connection	All I/O modules to be connected with field signals through use of intermediate Remote Termination Panel / Field Termination Assembly	
14.	Interconnection of Field Devices to PLC (Conventional / Safety) / Terminal Server	Safety Barriers to be used for interfacing IS devices to PLC system / Terminal Server	

SR. NO.	LRC SOFTWARE FEATURES	BPCL REQUIREMENTS	VENDOR'S CONFIRMATION.
15.	PLC (Conventional / Safety) I/O Racks Bus Topology	All I/O Racks to be multi-dropped on dual redundant bus	
16.	Auto I/O Testing - For Conventional PLC - For Safety PLC	**Not Required** **Required**	
17.	PLC (Conventional / Safety) to I/O Rack communication failover.	Active / Backup communication link status should be displayed on a standard display & failover should be annunciated both Audibly & Visually.	
B.	**Alarming**		
1.	User assignable different alarm priorities for point in alarm	Minimum Three required; EMERGENCY / HIGH / LOW.	
2.	PV in alarm state should be flashing / change color on all displays displaying the point.	User configurable required for both features.	
3.	Alarm banner / display of alarm.	Dedicated alarm line on all displays required; Most current emergency alarm should POP UP on screen as an X-WINDOW; User configurable.	
4.	Acknowledge alarm by selecting	Required.	

SR. NO.	LRC SOFTWARE FEATURES	BPCL REQUIREMENTS	VENDOR'S CONFIRMATION.
	any point in the display & press a dedicated Acknowledge Button.		
5.	Indication of point on a display still in alarm but Acknowledged	Yes; In Red Color.	
6.	Indication of point on a display which has had an alarm which has returned to normal but without Acknowledgement.	Yes; Flashing in normal color.	
7.	Multiple alarm entries in the alarm summary for a point that is fluctuating between alarms.	Yes; Required.	
8.	Associated display for points when clicked OR Double clicked when in alarm.	Yes; Required; Associated display should provide details of alarm Dead band; Alarm limits as minimum.	
9.	Alarm Paging System-	Yes; Required; Certain critical alarm to be paged to pager service provider – Pager / Phone	
10.	Event Analysis System – Abnormal situation handling & Generate process records for regulatory compliance	Yes; Required;	
C.	**Trending.**		
1.	Trend types available.	Minimum multi plot ; X – Y Plot; Numeric plot required.	

SR. NO.	LRC SOFTWARE FEATURES	BPCL REQUIREMENTS	VENDOR'S CONFIRMATION.
2.	Vertical axis readings.	Engineering units & percentage readings required.	
3.	Comparison between Real Time; Historical & Archived Data.	Trend comparison availability required.	
4.	Copy of currently selected trend data on to Clipboard for pasting into spreadsheet.	Yes; Required.	
5.	Automatic displaying of archived history if trend is scrolled past current history limits.	Yes; Required.	
6.	Trending of archived history files.	Yes; Required.	
D.	**Historical Data Archiving.**		
1.	Activation of archiving.	Operator demand; Periodic Scheduling OR event initiated as minimum.	
E.	**Reporting.**		
1.	Activation reports.	Operator demand; Periodic Scheduling OR Event initiated facility required.	
2.	Configurable custom reports.	Yes; Required; Either inbuilt OR third party EG.SEAGATE CRYSTAL REPORTS TOOL.	
3.	Microsoft Excel as per Formatted report.	Yes; Required.	
4.	Results from reports stored in	Yes; Required.	

SR. NO.	LRC SOFTWARE FEATURES	BPCL REQUIREMENTS	VENDOR'S CONFIRMATION.
	user database.		
F.	**Security.**		
1.	Automatic logout of user interface after pre-configured time of inactivity.	Yes; Required.	
2.	Control level Functionality.	Operator; Manager level control functionality user assignable to each point required.	
G.	**Application Programming Interface.**		
1.	Programming languages.	Minimum Visual Basic; C++ Support / compiler required. • Real time data acquisition • Data point management with settings for alarms etc • Supports links to its own GUI and also API for generic languages such as VC++ , VB etc • Interface with external database for History etc	
H.	**Data Exchange.**		
1.	Export data directly into Excel spreadsheet.	Yes; Required.	
2.	Retrieve real time / historical data from primary Server using Microsoft Excel.	Yes ; Required	

SR. NO.	LRC SOFTWARE FEATURES	BPCL REQUIREMENTS	VENDOR'S CONFIRMATION.
I.	**Data Base Configuration.**		
1.	Nos. of utilities required to configure parameter value points, printers; stations; controllers.	The offered software shall employ a standard control builder (development) package that offers standard easy to use tools to define system database comprising of analog/digital/pulse inputs, database configuration like linking dynamic parameter values on graphic screens shall not require individual code programming / compiling /linking (like VB scripting) & it should be possible to modify database online without re-start of the system.	
2.	Changes to common fields of points, controllers, and station should be globally applicable.	The utility shall be a standard feature of development pack & code programming / script based tools / utility shall not be acceptable.	
3.	User fields for each point for tagging information like cabinet Nos. / wire Nos.	Yes; Required, this shall be a standard tool of the development package, code	

SR. NO.	LRC SOFTWARE FEATURES	BPCL REQUIREMENTS	VENDOR'S CONFIRMATION.
		programmed /script based utility shall not be acceptable.	
J	**Operator Interface**		
1.	HTML as native display format – must be capable to be from operator interface or standard web browser without export	Yes; Required – without compromising on standard Internet Explorer functions.	
2.	Predefined area on screen for operator messaging.	Yes ; Required	
3.	Function keys.	User configurable; Frequently used tasks can be accomplished using dedicated function keys.	
4.	Zooming facility for trend display.	Yes ; Required	
5.	Standard Windowing conventions employed.	Yes; Required; In case of UNIX BASED SYSTEM; X-WINDOWS/ MOTIF BASED applications to be employed to provide functionality.	
6.	Configurable Toolbar Icons & Pull Down Menus.	Yes; Required; In case of UNIX BASED SYSTEM; X-WINDOWS/ MOTIF BASED applications to be employed to provide functionality.	
7.	Time Zone Availability.	Time Zone should be displayed on each	

SR. NO.	LRC SOFTWARE FEATURES	BPCL REQUIREMENTS	VENDOR'S CONFIRMATION.
		station.	
8.	Standard display for displaying unacknowledged Alarms & Alarms which have been Acknowledged but still in Alarm.	Alarm summary display Required. Alarm summary should show / differentiate Alarm status by flashing/color change; User configurable.	
9.	Summary pages for reports, Trends, Displays & Groups.	Yes; Required.	
10.	Point detail display.	Yes; Required.	
11.	Group detail display.	Yes; Required.	
12.	Software Compliance for Section C to J	Through standard development / runtime package, code programmed/ script based system not acceptable.	
13.	Pop up Display – Display within a display	Yes; Required.	
K.		**Update / Response Times**	**Max. Response Time.**
1.	Time taken to call a particular screen from any other screen with all the contents.	2 Sec.	
2.	Time taken to get a control target selected after Mouse click.	2 Sec.	
3.	Time taken for execution of any remote command from Operator stations i.e. Remote Stop	4 Sec.	

SR. NO.	LRC SOFTWARE FEATURES	BPCL REQUIREMENTS	VENDOR'S CONFIRMATION.
	command from time operator to reach field after issuing it at operator station.		
4.	Time taken for EG. Valve status that has changed in the field to get updated on display.	4 Sec.	
5.	Card Reader , RIT and Data entry panel RESPONSE TIME (Time between pressing a pushbutton & corresponding bulbs indication changing)	4 Sec.	
6.	Time taken between card flashing & barrier gate opening.	8 Sec.	
7.	Time taken between card flashing & corresponding Batch controller message appearance.	7 Sec.	
8.	Time for complete database update for the entire terminal.	10 Sec.	
9.	Time for controller scanning including input, calculation and output.	1 Sec.	
10.	Time for Non-controlled input.	2 Sec.	
11.	Time for Building CRT display.	2 sec.	
12.	Filling time considering 1 no. 3 compartment 12 kl tank truck at normal filling rate of 65 m3/hr.	15 min.	
13.	Other system responses required for driver interaction such as card validation, RIT lamp sequences, down loading of data etc.	4 Sec.	

SR. NO.	LRC SOFTWARE FEATURES	BPCL REQUIREMENTS	VENDOR'S CONFIRMATION.
19.	Presence of "Help" functions built into the Operator station software for operator guidance.	Available.	
20.	Presence of "System Diagnostic" mimic to quickly locate a faulty hardware.	Available.	
21.	System stability and system response when TLF is working at near full load (i.e. when all bays are loading)	No freezing, hanging, crash or slow down.	
22.	Rational allocation of bays (scheduling function) i.e. there is no long queue on one bay while some other bay capable of loading the same product is free.	Yes.	
23.	Is the system capable of manual filling through Batch controller (i.e. driver/bay officer keys in pre-set quantity at BC and carries out filling operation)	Yes.	
24.	How does a running loading operation behave if primary PLC / DCS or primary LRC is switched off.	No degradation, no interruption of ongoing loading operations.	
25.	After recovery how does a failed LRC equalize its status for the data updated during the time it was down.	No degradation, no interruption of ongoing loading operations.	
L	**Message Management**		
1.	It shall be possible to define	Yes, Required –	

SR. NO.	LRC SOFTWARE FEATURES	BPCL REQUIREMENTS	VENDOR'S CONFIRMATION.
	messages on operator console	minimum 2 line text	
2.	Message Processing – should be possible to assign a message to a point and should time stamped and logged in the Event database	Yes, Required;	
M	**Integrated Maintenance Manager**		
1.	It shall be possible to integrate with real time Maintenance Management System to Process Work orders and tracking their status	Yes, Required	
N	**Downtime Analysis**		
1.	System should have means to log equipment down time and reasons for downtime.	Yes, Required; pre-configured downtime category and reason to be assigned – user selectable.	
2.	Down time reporting – Report generation for various equipment downtime	Yes, Required; to be able to run on-demand and periodically	
O	**Licenses.**		
1.	Name / Version of SCADA software offered.	Original license from **PRINCIPAL** to be offered with mention of project name; Database size; Version / Name of offered software along with unpriced copy of IMPORT SHIPPING documents.	

SR. NO.	LRC SOFTWARE FEATURES	BPCL REQUIREMENTS	VENDOR'S CONFIRMATION.
2.	Name / Version of RDBMS offered.	Original license from **PRINCIPAL** Supplier to be provided for REDUNDANT RDBMS.	
3.	Name / Version of Operating System.	Original license from **PRINCIPAL** Supplier to be provided for OPERATING SYSTEM.	
4.	Name / Version of the Integrated Maintenance manager System – A single user license software to be offered with run time license for both LRC Servers.	Original license from **PRINCIPAL** Supplier to be provided for INTEGRATED MAINTENANCE MANAGER SYSTEM.	
5.	Name / Version of the Downtime Analysis System –	Original license from **PRINCIPAL** Supplier to be provided for DOWNTIME ANALYSIS SYSTEM.	
6.	Details on custody transfer system (LRC Application)	Availability of source code for LRC application with prime bidder required	

7.10 SYSTEM ACCESS SECURITY:

- All operator commands shall be automatically checked for validity of authorization by the system.
- Validity checks shall be automatically performed by the system to ensure that control parameters entered by the operator are within the defined limits.

– Access to all system functions shall be protected by a multi-level password system.

7.11 SYSTEM DIAGNOSTICS :

– The system diagnostics shall support fault isolation to a specific module or channel or subsystem device, which can be subsequently removed and replaced.

– The system diagnostics shall include both hardware and software diagnostics routines which upon detecting an abnormal conditions, reports this information on standard diagnostics displays on the OIC and printers.

– Once a diagnostic test has detected a failure, a descriptive alarm shall be generated and bumpless transfer to control to a redundant component shall be triggered wherever specified.

7.12 DIAGNOSTIC DISPLAY

– The system status level shall be accessible by a single dedicated key.

– A flashing diagnostic message prompt shall be displayed and allow the user to immediately view the specific error message in a single key stroke without going through a diagnostic display hierarchy.

– A system status display shall provide the current status of every subsystem. Subsystems with a diagnostic alarm shall be identified by flashing indicator. The system status display shall include information on the communications system including status of each of the communication modules for every subsystem.

– The subsystem level status display should provide detail information on the subsystem itself and the status of the individual modules contained therein.

– The I/O status display shall provide detailed information of each I/O Channel of the associated device.

– The message level diagnostic display shall provide English text message explaining the exact nature of the diagnostic error and the time and frequency of occurrence. The users shall be able to go to an archive file to obtain a history of diagnostic messages for the entire system and additionally shall be able to make a backup copy to a removable media.

7.13 INTERRUPTED LOADING SEQUENCE:

- During the normal loading, the loading operation may stop or interrupted in a number of ways including:

- Safety permissive interlock failure
- Batch Controller alarm condition
- Local stop from RIT
    - EMERGENCY STOP
    - Stop command from control room operator

7.14 HARDWARE SPECIFICATIONS

- The proposed automation system shall utilise latest and proven microprocessor based device which shall be configured to perform in real-time such essential functions as :
- Data acquisition/ Control
- Transaction processing
- Operator interface
- Interactive graphic displays
- Database for data collection, archiving reporting and trending
- Process alarms and system diagnostics.
- The system shall be capable of protecting the system integrity and security by implementation of redundancy for both communication links and system hardware. In case of failure the switch over shall be automatic and in no way affect the control operation.
- The hardware and system architecture shall be reliable and field proven, High grade components of proven quality having high MTBF shall be selected to achieve the desired functions

7.15 SYSTEM SOFTWARE (LATEST VERSION) & APPLICATION SOFTWARE (LATEST VERSION) :

– O.S. environment may be Windows 2008 SERVER STD EDN (for Sever) & Windows 7 PROF (for Client) & Application software may have RDBMS like SQL Server ; ORACLE. The operating system software should be modular in design & shall provide effective utilization of all system resources and facilitate future expansion.

- The application software should be GUI (i.e. Graphic User Interface) based & should have excellent features in regard to real time data acquisition, data & alarm processing, database downloading, Terminal security, access etc. The software should also meet our desired operational criterion in regard to TLF loading, scheduling, stock recording, monitoring & control of product movement, the GUI shall be standard programming tools as part of D+R+N package.

- The operator interface module shall provide centralized information to terminal operator to monitor and control the complete automated terminal operation at various locations of terminal in the fields like menu driven data entry screen through structured pull up & pull down menus, manipulation of control loops, alarm displays & annunciation, bar graphic displays & status indications, logging & trending including historical trend recording, self diagnostic messages etc. As far as operational displays are concerned, displays viz. Overview display, Group display, Loop/Point display, Graphic display, Alarm monitoring & display, Database Management system display, Trend display shall be possible at the minimum. **The offered base software shall have a copyright or registered trademark.** LRC software should be offered complete with standard 3rd party interface software functional modules like ODBC, MS Data Exchange, to enable LRC system to be integrated with ISC (SAP-TAS) SAP System.

7.16 The report generation module shall be capable of generating various reports and logs for all measured and computed parameters as per requirement. The system should provide scope for database generation & configuration with multilevel security access into the system. All the communication between LRC and peripheral units shall be established through secured data transfers. The networking communication shall be selected keeping in view of number of peripherals & instrument connected on the network and with higher throughput.

7.17 AUTOMATED PROVING MODULE :-

- A reference 5 KL proving measure is to be supplied & installed near the Pump house. All the meter run data pertaining to the master meter & bay meter to be calibrated, should be transmitted to the LRCS through dedicated dual pulse transmitter, via a dedicated batch controller. LRCS will derive the meter error i.e. calculate the new K factor or meter factor through a integrated proving module software application loaded in the LRC. The proving module executable files should be pass word protected & on validation of security password have the provision for down loading the new K factors to the batch controller. **Provision for historization of all calibration record's upto seven years is to be**

<u>provided.</u> The proving module should be GUI based with an easy to use interface for start ,stop , nos. of proving runs ; compensation enable /disable user selection .

– Two nos. Of Trolley mounted Master PD meter system are to be offered with a digital Two Sets control valve & single arm version batch controller. One set shall be for MS & One set for HSD/SKO. All the flexible hoses should be petroleum grade; SS corrugated; with minimum four **mtrs length with quick couplings type end connections.**

7.18 Local loading of TL should be possible from the TL Gantry by operating the Batch controllers. In batch controllers, the alphanumeric data entry facility shall be provided with necessary artwork on the keypad with the software compatibility to take care of the correct data retrieval & proper storage of information into the LRC.

7.19 PROGRAMMABLE LOGIC CONTROLLER - CONVENTIONAL

7.19.1 GENERAL

7.19.1.1 Programmable logic controller (PLC) shall be dual redundant hot standby PLC with dual processors and single I/O.

7.19.1.2 Programmable logic controller (PLC) system shall be programmable, modular microprocessor based safety system, which shall be used for implementation of safety shutdown/interlocks and terminal operation monitoring.

7.19.1.3 The system shall be designed "fault avoidant", as a minimum by selecting high grade components of proven quality and proper design of system electronics. The system shall be highly reliable, high-integrity safety system on both qualitative and quantitative technologies. Redundancy shall be provided as a minimum, as per this specification to improve system availability, reliability and safety. Due consideration shall be given to the environmental conditions particularly for field mounted subsystems.

7.19.1.4 The system shall be modular in construction and expandable in future by adding additional modules which shall be easily accessible for maintenance and repair. The modules shall be suitable for inserting in rack mount. The types of modules shall be kept to minimum possible in order to have interchangeability and low spares inventory.

7.19.1.5 The PLC (Processor & I/O SYSTEM) shall have very high noise immunity in order to ensure safe and reliable operation when subjected to electrical radio frequency interference and electromagnetic disturbances expected in a plant. The design of system electronics shall be in compliance with the electromagnetic compatibility requirements as per 'IEC-801-2, IEC – 801 – 3, IEC–801-5: Electromagnetic compatibility for Industrial Process Measurement and Control Equipment'.

7.19.1.6 PLC system should meet the following :

- Industrial Noise Test : NEMA1- 109
- Showering Arc test.
- Surge withstand capability test: IEEE 472/ANSI C37.90A
- 2KV/5KV Isolation test: IEC 255-4

7.19.1.7 The PLC System (Processor & I/O) shall also comply to UL 508 & CSA C22.2 No 142 Standards for Industrial Control Equipments / Process control equipments.

7.19.1.8 The system shall have extensive set of self diagnostics hardware and software for easy and fast maintenance of PLC. Routine checks should run automatically at frequent intervals for identifying any fault in software or hardware. Diagnostics shall be required at local module as well as operator interface console level.

7.19.1.9 Operation of the PLC shall be completely unaffected by a momentary power loss of the order of 20 milli –seconds.

7.19.1.10 The scan time of programmable controller shall be of the order of 100 milliseconds for logic & 300 milliseconds for closed loops. Scan time of PLC is defined as the cycle time taken by the system to read input, process input executing logic, and update control output for all the logic configured within the system. Other activities like diagnostic routines, output/dump of data to peripherals, or any other activity which consume processor time shall also be accounted while computing scan time.

7.19.1.11 On-line replacement of any module shall be possible in such a way that the removal and addition of the module shall be possible without de-energizing the system. Further, there shall not be any interruption in the system while replacing a faulty module except for the inputs/outputs, which are being handled, by that module.

7.19.2 SPARES PHILOSOPHY

Installed engineering spare modules upto 20% shall be provided in input/output subsystem on module basis and/or with a minimum of one module of each type to enhance the system functional requirements for future.

In addition the system shall have the following minimum spare capability

(a) I/O racks of PLC shall have 20% useable spare slots for installing I/O modules of each type in future. These racks shall be part of the offer.

(b) The processor system shall have the capability to execute logic for I O's including 20 % installed spares.

(c) Whenever relays are used to interface process input/outputs with PLC 20% additional relays shall be provided. In addition, 20% spare space shall be provided in cabinets to install 20% additional relays in future.

7.19.3 SYSTEM CONFIGURATION

The system shall consist of following major subsystems:-

7.19.3.1 **INPUT /OUTPUT SUBSYSTEM**

7.19.3.1.1 The I/O modules shall be mounted in the I/O racks located in control room i.e. I/O modules shall be general purpose unless otherwise specified. I/O devices interface with PLC shall be at I/O racks only.

7.19.3.1.2 The maximum number of input/outputs per module shall be limited as follows :

Sr.No.	Type of Configuration	No. of I/Os
1.	I/O Sub-system	16 for Digital inputs 16 for Analog inputs 16 for Digital outputs 8 for pulse Input 8 for Analog output 2 ports for Serial interface

7.19.3.1.3 Each I/O shall be electrically isolated from external control circuit by suitable means. The minimum isolation level between I/O and logic circuit shall be 1000 VDC. I/O status indication shall be provided for each I/O module.

7.19.3.1.4 Each I/O shall be protected against reversal of polarity of the power supply voltage to I/O.

7.19.3.1.5 Each module shall have LED for each I/O channel to indicate the status of each input/output.

7.19.3.1.6 Each input shall be provide with filters to filter out any noise in the input line or noise because of input contact bouncing.

7.19.3.1.7 PLC inputs shall be provided with potential free/dry contacts unless otherwise specified.

7.19.3.1.8 All the inputs shall preferably be double ended i.e. two wires per input and not common return for all inputs.

7.19.3.1.9 The interrogation voltage (24 V DC / 110 V AC) to the input/output contact shall be powered from separate redundant power supply units and shall not be a part of PLC

7.19.3.1.10 Output contacts from the PLC shall be potential free/dry contacts with contact ratings as below. Wet contracts/ powered contacts/ TTL outputs etc., shall not be acceptable. Suppression device for each output contact is to be provided**.**

The output contact rating shall be as follows:

Sr.No.	Applicable For		VOLT	Current Rating
1.	All output cards for driving solenoid valves and alarm annunciator.	} } }	230V AC 24 V DC	0.5 A 2.0 A
2.	All output cards for driving LT motors/pumps/solenoids		230V AC	5.0 A

7.19.3.1.11 Input type shall be intrinsically safe with barriers for analog input modules and explosion proof type for digital input modules. Only Active Barriers shall be employed for achieving galvanic isolation.

7.19.3.1.12 Each output shall be short-circuit proof and protected by fuse. Visual indication of fuse down/blown must be provided for each output. The digital output module offered should have this functionality; separate terminal block with fuse blow indication in conjunction with a general-purpose digital output module shall not be acceptable.

7.19.3.1.13 For all analog inputs & outputs related to Auto Re-circulation Valve for pumps; I/O redundancy is to be offered for closed loop control (if applicable)

7.19.4 PROCESSOR SYSTEM (32 BIT)

7.19.4.1 The offered processor type shall have a minimum reference capacity to handle 2000 real time I/O. Redundancy shall be provided such that in case of failure of the primary processor, the secondary processor shall take over automatically without any time lag. Both processors shall access the inputs simultaneously. If not possible, changeover time shall be maximum 100 millisecond. The changeover shall be bumpless and the system shall be safe. Redundancy shall be provided for complete processor subsystem including CPU, memory, power supply & host system communication interface i.e. rack to rack redundancy.

7.19.4.2 Memory shall be non-volatile. However, incase volatile memory is provided, rechargeable battery backup shall be provided for a minimum of one year to keep the stored program intact. A battery drain /pass indication shall be provided .The size of the memory shall be sufficient for storage of the program instructions required by the logic schemes. 20 % spare capacity shall be available.

7.19.4.3 In case of failure of complete processor system i.e both processors system outputs shall take fail safe automatically.

7.19.4.4 It shall be possible to generate the first out alarm output by the PLC in case where a group of parameters are likely to trip the system.

<u>VENDOR TO FURNISH DETAILS OF THE PROCESSOR LOADING ALONGWITH THE TECHNICAL OFFER.</u>

7.19.5 VENDOR TO FURNISH DETAILED CONTROLLER SCHEMATIC SHOWING MODULE WISE INTER CONNECTIVITY, WITH THE PROCESSOR, I/O MODULE, COMMUNICATION MODULE ETC. ALSO CONNECTIVITY OF VARIOUS FIELD DEVICES / INTERFACING DEVICES TO THE CONTROLLER SHALL BE SHOWN. THE SAME SHALL BE ENCLOSED ALONGWITH THE TECHNICAL OFFER.

7.19.6 COMMUNICATION SUB SYSTEM

7.19.6.1 The communication subsystem shall be a digital communication bus that provides reliable and high speed data transfer between the processor subsystem & I/O subsystem.

7.19.6.2 Redundancy in communication subsystem shall be as follows unless otherwise specified.

(a) Communication Interface between each I/O rack & the dual processor system shall be via separate dedicated dual redundant communication link in multi-drop mode; daisy chained redundant communication bus to establish interface between I/O racks & processor system shall not be acceptable.

(b) The communication interface between each processor subsystem and host LRC system shall be dual redundant consisting of two separate communication interface modules located in / from each individual processor rack and two individual communication links, with each one configured in redundant mode. **Use of PLC processor CPU port for establishing host interface connectivity shall not be acceptable.**

7.19.6.3 In case of redundant communication subsystem on the failure of the active device the redundant device shall take-over automatically without interrupting the system operation. Information about the failed device shall be displayed locally as on well as the console. It shall be possible to manually switch-over the communication from main bus/device to redundant bus/device without interrupting the PLC functions. The mechanism used by the system for error checks and control shall be transparent to the application information/program. Error checking shall be done on all data transfers by suitable codes. All communication interfaces shall be galvanically or optically isolated.

7.19.7 SELF DIAGNOSTICS

7.19.7.1 The system shall have an extensive set of self-diagnostic routines which shall be able to identify the system failures at least upto module level

including redundant components and power supplies through detailed CRT displays report print outs and logic programming.

7.19.7.2 At the local level, failure of a module in any subsystem shall be identified by an individual LED.

7.19.7.3 Self-diagnostics shall be provided to detect faults (which make the contacts in fail safe mode) in the input and output modules. Each module shall have separate arrangement for self-diagnostic facility. This may be achieved by automatically running the testing software at cyclic intervals. Testing software shall be capable of detecting faults in case of normally closed system as well as in normally open system.

7.19.7.4 Feedback shall be provided internally from the output voting logic system to detect any latent faults of the system.

7.19.8 POWER SUPPLY DISTRIBUTION

7.19.8.1 PLC system shall be powered with 230 V AC + 3%. Power pack shall be 100% redundant with safety factor of 1.5. The distribution network for AC power supply shall be designed such that a single power fault in any branch system shall not cause a trip of the entire system. The distribution network for interrogation voltage shall be designed such that a single fault in any branch shall not cause trip of the logic other than where the fault has occurred. Sequential starting of various load centers shall be provided whenever specified.

7.19.9 PLC SYSTEM CABINETS

7.19.9.1 All PLC system cabinets shall be completely wired with all modules in place. Inside cabinet wiring shall be done using ribbon type pre-fabricated cables. All the cabinets shall be free standing, enclosed type and shall be designed for bottom entry of cables. Cabinet structure shall be sound and rigid and shall be provided with removable lifting lugs to permit lifting of the cabinets.

Cabinet shall be fabricated from cold rolled steel sheets of minimum 2 mm thickness suitably reinforced to prevent warping and buckling. Doors & side panels shall be fabricated from cold rolled steel sheet of minimum 1.5mm thickness. Cabinets shall be thoroughly debarred and all sharp edges shall be grounded smooth after fabrication.

Cabinet finish shall include sand blasting, grinding, chemical cleaning, surface finishing by suitable filter and two coats of high grade lacquer with wet sanding between two coats. Three coats of paint in the cabinet colour shall be given for non-glossy high satin finish.

Each cabinet shall be maximum 2100 mm high (excluding 100-mm channel base), 1000 mm wide and 800 mm deep, in general. Construction shall be modular preferably to accommodate 19" standard electrical racks. All cabinets shall be of same height. Maximum swing out for pivoted card racks, doors and drawers shall be limited to 600 mm.

Cabinets shall be equipped with the front and rear access doors. Doors shall be equipped with lockable handles and concealed hinges with pull pins for easy door removal.

In order to remove dissipated heat effectively from cabinets, vent louvers backed by wire fly screen shall be provided in cabinet doors. Further two ventilation fans shall be provided.

Illumination shall be provided for all cabinets by incandescent lamps, which shall be operated by door switch.

Equipment within the cabinet shall be laid out in an accessible and logically segregated manner. Cable glands shall be provided for incoming and outgoing cables to prevent excessive stress on the individual terminals. All metal parts of the cabinet shall be electrically continuous and shall be provided with a common grounding lug.

The front doors for the PLC cabinet shall have toughened glass / acrylic window for visual ergonomics.

7.19.10 EARTHING

7.19.10.1 Each cabinet, console and other equipment supplied as a part of PLC system shall be provide with an earthing lug. All these lugs shall be properly secured to the AC mains earthing bus.

All circuit grounds, shields and drain wires of control cables shall be connected to the system ground bus which shall be electrically isolated from

AC mains earthing bus. This bus shall be typically of 25 mm wide and 6 mm thick of copper.

All barriers, if used, shall be securely grounded. Safety barrier ground wire shall be capable of carrying a maximum fault level current of 0.5 A at 250 V r.m.s per barrier.

7.20 SAFETY PROGRAMMABLE LOGIC CONTROLLER-SIL 2 (or better) CERTIFIED

7.20.1 GENERAL

7.20.1.1 This safety PLC is required for Emergency Shut down operations. The PLC shall have SIL2 (or better) certification along with TUV approvals.

7.20.1.1.1 Programmable logic controller (PLC) shall be dual redundant hot standby PLC with dual processors and single I/O.

7.20.1.1.2 Programmable logic controller (PLC) system shall be programmable, modular microprocessor based safety system, which shall be used for implementation of safety shutdown/interlocks and terminal operation monitoring.

7.20.1.1.3 The system shall be designed "fault avoidant", as a minimum by selecting high grade components of proven quality and proper design of system electronics. The system shall be highly reliable, high-integrity safety system on both qualitative and quantitative technologies. Redundancy shall be provided as a minimum, as per this specification to improve system availability, reliability and safety. Due consideration shall be given to the environmental conditions particularly for field mounted subsystems.

7.20.1.2 The system shall be modular in construction and expandable in future by adding additional modules which shall be easily accessible for maintenance and repair. The modules shall be suitable for inserting in rack mount. The types of modules shall be kept to minimum possible in order to have interchangeability and low spares inventory.

7.20.1.3 The PLC (Processor & I/O SYSTEM) shall have very high noise immunity in order to ensure safe and reliable operation when subjected to electrical radio frequency interference and electromagnetic disturbances expected in a plant. The design of system electronics shall be in compliance with the electromagnetic compatibility requirements as per 'IEC-801-2, IEC – 801 – 3, IEC–801-5: Electromagnetic compatibility for Industrial Process Measurement and Control Equipment'.

7.20.1.4 The safety PLC should be SIL2 (or better) in accordance with IEC 61508 / IEC 61511.

7.20.1.5 **Designed SIL 2 (or better) type of safety PLC is required. Pl. Note that SIL2 approval of the PLC shall remain valid in case of failure of any one of redundant module (i.e. CPU / power supply/ communication module). Documentary proof from SIL2 approving agency (TUV/ equivalent) is required for above.**

7.20.1.6 PLC system should meet the following :

- Industrial Noise Test : NEMA1- 109
- Showering Arc test.
- Surge withstand capability test: IEEE 472/ANSI C37.90A
- 2KV/5KV Isolation test: IEC 255-4

7.20.1.7 The PLC System (Processor & I/O) shall also comply to UL 508 & CSA C22.2 No 142 Standards for Industrial Control Equipments / Process control equipments.

7.20.1.8 The system shall have extensive set of self diagnostics hardware and software for easy and fast maintenance of PLC. Routine checks should run automatically at frequent intervals for identifying any fault in software or hardware. Diagnostics shall be required at local module as well as operator interface console level.

7.20.1.9 Operation of the PLC shall be completely unaffected by a momentary power loss of the order of 20 milli –seconds.

7.20.1.10 The total load on any communication bus at any point of time shall not exceed 60% of total capacity.

7.20.1.11 The scan time of programmable controller shall be of the order of 100 milliseconds for logic & 300 milliseconds for closed loops. Scan time of PLC is defined as the cycle time taken by the system to read input, process input executing logic, and update control output for all the logic configured within the system. Other activities like diagnostic routines, output/dump of data to peripherals, or any other activity which consume processor time shall also be accounted while computing scan time.

7.20.1.12 On-line replacement of any module shall be possible in such a way that the removal and addition of the module shall be possible without de-energizing the system. Further, there shall not be any interruption in the system while replacing a faulty module except for the inputs/outputs, which are being handled, by that module.

7.20.1.13 Auto I/O Testing of all the Input and Output Modules is required.

7.20.2 SPARES PHILOSOPHY

Installed engineering spare modules up to 20% shall be provided in input/output subsystem on module basis and/or with a minimum of one module of each type to enhance the system functional requirements for future.

In addition the system shall have the following minimum spare capability

(a) I/O racks of PLC shall have 20% useable spare slots for installing I/O modules of each type in future. These racks shall be part of the offer.

(b) The processor system shall have the capability to execute logic for I O's including 20 % installed spares.

(c) Whenever relays are used to interface process input/outputs with PLC 20% additional relays shall be provided. In addition, 20% spare space shall be provided in cabinets to install 20% additional relays in future.

7.20.3 SYSTEM CONFIGURATION

The system shall consist of following major subsystems:-

7.20.3.1 **INPUT /OUTPUT SUBSYSTEM**

7.20.3.1.1 The I/O modules shall be mounted in the I/O racks located in control room i.e. I/O modules shall be general purpose unless otherwise specified. I/O devices interface with PLC shall be at I/O racks only.

7.20.3.1.2 The maximum number of input/outputs per module shall be limited as follows :

Sr.No.	Type of Configuration	No. of I/Os
1.	I/O Sub-system	16 for Digital Inputs 08 for Analog Inputs (3-wire Tx. HART) 08 for Analog Inputs (2-wire Tx. HART) 16 for Digital outputs 8 for pulse Input 8 for Analog output 2 ports for Serial Interface

7.20.3.1.3 Each I/O shall be electrically isolated from external control circuit by suitable means. The minimum isolation level between I/O and logic circuit shall be 1000 VDC. I/O status indication shall be provided for each I/O module.

7.20.3.1.4 Each I/O shall be protected against reversal of polarity of the power supply voltage to I/O.

7.20.3.1.5 Each module shall have LED for each I/O channel to indicate the status of each input/output.

7.20.3.1.6 Each input shall be provided with filters to filter out any noise in the input line or noise because of input contact bouncing.

7.20.3.1.7 PLC inputs shall be provided with potential free/dry contacts unless otherwise specified.

7.20.3.1.8 All the inputs shall preferably be double ended i.e. two wires per input and not common return for all inputs.

7.20.3.1.9 The interrogation voltage (24 V DC / 110 V AC) to the input/output contact shall be powered from separate redundant power supply units and shall not be a part of PLC.

7.20.3.1.10 Output contacts from the PLC shall be potential free/dry contacts with contact ratings as below. Wet contracts/ powered contacts/TTL outputs etc., shall not be acceptable. Suppression device for each output contact is to be provided**.**

7.20.3.1.11 The output contact rating shall be as follows

Sr.No.	Applicable For	VOLT	Current Rating
1.	All output cards for driving} solenoid valves and alarm} annunciator. }	230V AC	0.5 A
		24 V DC	2.0 A
2.	All output cards for driving LT motors/pumps/solenoids	230V AC	5.0 A

7.20.3.1.12 Input type shall be intrinsically safe with barriers for analog input modules and explosion proof type for digital input modules. Only Active Barriers shall be employed for achieving galvanic isolation.

All analog input channels shall be provided with barriers.

7.20.3.1.13 Each output shall be short-circuit proof and protected by

fuse. Visual indication of fuse down/blown must be provided for each output. **The digital output module offered should have this functionality; separate terminal block with fuse blow indication in conjunction with a general-purpose digital output module shall not be acceptable.**

7.20.3.1.14 Failure in the ESD system will de-energise the relevant system components causing them to move to tripped (safe) position. All relays are normally energized and all contact normally closed (normally here means process normal condition and not “no power condition”). Where ever normally open field contacts are used, the ESD PLC I/O cards shall have line monitoring to detect wire open condition.

7.20.4 PROCESSOR SYSTEM (32 BIT)

7.20.4.1 The offered processor type shall have a minimum reference capacity to handle 2000 real time I/O. Redundancy shall be provided such that in case of failure of the primary processor, the secondary processor shall take over automatically without any time lag. Both processors shall access the inputs simultaneously. If not possible, changeover time shall be maximum 100 millisecond. The changeover shall be bumpless and the system shall be safe. Redundancy shall be provided for complete processor subsystem including CPU, memory, power supply & host system communication interface i.e. rack to rack redundancy.

7.20.4.2 Memory shall be non-volatile. However, incase volatile memory is provided, rechargeable battery backup shall be provided for a minimum of one year to keep the stored program intact. A battery drain /pass indication shall be provided .The size of the memory shall be sufficient for storage of the program instructions required by the logic schemes. 20 % spare capacity shall be available.

7.20.4.3 In case of failure of complete processor system i.e. both processors system outputs shall take fail safe automatically.

7.20.4.4 The processor shall have capability to implement all the control functions required to implement the logic scheme, as logic/ladder diagram.

7.20.4.5 Time stamping for all alarms / event shall be done at the PLC processor level.

7.20.4.6 It shall be possible to generate the first out alarm output by the PLC in case where a group of parameters are likely to trip the system.

VENDOR TO FURNISH DETAILS OF THE PROCESSOR LOADING ALONGWITH THE TECHNICAL OFFER.

7.20.5 VENDOR TO FURNISH DETAILED CONTROLLER SCHEMATIC SHOWING MODULE WISE INTER CONNECTIVITY, WITH THE PROCESSOR, I/O MODULE, COMMUNICATION MODULE ETC. ALSO CONNECTIVITY OF VARIOUS FIELD DEVICES / INTERFACING DEVICES TO THE CONTROLLER SHALL BE SHOWN. THE SAME SHALL BE ENCLOSED ALONGWITH THE TECHNICAL OFFER.

7.20.6 COMMUNICATION SUB SYSTEM

7.20.6.1 The communication subsystem shall be a digital communication bus that provides reliable and high speed data transfer between the processor subsystem & I/O subsystem.

7.20.6.2 The PLC shall have open protocol and share data with read only permission through Ethernet. PLC shall be configured in fail safe manner considering processor I/O module / power supply failure.

7.20.6.3 Redundancy in communication subsystem shall be as follows unless otherwise specified.

(a) Communication Interface between each I/O rack & the dual processor system shall be via separate dedicated dual redundant communication link in multi-drop mode; daisy chained redundant communication bus to establish interface between I/O racks & processor system shall not be acceptable.

(b) The communication interface between each processor subsystem and host LRC system shall be dual redundant consisting of two separate communication interface modules located in / from each individual processor rack and two individual communication links, with each one configured in redundant mode. **Use of PLC processor CPU port for establishing host interface connectivity shall not be acceptable.**

7.20.6.4 In case of redundant communication subsystem on the failure of the active device the redundant device shall take-over automatically without interrupting the system operation.

Information about the failed device shall be displayed locally as on well as the console. It shall be possible to manually switch-over the communication from main bus/device to redundant bus/device without interrupting the PLC functions.

The mechanism used by the system for error checks and control shall be transparent to the application information/program. Error checking shall be done on all data transfers by suitable codes. All communication interfaces shall be galvanically or optically isolated.

7.20.7 SELF DIAGNOSTICS

7.20.7.1 The system shall have an extensive set of self-diagnostic routines which shall be able to identify the system failures at least upto module level including redundant components and power supplies through detailed CRT displays report print outs and logic programming.

7.20.7.2 At the local level, failure of a module in any subsystem shall be identified by an individual LED.

7.20.7.3 Self-diagnostics shall be provided to detect faults (which make the contacts in fail safe mode) in the input and output modules. Each module shall have separate arrangement for self-diagnostic facility. This may be achieved by automatically running the testing software at cyclic intervals. Testing software shall be capable of detecting faults in case of normally closed system as well as in normally open system.

7.20.7.4 Feedback shall be provided internally from the output voting logic system to detect any latent faults of the system.

7.20.8 POWER SUPPLY DISTRIBUTION

7.20.8.1 PLC system shall be powered with 230 VAC +/- 3%, UPS Supply. Power pack shall be 100% redundant with safety factor of 1.5. The distribution network for AC power supply shall be designed such that a single power fault in any branch system shall not cause a trip of the entire system. The distribution network for interrogation voltage shall be designed such that a single fault in any branch shall not cause trip of the logic other than where the fault has occurred. Sequential starting of various load centers shall be provided whenever specified.

7.20.9 PLC SYSTEM CABINETS

All PLC system cabinets shall be completely wired with all modules in place. Inside cabinet wiring shall be done using ribbon type pre-fabricated cables. All the cabinets shall be free standing, enclosed type and shall be designed for bottom entry of cables. Cabinet structure shall be sound and rigid and shall be provided with removable lifting lugs to permit lifting of the cabinets.

Cabinet shall be fabricated from cold rolled steel sheets of minimum 2 mm thickness suitably reinforced to prevent warping and buckling. Doors & side panels shall be fabricated from cold rolled steel sheet of minimum 1.5mm thickness. Cabinets shall be thoroughly debarred and all sharp edges shall be grounded smooth after fabrication.

Cabinet finish shall include sand blasting, grinding, chemical cleaning, surface finishing by suitable filter and two coats of high grade lacquer with wet sanding between two coats. Three coats of paint in the cabinet colour shall be given for non-glossy high satin finish.

Each cabinet shall be maximum 2100 mm high (excluding 100-mm channel base), 1000 mm wide and 800 mm deep, in general. Construction shall be modular preferably to accommodate 19" standard electrical racks. All cabinets shall be of same height. Maximum swing out for pivoted card racks, doors and drawers shall be limited to 600 mm.

Cabinets shall be equipped with the front and rear access doors. Doors shall be equipped with lockable handles and concealed hinges with pull pins for easy door removal.

In order to remove dissipated heat effectively from cabinets, vent louvers backed by wire fly screen shall be provided in cabinet doors. Further two ventilation fans shall be provided.

Illumination shall be provided for all cabinets by incandescent lamps, which shall be operated by door switch.

Equipment within the cabinet shall be laid out in an accessible and logically segregated manner. Cable glands shall be provided for incoming and outgoing cables to prevent excessive stress on the individual terminals. All metal parts of the cabinet shall be electrically continuous and shall be provided with a common grounding lug.

The front doors for the PLC cabinet shall have toughened glass / acrylic window for visual ergonomics.

7.20.10 EARTHING

Each cabinet, console and other equipment supplied as a part of PLC system shall be provide with an earthing lug. All these lugs shall be properly secured to the AC mains earthing bus.

All circuit grounds, shields and drain wires of control cables shall be connected to the system ground bus which shall be electrically isolated from AC mains earthing bus. This bus shall be typically of 25 mm wide and 6 mm thick of copper.

All barriers, if used, shall be securely grounded. Safety barrier ground wire shall be capable of carrying a maximum fault level current of 0.5 A at 250 V r.m.s per barrier.

NOTE : Analog Input modules for 3-wire Transmitters (HC Detectors/Tx.) are also required for this PLC. Detailed Technical specifications of the PLC system are to be furnished by vendor as part of Technical bid. These Technical specifications & I/O count will be frozen during Technical evaluation.

8 SYSTEM SOFTWARE SPECIFICATIONS

8.1 System Software

The operating system must be having real time capabilities.

The operating system shall be modular in design and shall provide effective utilization of resources and facilitate future expansion. It shall have the following features:

- Real time capabilities.
- Multiprogramming and Multitasking facilities including background and foreground operations in real time mode.
- Virtual Memory System.
- Event based priority scheduling/ priority driven preemptive kernel
- Dynamic memory allocation
- Memory lock/unlock feature
- Hardware based control interrupt handling
- System Security Features
- RDBMS/SQL database management system
- Dual LAN support
- Bulk Storage Management
- OSI/TCP/IP network connectivity support
- Input/output drivers for all peripherals
- Graphic support package
- Online and detailed offline diagnostic package to troubleshoot CPU, memory and various system and peripheral cards

8.2 Terminal Automation Software

The Terminal Automation Software shall be built around real time data base management system, which handles both data storage and inter-process communications. The Terminal Automation Software as a minimum shall meet the functional and terminal operational requirement as defined in terminal operations

and Functional specifications. The application software shall be designed in modular and structured manner for easy operation and maintenance.

The TAS software should have the following functionalities in order to meet the Operations and Functional requirements (in real time) as minimum

- Data Acquisition
- Data & Alarm Processing
- Database Downloading
- Terminal Security Access
- Tank Lorry Loading
- Scheduling
- Stock Control
- Overview Display
- Group Display
- Alarm and Monitoring Display
- Trend Display
- Report Generation
- Diagnostics Display
- Redundancy

8.3 Utility programs need to be provided such as editors, compilers, linker and extensive debugger etc; which shall have the capability to facilitate real time computation and database manipulation.

8.4 The software shall acquire real time data from various field/ control room mounted instruments like RIT, Card Readers, Batch Controller, Data entry terminals etc. through polling of each device.

8.5 The polled devices shall communicate with all real time parameters and alarms, operator interactions and start and stop of batch operations, etc.

8.6 Secured data acquisition shall be achieved through communication error handling and error detection and correction features.

8.7 The standard application should include database editors, file creation and maintenance facilities, real-time display of load-out activities, alarm and event display and logging.

8.8 The Bidder shall note that the system software (i.e. control and management database, graphics, reports, etc.) shall be forward migrating within Bidder's evolving technologies with no re-configuration required by the Owner.

8.9 The proposed system shall have minimum 10 years of product life & product maintenance service support. After completion of product life, system shall be upgradable on product level & no need for replacement for other system components.

8.10 The capacity of offered software should be with 50 % spares with respect to nos. of data base points/ tags after calculating requirements of the total system. The offered

software should have in-built capability / provision to take care for future expansion eg. additional bays and additional tanks; System should be flexible from the point of view of up gradation. These shall be verified during FAT. In case of tag based system, unlimited tags shall be offered.

8.11 The TAS software offered shall be of proven and bidder's own software. The offered software should be of proven technology & latest; with copyright or trademark registration.

8.12 The operating system software for all the PC's and the application software used in PC's / system shall be original and licensed copies for each of the PC's/system along with certificates shall be provided to BPCL. All PC's/server as a part of this project shall have latest licensed Anti-virus software.

8.13 The operational requirements as specified in this tender might undergo revisions during detail design and engineering. Vendor must ensure that the offered system software packages have the capacity and flexibility to take care of these revisions e.g. product changed, bays changed, product codes etc.

8.14 All software licenses shall be from Principal software manufacturer and not from the reseller.

8.15 Communication Requirements

a) The system communications shall be of the high speed and shall utilize industry standard protocols to the maximum extent possible.
b) To ensure maximum reliability, communications shall be dual redundant. The communications system shall be capable of sustaining loss of one media channel without loss of data or performance degradation.
c) Loss of communications shall not cause loss of control at the local subsystem.
d) Communication throughput on any given communication bus shall be sufficient to ensure that all operator screen variables are updated to reflect process variable status changes, within stipulated time, specified in this specification.
e) Loss of a subsystem shall not disrupt communications to other subsystems. Loss of a subsystem shall cause automatic isolation bypass of the failed subsystem without disrupting communications. Loss of a subsystem shall generate a diagnostic message to be displayed at the operator stations and logged.
f) Comprehensive error checking shall be employed to assure message integrity.

8.16 System Access Security

All operator commands shall be automatically checked for validity as authorized by the system. Validity checks shall be automatically performed by the system to

ensure that control parameters entered by the operator are within the defined limits.

Access to all system functions shall be protected by a multi-level password system.

9 CABLE LAYING

Cables shall be laid above ground in gantry or in some road cuttings etc if required the same shall be laid underground. All above ground cables shall be laid on the cable tray with cover as per specification.

When the cable is laid above ground, it shall be laid on the perforated cable tray with cover. The cable shall be tied on the GI or Aluminium Cable tray (as per site conditions) with GI Clamps. No PVC ties or MS wire shall be used for tying the cable on the GI cable tray. The cable shall be laid on the tray with min. D spacing (D being the diameter of the thicker cable). Bunching of cables or laying cable on top of each other is not permitted.

Separate cable tray shall be used for laying Power & Signal / Communication / Control Cables.

The perforated GI or Al Cable Tray shall be supported at regular interval. The existing structural support at Gantry, Tanks may be used for supporting the cable tray. In case additional supports are required the same shall be supplied & erected by the vendor & shall be include in the cost of cable laying.

Laying of the cables underground shall be in trenches of min. 1mt depth in all types of soil both hard and soft soil including dewatering, if required. Big boulders, sharp edges of the steel sections, vegetation, growth roots etc. if encountered shall be removed completely. Only soft earth excavated shall be kept for refilling. Such earth shall be approved by the BPCL Engg-In-Charge (EIC). Excavated trench shall be in true straight line as far as possible and bends if necessary shall be provided. Such bends shall be gradual and not sharp in nature, the excavated trench shall be approved by BPCL EIC before cables. In case, during excavation hard rock is encountered which in opinion of BPCL EIC / cannot be excavated further, then additional sand bedding of 150mm shall be provided over & above the 150mm specified for the bedding. The decision of BPCL / is final & binding in this regard. Rate of cable laying shall include excavation, supply and laying of two layers (150mm thick each, below and above) of river sand conforming to IS 383 and a layer of good quality bricks of compressive strength min. 35kg/sqcm on top of the second layer of sand & backfilling with good quality excavated earth. Job shall also include cutting / excavation of RCC wherever encountered & construction of RCC Culvert / cable alley in RCC 1:1.5:3 with reinforcement as per design requirement. All care shall be taken to ensure that no underground utilities like cables, pipelines etc. gets damaged. However, in case any underground utility like cables / pipes are damaged, the same shall be repaired / replaced by the vendor immediately at no extra cost. Rate to include backfilling of the excavated earth & carting away surplus earth within the depot premise as directed by BPCL EIC / Installation Manager.

Before cutting the cables exact length as per the site conditions shall be measured and recorded. Cut ends of the cable shall be wound by insulating tape to protect them from rain water etc. Cable ends shall not be kept open for long.

The cables shall be laid with min. spacing of “D” (D being the diameter of the thicker cable) * 15mm from edge of the cable tray. Power Cable shall be laid in separate trench and Signal & Communication Cabling shall be laid different trench. The same may be laid in common trench provided physical barrier in the form of bricks are provided in such a way that both are laid min 300mm apart. Power & Signal / Communication / Control Cables shall be laid separately.

Wherever the cables have to cross the asphalt roads, the job shall include cutting of the asphalt and WBM roads including soiling and necessary excavation to the required depth and back filling the trench with river sand and restoring the asphalt / WBM roads to its original condition including compacting and rolling the surface.

Road crossing shall be done through the Hume pipe. The existing Hume pipes may be used in case sufficient space is available for laying the cables. Supply & laying of the NP2 Hume pipes, if required, shall be in the scope of the vendor.

Wherever the cable comes aboveground, a suitable size GI sleeve with bend shall be used. Such pipe shall be laid 150mm below ground level and the projecting bend shall raise to 500mm above ground level along the steel / concrete / brick columns. The sleeve shall be neatly clamped by MS clamps of adequate size and wooden bushes. Necessary precautions shall be taken to make the opening water tight by wooden bushes.

All the cables be neatly clamped on the cable tray and loose hanging cables shall not be allowed.

Required loops shall be provided at both ends of the main cables. Cable shall be laid without any joints.

Cable route markers at 20m/c and at all the bends/turnings shall be provided.

Bending radius of cables shall not be less than 12times O.D. of cable.

All cores of cable shall be identified at both ends by means of PVC ferrule.

Line drivers & all other accessories required in this regard are included in the scope of work of the vendor.

Cable laying shall also include termination of cables at both the ends. Cable leads shall be terminated at both ends by crimped type soldering.

Rate shall also include megger test by 1000V megger for establishing the healthiness of cable in the drum before removing the same, unwinding and straightening the cable & after laying of cables.

10 Earthing

All junction boxes, local cabinets, field mounted instruments shall be connected to the nearby earth bus bar/earth pit through minimum 1.5 mm2 copper conductor

Earthing network shall be realized with earth electrodes and/or buried bare conductors.

Two types of earthing system shall be envisaged –

- Main earthing system (ME)
- Electronic earthing system (EE)

The electronic earth system shall be separate from main earthing system. Main earthing system (ME) shall be installed by BPCL. However, Electronic-earthing system (EE) is included in the tenderer scope.

The earth electrode(s) for EE shall be of the same type as those for the ME, but in addition shall be placed in a galvanized steel pipe line for a depth of 4m to shield the electrode from surface earth stray currents which may cause unwanted interference.

In general, the earth conductor between cabinets/instruments/junction box upto the local earth bus shall be 1.5 mm 2 insulated copper conductor.

From local earth bus to the earth pit 2.5 mm2 insulated copper conductor shall be used.

In general the following rules shall be apply for earthing :

- The metallic housing of electronic equipment/junction box/panel shall be connected to the main earthing system (ME).
- The active electronic parts of a electronic equipment/computer system shall be connected to the electronic earth (EE).
- All armors of armored cables shall be connected to the earth (ME) at both ends.
- The shield of the shielded cable shall be earthed with electronic earth at one end only i.e. at control room end.

11 Painting

This part of the specification is applicable to cable ducts, cable trays, CS impulse pipes, instrument supports and all other structural supports for cable trays, ducts, impulse tubes, air lines etc.

The surface to be painted shall be thoroughly cleaned with wire brush, sandpaper to remove all scales. After cleaning, the surface is painted with one coat of red oxide zinc chromate primer conforming to IS 1074 and allowed to dry completely.

Primer coated surface is painted with one coat of synthetic enamel paint to the colour nearest to the final paint and allowed to dry. The colour number shall be from IS 5.

Final second coating shall be with the paint of desired colors and shall be elected from IS 5.

The name of manufacturer, colour and quality of all types of primer paint shall be subject to approval of purchaser.

12 TECHNICAL SPECIFICATIONS FOR EQUIPMENTS & ITS DATA SHEETS.

12.1 GENERAL SPECIFICATION FOR POSITIVE DISPLACEMENT ELECTRONIC FLOWMETER ASSEMBLY SYSTEM & PROVING SYSTEM

SR. No.	DESCRIPTION OF REQUIREMENTS	VENDOR'S OFFER
1.	General	
1.1	Scope	
1.1.1	This specification together with data sheets attached herewith cover the requirement for the design, materials, nameplate, testing and transportation of Positive Displacement (PD) Electronic Flow Metering assembly with their accessories.	
1.1.2	The meters assemblies shall be electronic type which shall include pulse transmitter, digital set stop valve, etc complete.	
1.1.3	The offer should mention the model and make of the following sub-components :	
a.	P. D. Meter	
b.	Strainer	
c.	Air Eliminator	
d.	Digital Control Set Stop Valve.	
e.	Pulse Transmitter	
f.	Differential Pressure Gauge & Manifold	
g.	Pressure Gauge & Manifold	
h.	Ball valve for Drain	
i.	Safety Release Valve	
1.1.4	The following related standard referred shall be the latest editions prior to the date of purchaser's enquiry:-	

SR. No.	DESCRIPTION OF REQUIREMENTS	VENDOR'S OFFER
a.	ANSI/ ASME - American National Standards Institute/ American Society of Mechanical Engineers.	
b.	B1.20.1-Pipe threads	
c.	B 16.5 - Steel Pipe flanges and Flanged fittings	
d.	B16.20-Ring joint Gaskets and Grooves for steel pipe flanges	
e.	ASME Sec VIII - Boiler & Pressure Vessel Code Rules for construction of pressure vessels.	
f.	ANSI/ API MPMS-American Petroleum Institute. Manual of Petroleum Measurement standards {Chapter 4, Sec.1 "Introduction to Proving Systems" , Chp.4, Sec.8 "Operation of Proving Systems" & Chapter 5 Metering}	
g.	DIN 50049 - Document on material testing	
h.	IEC60079-10 - Electrical apparatus for explosive gas atmosphere. (If applicable)	
1.1.5	If a conflict arises between this specifications, data sheets, related standards, codes etc., the Bidder should refer the matter to the Purchaser for clarifications and only after obtaining the same, they should proceed with the manufacture/supply of the items in question.	
1.1.6	Purchaser's data sheets indicate the material for the body and trim of the meter, material for the air eliminator, strainer etc. However, this does not absolve the Bidder of the responsibility for proper selection w.r.t. the following :	
a)	Tenderer shall Select proper type of materials for all parts of the flow meter and its accessories so as to be compatible with the fluid and operating conditions as well as overall operational accuracy.	

SR. No.	DESCRIPTION OF REQUIREMENTS	VENDOR'S OFFER
b)	Material of all wetted and non-wetted parts of the PD flow meter, gaskets, nuts & bolts shall be suitable for the service conditions indicated in the data sheet or else where in the T.S	
c)	Proper sizing of the flow meter, air eliminator and strainer, DCV etc.	
d)	The PD flow meter shall have magnetic coupling between rotary element BI-ROTOR/TRI-ROTOR/OVAL-GEAR) and sensing element to ensure a glandless transmission of the rotation of rotary element from the wet chamber to the dry chamber.	
1.2	Bid :	
1.2.1	The Vendor's offer shall include a detailed specification sheet for each electronic Positive Displacement flow meter which shall have the following information :	
a)	All details regarding type, construction, materials etc. for various parts of the flow meter and its accessories.	
b)	Maximum pressure loss through meter and other accessories such as strainer, air eliminator at max. flow rate.	
c)	Viscosity range for which the equipment meeting the stated performance.	
d)	Over all dimension of the flow meter, strainer cum eliminator in mm.	
1.2.2	All the units of measurement for various items in the Vendor's offer shall conform to the same standards as in Purchaser's data sheets.	
1.2.3	All material specifications for various parts shall conform to the same standards as in purchaser's data sheets.	
1.2.4	The detailed technical specifications for each meter and accessories.	
1.2.5	Vendor shall attach a list of meters tag wise, summing up the deviations, if any, from the purchaser's data sheets. Reasons for the deviations need to be attached.	

SR. No.	DESCRIPTION OF REQUIREMENTS	VENDOR'S OFFER
1.2.6	Vendor shall enclose catalogues giving detailed technical specifications for each meter and accessories.	
1.2.7	Bidder /Vendor shall submit along with TECHNICAL BID necessary statutory approval/certificate such as CENELEC/ CSA/ UL/ FM/ BASEEFA/ INEX or any other authorities recognised under the Harmonised European/ Canada/ USA/ UK Norms for all field equipments to use in Flammable/Explosive environment & over and above approval from Indian CCOE in case of Imported equipment . In case of Indigenous equipments, CMRS/CCOE Nagpur Approval/Certificate is needed for flameproof & weather proof requirements. Also the Model approval on OIML recommendation basis for custody transfer.	
1.2.8	Flameproof equipment manufactured indigenously, tested and certified by any of the foreign agencies is not acceptable for approval even through the equipment conforms to recognized standards, Flameproof equipment manufactured indigenously has to be necessarily tested and certified by either CMRS, Dhanbad or BRTL Calcutta who are the only approved testing and certifying authorities recognised by CCOE, Nagpur.	
1.2.9	Flameproof equipment manufactured by a foreign company and tested and certified by Government accredited testing and certifying authorities in the country of manufacture like CENELEC/ CSA/ UL/ FM/ BASEEFA/ INEX or any other authorities recognised under the Harmonised European/Canada/USA/UK Norms can be considered provided that complete test report submitted with necessary drawings are made available for all field equipments to use in Flammable/Explosive environment & over and above approval from Indian CCOE Nagpur needed & weather proof to IP 65 . Also the Model approval on OIML recommendation basis for custody transfer.	
1.3	Drawings and Data :	
1.3.1	Detailed drawings, data, catalogues and manuals are indicated as per the Contractor's quotation.	

SR. No.	DESCRIPTION OF REQUIREMENTS	VENDOR'S OFFER
a)	In addition to the above requirement, after placement of order, Bidder shall submit certified drawings and specification sheets for each flow meter and accessories which shall include :	
b)	Calibration and performance characteristic curve for meters after meter proving in proper format.	
c)	Meter accuracy curve plot of flow rate v/s accuracy.	
d)	Weight of the flow meter, strainer, air eliminator in kgs and foundation details.	
e)	Graph of temperature correction factor.	
2.0	**DESIGN AND CONSTRUCTION :**	
2.1	Electronic PD Flow meter & PD Master Meter :	
2.1.1	The flow direction shall be clearly stamped or cast on the body.	
a)	Unless otherwise specified, end connections shall be as below:	
b)	Threaded end connections shall conform to NPT as per ANSI B. 1.20.1.	
c)	Flanged end connections shall be as per ANSI B 16.5	
d)	Grooves of ring type joint flanges shall be octagonal as per ANSI B 16.20	
2.1.2	Flange face finish shall be serrated concentric to paragraphs 6.3.4.1, 6.3.4.2 and 6.3.4.3 of ANSI B 16.5	
2.1.3	The electronic flow meter shall have an over range protection of at least 20%.	
2.2	Accessories :	
2.2.1	Unless otherwise specified, end connections for the accessories shall conform to para 2.1 of this specification.	
a)	Air Eliminator :	

SR. No.	DESCRIPTION OF REQUIREMENTS	VENDOR'S OFFER
b)	The air eliminator where specified shall be supplied complete with all accessories such as pressure gauge, thermal safety valve, etc. as required	
2.2.2	The air eliminator shall be equipped with necessary supporting brackets suitable for floor mounting/structure mounting	
a)	Strainer:	
b)	The Contractor shall suitably select strainer for the service conditions indicated in the purchaser's data sheets and also for the type of PD meters offered. These also shall meet ASME Section VIII as applicable.	
2.2.3	Strainer shall be supplied complete with all accessories including DP gauge.	
a)	Pulse Transmitter :	
b)	The selected pulse transmitter shall be dual pulse quadrature output type and should conform to pulse security level A or B according to ISO 6551 – 1982. The pulse transmitter shall be integrated with PD meter. The enclosure of pulse transmitter shall be explosion proof to NEMA 7 and weather proof to IP-65.Necessary explosion proof certificate from reputed international agency such as CENELEC/UL/CSA/FM/BASEEFA/INEX/Equivalent from country of origin shall be furnished along with Technical quotes. Over and above CCOE-Nagpur approval is needed to use in Indian Explosive environment. The pulse transmitter shall be of same make as the PD meter. The phase shift for pulse output shall be verified during FAT/Batch accuracy test.	
c)	It is specially designed for positive displacement volume flow meter applications in the oil industry.	
d)	It should be certified for use in hazardous area.	
2.2.4	Digital Control set stop valve	

SR. No.	DESCRIPTION OF REQUIREMENTS	VENDOR'S OFFER
	IEC-60079-10 Electrical apparatus for explosive gas atmosphere IEC/EN 60529- Degree of protection provided by enclosures ANSI/ASME – American National standards Institute/American Society of Mechanical Engineers DIN 50049 – Document in material testing. Functionality test of valves with the random sampling. Approval of explosive & weatherproof for solenoids and limit switch. Breaking strength test of Diaphragm, in Kg./2.5 cm. Width according to ASTM D-751.	
2.2.5	Meter Proving :	
2.2.6	Bidder /Vendor/Contractor shall calibrate each meter at his shop using a suitable method as per API-MPMS / IS 2801. However, calibration using meter prover is preferred. The mechanical displacement meter prover shall be as per API-MPMS / IS 2801.	
2.2.7	Vendor shall indicate the range of viscosities over which the measurement accuracy is within limits.	
3.0	NAMEPLATE :	
a)	Each positive displacement flow meter shall have a SS name plate attached firmly to it at a visible place, furnishing the following information :	
b)	Tag number as per purchaser's data sheet.	
c)	Manufacturer's serial number or model number.	
d)	Manufacturer's name/ trade mark	
e)	Nominal end connection size and rating	
f)	Body and trim material	
g)	Calibrated range and units of measurement of flow.	

SR. No.	DESCRIPTION OF REQUIREMENTS	VENDOR'S OFFER
4.0	INSPECTION AND TESTING :	
4.1	Unless otherwise specified, purchaser reserves the right to test and inspect all the items at the Manufacturer's/Bidder's works.	
a)	Bidder shall submit the following test certificates and test reports to purchaser.	
b)	Material test certificates for PD meter and accessories.	
c)	Certificate of radiography / x-ray of welded joints. Dye penetration test certificates shall be provided where radiography / x-ray is not possible. (For Strainer / Air Eliminators)	
d)	Hydro-static test reports as per para 4.1 below.	
e)	Calibration report for electronic PD meter.	
f)	Dimensional test report	
4.1	Hydrostatic test	
4.2	Each PD meter shall be subjected to hydro-static test. The hydro-static pressure shall be 1.5 times maximum allowable working pressure.	
4.3	**Witness Inspection :**	
a)	All PD meters and accessories shall be offered for pre-dispatch inspections for the following at vendors works	
b)	Physical dimensional checks and workmanship	
c)	Hydro-static test	
	Calibration, including establishing accuracy and repeatability over the operating range.	

SR. No.	DESCRIPTION OF REQUIREMENTS	VENDOR'S OFFER
4.4	Imported Products (Meter/ Batch Controller/ pulser etc.) must have "MODEL APPROVAL" as per OIML R 117. In case they don't have the model approval then they can get it done through OIML Recognized laboratory i.e. FCRI in India and submit the same. FOR DETAILS OF FACTORY ACCEPTANCE TEST, BATCH ACCURACY TEST & MODEL APPROVAL TESTS ON FLOW METERS AT FCRI - PALGHAT AS PER OIML RECOMMENDATION BASIS, PLEASE REFER QUALITY INSPECTION PROCEDURE & OIML R117.	
5	Transportation :	
5.1	All threaded and flanged joints shall be suitably protected to prevent entry of foreign materials.	
5.2	The flow meter and its parts shall be oiled to minimize the effect of corrosion.	
5.3	The flow meter accessories shall be packed separately.	
6.0	SITE ACCEPTANCE TEST: As per tender.	
6.1.1	On receipt of the meters at site, the meters are checked visually for any defects, the test certificates, tag numbers etc. cross checked.	
6.1.2	Meters are then checked after installation for their accuracy and repeatability.	
6.1.3	Master meters located in the headers will be used to establish the "k" factor of the individual line meters.	
6.1.4	Master meters should be first calibrated by the Bidder with Calibration vessel of 5KL. (The Contractor will arrange stamping of the vessel after establishing the accuracy and proper calibration charts are prepared for the same.).	

SR. No.	DESCRIPTION OF REQUIREMENTS	VENDOR'S OFFER
7.0	WARRANTEE : During the warrantee period, the Contractor on a regular basis would service the meter assembly as per tender condition. If the shift in calibration is observed (deviation from overall batch accuracy of ±0.05%), such meter assembly shall be re-calibrated and the weights and measures sealing done. Any payment on account of this during the warrantee period would be borne by the Contractor. It is expected that the frequency of calibration of meters should be as minimum as possible in order to maintain the specified accuracy limits.	

12.2 DATA SHEET FOR ELECTRONIC POSITIVE DISPLACEMENT FLOWMETERS (COMPOSITE UNIT CONSISTING OF PD METER & PULSE TRANSMITTER)

SR.NO	PARTICULARS	REQUIREMENTS	VENDOR'S OFFER
1.	Line size	3"	
2.	Schedule	40	
3.	Service	Flow through loading arms	
4.	Flow range	Manufacturer to specify	
5.	Normal flow rate	1200 lpm	
6.	Temperature	0 - 55 deg. C.	
7.	Element type	Rotary Vane/ bi-rotor / tri-rotor/ oval-gear.	
8.	Body type	Double case	
9.	End connections:- size & rating Facing & finish	3" flange, class 150 # RF serrated 125 – 250 , ANSI B16.5	
10.	Type of coupling	Magnetic/ Optical.	
11.	Material – inner housing Outer housing	Anodised aluminium Carbon steel	
12.	Rotating element/ shaft	Anodised Aluminium / SS-316	
13.	Bearings: type & material.	SS 316 / Tungsten Carbide / Ni-Resist	
14.	Seal.	Viton / Buna N	
15.	Linearity Repeatability Batch accuracy.	+/- 0.1% or better +/- 0.02% +/- 0.05%	

SR.NO	PARTICULARS	REQUIREMENTS	VENDOR'S OFFER
16.	Transmitter output	DUAL PULSE quadrature output	
17.	Enclosure / cable entry	Is / ex-proof to NEMA 7, weather proof to IP 65	
18.	Strainer- size & mesh	Refer spec for details	
19.	Air eliminator/ end connections	Refer spec for details	
20.	Liquid to be handled	HI-SPEED DIESEL, HSD, MS, SPEED, SKO	
21.	Flow min/max	120 / 1200 lpm	
22.	Pressure min,(op), max Design pressure. Body Hydro test pressure	1 to 6 kg/cm2 15 kg/cm2 1.5 times max. design pressure i.e. 22.5kg/cm2.	
23.	Temperature, min/max	0 / 55 deg. C	
24.	Specific gravity / Kinematic viscosity (at 15 deg c), sq. m/ sec	HSD – 0.83, SKO – 0.79, MS – 0.73, HSD – 7.5 * 10(-6), SKO – 2.3 * 10 (-6), MS – 0.7.	
25.	System pressure drops comprising of strainer, air eliminator, pd meter & digital control valve etc. complete.	Within 1.0 Kg/sq.cm at Maximum flow rate for white oils .	
26.	Quantity.	As per price schedule.	
27.	Model no./ Make	Vendor to specify	
28.	Note:		

SR.NO	PARTICULARS	REQUIREMENTS	VENDOR'S OFFER
A.	• Air eliminator and strainer shall be separate unit • The pulse transmitter shall be of same make as of PD meter. • The flow direction shall be clearly stamped or cast on the Meter body.		
B.	Measurement chamber of PD Meter alongwith its internals shall be fully imported.		
C.	The total pressure drop across the metering assembly including strainer, air eliminator, electronic pd meter, digital set stop valve and any reducers / expanders etc. Should be within 1.0 kg/cm2.		
29.	Pulse Transmitter –Type	Dual channel, magnetically coupled, gland-less drive. OR Opto-electric, serrated disk type , 2 wire OR Mechanical	
30.	Pulse Transmitter -Power supply	From Batch Controller (Vendor to specify)	

SR.NO	PARTICULARS	REQUIREMENTS	VENDOR'S OFFER
31.	Pulse Transmitter -Pulse resolution	Min. 100 pulses per revolution of the calibrator output shaft for pulse security conforming to Level A as per IP 252 / 76 OR Min. 1000 pulses per revolution of the calibrator output shaft for pulse security conforming to Level B as per IP 252 / 76	
32.	Pulse Transmitter -Max pulse frequency	Up to 2 KHz	
33.	Pulse Transmitter -Output	Dual pulse quadrature output to batch controller	
34.	Pulse Transmitter -Phase shift between two pulse output	Approx. 90 Degrees [The phase shift between two pulses from pulse transmitter shall be checked / verified on oscilloscope at vendor's works]	
35.	Pulse Transmitter - Enclosure	IS / EX-PROOF TO ZONE 1 & 2 GAS GROUP II A, IIB AS PER IS-2148 WEATHER PROOF TO IB 65 AS PER IS 2147 (Must be CCOE approved)	
36.	Pulse Transmitter - Mounting	On the PD meter	
37.	Pulse Transmitter - Temperature	0 to 55 Deg. C	
38.	Pulse Transmitter - Installation procedure	In line with IS 252/76	
39.	Pulse Transmitter -Signal range	Vendor to specify.	

SR.NO	PARTICULARS	REQUIREMENTS	VENDOR'S OFFER
40.	Pulse Transmitter -Model no./make	Vendor to specify Model No. ; However make shall be same as of PD Meter	
41.	Pulse Transmitter - Body material	Vendor to specify	

NOTE:

1. The Positive Displacement type Electronic Flow Meter (composite unit consisting of PD Meter & Pulse Transmitter)' shall have following approvals/certificates –
   - Approval for Custody Transfer Application (as per OIML R 117) from 'Department of Legal Metrology from country of origin' and Weights & Measures Department (W&M), Govt. of India.
   - Approval/ certificate from Petroleum & Explosive Safety Organization [formerly Chief Controller Of Explosives (CCOE), Govt. of India] for the above Flow Meter Enclosure (housing electrical part) as detailed below-
     (a) Flameproof housing – Flameproof/ Ex(d) as per IEC-60079/IS-2148.
     (b) Weatherproof Housing – IP 55 to IEC-60529/IS2148

12.3 DATA SHEET FOR STRAINER

Sr.no	Particulars	Requirements	Vendor's offer
1.	Service	Product Filtration	
2.	Design code	ASME section VIII , Div.I, 1995	
3.	Body a.) Sizing & rating b.) Material c.) Mesh material d.) Mesh Size e.) Seals	 3" (80mm), 150# Carbon Steel SS 316 / SS304 40 Micron Viton / Buna N / IS 2712 gr. 0/1	
4.	a.) End connections b.) Flange material	3", ANSI 150# RF serrated	
5.	Service conditions	Strainer shall be part of pd meter assembly. Flow conditions are same as of pd meter.	
6.	Design parameters a.) Pressure b.) Temperature c.) Max. Flow rate d.) Pressure drop i. At max. Flow ii. At normal flow	 15 kg/cm2 55 deg. Cent. 1200 lpm Vendor to specify Vendor to specify	
7.	Drain connection	1" flanged with full bore isolation ball valve.	
8.	Vent	¾" NPT (F) / ½" BSP	
9.	Differential pressure gauge	Required with ½" taps (ref. Specification for details). Mounted integral on strainer with two isolation valves and two drain	

		valves. Pressure tapings shall be from strainer.	
10.	Quantity	One with each pd meter & one with each master pd meter.	
12.	Make & Model	As per approved vendor list	

12.4 DATA SHEET FOR AIR ELEMINATOR

Sr.no	Particulars	Requirements	Vendor's offer
1.	Service	To eliminate entrapped air/ vapours	
2.	Design code	ASME section VIII , Div.I, 1995	
3.	• End connections • Flange material	3", ANSI 150# RF serrated	
4.	Material of construction • Shell • Dish Ends • Flanges • Fasteners • Seals	 ASTM A 106 Gr. B Seamless / CS SA 516 Gr. 70 ASTM A 105 A 193 B7 / A 194 2H SPIRAL WOUND SS 304 / Viton	
5.	Design parameters a.) Pressure b.) Temperature c.) Max. Flow rate d.) Dead volume capacity e.) Pressure drop i. At max. Flow ii. At normal flow	 15 kg/cm2 55 deg. Cent. 1200 lpm 120 Litres Vendor to specify Vendor to specify	
6.	Drain connection	1" flanged with full bore isolation ball valve.	
7.	Vent	¾" NPT (F) / ½" BSP	
8.	Quantity	One with each pd meter & one with each master pd meter.	
9.	Make & Model	As per approved vendor list	
	NOTE: **Air Eliminator is not to be considered if the product viscosity is more than 300cst.**		

12.5 DATASHEET FOR DIFFERENTIAL PRESSURE GAUGES

Sr.No	Description	Requirement	Vendors offer
1.	Type	Direct	
2.	Mounting	Local across strainer	
3.	Dial size Colour	6” (150 mm) White with black number	
4.	Case material	SS 316 / SS 304	
5.	Bezel ring	Screwed	
6.	Window materials	Shatter proof glass	
7.	Enclosure	Weather proof (IP 55)	
8.	Pressure element	Bourden / diaphragm / piston	
9.	Element materials	SS 316	
10.	Socket materials	SS 316	
11.	Accuracy	+/- 2 % of FSD	
12.	Zero adjustment	Micrometer pointer	
13.	Connection Location	1/2” NPT(M), 2nos. Bottom	
14.	Movement	SS 304	
15.	Over range protection	As per IS 3624	
16.	Blow out protection	Required as per IS 3624	
17.	Make.	As per approved vendor list.	
	Note :		
A.	Quantity required is one for each strainer.		
B.	The differential pressure gauge shall be suitable for static pressure rating as per ANSI 150#(10.5 kg/cm2)		

12.6 DATA SHEET FOR PRESSURE GAUGES

Sr.no	Description	Our requirement	Vendors offer
1.	Type	Direct	
2.	Mounting	Via a two way valve on each loading point	
3.	Dial size Colour	150 mm White with black number	
4.	Case material	SS 316 / SS 304	
5.	Bezel ring	Screwed	
6.	Window materials	Shatter proof glass	
7.	Enclosure	Weather proof (IP-55)	
8.	Pressure element	Bourden / Diaphragm	
9.	Sensor/element materials	SS 316	
10.	Pressure measurement range	0 to 6 Kg/cm2	
11.	Socket materials	SS 316	
12.	Accuracy	+/- 2 %	
13.	Zero adjustment	Micrometer pointer (ext.)	
14.	Connection Location	1/2” NPT(M) Bottom	
15.	Movement	SS 304	
16.	Over range protection	130% of max. static pressure.	
17.	Blow out protection	Required	
18.	Make.	As per approved vendor list	
A.	Quantity required is one for each air eliminator		

12.7 TECHNICAL SPECIFICATIONS FOR RTD

SL. NO.	ITEM DESCRIPTION	APPLICABLE CODE / SPECIFICATIONS	VENDOR'S OFFER
	GENERAL		
1.	Type	Pt 100 RTD/100 Ohms @ 0 degree Celsius, 4-Wire type as per Din 43760	
2.	Make & Model No.	Bidder to state	
	SERVICE CONDITIONS		
3.	Area Classification	Zone 1&2, Gr IIA & IIB, T3 as per IS:2148	
4.	Service Area	Outdoor Unprotected	
	CONSTRUCTION		
5.	Enclosure (For RTD/ Thermowell assembly)	Intrinsically safe & explosion proof and Weather Proof to IP-65	
6.	Body Material	Die Cast Copper Free Aluminium	
7.	Mounting	Sensor & Thermowell on pipeline	
8.	Tropicalisation	Required	
10.	Electrical Connection	½" NPTF	
	THERMOWELL		
1.	Material	Bar Stock drilled 316 SS, Tapered	
2.	Hot End O.D.	16 mm	
3.	Cold End O.D.	21 mm	
14.	Hydro test	1.5 Times max. operating pressure	
15.	Process connection	1½" ANSI 150# RF 125 AARH Flanged	
16.	Bore Diameter	To suit element	
	ELEMENT		

17.	Connector, Nipple & Union	Required	
18.	Type	Pt 100 RTD / 100 Ohm @ 0 degree C / 4-wire configuration having temperature coefficient 0.000385 and shall comply with DIN 43760 standard and requirements.	
19.	Tags	Required guidelines and drawings	
20.	Cable Glands	Required : SS Tags With Tag nos calibrated span	
21.	Documentation	• Calibration / test certificate • Certificate of explosion proofness and intrinsic safety. • Dimensional Drawing of Thermowell • Hydrotest certificate for Thermowell	

12.8 DATA SHEET FOR PROVING VESSEL

SR. NO	PARTICULARS	REQUIREMENTS	VENDOR'S OFFER
1.	The proper assembly shall consist of prover tank which has the following specification :		
2.	Tank Size	5 KL as per design.	
3.	Materials Of Construction	CS with interior surface coated with Epoxy.	
4.	Design	As per IS 2341.	
5.	Process Connection	3" (80mm) class 150# inlet 4"(100mm) class 15# (outlet to drain pump)	
6.	Mounting Type	Stationary.	
7.	Side Glass and Cocks including mounting accessories like spirit level, temperature gauge, isolation valve and drain valve etc. are required.	Yes.	
8.	Graduation Marking	As per API MPMS chapter IV for Proving System.	
9.	Accuracy	To ascertain the accuracy of metering assembly system namely; + / - 0.1%	
10.	Drain Pump & FLP Motor.	Required as per site condition.	
11.	Weight & Measures Approval is mandatory & to be arranged by Contractor.	Yes.	

12.9 DATA SHEET FOR DIGITAL CONTROL VALVE

Type 1 [White oils, min. operating pressure: 1.5 Kg/cm2]	Hydraulically powered, Solenoid controlled Diaphragm type globe valve
Type 2 [Black oils in general & White oils, min. operating pressure < 1.5 Kg/cm2]	Pneumatically powered, Solenoid controlled Ball valves with pneumatic actuator
Design Pressure (max)	15 Kg / Sq cm
Size	3” (80 mm)
Tubing	SS 316
Needle Valve / Ball Valve	Steel tubed through compression type fittings
Limit Switch	Single, explosion proof, class I, Gr. IIA & IIB, WP to IP65
End Connection	3” ANSI 150 # Flanged
Mounting	Horizontal
Valve Body	Carbon Steel ASTM A –216 Gr. WCB
Body [Type1]	Globe
Body [Type2]	Ball (Full Bore)
Seals / Diaphragm	Viton / Buna N
Actuator [Type2]	Piston type pneumatic cylinder with spring return Mechanism (Detailed tech specifications are detailed below).
Fail safe condition	Valve to close in case of air failure/ power supply failure
Model No.	Vendor to specify

Leakage Class	Class VI.
Characteristics	Linear
Response Time	Less than 3 Sec

MOC [Type 2]

Body	: ASTM A 216 Gr.WCB
Ball	: ASTM- A 351 CF 8M
Stem	: ASTM A 479 SS 304/ A 479 SS 316
O ring	: VITON
Stem Gasket	: PTFE
Body Gasket	: PTFE

Design and Setting standards

Manufacture	: ASNI B 16.34, API 6D, BS 5351
Dimensional	: ANSI B 16.10
Flange	: ANSI B 16.5
Pressure Testing	: API 598 / BS 6765 Part I
Fire Safe	: API 607 / API 6FA/ BS 6755 Part II

SOLENOIDS

Type	1 No. NO. & 1 No. NC
Body {Type1}	Stainless Steel
Body {Type2}	Brass
Trim {Type1}	Stainless Steel
Trim {Type2}	Brass
Mounting	On Control Valve
Connection	Min. ¼” NPTF / Vendor to specify
Seals	BUNA-N / Viton
Max working Pressure [Type1]	15 Kg/ cm2 –Hydraulic pressure

Max working Pressure [Type2]	10 Kg/ cm2 –Air Pressure
Hazardous Approval	Explosion proof with increased safety & Weatherproof to IP 65
Power supply	24 VDC OR 230 V DC
Coil Insulation	F Type or better
Max Allowable Sound Level	Less than 80 dBA

Accessories

Pneumatic Actuator specifications

Quarter turn Rotary, Dual rack and pinion design, symmetrical mounting valve actuators for quarter turn valve automation-**2 stage control**.

The actuators shall be pneumatically operated and must be capable of traveling 95 Degrees in forward and backward direction and deliver linear torque through the travel

The travel must have an external arrangement to adjust the stroke a minimum of +/-5% both open and close positions.

Travel stop arrangement must be located outside the pressure chamber of the actuator body to prevent accidental blowouts of the travel stop screws and to avoid leak paths.

The travel stop arrangement must also be capable of locking out the actuator in both the fully open and fully closed positions for performing field maintenance safety.

The actuator must be totally enclosed in a single enclosure with no moving parts exposed.

All pneumatic passageways must be integral in the housing so as to eliminate the need for external tubing. The single enclosure shall be extruded and hard anodized aluminium with super finished cylinder bore walls covered with end caps. The end caps must be assembled with high strength stainless steel fasteners.

The end cap must have well rounded external contours to prevent trapping of foreign material. The end caps shall be epoxy powder coated for corrosion protection.

All interfacing air connections will be according to NAMUR to facilitate direct mounting of a variety of solenoid valves.

All metallic sliding and rotating parts must be mounted on bearings and guides designed for high cycle life and permanently factory lubricated for trouble free, long service life.

The actuator shall be provided with a mechanical visual position indicator and the shaft must be designed to allow manual override by simply removing the position indicator.

The standard output pinion shaft shall be designed and manufactured from high strength alloy steel and electroless nickel plated for corrosion protection.

The pinion output shaft will have a slotted connection at the top to engage various drive connection of valve position and control accessories. The bottom of the pinion shaft shall be available in a variety of shapes to accommodate several valve-mounting options without brackets and couplings.

All interfacing for external accessories shall comply with international standards such as ISO 5211/ EN 12116/ VDI /VDE 3845.

The springs shall be of high quality spring steel and epoxy coated for corrosion protection.

All seals shall be in permanently lubricated nitrile rubber and the bearings shall be high-grade acetal for long life.

The actuator shall be of a modular design with the same body and end caps used for double acting and spring return design. The spring system must be designed in a safely contained, pre-compressed, cartridge construction to facilitate safe and easy field conversion from double acting to spring return and vice versa.

Special Instructions-[Type1] :

- Hydrostatic /Pneumatic Test Reports for Class VI leakage tests shall be required to be submitted for dispatch clearance.
- Micro strainer of 80 mesh shall be provided in the inlet of opening speed control valve
- Needle valve shall be provided for opening & closing speed control.
  Valve position stem indicator shall be provided.

Special Instructions-[Type 2] :

- Air compressor with refrigerated air drier along with heavy duty GI piping & copper tubing is to be supplied, installed & commissioned by vendor for providing air supply to pneumatic actuators.
- Air quality requirement as recommended by actuator supplier is to be fulfilled by vendor.

Valve position stem indicator shall be provided

BPCL will provide 415 volt, 3 phase (non-UPS) & 230 Volt, single phase UPS power supply at single point.

12.10 Data Sheet for Field Mounted Flow Indicator cum Totaliser

SNO	DESCRIPTION	VENDOR'S OFFER

	General		
1	Display	LCD which is continuously powered.	
2	Resettable Total	7 Digits with 10mm (0.4”) high digits. Resettable from front panel.	
3	Accumulated Total	Displayed when “Accumulated Total” button is pressed.	
4	Rate Display	4½ digits with 8.5mm (0.33”) high digits.	
5	K-Factor	Range: 0.001 to 59999 Decimal Point Locations: XX.XXX to XXXXX Factor Multiplier: Multiplies entered K-Factor by 1, 10, 100, 1000. 10 Point Linearization.	
6	Decimal Points	Decimal Point positions to be fully programmable for both rate and total.	
7	Time base	Rate can be displayed in units per minute, hour or day.	
8	Input Frequency Range	0.01 Hz to 10 kHz.	
9	Signal Type	Dual pulse from Pulse Transmitter	
	Power		
10	Battery Powered	2 Lithium battery packs (1 main + 1 Standby). With Low Battery Indication.	
11	Battery Life	Minimum 3 years with run time of ~ 2hrs/day. Idle life time:5 years	
	Enclosure		
12	Explosion Proof	Class I, Division I, Gas Groups 2A, 2B CCOE Certification is required.	
13	Weather Proof	As per NEMA 4 / IP 65	

	Performance Parameters		
14	Linearity	0.05% of span	
15	Accuracy	0.05% of span	
16	Resolution	0.05 % of span	
15	Humidity	0-90% Non condensing (Conformal Coating)	
	Physical		
16	Temperature	Operating Temp: -20°C to 60°C.	
17	Humidity	0-90% Non condensing (Conformal Coating)	
18	Cable Entry	By Cable glands (SS316)	
19	Mounting	To be supplied with mounting brackets / accessories for mounting on mobile master meter trolley.	
20	Vibration protection	Shall withstand the vibration of moving trolley	
21	Approvals	Custody Transfer approvals as per OIML R117 & Weights & Measures, India	

12.11 DATA SHEET FOR BATCH CONTROLLER

SR.NO	DESCRIPTION OF REQUIREMENTS	
1	Purpose	To perform the Tank Lorry / Wagon Filling Operations of Petroleum products (alongwith additive blending facility as applicable) at TLF / TWF gantry.
2	Type	**Single Arm Batch Controller [with additive injection (2 additives) & blending (1 product)]** required for TLF/TWF operation in a bay/loading island through one loading arm. The Batch Controller should be Field Mounted Microprocessor based configurable, indicating type with display and data entry keyboard, flame proof and weather proof capable of performing following TLF / TWF operational functionalities.

SR.NO	DESCRIPTION OF REQUIREMENTS	
3	Mounting	**Surface mounted**- located at bay/loading island near each metering system. Mounting accessories are required from Vendor.
4	Enclosure Classification	Explosion proof to Zone 1 & 2, Gr. 2A & 2B as per IS:2148, Weatherproof to IP65 or equivalent national standard applicable in country of origin and conforming to T3.
5	Operating Temperature	0 – 50^{o} C
6	Relative Humidity	98% non-condensing
7	Power Supply	230V AC $\pm$10%, 50Hz $\pm$3%
	Protection	Surge arrestors are to be provided to protect Batch controller from external Electric surges/ transients.

8	Input/output Channels	• Dual Pulse Quadrature Input from Pulse Transmitter (BC to provide Power to Pulse Tx)
		• Signal from RTD (necessary linearisation should be included in Batch controller)
		• Pulse Input from Additive Flow Meter (BC to provide Power to PT)
		• 2 nos. 4-20 ma inputs. (Optional requirement)
		• Digital Inputs
		  o Earthing Relay
		  o Loading Arm Position
		  o Start / Stop / Acknowledge input command from RIT
		  o ESD
		  o Over-spill protection device
		  o Limit switch inputs from DCV
		• Digital Outputs
		  o Solenoid operated valves of DCV (BC to provide Power to SOV)
		  o Pump Demand
		  o RIT Lamps (3 Nos) (BC to provide Power to RIT)
		  o Additive line Solenoid valve(BC to provide Power to SOV)
		  o Prover Pulse Output
		• Totaliser 'Reset mode' Switch and Quantity Presetting PB at BC shall be enabled
		  o From LRC through serial communication port when BC is in Remote mode.
		  o Automatically whenever either BC operates in local mode or serial communication link (BC-LRC) fails
		• Serial Port to interface card reader (optional requirement)
		Note: All Inputs and Outputs from/to Batch controller shall be galvanically / optically isolated.

9.	Control Functionalities	• Indication • Totalisation • Batch Control operations in Local Mode and Remote Mode • Flow Rate Control • Ratio Control for additive blending (with additive meter) • Additive injection facility (intermittent injection without additive meter) • Pressure & Temperature compensation • Configurable Ramp down for Multi-Stage Opening / Closing of Set-Stop Valve • Meter Factor Linearisation: - minimum 4 point over 10% to 100% of flow range by entering "K" factor in Memory. • Dynamic Flow Totaliser Display. • Batch Summary • Local Loading • Provision to enter Truck No. / Wagon No. (Local Mode), Local Start / Stop, Low / High Flow Rate alarms through Alpha Numeric Keypads.

SR.NO	DESCRIPTION OF REQUIREMENTS	
10.	Essential Features	• Storage of minimum 200 Load Transactions in case of Local Mode Operation / Communication Link failure (BC-LRC). On revival of Communication Link / Switching over to Remote Mode Operation the Load Transactions shall be downloaded to LRC and Batch Controller should be ready to store new Load Transactions (upto 200) while operating Local Mode in future. • Batch Controller level security shall be as per Level A or Level B as per API IP 252/76 part 13. • Batch controller shall adopt necessary linearisation technique for RTD signal as per API/ASTM tables. • Batch Controller local display should indicate validation of Access Cards / Status of Permissives. • Batch Controller shall be capable to operate in Local / Remote Mode. Automatic transfer from Remote Mode to Local Mode is required on failure of Communication Link. Flagging of Communication Link failure alarm is required at LRC/BC. • Product Over Flow (w.r.t. preset Batch Quantity) due to DCV failure shall be evented / displayed as alarm at BC/LRC. • BC shall have short circuit protection for Digital Output driving solenoid valves. • BC shall read density parameters downloaded from PLC/LRC with Load Details. • User defined security password for programming. • Facility for automatic updation of 'K' factors after meter proving through software. (optional requirement) • The batch controller should be provided with in-built rechargeable dry cell battery which takes care of the display in case of power failure and the life of the battery should be 10 yrs. Minimum.
11.	Diagnostics & Alarms	• Overflow / Under flow/ No flow • Interlock failure • Stop command from RIT. • Pulse Transmitter failure BC front panel shall have status LED's for indicating alarm, operation mode and permissive status etc. Self Diagnostics shall be able for RAM, keypad, Displays, I/O's and Communication.
12.	Hardware & Performance Parameters	○ Scan Time - 300 m sec ○ Hardware ▪ Memory • EPROM: 128K • RAM: 128KB (Data Storage, Battery Backup required) • NVRAM: 32KB (Non-volatile RAM for Configuration storage) Retentive, Erasive device required for re-configuration of RAM.
13.	Serial Communication Requirement	○ Dual Redundant RS 422/RS485 standard or LAN/Ethernet to host computer with dual channel communication ○ Communication Speed ▪ Baud Rate: 19600 bps (Minimum)- for Dual RS485 communication. ▪ Baud Rate: 10/100 Mpbs – applicable to BC's having Ethernet Communication Capability. ○ Mode – Full duplex ○ Minimum 4 No. BC's to be multi-dropped per serial communication link on each port of the Terminal Server. ○ **Protocol Requirement – Modbus RTU / TCP-IP/ Fieldbus / profibus /any other open Protocol [Protocol details are required along with Technical bid]**
14.	Display	
	Display type	Alpha numeric key pad (each alpha numeric shall be followed by a number) Back lighted LCD.

SR.NO	DESCRIPTION OF REQUIREMENTS	
	Display parameters	• Simultaneous display of dynamic parameters (Flow rate / Totalised volume / pressure / temp) at BC in case of simultaneous loading through the two loading points / arms • Preset quantity • Quantity being loaded • Gross (resettable / non-resettable) • Net (resettable / non-resettable) • Temperature Diagnostic/alarm results • Rate of flow • Engineering units • Control mode • Display of data pertaining to last 200 transactions
15.	Keyboard	
	Keyboard type	Alpha numeric inscription, Push button key pad rugged for explosion proof environment.
	Keyboard functions	To enter configuration, all operator data entry, display selection, alarm acknowledgement, start/stop.
16.	Accessories	Flameproof / Weather proof Double Compression type Cable Glands (SS316) are required for each cable connection / entry.
17.	Approvals Requirement.	
	• OIML R117 custody transfer approval. • W & M approval – country of origin. • Explosion proof certification from CENELEC/CSA/ UL/FM/INEX/BASEEFA or any other authorities recognized under the Harmonised European/Canada/USA/UK. Over and above CCOE-Nagpur approval is also needed. • Weather proof to IP65.	
18.	Documentation	• Installation and Commissioning Manual • Operation and Maintenance Manual • Test and Calibration Certificate from OEM. • Certificate for Ex-Proof & Weather Enclosure. • W&M Approvals for Custody Transfer Applications • CCOE/PESO Certificate

12.12 DATA SHEET FOR EARTHING RELAY

SR.NO	PARTICULARS	REQUIREMENTS	VENDOR'S OFFER
1.	Function	To detect proper earthing of Tank Truck and will stop loading upon loss of earth connection.	
2.	Power Supply	230V AC ± 10% 50 Hz ± 3%	
3.	Principle.	Earth potential limit value monitor.	

SR.NO	PARTICULARS	REQUIREMENTS	VENDOR'S OFFER
4.	Protection.	Intrinsically safe.	
5.	Input to	Batch Controller	
6.	Control output	Typically 5A @ 230 VAC rated contact.	
7.	Enclosure	Explosion proof to Zone 1 & 2, Gr. 2A & 2B as per IS:2148, Weatherproof to IP65 or equivalent national standard applicable in country of origin and conforming to T3.	
8.	Cable /Connector	Flexible cable with Ball & socket type clip.	
9.	Indicating Lamp.	ON/OFF Indicating Lamps.	
10.	Area classification	NEC CL I, DIV II Gr. C&D	
11.	Special instructions.	One no. of flexible coiled cable of minimum 32 (Thirty two) feet each with Ball & socket type clip for Tank Truck connection.	
12.	Approvals	CMRI & CCOE approval is required for Flameproof and Weather proof enclosures.	
13.	APPROVED MAKES	As per approved list of bought out items	

12.13 DATA SHEET FOR REMOTE INTERACTING TERMINAL [RIT]

SR.NO	PARTICULARS	REQUIREMENTS
1.	Enclosure	IS or explosion proof suitable for Gas Group II A & II B as per IS : 2148 and weather proof to IP 65
2.	Push Buttons	Three nos. for START, STOP & ACKNOWLEDGE.

SR.NO	PARTICULARS	REQUIREMENTS
3.	Cluster of LED	Three nos. i.e. Green, Red and Amber.
4.	Power Supply	230 VAC, +/- 10% @ 50Hz.
5.	Cable Glands	Weather proof, Flameproof, double compression SS316 cable glands required for cable connections
6.	Approvals	CMRI & CCOE/PESO approval is required for Flameproof and Weather proof enclosures.
7.	Special instructions	The RIT is to be hardwired to the Batch Controller.

12.14 DATA SHEET FOR PROXIMITY CARD READERS

SR.NO	PARTICULARS	REQUIREMENTS
1.	Wiring	Vendor to specify
2.	Host Communication	Vendor to specify
3.	Read Range	25mm from the surface of the card reader
4.	Command Key / Cards	Proximity, Scratch proof / waterproof with BPCL Logo / highly durable quality and long life
5.	Diagnostics	Proximity Card Reading sensor & data line integrity to be monitored continuously with alarm and device indication incase of on failure detection at the LRC / OIC.
6.	Environmental Ruggedness	Humidity : 0 to 95 % non-condensing Temperature : 2 DEG C to 55 DEG C
7.	Indication	LED's for Access / Alarm / power & communication.
8.	Enclosure Class	IP 65 / NEMA 4X or better Area classification: Zone 1 Gr. IIA/IIB T3
9.	Sensing Time	< 4 secs
10.	Statutory Approval	Intrinsically Safe or ex-proof for use in hazardous areas & UL 294 listed wherever specified.
11.	Approval / Certification	PESO / CCOE
	Controller	
12.	Controller for Proximity card reader	The controller for proximity card reader shall be installed in the Planning Room. Controller for proximity card reader shall be of a compact panel mounted having serial communication link with redundant communication server/ stand alone controller with provision for both powering and receiving

SR.NO	PARTICULARS	REQUIREMENTS
		communication from individual card reader in field. The I.S. isolator with surge arrestors for both power and communication signal is required.
13.	Special Instructions	• Door Lock and Switch are to be provided at the Control Room Door • Access Control Unit for Card reader interface and hookup to the LRC / TAS Server to be provided. • Communication shall be between field mounted card reader and batch controller directly OR Communication shall be between LRC through Terminal Server. • Sensor Standoff for Card Readers shall be offered in case WSE system is offered.

12.15 DATA SHEET FOR 2 KL MOBILE PROVING VESSEL

2KL MOBILE PROVING VESSEL		
Brief Description		
1	Type	Mobile Proving Vessel
2	Applicable Products	White Oil Products : MS, HSD, Hi-SPEED, SPEED, SKO & LAN
3	Service	To verify product delivery of PD Meters of gantry area.
4	Components	• 2 KL Mobile Proving Vessel with drain pump and FLP Motor. • FlameProof & WP switch / socket for providing power (230 V AC) to the FLP Motor. *Note :* *1. 3 core PVC armoured FRLS Power cable between the FLP Motor & FLP Switch / Socket is to be supplied / laid / glanded & terminated by vendor.*

SR. NO	PARTICULARS	REQUIREMENTS
1.	Type	Mobile Skid with pump filling facility, quick connect coupling, valves and accessories. Suitable for top loading as well as bottom loading.
2.	Accuracy	+/- 0.1%
3.	Capacity	2 KL
4.	Gauge glass	Shall be provided at top and bottom
5.	Drain valve	Shall be provided
6.	Fill Pipe	3” Slotted pipe suitable for top loading through 2½ inch loading arm shall be provided up to 100 mm from the bottom.
7.	Vent	Design & Provide suitable Vent for loading products up to 1500 LPM flow rate.
8.	Gauge Glass Resolution	+0.1% of tank cap

SR. NO	PARTICULARS	REQUIREMENTS
9.	Graduation Marking	As per API MPMS Chapter IV for prover system.
10.	Top Cover	Required. It shall be hinged with locking arrangement.
11.	Displacement tube volume	+0.5% of tank cap.
12.	Plug Valve Size	3”
13.	Process Connection	3”, 150# Inlet 3”, 150# Outlet to drain pipe
14.	Mounting	On Skid mounted with suitable wheels for towing
15.	Gauge Glass	Shall be provided with mounting accessories
16.	Drain Connections	Shall be provided
17.	Accessories	Pump & Flame proof Motor with starter and piping. Plug with FLP type 32A rating socket shall be provided on skid. Temperature gauge 3 Nos., Spirit Level 2 Nos. for pump design Q may be taken as 200 lpm and H as 20 M for all type of products handled. Providing three phase connections & laying cable from MCC to Gantry shall be in scope of the vendor. Spare feeder if required shall be provided as a part of MCC modification.
18.	Weight & Measures Approval	Mandatory & to be arranged by Vendor.

SKID DETAILS		
1.	Skid Dimension	2000mm (Length) x 1500mm (Width)
2.	Outer Member	ISMC 100 as per IS2062
3.	Cross Member	75 mm Angle as per IS2062
4.	Chequered Plate	6mm thick of MS as per IS2062

5.	Paint	2 coats of coaltar epoxy primer (min 25 Micron DFT per coat) followed by two coats of coaltar epoxy finished paint (100 microns DFT per coat)
6.	Skid Installation	Trolley mounted with leveling jack & spirit Level gauge. Note: The GA drawing for the Mobile Proving Vessel & its weight with all its components shall be submitted along with Technical bid.
7.	Ground Clearance	300mm
8.	Castor Wheels (cast iron) with solid Tyres (Polyrethene)	4 Nos [2 fixed and 2 rotating (with brakes)]. Load bearing capacity should be 1.5 Times the weight of loaded skid. Make : Rexello /Flexel
9.	Approved Makes for Mobile Proving Vessel	FMC, Flash Point, Bopp & Reuther, Liquid Controls, Cryogenic Liquide

12.16 DATA SHEET FOR PRESSURE SWITCH

General:

Service	MS/HSD/SKO/NAPTHA
Mounting / Location	On 2" Vertical Pipe / on main line Header (Pump Suction Header)
Enclosure	Weatherproof as per IP65 Flameproof as per IS 2148 and Area Classification specified below
Area Classification	Zone – 1 &, Gas groups – IIA & IIB as per IS:2148/1981, Temp. Class – T3

PRESSURE SWITCH

Primary Sensor	Bellows/ Diaphragm
Range (operating range)	-1 to 7 Kg/cm2
Maximum Static Pressure	15 kg/cm2
Set Point	manual adjustment to set for entire measurement range
Differential	adjustable
Power Supply	230 VAC; 50 Hz
Output	Potential Free SPDT Contact (2NO + 2NC)
Accuracy	1.0% of calibrated span
Mounting Accessories	Necessary accessories suitable for 2" NB Pipe mounting

MATERIAL:

Wetted Parts	SS 316
Enclosure	Die-Cast Aluminium (LM 6) / SS

APPROVAL:

CCOE / PESO / CMRI	Required.

12.17 Technical Specifications of Flameproof / Weatherproof Electronic Hooters

Flameproof	Zone – 1 & , Gas groups – I, IIA & IIB as per IS:2148/1981, Temp. Class – T6
Weatherproof	IP 65 Degree of protection as per IS:13947 (Part-1) 1993. IP certificate for the same to be submitted.
Material	Cast Aluminium Alloy LM6 / SS
Finish	Inside & Outside light grey epoxy powder coated to shade 631 as per IS:5
Earthing	Required
Terminals	8 Nos. for 1.5/2.5 sqmm clip-on Terminals
Cable Entries	2 Nos 1/2” NPT cable entries from bottom side. FLP / Weatherproof double compression cable glands (SS316) are to be provided on cable entries.
Sound Level	Shall be audible atleast upto 1 km coverage(Vendor to specify dB)
Mounting	Surface Mounting Type (Mounting Accessories / Canopy to be provided)
Certified temperature	–20°C to +55°C.
Power Supply	230 VAC
Approvals	PESO, CMRI. Certificate for the same to be submitted for approval before procurement of the same.
Makes	Baliga / FCG/ Flexpro/ Ex-protecta/ CEAG/ Sudhir Switchgears / Equivalent

12.18 SPECIFICATION FOR THERMAL SAFETY VALVE

SR. NO	PARTICULARS			REQUIREMENTS	
1.	Valve Type			Thermal Safety Valve	
2.	Bonnet Type			Closed	
3.	Conventional / Bellows / Pilot Operated			Conventional	
4.	Inlet	Size	Rating	¾”	Threaded
		Facing	Finish	NPT(M)	
5.	Outlet	Size	Rating	1”	Threaded
		Facing	Finish	NPT(F)	
6.	Cap over adjustment Bolt			To be provided, Screwed	
7.	Applicable code			ASME SEC VIII DIV 1 & API 520	
	Material				
8.	Body & Bonnet			ASTM A 216 WCB	
9.	Nozzle & Disc			SS 316	
10.	Guide & Rings			SS 316	
11.	Spring			Zinc plated CS	
12.	Basis of Selection			Liquid Thermal Relief	
	Service Conditions				
13.	Fluid	State		MS, HSD, Hi-SPEED, SPEED, SKO & LAN	Liquid
14.	Required Flow Capacity			Nominal	
15.	Operating Pressure Min./Max.			2.0/7.0 Kg/cm² g	
16.	Temperature Min./Max.			0/60 Deg. C	

SR. NO	PARTICULARS		REQUIREMENTS	
17.	Back Pressure		ATM (constant)	
18.	Set Pressure		7.5 kg/cm2 g	
19.	Allowable Over Pressure (%)	Blow Down (%)	25	Vendor to specify
20.	Viscosity at Relieving Temperature (cP)		0.6 – 6 (as per the product)	
	Orifice			
21.	Calculated Area (cm2)		Vendor to specify	
22.	Selected Area (cm2)	Orifice Design	Vendor to specify	Vendor to specify
23.	No. of valves required for capacity	Total Area	One	Vendor to specify
24.	Total Flow capacity		Vendor to specify	
25.	Make / Model (As per Approved makes)		Vendor to specify	

12.19 Technical Specifications of ESD PB Station SIL2 certified

Product	Flameproof – Weatherproof Enclosure of Indicating lamp with Stop push button station with separate cable terminal box wired upto the terminal.
Flameproof	Zone – 1 & , Gas groups – IIA & IIB as per IS:2148/1981, Temp. Class – T6
Weatherproof	IP 65 Degree of protection as per IS:13947 (Part-1) 1993. IP certificate for the same to be submitted.
Material	Cast Aluminium Alloy LM6
Finish	Inside & Outside light grey epoxy powder coated to shade 631 as per IS:5
Earthing	1 No. inside & 2 No
Hardware	Stainless Steel
Gasket	'O' Ring endless Neoprene rubber gasket.
Terminals	8 Nos. for 1.5/2.5 sqmm clip-on Terminals
Cable Entries	2 Nos ¾" ET cable entries from bottom side. SS plugs to be provided on cable entries.
Indicating Lamp.	1 No. 24V DC . 5 Watt LED type Indication Lamp (RED COLOUR)
Element	2 Nos. 5A, 230 VAC (1NO + 1NC Contact elements)
Actuator	'Stop' push button of red mushroom head press to Stop & Reverse turn to release with pad locking arrangement in stop position.
Mounting	Surface Mounting Type (Mounting Accessories / Canopy to be provided)
Approvals	PESO, CMRI. Certificate for the same to be submitted for approval before procurement of the same. SIL2 certification by TUV / equivalent agency.
Makes	Baliga / FCG/ Flexpro/ Ex-protecta/ CEAG/ Sudhir Switchgears or équivalent

12.20 DATA SHEET FOR TEMPERATURE TRANSMITTER (Including RTD with Thermowell)

S.No.	ITEM DESCRIPTION	APPLICABLE CODE / SPECIFICATIONS	VENDOR'S OFFER
	GENERAL		
1	Type	Transmitter Indicating, Microprocessor based SMART, HART	
2	Make & Model No.	Bidder to state	
3	Area Classification	Zone 1&2, Gr IIA & IIB, T3 as per IS:2148	
4	Enclosure Class	Weatherproof IP-65 as per IS-13947	
5	Intrinsically Safe	Yes	
6	Power Supply	24VDC (2 wire)	
7	Cable Entry	½"NPTF (2 Nos)	
8	Accuracy	+/-0.2% of FSD	
9	Repeatability	+/-0.1% of FSD	
10	Service Area	Outdoor Unprotected on TLF Product Headers going to gantry	
11	Output	4-20mA superimposed with digital signal	
12	Mounting Set	2" pipe mounting kit of SS (material / coated)	
	ELEMENT		
13	Element	RTD	
14	Number of Elements	Single	

15	Type	Pt 100 RTD / 100 Ohm @ 0 degree C / 3-wire configuration having temperature coefficient 0.000385 and shall comply with DIN 43760 calibration standard and requirements.	
16	Connector, Nipple & Union	Required	
17	Cable Glands	Required : SS Tags With Tag nos calibrated span	
18	Head Cover Type	Screwed Cap and SS Chain	
19	Cable Entry Type / Entries	Screwed Cap with SS Chain / One	
20	Enclosure	Weatherproof IP-65 as per IS-13947	
	CONSTRUCTION		
21	Enclosure (For RTD/ Thermowell assembly)	Intrinsically safe & explosion proof and Weather Proof to IP-65	
22	Body Material	Die Cast Copper Free Aluminium	
23	Mounting	Sensor & Thermowell on pipeline	
24	Tropicalisation	Required	
25	Electrical Connection	½" NPTF	
	THERMOWELL		
26	Material	Bar Stock drilled 316 SS, Tapered	
27	Hot End O.D.	16 mm	
28	Cold End O.D.	21 mm	
29	Hydro test	1.5 Times max. operating pressure	

30	Process connection	1½" ANSI 150# RF 125 AARH Flanged	
31	Bore Diameter	To suit element	
32	Documentation	• Calibration / test certificate • Certificate of explosion proofness and intrinsic safety. • Dimensional Drawing of Thermowell	

12.21 DATA SHEET FOR PRESSURE TRANSMITTER

General:

Service	MS/ SPEED/ HSD/ P-HSD/ SKO.
Primary sensor	Piezo-Resistive / Capacitance
Mounting / Location	On 2” Vertical Pipe / on main line Header
Enclosure	NEMA 4X
Area Classification	EExib IIB, T3
Lightening Protection Block	Required

TRANSMITTER

Type	Smart
Range	0 to 15 bar
Power Supply	24 VDC, 2 wire
Output	4 – 20 ma with smart protocol
Accuracy	0.075% of calibrated span

MATERIAL:

Wetted Parts	SS 316 Diaphragm

OTHER:

In-built local display	Required – Digital.
Manifold	SS316 2 way manifold with suitable Process connection
Mounting Accessories	Necessary accessories suitable for 2” NB Pipe mounting

12.22 TECHNICAL SPECIFICATIONS OF MASS FLOW METER:

MASS FLOW SENSOR	**TYPE**	CORIOLIS PRINCIPLE BASED MASS FLOW SENSOR
	FUNCTION	MASS FLOW MEASUREMENT
	CONN.SIZE & RATING	VENDOR TO SPECIFY
	BODY/HOUSING MATERIAL	SS 304
	WETTED PARTS MATERIAL	SS 316 OR BETTER
	FLANGE MATERIAL	SS 316 OR BETTER
	ENCLOSURE	IP-65 WEATHER PROOF
	HAZARDOUS AREA CLASSIFICATION	EX-PROOF/INTRINSICALLY SAFE SUITABLE FOR CLASS I DIV.I GROUP C& D. CENELEC & ATEX CERTIFIED
	FLOW RANGE	0 – 1200 LPM
	MASS FLOW ACCURACY	± 0.15% OF MASS FLOW RATE OR BETTER INCLUDING THE COMBINED EFFECTS OF LINEARITY, HYSTERESIS, REPEATABILITY & ZERO STABILITY FOR 1:10 RANGE
	MASS FLOW REPEATABILITY	± 0.05% OF FLOW RATE
MASS FLOW TRANSMITTER	**MOUNTING**	REMOTE FIELD MOUNTING
	INPUT	FROM MASS FLOW SENSOR
	OUTPUTS	- 1 NO. 0-10,000 Hz PULSE OUTPUT CONFIGURABLE FOR MASS FLOW RATE/TOTALISED MASS, VOLUME FLOW RATE/TOTALISED VOLUME OUTPUT [THE MASS FLOW METER PULSE OUTPUT IS TO BE CONNECTED TO BATCH CONTROLLER PULSE INPUT CHANNEL]
	INPUT	TRANSMITTER SHALL BE CAPABLE OF ACCEPTING A 4-20 mA DC ANALOG INPUT FROM AN EXTERNAL PRESSURE TRANSMITTER FOR PRESSURE COMPENSATION PURPOSE.
	LOOP RESISTANCE-Ohms	TRANSMITTER SHALL BE ABLE TO DRIVE MINIMUM 1000 Ohms LOOP RESISTANCE.
	POWER SUPPLY	a) 230 V A.C. ± 10%, 50 Hz SINGLE PHASE
	INTER CONNECTING CABLE	10 METER SENSOR-TRANSMITTER INTER CONNECTION CABLE TO BE PROVIDED.
	HOUSING MATERIAL	EPOXY COATED ALUMINUM / SS
	MAX. ALLOWED DISTANCE FOR SENSOR	VENDOR TO SPECIFY

	CABLE ENTRY NUMBERS/SIZE	VENDOR TO SPECIFY
	HAZARDOUS AREA CLASSIFICATION	EXPLOSION-PROOF SUITABLE FOR CLASS 1 DIV.1 GROUP C & D, CENELEC & ATEX CERTIFIED.
	ENCLOSURE	WEATHER PROOF & EXPLOSION PROOF IP-65
	MOUNTING BRACKETS	TO BE PROVIDED WITH 2" U CLAMPS
	CABLE GLANDS FOR INTERCONNECTION CABLE	TO BE PROVIDED
	MASS FLOW NET VALUE HIGH/LOW	TO BE PROVIDED
	SELF DIAGNOSTIC FACILITY	TO BE PROVIDED
OPERATING CONDITIONS	**FLUID AND STATE**	FURNACE OIL
	MAXIMUM FLOW	*
	MINIMUM FLOW	*
	NORMAL FLOW	*
	PRESSURE OPR / MAX	*
	TEMP. OPR / MAX/MIN	*
	OPR.SPECIFIC GRAVITY	*
	MAXIMUM OPR.VISCOSITY	*
	MAXIMUM ALLOWABLE PR.DROP	*
	PRESSURE DROP. AT MAX. FLOW RATE	*
	* REGIONAL E&P TO FILL IN THE DETAILS AS PER SITE CONDITIONS.	
NOTE	Vendor to provide following test certificates • 5 Point Calibration Certificate for Mass Flow Accuracy • Material test Certificate • Hydrostatic Test Certificate • X-ray / Radiography Test Certificate • Custody-transfer approval certificate from Department of Legal Metrology, Government of India • Hazardous Area approval certificate from CCOE Nagpur	

Offered Mass Flowmeters shall be of latest design, version & of highest quality duly certified by Legal Metrology Agencies such as OIML, PTB, NMI and also by Department of Legal Metrology, Government of India for custody transfer applications.

Vendor to enclose above certification along with their offer.

12.23 DATA SHEET FOR EXPLOSION PROOF / WEATHER PROOF JUNCTION

BOX

S.No.	Item Description	Requirement
1	Body & Cover	Cast Al. Alloy (LM6); Minimum 5mm thick
2	Gasket	Neoprene rubber
3	Terminals	Clip on type, block locked at both ends suitable for up to 2.5 sqmm conductor. Make - Elmex, Phoenix
4	Tag Nameplate	To be provided
5	Paint	Anti Corrosive epoxy paint, shade light gray
6	JB Type	Suitable for area classified as IEC Zone 1&2, Gr. IIA & IIB T6; as per IS:2148
7	Protection Class	IP-65 as per IS:2147
8	Other	• Explosion proof junction boxes shall have detachable cover, which is fixed, to the box by means of cadmium plated hexagonal head screws. Terminal shall be spring loaded, vibration proof, clip on type, mounted on nickel plated steel rails completed with end cover and clamps for each row. • Sizing shall be done with due consideration for accessibility and maintenance in accordance with the following guidelines: o 50 to 60 mm between terminals and sides of box parallel to terminals strip for up to 50 terminals and additional 25 mm for each additional 25 terminals. o 100 to 120 mm between terminals for up to 50 terminals and additional 25 mm for each additional 25 terminals. o All junction boxes shall be provided with 20% spare cable entries and terminals. o All cable glands and plugs shall be nickel plated brass material. o Double compression type cable glands shall be used for armoured cable.
9	Approvals	CMRI & CCOE/PESO approval is required for Flameproof and Weather proof enclosures.
10	Accessories required	a) Flame Proof Double compression Cable Glands and Plugs of SS316 for all the cable entries are in Vendor's scope. b) Mounting Accessories for JB's are in vendor's scope.

12.24 DATA SHEET FOR ELCTRO MAGNETIC DISPLAY BOARD WITH INTEGRATED VOICE ASSEMBLY.

Sr. No.	Parameter	Specifications
1.	Type of Display Board	Electromagnetic Display with embedded LCD/ dot matrix LCD
2.	Visibility	Day and Night
3.	Size of mosaic	15 mm square / equivalent
4.	Matrix of mosaics	Minm.100 x 7 arranged along length x width. Total 700 dots./ Equivalent
5.	Colour of mosaic	One side fluorescent yellow and another side black / equivalent
6.	LEDS	Centre of each mosaic shall have an yellow-green LCD/ equivalent
7.	No. of display lines	5 (FIVE)
8.	Character height	105 mm (4.13")
9.	No. of characters per line	16
10.	Display area/line	1500 x 105 mm
11.	Power supply	230 V +/- 10%, 50 Hz +/- 5%, single phase A/C mains
12.	Power requirement	To be informed by vendor
13.	Visibility	Upto 55 mtrs. Excellent visibility reqd. during day & light, low ambient light and night.
14.	Angle view	Upto 150 $^{0`}$
15.	Operating temperature range	0 to 55^{0} C
16.	Communicating link between PC and Display Board	Via RS-422/RS 485 interface
17.	Communication protocol	Vendor to specify
18.	Dimensions of the Board	1753 mm {W} x 1050 {H} minimum
19.	Integrated Voice	Via sound blaster card housed in PC. The selected 5 lines should be announced using the voice software for

	Announcement System	conversion of displayed alpha-numeric character to voice in 3 languages
20	Languages	English, Hindi and regional language [any one specified]
21.	Order in which the announcement should be made	Hindi, Regional Language and English
22	No. of times announcement to be made	3 times of each line in different languages
23.	Logic for display and announcement	Vendor to specify.
24.	Display mode	Out of the 5 lines displayed, 4 lines should display the Truck Registration Number allocated to 4 loading bays. The 5^{th} line should flash the Truck Registration Number with the words "WL" against it to advice that the truck is "Wait Listed".
25.	Sequence for converting the Wait Listed Truck Registration Number	If any one truck fails to report to the allocated Bay Number within a reasonable time, the Terminal Manager has to allocate a bay number to the Wait Listed truck and move the non-responsive Truck Registration Number into a special position in the PC for calling later on. This software has to be incorporated in the LRC by the vendor.
27.	Amplifier capacity	Min. 1 No. of 100 Watts
28.	No. of speakers supplied	Min. 1 No. either Horn type or Column type
29.	Mounting options for Display	Suitable for wall mounting or hang mounting or frame mounting.
30.	Duty	Outdoor duty.

12.25 DATA SHEET FOR ADDITIVE INJECTION BLOCK.

The proposed additive system shall have the following minimum components but not limited to following:

- Additive injection block

- SS pipelines and tubings. SS piping welding with sockets. Supply of sockets along with pipeline is in scope of vendor. SS piping shall be measured in one run including all fittings & paid separately in running meter basis actual quantity executed at site. No separate payment will be made for supply and welding of required fittings, sockets etc. The pipeline for payment purpose shall be measured from the outer flange of the existing pipe where extension is taken up to the last loading spud point. Drop from the header shall not be considered for payment. For all SS piping jobs rate to include supply and welding of pipes with sockets, supply and welding of flanges (SORF, blind flanges) wherever required. Each tap-off from gantry header shall be provided with 1 number manual isolation ball valve to isolate the flow for particular loading point for maintenance purpose. The ball valve shall be placed at hand rail level of loading platform for operational convenience. Supply of required associated hardware like matching flanges in pipeline, tubings sockets, Manual Ball valve nuts, bolts, gaskets etc shall not be considered for payment and are a part of supply and erection of SS piping under BOQ.

Additive Injection Block

The additive injection block shall comprise of a Stainless Steel block with an inbuilt Additive meter (Oval gear meter / equivalent meter), Solenoid Valve, Needle valves for inlet and outlet isolation, a quick connect strainer and a check valve is screwed at the outlet of the additive block, the check valve ensures there is no reverse flow of the additive. The additive injection system is designed to accurately dispense additives in to petroleum products. Additive Injection Block shall provide intermittent metered flow of a single additive into the product line. The Additive Injection block controller provides flow measurement and control of the additive and main product. The combination of Additive Block and existing Batch Controller shall ensure the correct amount of additive is dispensed at all times. CCOE approval is a must for additive Injection block

FEATURES:

- Metered Additive Flow
- Optimized for use with petroleum additive products by use of Additive meter for its characteristics of viscosity & flow with petroleum products.
- Additive meter design to provide pulse output through in-built pulse generator electronics to existing batch controller (BC).
- Provision for online Calibration to be provided
- Facility to control Additive Pump, through Terminal Automation System (TAS).

S.No.	Item Description	Requirement
1	SS piping (gantry header) with sockets	
	Size	To be designed by vendor
	Quantity	Dedicated line for MS & HSD as per BOQ.
	Type	Seamless
	Schedule	40
	Material	SS 304
	Location	From Additive Storage Skid to the gantry
	SS Tubing	
	Size	Vendor to specify the size to match the inlet and outlet ports of additive block
	Quantity	As required for individual metering
	Type	Seamless
	Schedule	Vendor to specify
	Material	SS 304
	Location	From drops of gantry header to additive block and from outlet of block to main line
2	Additive Injection Block	
		Additive injector panel (IP65),CCOE approved, enclosure certified by UL / CSA /ATEX; shall be compact SS design comprising of SS manifold with a) Additive flow meter, pulsar b) Solenoid valve c) Strainer d) Check valve e) Inlet, Outlet needle isolation valves f) SS fittings
A	Additive Flow Meter	
	Type	Oval Gear Meter (Positive displacement type) / equivalent
	Quantity	As per BOM
	Flow range	0.3 GPM to 2 GPM
	Accuracy of Meter	+/- 0.5% of the flow

	Accuracy of entire system	+/- 1% of the flow
	Linerarity / Repeatability	+/- 0.25%
	Elastomers	Chemraz and Teflon
	Gears	Ryton ,SS, Tungston or equivalent
	All wetted parts	SS 316
	Housing	SS
	Output	Pulses suitable for batch controller
	Sensor Voltage	5 to 30 V
	Temperature Limit	-5 degree to +65 degree centigrade
	Bearings	SS 316
B	Solenoid Valve (inbuilt with additive block)	2 way direct acting, normally closed ,SS 316, explosion proof suitable for use in hazardous area division 1 group IIA & II B, conduit connection ½" NPT , 230 V ,50 Hz, weather proof to IP 65. Chemraz solenoid seat material shall be preferred
C	Strainer (at additive panel)	Built in additive block
	Size	15mm/ 12 mm
	Type	Y/ Basket Type
	Mesh	230 micron
	End Connection	Threaded (NPT F)
	Working Pressure	10 kg/cm2
D	Check Valve	SS 316,built in/External
E	Needle valve	SS 316 high pressure rated ,built in block
F	Calibration Kit	1 no per product to be provided at each location
3	Manual Ball Valve	
	Type	Hand lever operated ball valve- quarter turn
	Quantity	1 at each loading point
	Size	As per requirement
	Material of Construction	SS 316

	Seat & Seal	PTFE
	Leakage Class	Class VI
	End Connection	Class 150 flanged end for 25 mm size and threaded ends for 12 mm size
	Line Pressure	10 kg/cm2
	Standard	As per IS code –latest

12.26 SKID MOUNTED ADDITIVE STORAGE & PUMPING FACILITY

(1) Technical specifications for the Metering Pump / Motor		
1.	Type	Diaphragm type Motor driven Positive Displacement Pump with Dual Pump Heads
2.	Service	required for additive Injection System for SPEED / Hi-SPEED product at TLF Loading Point
3.	Pump Discharge Pressure	> 7 Bar for each pump head
4.	Material / wetted parts	SS 316/304 Other wetted parts shall be suitable for Naptha based Additive
5.	Metering Accuracy	(+/-) 1%
6.	Suction Pressure	Flooded
7.	Flow Capacity	Vendor to specify
8.	Max. Pump Speed	Vendor to specify
9.	Motor	Flameproof as per IS 2148 suitable for Class1, Div.1, Gas Gr.2A/ 2B Weatherproof as per IP55 Insulation class- Invertor Grade Motor shall be suitable for getting operated through Variable Speed Drive. Vendor shall submit related CMRI/ CCOE certification. Motor rating to be specified by vendor
10.	Accessories	Pressure Gauge with pulsation Dampner at the dischage of two pump heads
(2) Technical specifications for Skid		
1.	Additive Tank	MAT. SS304; Thickness 3 mm ; capacity 200Ltrs ; Accessories :Flameproof/Weatherproof Level Transmitter & Level Gauge

	Piping / Tubing / Fitting	SS 304
	Additive Tube Size	½“ SS
2.	Ball valves / NRV	Mat.SS 316/304 ; 150# rating
3.	TSV	To be provided at skid.
4.	Skid frame	Outer Member-ISMC 150 Cross members- 75 mm Angle Chequered plate- 6 mm thick MS Paint –2 coats of coaltar epoxy primer (min 25 Micron DFT per coat) followed by two coats of coaltar epoxy finished paint (100 microns DFT per coat)

12.27 DATA SHEET FOR LOAD RACK COMPUTER SYSTEM

SR.NO	PARTICULARS	REQUIREMENTS
1.	PC Type	Server
2.	Form Factor	Tower
3.	Make / Model	Vendor to specify
4.	Processor	Quad core Intel Xeon or better
5.	Processor Chip Set	Intel Latest
6.	Display	Colour, 21” LCD Monitor (Resolution 1920x1080)
7.	Display arrangement	Single tier
8.	HDD	180 GB minimum (SCSI) Hot swappable with RAID5 configured
9.	Hard Disk Controller	SMART ARRAY CONTROLLER WITH RAID 5 SUPPORT
10.	RAM	Minimum 4 GB ECC, DDR3 low power
11.	I/O Expansion Slots	SIX; with 3 PCI EXPRESS.
12.	CD – R/ W Drive	DVD-RW Drive
13.	Graphics	Suitable graphics adapter with 16MB of Video RAM
14.	Keyboard	USB Minimum 101 keys, Membrane type / dust proof
15.	Mouse	USB Optical
16.	NIC	support Dual Integrated 10/100/1000 Mbps Ethernet (standard) + 2 Additional 10/100/1000 Mbps NIC card with RJ45 / UTP interface with wake on LAN enabled
17.	Built In IO	1 serial; 1 parallel; keyboard, mouse, 4 USB required
18.	Power Supply	Redundant
19.	Operating System	Windows Server 2008 Stnd Edition, preloaded and on media (DVD) with paper license and recovery media

SR.NO	PARTICULARS	REQUIREMENTS
20.	RAID Storage box	RAID level 5 to be offered using internal storage box with redundant power supply & cooling fans connected to each server in RAID 5 configuration is to be offered.
	Note : • USB / Parallel port converters shall be provided in absence of parallel ports. • RAID Diagnostics: The System shall have software for checking RAID diagnostics. The level of RAID 5 shall be clearly demonstrated by the system. In case of defective hard disk, it shall be possible to replace the same online without shutting down the system. Hot spare or clod spare drive shall not be acceptable. The system shall show auto build of date on the new drive. • USB ports to be disabled	

12.28 DATA SHEET FOR OIC/TM/TTES/ISC COMPUTER

SR.NO	PARTICULARS	REQUIREMENTS
1.	PC Type	Workstation
2.	Form Factor	Tower
3.	Make / Model	Vendor to specify
4.	Processor	Intel Core 2 Duo or better
5.	Processor Chip Set	Intel Latest
6.	Display	Colour, 21" LCD Monitor (Resolution 1920x1080)
7.	Display arrangement	Single tier
8.	HDD	160 GB minimum (SCSI) (Redundant)
9.	Hard Disk Controller	Integrated Controller
10.	RAM	Minimum 2 GB DDR-2 SDRAM
11.	I/O Expansion Slots	Min Four (2PCI/ 2PCI Xi) full height
12.	CD – R/ W Drive	DVD-RW Drive
13.	Graphics	Suitable graphics adapter with 16MB of Video RAM
14.	Keyboard	USB Minimum 101 keys, Membrane type / dust proof
15.	Mouse	USB Optical
16.	NIC	support Dual Integrated 10/100/1000 Mbps Ethernet (standard) + 2 Additional 10/100/1000 Mbps NIC card with RJ45 / UTP interface with wake on LAN enabled
17.	Power Supply	Redundant
18.	Operating System	Windows 7 Professional, preloaded and on media (DVD) with paper license and recovery media
	Note : • USB / Parallel port converters shall be provided in absence of parallel ports. • USB ports to be disabled	

12.29 DATA SHEET FOR DOT MATRIX PRINTER

1.	Make	As per Approved List.
2.	Type	Dot Matrix
3.	Model	Vendor to specify
Printer Specs.		
4.	Print Head	24 Wire
5.	Columns	136 columns
6.	Print Speed (cps)	360 cps @ 12 cpi (draft)
7.	Print Direction	Bi-directional with logic seeking
8.	Nos. of copies	Original + 3 (With Carbon)
9.	Interface Standard	RS 232 Serial interface
10.	Connecting Ports	Ethernet, Parallel, USB port
11.	Paper feed	Cut Sheet - Top friction, Continuous - Rear push tractor.
12.	Paper Path	3 Paths
13.	Drivers	Windows 9X, 2000, 2003, XP, Windows 7 Prof
14.	Supply Voltage	230 V ac, +/- 10%, 25W typical power consumption
15.	Note: The DOT Matrix printers are required for text and Laser printer for graphics / text printout. The printers shall be Network printer put on the LAN and shall be accessed over the LAN.	

12.30 DATA SHEET FOR LASER PRINTER

1.	Make	As per approved list.
2.	Type	Laser
Printer Specs		
3.	Print Speed (black, A3)	20 PPM
4.	Print Speed (Color)	15 PPM
5.	Printing Resolution (Color)	600 x 600 dpi
6.	Duplex Printing Option	Automatic (Standard)
7.	Processor speed	Minimum 540 MHz
8.	Pages per month	Up to 35000
9.	Standard memory	128 MB
10.	Memory slots	One 100-pin DIMM slot
11.	Standard connectivity	1 Hi-Speed USB (compatible with USB 2.0 specifications) port, 1 built-in Fast Ethernet Print Server (10/100Base-TX, RJ45)
12.	Compatible Operating	Windows 9X, 2000, 2003, XP, Windows 7 Prof
13.	Supply Voltage	230 V ac, +/- 10%, 50 Hz +/-2Hz
14.	Note: The DOT Matrix printers are required for text and Laser printer for graphics / text printout. The printers shall be Network printer put on the LAN and shall be accessed over the LAN.	

12.31 DATA SHEET FOR BARRIER GATE SYSTEM

S.No.	Item Description	Requirement
1	Type	Electrically operated barrier system with complete drive mechanism box, 4 band circuit controller, counter balance channel and weights, control switch gear etc. for 6 – 8 meter wide gate.
2	Entry / Exit Detection	Infrared sensor system for sensing of entering of vehicle and automatic closing of gates after passing of vehicle. Automatic stop in fully opened and closed position.
3	Operating time	Closing/Opening operation within 10 seconds
4	In case of card / Sensor failure	Manual (electrical) control available locally
5	Operating in manual (electrical) mode	Remote push button control from control room for opening and closing of gates
6	Operating while power failure	Manually with hand cranking attachment
7	Input	• Input ports for connectivity for Open/Close command from PLC • Input port for connectivity for ESD(Open) command from Safety PLC
8	Outputs	2 nos. potential free contact output y for PLC for Open/Close status.
9	Supply voltage	415 V AC, 50 Hz, 3 ph. / 240 V AC, 50 Hz, 1 ph.
10	Motor	FLAMEPROOF & WEATHER PROOF, wherever the accessories are installed within licensed premises. The control panel shall be weather proof only.
11	Beeper / Sounder / suitable sign boards etc	Shall be provided, to alert the closing of barrier. Shall also have mute facility.
12	IR sensors	To be provided with suitable canopy to sense the passage of truck. It shall be provided in such a fashion that transmitter and receiver are not in line for the space between truck cabin and compartment

CONSTRUCTION :

18” Square mild steel pedestal made out of 10mm thick MS plate.

Square type boom made out of 10 gauge aluminum sheet with suspended pendent fringes, painted as per standard Color combination i.e. yellow & black Color bands painted alternate, circular target fixed on the boom painted with “STOP” lettering, caution high box complete with heavy duty brass light holder, bulb, wiring etc.

MS fabricated boom support with spring loaded plate with rubber padding.

Necessary warning device to give Beep-Beep-Beep sound as the boom of barrier gate starts coming down for closure of gate.

Floor mounted type, sheet metal controller panel box complete with red & green indicators to indicate closed & open position of barrier respectively, 3 nos. push buttons and over load release suitable for operation of barrier.

Separate wall mounted remote control panel with 3 nos. push buttons to be installed on outer face of security room wall.

Job also includes providing necessary RCC foundation complete with foundation bolts, etc.

12.32 DATA SHEETS FOR CABLES

12.32.1 SIGNAL & COMMUNICATION CABLE

1	Type of cable	PVC Insulated (Fire Redundant Low Smoke) copper cable, Single Pair/ Multipair shielded copper cable
2	Construction	1.5 sq. mm multi strand/ solid annealed electrolytic copper
3	Primary insulation	Extrude PVC as per IS 5831 type A. Min thickness 0.6mm
4	Pair twist	Two cores of the pair shall be twisted. Ten number of twist per meter shall be minimum
5	Shield (Individual Pair)	Each pair shall be shielded with aluminum backed myler, tape with 100 % coverage and minimum 25 % overlap.
6	Shield (Multipair)	Same as above for individual pair shielding. Also the overall shield shall be of aluminum backed myler tape with 100 % coverage and minimum 25 % overlap
7	Shield thickness	Min. 0.05 mm for individual and overall shielding
8	Inner Jacket	Extruded PVC, type STI, Min. thickness 0.7 mm
9	Outer Jacket	Extruded PVC, type STI, Min. thickness 1.4 mm
10	Pair identification	Pair identification number shall be provided at distance of not more than 1 meter
11	Rip cord	Shall be provided
12	Drain wire	0.5 sq.mm multistrand bare tinned copper conductor in a continuous contact with aluminum side of the shield shall be provided
13	Armour	Armour over inner jacket shall be of Galvanised steel wire as per IS 1554 Part – I. (1.4 mm. Wire for 2-pairs and 4x0.8mm strip for multipair)
14	Electrical characteristics	Maximum resistance of the conductor of the complete cable shall not exceed 26.6 ohm /Km at 20-deg. c. Mutual capacitance of the adj. cores or pair shall not exceed a Max. Of 250 pF/mtrs at a frequency of I kHz. Capacitance between any core and screen shall not exceed 400 pF/mtr at a frequency of 1 kHz. The drain wire resistance including shield shall not exceed

		30 ohms/km. Electrostatic noise rejection ratio shall be over 76 dB. L/R ratio shall not exceed 25 microhenries per ohm.

12.32.2 CONTROL CABLE

1	Type of cable	PVC (FRLS) insulated armoured Cable
2	Construction	1.5 sq. mm solid bright annealed electrolytic copper conductor, insulated and sheathed.
3	Voltage Rating	Up to and including 1100 volts
4	Primary insulation	Extruded PVC compound as per IS 5381 type A. Min thickness 0.7 mm
5	Inner Sheath	Extruded PVC compound, type STI, min thickness 0.7mm as per IS 5831.
6	Outer Sheath	Extruded PVC compound, type STI, min thickness 1.4mm
7	Electrical characteristics	Max. resistance of the conductor of the complete cable shall not exceed 12.3 ohm/km at 20 deg. C
8	Armour over inner sheath	Armour over inner sheath shall be provided of galvanised steel wire/flat strip (1.4 mm. wire for 2-pairs and 4x0.8mm strip for multipair)
9	Core identification	Core identification number shall be provided at a distance of not more than 1 meter
10	Rip cord	Shall be provided

12.32.3 POWER CABLE

1	Type of cable	PVC (FRLS) insulated armoured Cable
2	Construction	Size as per actual design, multi stranded annealed bare electrolytic grade copper conductor.
3	Voltage Rating	Up to and including 1100 volts
4	Primary insulation	Extruded PVC compound as per IS 5831 type A
5	Inner Sheath	Extruded PVC compound type STI, min thickness as per table 4 of IS 1554 Part (I)

6	Outer Sheath	Extruded PVC compound, type STI, Min thickness as per table 7 of IS 1554 part (I), Colour black, Oxygen index of 29 at 27 (+/- 2) deg C.
7	Armour over inner sheath	Galvanized steel wire for UAD less than 13 mm, Galvanised steel strip for UAD greater than 13 mm Dimensions as per table 5 of IS 1554 Part I
8	Core identification	2 Core : Red & Black 3 Core : Red, Yellow & Blue

12.32.4 Fibre Optic Cable

S.No	Item Description	Requirement
1	Standard	The fibres shall fulfil latest ITU-T Recommendation G-652 & G-651 for single mode optical fibres.
2	Type	Single-mode Germanium doped silica 9/125 µm. Multitube
3	Number of fibre	Twelve (12)
	Geometrical & physical characteristics	
4	Mode field diameter	8.6 to 9.5 µm □□5% at 1310nm
5	Cladding diameter	125 µm ± 1µm
6	Mode field concentricity error	<=1 µm
7	Cladding non-circularity	<= 2%
8	Protective materials / coatings	Optical fibres shall be coated with UV cured double Acrylate Resin. It should not have any reaction with cladding or core material. The coatings should provide maximum resistance to micro bending & abrasion and ensure mechanical & optical strength. The coatings shall be easily stripped with mechanical tools.
9	Nominal Overall Thickness	250 µm □□15 µm
10	Fibre Identifcation	The coatings shall be in various colours in order to facilitate fibre identification. The colours shall correspond with standard colours and shall readily be identifiable and shall be durable. The colours should

		have good colourfast properties also in the presence of other materials during the lifetime of cable. The coating and the colour shall not react with surrounding jelly. Each fibre and tube shall be identifiable throughout the length of the cable as per ITU-T-652. **The colour scheme of the fibres shall be as per EIA/TIA 598A**
	Transmission characteristics	
11	Attenuation	The cabled fibre shall have the following attenuation coefficient. 0.38 dB/km maximum at 1310nm wavelength region. 0.22 dB/km maximum at 1550nm wavelength region.
12	Chromatic dispersion	<=3.5 ps/nm.km at 1285 to 1330 nm. <=5.3 ps/nm.km at 1270 to 1340 nm. <=18 ps/nm.km at 1550 nm.
13	Zero dispersion slope	<= 0.093 ps/nm2.km
14	Polarization mode dispersion coefficient	<=0. 5 ps/□.km .
	Construction details of cable	
15	Central Strength member	FRP Rod
16	Loose Tube & filling of Core	Fibres to be laid in tightly buffered loose tubes. The tubes shall be filled with moisture resistant non-hygroscopic jelly, which should be compatible with the coated fibre and the surroundings. The jelly shall also be flooded over the stranded tubes to ensure ingress protection.
17	Number of fibres per tube	4
18	Moisture barrier	Polymer coated Aluminium tape placed longitudinally over the cable core. The tape shall form a close fit around the cable core with a sealed overlap of 10% minimum.

19	Inner sheath	Polyethylene sheath
20	Thickness of inner sheath	1.50 mm minimum
21	Armouring (for direct burial)	Burial - (or) SWA – Steel Wire Armoured (SWA to BS-5308)
22	Thickness of steel tape	0.15 mm minimum
23	Thickness of each polymer layer	0.04 mm minimum
24	2nd PE sheath	Polyethylene sheath
25	Thickness of 2nd PE sheath	1.50 mm minimum
26	Outer Sheath /Jacket	FRLS Black LSZH (Low Smoke Zero Halogen) HDPE
27	Thickness of outer sheath	0.65 mm minimum
28	Overall diameter of cable	Bidder to specify
29	Cable weight in kg/km	Bidder to specify
30	Protection required	The cable shall have protection against damages from termite, rodent, chemicals (such as oil, natural gas and other petroleum products), moisture and water, over the lifetime of the cable. The cable shall also be flame retardant to IEC 60332
31	Cable identification	The outer surface of the cable shall be permanently & legibly marked with colour in contrast to the outer sheath at regular intervals not exceeding one meter with • Legend containing FO mark and laser symbol • Number and type of fibre eg. (36F OFC G.652) • Month & year of manufacture • Manufacture batch ID or job no. • Country of origin • Cable ID number • Sequentially numbered metric length markers spaced at regular intervals of one meter.

12.33 DATA SHEET FOR INSTRUMENT FITTINGS (steel Fittings)

- Fittings shall be socket-weld type forged pipe fittings of material cadmium plated ASTM A 105. The minimum rating shall be class 3000.

SS tube Compression Fittings

- Nomenclature of all tube fittings shall be as per ISA 42.1
- Fittings shall be flare less compression type and of three-piece construction with ferrule, nut and body suitable for use on SS tube conforming to ASTM A 269 TP316, hardness not exceeding RB 80.
- Hardness of ferrules shall be in the range of RB 85-90 so as to ensure minimum hardness difference of 5 to 10 between tube & fittings for better sealing.
- Threaded ends of fittings shall be NPT as per ANSI B1.20.1.

Instrument Valves

- The impulse line isolation and drain valves shall be forged gate valves with inside screwed bonnets. For SS valves body and trim material shall be ASTM A182 Gr. F316.
- For CS valves body material shall be ASTM A 105-gr. and trim material shall be ASTM A182 Gr.F316.
- Valve hand-wheel material shall be cadmium or nickel-plated steel.

13 APPROVED VENDOR LIST FOR BOUGHT OUT ITEMS.

Orifice Plate	Star-Mech, Micro-precision ;Switzer
Digital Control Valve – Diaphragm type.	BERMAD, OCV, LCIL, FMC, DARLING MUESCO, ISOIL, DANIEL,BRODIE
Digital Control Valve – Ball Valve with pneumatic actuator • Ball valve • Pneumatic actuator • Air compressor/air drier	 • Audco, Virgo, Microinish • Virgo, Ellomatic, Audco, • Ingersoll rand, Atlas-copco, Elgi
Batch Controller	FMC, Daniel, Smartload (M/s AST), Contrec, Bopp & Reuther(Germany), ISOIL (Vega)
Earthing Relays	Scully, Timm Elektronik , Honeywell, AST, BALIGA-STAHL, OSNA.
Server & Work Stations with Monitor	HP, IBM, DELL
Printers (Dot Matrix/ Laserjet)	WIPRO, EPSON, PANASONIC, HP, PANASONIC, CANON.
PLC (32 Bit CPU)-Conventional	Rockwell (Allen Bradley), GE/ GE Fanuc, Schneider Modicon, YIL, Honeywell, Invensys, Emerson, ABB, Siemens
PLC –SIL2 (or better) certified	Rockwell (Allen Bradley), GE, HIMA, YIL, Invensys (Triconix), Emerson, Siemens, Honeywell, ABB, Schneider Modicon,
Access Control System	WSE, Balogh, Daniel – For loading rack ; HID – Control Room
UPS	EPM, DB Power, Hirel, Aplab, APC, GE.
Control Panels	Pyrotech, Rittal, Hoffmann
Signal Cables, Control Cables, Power Cables	Associated Cables, Associated Flexible & wires, Brooks cable works, Thermopads, Finolex, Fort gloster, CCI, Cords Cables, Universal Cables,
D.P.Gauge, Pressure Gauge, Temp. Gauge	A.N.Instruments, General Instruments, Switzer, Hillerkar, Waree.

Solenoid Valves	ASCO, Herion, Rotex
PD Flow Meter with pulse transmitter	LIQUID CONTROLS/ BRODIE / BOPP & REUTHER(Germany) / FMC/ ISOIL
Strainer & Air Eliminator	Liquid controls/ Brooks/ Bopp & Reuther/ Flash point / FMC/ Flash Point
Flow indicator cum Totaliser	DANIEL, CONTREC, B&R, LIQUID CONTROLS, ISOIL, EPM, FMC
Electronic Transmitters (PT/TT/FT)	EPM, E&H, YIL, HONEYWELL, SIEMENS,ABB
Mass Flow Meters	EPM, E&H, HENRICHS, B&R, GE(Rheonic)
Fiber Optic Cable	Lucent-AT&T, Ericsson, Avaya, Optel, Finolex .
Cable trays	GRAM ENGG, HOPES MANFG, INDIANA, GLOBE ELECT. ; INDMARK ASSOCIATES
Alarm Annunciator	IIC, Procon, Aplab.
Zener Barriers/Surge Arrestors	MTL, Pepperl & Fuchs, STAHL.
Pressure Switch	Dag process instruments, Switzer Instruments, Indfoss.
Pressure Gauge	H.Guru, A.N. Instruments, HILLERKAR. General Instruments
Servo Type Level Tx	HONEYWELL- ENRAF / E&H / TOKIO KEISO
Radar Type Level Tx / CIU / TFMS software	SAAB/ HONEYWELL- ENRAF / E&H
Guided wave Radar type Level Transmitters	SAAB / MAGNETROL / HONEYWELL-ENRAF / E&H
Level Switch (Vibrating Fork type)-SIL2 certified	E&H , SAAB, Magnetrol
AvgTemp Sensor with Water Bottom Sensor	SAAB, Honeywell- ENRAF , E&H
FLP/WP Junction Box & Cable Gland, MPBS	Baliga, FCG, Flaxpro,Ex-Protecta,CEAG, STAHL,
FLP Actuators	Rotork, Biffi, Limitorque, Auma

RTD Element with thermowell	Nagman/ General Instruments/ ALTOP
ESD PB Station	Baliga / FCG/ Flexpro/ Ex-protecta/ CEAG/ Sudhir Switchgears / équivalent
Flameproof / Weatherproof Electronic Hooters	Baliga / FCG/ Flexpro/ Ex-protecta/ CEAG/ Sudhir Switchgears / Equivalent
Ethernet switches and Terminal servers	IBM, DELL,CISCO ,EMULEX, STALLION, SYSTECH, NORTEL NET WORKS, D-LINK, ,MOXA
Relays	OMRON, TELE MECHANIQUE, HONEYWELL,
Push Buttons	Teknic, Siemens, L&T, Merlin Gerin/ Telemechanique
Terminal Blocks	Phoenix, WAGO,
MCBs/ Contactors	MDS, Siemens, L&T, Merlin Gerin
Print servers	HP, INTEL, IBM
Data Entry Terminal.	MTL (EXTEC) , P&F, STAHL , Daniel, B&R, Contrec
Thermal relief valve	KEY STONE, CROSSBY, L&T
Ni-Cd Battery	AMCO Batteries Limited (Bangalore) / HBL – Nife Batteries Ltd (Hyderabad) - (Formerly called SABNIFE), Exide
Barrier gate	Heidz India, Autodoor, Technica.
Limit Switch	Telemechanique , Microswitch, Honeywell.
Electro Magnetic displays.	Bharat Electronic Limited, IRA, Magneto Dynamic.
C.S.Ball/ Gate Valve	Audco, Fisher – Xomox, Virgo Engineers.
Tube & Tube Fittings	Swagelock, Parkar,
Loading Arms	Associated Engg., Shreeraj, Technica
Additive Block	Chemtec / Enraf / B&R any other equivalent make having valid CCOE approval
Additive Pump	Vindi Accuflow systems / V K Pumps / Shapatools / Grosvenor / Dencil / Swellore/ MiltonRoy
FLP motor for Additive Pump	Kirloskar / Crompton Greaves /Siemens /ABB / Bharat-Bijlee
MMI Software	As listed in General Specification.
LRC Application Software	As listed in General Specification

Operating Software	As listed in General Specification
RDBMS	As listed in General Specification
Maintenance Manager Software	As listed in General Specification
Downtime Analysis system Software	As listed in General Specification

Note:

1) Approved vendor list is for the manufacturers only. The list is not for any specific model. For any instrumentation, offered model for the same must meet the Technical specifications given in tender document.
2) For any other items not listed above, purchaser's approval shall be taken before ordering.
3) Party should indicate the vendors name on which they have based their offer as first choice and indicate another vendors name as second choice positively for all the components indicated in the above list in the SOS format as well as not indicated in the list.
4) Party shall offer various components of flow meter assembly i.e. PD meter, strainer cum air eliminator and pulse transmitter, proving vessel etc. of one family only.
5) Party shall submit technical literature of make & model offered. CCOE approval for all FLP (IS/Ex) materials shall be furnished along with the supply of material, else payment for the materials will be affected.

14 SOURCE OF SUPPLY (SOS) FORM TO BE FILLED AND SUBMITTED ALONG WITH TECHNICAL DATA/ LITRATURE BY VENDOR ALONG WITH TECHNICAL BID.

S. No.	Description	Qty	Make-Option - 1	Model No.	Country of Origin	Make-Option - 2	Model No	Country of Origin
1.1	3” Electronic Double case P.D. meter Assembly (composite unit with Pulse Transmitter)							
1.2	Strainer Air eliminator							
1.3	Pressure gauge.							
1.4	DPG							
1.5	TRV							
2.	Set Stop Valve3” DCV							
2.1	Diaphragm Type. • Globe valve • Solenoid valve • Limit switch							
2.2	Ball valve type • Ball valve • Pneumatic actuator • Solenoid valve • Limit switch • Air compressor							
3.	Batch Controller complete.							
4.	Mass Flow Meter (if applicable)							
5.	Temperature Transmitter							
6.	RTD element with thermowell							

S. No.	Description	Qty	Make-Option - 1	Model No.	Country of Origin	Make-Option - 2	Model No	Country of Origin
7.	RIT							
8.	Electro Magnetic Display							
9.	• Loading Rack Computer • Operator Interface Console • Tank Truck Entry System • Terminal Manager Computer							
10.	Printers • BOL Dot Matrix Printers • Alarm Event Report Printers • Laser printer							
11.	Proving system consisting of • Master Meter • Strainer & Air Eliminator • Pulse Transmitter • 2KL proving tank with pump & Flameproof Motor • Batch Controller complete.							

S. No.	Description	Qty	Make-Option - 1	Model No.	Country of Origin	Make-Option - 2	Model No	Country of Origin
	• Digital Control Valve complete. • 5 KL PROVING VESSEL							
12.	Hot Standby Programmable Logic Controller / DCS complete.							
13.i	CONVENTIONAL PLC PROCESSOR							
13.ii	SAFETY PLC PROCESSOR [SIL2 CERTIFIED]							
13.iii	INPUT/OUTPUT MODULES							
14.i	Relays.							
14.ii	Electrical Contactor							
15.	Pressure/Temp. Transmitter							
16.	Pressure Switch							
17.	Flameproof Hooter							
18.	Weatherproof Hooter							
19.	ESD Push Button Station							
20.	Cables (Power / Control / Signal)							
21.	Additive Block							
22.	Additive Pump							
23.	FLP motor for Additive Pump							
24.	Data Entry Terminal							

S. No.	Description	Qty	Make-Option - 1	Model No.	Country of Origin	Make-Option - 2	Model No	Country of Origin
25.	Access Control System							
26.	Earthing Relays							
27.	Barrier Gate							
28.	Control panels and consoles.							
29.	Managed Ethernet switches							
30.	Fiber optic cable system.							
31.i	Fiber optic cable							
32.	System Software and Application Software packages to meet the all requirements.							
32.i	Operating software system							
32.ii	RDBMS							
32.iii	HMI							
32.iv	Terminal Automation S/W							
33.	24 volt Power supply at PLC cabinets							
34.	LAN Server / Terminal servers							
35.	Cable Trays							
36.	FLP/WP Junction box & cable gland							
37.	UPS system							

S. No.	Description	Qty	Make-Option - 1	Model No.	Country of Origin	Make-Option - 2	Model No	Country of Origin
38.	Radar TYPE Level Tx (1mm instrument accuracy)							
39.	Servo TYPE Level Tx (1mm instrument accuracy)							
40.	Avg. Temp cum Water bottom sensor							
41.	Guided wave type Level Tx (3 mm instrument accuracy)							
42.	Level Switch (SIL2 certified)							
43.	Signal barriers/ surge arrestors/ signal multiplier							

NOTE:

1. Vendor to note that make and Model no. offered against Option –1 shall only be supplied. Option – 2 shall be considered only after prior approval from BPCL.
2. Any other item not mentioned but required for safe and efficient operation of system shall be indicated and included by the vendor in their offer. Any item not included by vendor but later found necessary for implementation of the system shall be vendor's responsibility to supply without any extra charge to the client.
3. Make and Model number shall be clearly indicated in the SOS form complete along with the necessary supporting catalogue, model de-codification details.
4. Shipping documents shall be provided for all imported equipment.

Any other item not mentioned but required for safe and efficient operation of system shall be indicated and included by the vendor in their offer. Any item not included by vendor but later found necessary for implementation of the system shall be vendor's responsibility to supply without any extra charge to the client. **Shipping documents shall be provided for all imported equipment.**

15 TERMS AND CONDITIONS FOR POST WARRANTY COMPREHENSIVE ANNUAL MAINTENANCE CONTRACT FOR FIVE (5) YEARS FOR CENTRALISED AUTOMATION SYSTEM

SR. NO.	OUR REQUIREMENT
1	Plant Incharge – Installation is entering into a Maintenance Contract for 5 years which will start after the expiry of warranty period of 12 months from the date of commissioning / integrated SAT or 18 months from the date of supply (whichever is earlier) and will remain valid for 5 years.
2	**Scope of services :**
2.a	• Service Engineer to visit once in a quarter for carrying out preventive maintenance of following- • Field & control room instrumentation provided by the TAS vendor as an OEM • Field & control room instrumentation provided by TAS vendor(as Bought out items) through the Service engineers of OEMs of respective/individual bought out items
2.b	Service Engineer to carry out break down calls as and when required / informed by BPCL location in following manner- • Field & control room instrumentation provided by the TAS vendor as an OEM • Field & control room instrumentation provided by TAS vendor (as Bought out items) through the Service engineers of OEMs of respective/individual bought out items.
2.c	No payment will be made under the Comp. Annual Maintenance Contract - • Towards the supply of skilled/unskilled manpower required for repair/servicing of equipments/systems during preventive/breakdown maintenance. • On the basis of no. of man days required during a preventive or breakdown maintenance visit.
2.d	Cost of all **spares & consumables**, instrument & services (preventive & break down) to take care of maintenance will be borne by BPCL. Following rates are to be finalized in AMC- • Unit rates of spares & consumables. • Unit rates for Annual stamping & and re-stamping (arising out of repair & maintenance) of meters, master meters & proving vessel by local W&M body • Unit rate for a quarterly preventive maintenance visit for the entire system including traveling, boarding, lodging of service engineer of TAS vendor & service engineers of OEMs of bought out items. • Unit rate for a break down maintenance visit including traveling, boarding, lodging of service engineer of TAS vendor & service engineers of OEMs of bought out items. Note : • During a preventive maintenance visit, the scope of work pertaining to preventive maintenance shall be completed. • During a breakdown maintenance visit, the breakdown system or instrument shall be repaired/ replaced & re-commissioned.

SR. NO.	OUR REQUIREMENT
2.e	Old spares, which are replaced by vendor, shall be returned to BPCL, wherever it is applicable.
2.f	In case the spares are repairable, the same will be done by contractor and returned to BPCL for future use. Cost of such repairs will be agreed upon between Plant In-charge of BPCL Location and payments will be made extra in such cases by Plant In-charge, BPCL
2.g	Standby / replacement meters to be provided by contractor in case meter is taken out of service.
3	**Duration of AMC :**
3.a	The AMC will come into effect from the date of expiry of the warrantee period i.e. 12 months from the date of commissioning / integrated SAT or 18 months from the date of supply (whichever is earlier)and will be valid for 5 years from the same.
3.b	BPCL reserves the right to renew the AMC contract after expiry of the current AMC on the same, terms and conditions except for rate (charges) for a period of another 3 years.
4	**Working Hours/Response Time :**
4.a	Preventive maintenance to be carried out within the normal working hours of 09:00 hrs to 05:00 hrs.
4.b	Breakdown maintenance calls to be attended as per the details given below: ➢ For Metro & Nearby Location (within 30 Kms range) → Within maximum of 24 hours of receipt of complaint from BPCL. ➢ For Other Location → Within maximum of [24 Hours + Travelling Time (which should not be more than 48 Hrs. in any case)] from the receipt of complaint from BPCL. However, contractor shall endeavor to make the Unit operational within 72 Hours from the receipt of complaint in case of MAJOR BREAK DOWN.
5	**Prices and Payment Terms :**
5.a	Payment will be made QUARTERLY. The AMC charge will be payable at the end of the QUARTER.
5.b	Payments will be made by Plant In-charge of BPCL Location where terminal automation is to be carried out. The contractor has to submit bill regularly at the end of quarter for the services offered under maintenance contract. Based on satisfactory service and bill for services, payment will be released by Plant In-

SR. NO.	OUR REQUIREMENT
	Charge, BPCL.
5.c	***The actual fee for stamping of meters, master meters & proving vessel by W&M will be reimbursed to contractor on production of original receipt of W&M by Plant In-Charge***.
5.d	AMC charges will remain firm till the expiry of contract and no increase will be considered during the contract period.
6	**General Terms & Conditions ;**
6.a	Electricity & water if required for carrying out maintenance will be provided by BPCL free of cost.
6.b	Vendor to observe all safety, statutory rules and regulations applicable at the locations.
6.c	All labours, materials, equipment, tools & tackles to be provided by vendor at their own cost.
6.d	In case of failure to attend to the problem within the specified time BPCL is entitled to recover loss as per the clause mentioned elsewhere in the general specification of the tender.
8	**Termination of Contract :**
8.a	BPCL reserves the right to terminate the contract by giving 1 month notice to the vendor in case of failure by vendor to complete the job as per satisfaction of BPCL.

16 SCOPE OF JOB OF RESIDENT ENGINEER DURING WARRANTEE PERIOD

A) DAILY JOBS

1) JOINT VERIFICATION OF 10% OF THE FILLED TANK LORRIES FOR ACCURACY WITH RESPECT TO DIP.
2) JOINT VERIFICATION OF PRODUCT TANKS FOR THE ACCURACY AGREED IN THE AGREEMENT WITH REPECT TO DIP TAP.
3) PERFORMANCE MONITORING OF EACH BAY IN THE TLF GANTRY FROM CONTROL ROOM.
4) REPORT GENERATION AS REQUESTED BY USER
5) LOGGING OF ALARMS AND INVESTIGATING AND RECTIFICATION OF THE SAME.
6) MONITORING OF GENERAL UPKEEP OF THE SYSTEM

B) WEEKLY JOBS

1) CROSS CHECKING ACCURACY OF DENSITOMETERS AND RTD WITH MASTER INSTRUMENT AND RECALIBRATING THE SAME IF FOUND INACCURATE. (ANY CHARGE FOR RECALIBRATION SHALL BE BORNED BY THE VENDOR)

2) SUPERVISON FOR CLEANING & HOUSEKEEPING IN THE CONTROL ROOM INCLUDING SYSTEMS/SERVERS/PLC/UPS/TFMS etc. IN CONTROL ROOM. (REQUIRED MANPOWER FOR CLEANING WILL BE PROVIDED BY BPCL)

3) MEMORY MANAGEMENT FOR EFFECTIVE UTILIZATION OF THE PROCESSING SPEED.

4) CHECKING OF LOGS GENERATED IN THE SYSTEM. STUDYING THE SAME AND CLEARING THEREAFTER.

5) GENERATING WEEKLY REPORT AS REQUIRED BY PLANT INCHARGE.

C) MONTHLY

1) TAKING BACKUP OF THE LOADING DATA ON TAPE AND STORING THE SAME WITH PROPER DATE WISE RECORD AS INSTRUCTED BY PLANT INCHARGE AND REMOVING THE DATA FROM THE SERVER.

2) DELETION OF THE TRANSACTIONS IN THE BATCH CONTROLLER.

3) GENERATING MONTHLY REPORT AS REQUIRED BY PLANT INCHARGE.

4) CHECKING THE HEALTH OF ENTIRE SYSTEM AND SUPERVISON OF CLEANING OF STRAINERS CUM AIR ELIMINATOR IF REQUIRED. (REQUIRED MANPOWER WILL BE PROVIDED BY BPCL)

5) CROSS CHECKING AND RECORDING THE ACCURACY OF LINE METER WITH RESPECT TO MASTER METER AND RECALIBRATING THE SAME IF FOUND INACCURATE. (MINIMUM THREE READINGS SHALL BE TAKEN FOR THIS PURPOSE.)

6) CROSS CHECKING AND RECORDING THE ACCURACY OF TANK GAUGING SYSTEM AND RECALIBRATION THE SAME IF FOUND INACCURATE.

7) SUPERVISING COMPLETE CLEANING OF CONSOLES, PANELS AND CONTROL ROOM.

D) QUARTERLY

1) CROSS CHECKING AND RECORDING THE ACCURACY OF MASTER METER WITH RESPECT TO PROVER VESSEL AND RECALIBRATING THE SAME IF FOUND INACCURATE. (MINIMUM THREE READINGS SHALL BE TAKEN FOR THIS PURPOSE.)

2) CROSS CHECKING ACCURACY/CALIBRATION OF OTHER FIELD VIZ. PRESSURE GUAGE, DPG, DENSITOMETER, RTD, PRESSURE TRANSMITTER ETC. WITH RESPECT TO MASTER INSTRUMENTS. (MASTER INSTRUMENTS WILL BE PROVIDED BY BPCL)

E) ANNUAL

1) ORGANISING ANNUAL CALIBRATION OF FIELD INSTRUMENTS, METERS, PROVERS ETC. INCLUDING LIASIONING WITH WEIGHTS AND MEASURES REPRESENTATIVE AS PER TENDER REQUIREMENT.

2) GENERATING ANNUAL REPORT AS REQUIRED BY PLANT INCHARGE.

3) CALIBRATION OF ALL MASTER INSTRUMENTS FROM REPUTED LABORATORY. (CALIBRATION CHARGES WILL BE REIMBURSED BY BPCL ON PRUCTION OF ORIGINAL RECEIPT)

F) PREVENTIVE MAINTENANCE

MAINTAINING PREVENTIVE MAINTENANCE SCHEDULE FOR ENTIRE SYSTEM AND EQUIPMENTS AND ENSURING ADHERANCE.

G) BREAK DOWN MAINTENANCE

ATTENDING TO SYSTEM BREAKDOWN AS AND WHEN IT OCCURS INCLUDING LIASIONING WITH VENDOR, SUB VENDOR AS THE CASE MAY BE TO BRING BACK THE SYSTEM BACK TO NORMAL OPERATION WITHIN THE TIME STIPULATED IN THE TENDER**.**

A COMPLAINT LOG REGISTER WILL BE MAINTAINED WITH THE PLANT INCHARGE WITH DATE , TIME AND DESCRIPTION OF COMPLAINT LOGGED AND DATE AND TIME WHEN THE SYSTEM WAS BROUGHT BACK TO OPERATION DULY ACKNOWLEDGED BY THE RESIDENT ENGINEER. THIS WILL FORM BASIS FOR RECOVERY CLAUSE AS PER THE TENDER.

H) GENERAL

ENSURING PROPER UPKEEP OF THE ENTIRE SYSTEM.

1) IMPARTING TRAINING TO STAFF AS AND WHEN REQUIRED.

2) MAINTAINING SYSTEM BACKUP AT ALL TIMES.

3) TAKING SYSTEM BACKUP DURING SHUTDOWN WHERE EVER REQUIRED.

4) KEEPING RECORD OF ALL THE QUALITY CHECKS, MAINTENANCE, ALARMS GENERATED, SYSTEM BREAKDOWN ETC. AS DIRECTD BY THE PLANT INCHARGE.

NOTE :-

1. REQUIRED MANPOWER WILL BE PROVIDED BY BPCL.
2. REQUIRED TOOLS AND TACKLES FOR MECHANICAL MAINTENANCE JOBS WILL BE PROVIDED BY BPCL
3. REQUIRED TOOLS AND TACKLES FOR ELECTRICAL AND INSTRUMENTATION JOBS SHALL BE PROVIDED BY VENDOR.
4. REQUIRED COMMUNICATION CHANNELS VIZ. TELEHONE, FAX, E-MAIL ETC. WILL BE PROVIDED BY BPCL.
5. REQUIRED MASTER INSTRUMENTS FOR CALIBRATION OF INSTRUMENTS WILL BE PROVIDED BY BPCL
6. RESIDENT ENGINEER SHALL BE GRADUATE ENGINER WITH MINIMUM TWO YEARS EXPERIENCE IN THE FIELD.

17 FORMAT FOR DECLARATION FROM SUBVENDOR FOR BACKUP SUPPORT

"We, _____ (*name of sub vendor*), a sub-vendor to M/s Bharat Petroleum Corporation Ltd. for _____ (*name of product*), hereby confirms backup responsibility as a sub-vendor to original bidder _____ (*name of the bidder*), that in the event of order to _____ (*name of bidder*) for Terminal Automation Job at _____ INSTALLATION, for all the phases of project execution including design, Engineering, supply, testing, erection and commissioning etc; including spares availability of the quoted product _____ (*name of product*) for 10 years from warranty of the equipment by us, in line with M/s Bharat Petroleum Corporation Ltd. project requirement.

As a sub-vendor for this product, we are fully committed and have the necessary resources and capabilities for its successful implementation, commissioning and after - sales service. We are sure that, along with main bidder, we are in a position to do full justice to this prestigious project

Note: This format is essentially required from sub-vendors. Bidder has to ensure availability of the same.

GENERAL NOTE : THE 'SCOPE OF WORK' & 'TECHNICAL SPECIFICATIONS' ARE TO BE READ IN CONJUNCTION WITH P& IDs & SYSTEM ARCHITECTURE DRAWING SPECIFIED BELOW.

B. System Architecture Drawing [E&P:INST/AP11/TAS-SA/1(REV.2)]

1. **OBJCTIVE**: Tank Farm Management System (TFMS) shall be considered a sub-system of Terminal Automation system for inventory management & custody transfer applications of Oil product storage tanks [Floating Roof Vertical Tanks (FRVT), Conical Roof Vertical Tanks (CRVT)]. The TFMS system shall be SIL2 certified.
   All Horizontal tanks (HGT) & underground Tanks (UGT) shall be provided with non-custody transfer Level Tx.

2. SCOPE OF WORK

2.1. BPCL intends to provide Tank farm automation system for its various product storage tanks at POL Installation in following manner:

2.1.1. All Above Ground tanks (FRVT & CRVT) shall be provided with :

2.1.1.1. SIL-2 certified Radar Gauges [(+/-) 1 mm accuracy- Level measurement] - 1 Nos.

2.1.1.2. SIL-2 certified Servo Gauges [(+/-) 1 mm accuracy- Level measurement] - 1 Nos.

2.1.1.3. Multi Element averaging temperature sensor cum Water bottom sensor-1 No.

2.1.1.4. SIL-2 certified Level Switch [Hi-Hi Level measurement]

2.1.2. All Horizontal Tanks (Underground & Overground) shall be provided with:

2.1.2.1. Radar Gauges [(+/-) 3 mm accuracy- Level measurement] -1 No.

2.1.3. All process parameters like Gross Level, Water Level, Temperature & density shall be available locally in the tank side indicator for each tank. These process parameters as well as inventory calculations shall be available in the TFMS computer & all the Client Machine at the control room, Installation Manager Room & Planning Room.

2.2. The TFMS control Room instrumentation shall consist of :

2.2.1. Redundant Communication Interface unit (CIU)

The CIU shall have surge arrestors at its field ports. The serial communication of CIU with field instrumentation could be over proprietary /open protocols. However

serial communication of CIU with TFMS computer & PLCs shall be over MODBUS RTU.

2.2.2. TFMS computer along with TFMS software(Windows 7)] . The TFMS computer shall communicate with main Terminal automation system through Ethernet (over TCP/IP protocol). *TFMS software shall have Custody Transfer Approvals (as per OIML R 85) from country of origin & ' Dept. of Weights & Measures, India'. The TFMS software shall also be OPC Compliant*.

2.2.3. The TFMS field instrumentation shall also communicate with the control Room PLCs in following manner:

2.2.3.1. The analog outputs (4-20 mA) of Radar Gauge shall be hardwired with Conventional PLC.

2.2.3.2. The analog outputs (4-20 mA, SIL) of Servo Gauge shall be hardwired with Safety PLC.

2.2.3.3. The SIL certified Hi-Hi Level Alarms (Potential Free Relay outputs from Radar Gauges and Servo Gauges) and SIL certified Hi-Hi Level Alarm (Potential Free Relay output from Level Switch) shall be hardwired with Safety PLC.

2.2.3.4. The Lo-Lo Level Alarm output (Potential free Relay outputs from Radar Gauges and Servo Gauges) shall be hardwired with Conventional PLC.

2.2.3.5. The CIU shall also be serially interfaced with Conventional PLC over MODBUS RTU.

2.3. Following process parameters are to be measured & displayed for each tank (in field & Control Room server & client machines):

2.3.1. Product Level, Temperature , Density& Water interface level Indication-Local & Remote display

2.3.2. Product Low Level & High Level Alarms –

2.3.2.1. Software generated low level alarm- Remote display

2.3.3. Product Low Low Level Alarm –

2.3.3.1. Potential free contact from level Transmitters- Remote display & control action (by normal PLC)

2.3.3.2. Software generated alarms- Remote display

2.3.4. Product High High Level Alarm –

2.3.4.1. Potential free contact from level Transmitters [Hi- Hi Level] - Remote display & control action (by safety PLC)

2.3.4.2. Potential free contact from Level switch [HI-HI Level] - [High High Level] - Remote display & control action (by safety PLC)

2.3.4.3. Software generated High High level alarm- Remote display

.

2.4. The Supply , laying(underground/ Overhead) , glanding, termination of all power supply & signal cables alongwith junction box, Aluminium /GI perforated cable trays & other erection hardware required for completion of job is in TFMS vendor's Scope of work.

2.5. TFMS vendor 's responsibility includes establishing proper communication of their system with Terminal Automation system in following manner:

2.5.1. Serial interface (open Protocol) between TFMS computer & Dual redundant Ethernet (TCP/IP) network of Terminal automation system

2.5.2. Serial interface (open Protocol) between Communication Interface unit (CIU) & PLCs (Terminal automation system)

2.5.3. Level Transmitters (4-20 ma signals for level) with PLC (Analog input modules)

2.5.4. Level Transmitters (Potential free alarm contacts- Lo/ Hi/ Hi-Hi) with PLC (Digital input modules)

2.6. Vendor's are required to visit the installations/ sites before submission of Technical bids , in order to see the suitability of existing Process nozzles / Still wells at existing tanks. Vendor

has to submit the site survey report & suggestions (if any) , required for proper performance of their offered system in accordance with the Technical specifications, subsequent to commissioning of system.

2.7. Individual Power supply (230V,50Hz , UPS) points with MCBs will be provided by the vendor at control room (Power Distribution Cabinet) for all the TFMS Field & control Room instrumentation.

2.8. All the activities pertaining to Engineering , supply, FAT, installation, commissioning & SAT , required for the completion of job is in Vendor's scope.

2.9. The following philosophy will be applicable for power cabling for the field instrumentation:

- In general, 20% spare cores in cables & 20% spare terminals in JBs & Marshalling cabinets/system cabinets are to be provided.
- For each Tank Farm Area 24 X 1.5 sq mm copper conductor, armoured , FRLS PVC cables are to be laid from control Room (Power distribution cabinet) upto Tank farm specific FLP Power Junction box.
- From the above Power Junction box, 3X 1.5 sq mm copper conductor, armoured , FRLS PVC cables , are to be provided/laid to the individual Tank instruments.

Note : During design stage ,in case of long distances, if voltage drop between Power supply source & receiving instrument exceeds more than 5%, then 2.5 sq mm copper conductors are to be considered instead of 1.5 sq mm as specified above.

2.10. The following philosophy will be applicable for signal cabling for the field instrumentation**.**

- In general, 20% spare cores in cables & 20% spare terminals in JBs & Marshalling cabinets/system cabinets are to be provided
- Level Transmitter (Radar / Servo Type)-
  - Maximum Four Level Transmitters are to be multi dropped up to Redundant Communication Interface Units .
  - Single pair [1-pair(twisted) , 1.5 sq mm copper conductor PVC , shielded], overall shielded ,armoured , Fire Retardent PVC cable between Level Transmitters & field Signal junction box.
  - Multi pair [12-pair (twisted), 1.5 sq mm copper conductor, PVC , shielded], overall shielded ,armoured , FRLS (Fire Retardent Low Smoke) PVC cable

between above field Signal JB & CIU /Marshalling/system cabinet(control room) is to be used.

- 2-wire /4-wire transmitters-
    - Single pair [1pair(twisted) , 1.5 sq mm copper conductor, PVC , shielded], overall shielded ,armoured , Fire Retardent PVC cable between a Transmitter & field Signal JB .
    - Multipair [12-pair (twisted), 1.5 sq mm copper conductor, PVC , shielded], overall shielded ,armoured , Fire Retardent PVC cable between field JB & Marshalling/PLC cabinet/(control room).

2.11. The following philosophy will be applicable for control cabling for the field instrumentation.

- In general, 20% spare cores in cables & 20% spare terminals in JBs & Marshalling cabinets/system cabinets are to be provided
- Level Switches-
    - Control cable [2 core , 1.5 sq mm copper conductor, PVC ,armoured , Fire Retardent PVC] between a Switch & field Control JB .
    - One no. multi core control cable [24 core , 1.5 sq mm copper conductor, PVC , ,armoured , Fire Retardent PVC] between field JB & Marshalling/PLC cabinet(control room).

2.12. Field instrumentation /scope of work will include following

- Installation, cabling , loop checking , commissioning of field instrumentation(as indicated) in general as well as specified in 'Schedule Of Quantities' .
- All instrument installation materials as well as cable laying material such as instrument supports (2" pipe yokes), MS angles/flats, Field Junction boxes, trays, ducts, compression fittings, cable glands, aluminium saddles, lead markers , sand, bricks, cement, etc. as required for the system.
- All field equipment shall be weatherproof to NEMA-4/IS-2147 or equal unless otherwise specified. They shall also be intrinsically safe or explosive proof (NEMA-7/IS-2148) suitable for area classification Zone 1 & 2, Gr., IIA & IIB as per IEC / CENELEC/ IS as a minimum. Intrinsically safe equipment is preferred and shall be used as the first option. Also all the field instruments shall be approved by Chief controller of Explosives.

- Supply and laying of all cables including ferruling, dressing, glanding and termination etc. as per Plant layout & finalized cable routes.
- Civil/ Mechanical/ Electrical works including the casting of foundation as per requirements for instruments support where paved surfaces do not exist.
- Minor civil works like chipping of pavement and grouting on the pavements for the instruments panels/supports stand, and chipping and refilling of the pavement for conduits.
- Sealing of cables/tube/pipe entries into the control room after laying and testing of all boxes, cables etc. by installing Multi cable transit (MCT) blocks. All works relating to the sizing, designing and installation of MCT blocks is within the scope of the vendor.
- Installation of main control panels, marshalling cabinets and system cabinets in control room.
- Supplying & providing supports for installation of equipments are included in the scope of the vendor.
- All the pipeline works for installation of all field instrumentation and other instruments are also included in the scope of the vendor.
- Pipes, Bends, Isolation Valves & Flanges only below 80 mm size required in this regard will be supplied/ by the vendor.
- All the structural & other materials are to be supplied by the vendor.
- Laying and termination at both ends of instruments earth buses provided in control panels to instrument earth pit.
- Complete earthing of control room equipment, TFMS Instruments & FLP equipment in the field.
- Painting of all structural supports for trays, panels, junction boxes, instruments, ducts etc.
- Drilling holes on all panels, shut down cabinets, power supply cabinets, control panels, etc. for cables/ glands/ grommets.
- No hot work in the TLF, Tank Farm area, only fabricated clamps are to be used for installing cable trays, equipment erection etc.
- Grounding of shielded cables to respective instrument earth bus.
- Supply of all types of consumables required for erection of the job.

- Completion of drawings/documents as per the execution of work at site and submission to BPCL.
- Preparation and submission of as built drawings as required and submission to BPCL.
- The bought out items shall be supplied from BPCL approved vendors/SOS Form as per vendor list enclosed.

All the instruments/ equipments/ subsystem supplied shall be from original manufacturers and make/model offered shall have sufficient successful proven operational track record at the time of the bid

3. Site Details(to be provided by Regional E&P) in following Format. Also Lay-out plan of installation indicating Tank Farm area , control Room & Cable routes for Power/signal cables may be provided.

Location	Tank No.	Product	Type of tank	Tank Height (Meter)	Tank Dia (Meter)	Details of existing Process nozzles proposed for installing Level Transmitters	Details of existing stillwells	Details of existing Tankage instrumentation	Distance of process nozzle/ Stillwell from Tank shell	Approx. distance (cable length) between Tank & Control room	Remarks

4. Standards & Codes

The storage tank monitoring system shall meet applicable standards and regulatory agency requirements including, but not limited to, the standards and requirements of the following :

4.1. Safety Standards

4.1.1. **Applicable safety standards**

- CCOE, Nagpur is a must and any of the below
- CENELAC or FM from country of origin

4.1.2. Vendor to specify the design classification of the field equipment for operation in continuos hazardous area according to one of applicable standards above mentioned.

4.2. Application standards

4.2.1. **OIML -International Organization for Legal Measurements;**

OIML R85 Conformity to pattern requirements by the International Organization of Legal
Metrology (OIML) R85, edition 1998 class 2. Test report format R85 annex E shall be available. The product shall be registered at the OIML certificate database.

R85- Automatic level gauges for measuring the level of liquid in fixed storage tanks.

R125 - Measuring systems for mass of liquids in tanks.

API - American Petroleum Institute; Chapter 3.1B : Standard Practice for Level. Measurement of Liquid hydrocarbons in Stationary Tanks by Automatic Tank Gauging.

ASTM - American Society for Testing and Materials; Applicable tables and Calculation methods for quantity assessment of liquids (metric units).

ISO/TC28/section 3; Terms relating to the calculation of oil quantity.

ISO 4266; Petroleum and liquid petroleum products - Measurement of level and temperature in storage tanks by automatic methods.

4.3. Design standards

4.3.1.ANSI - American National Standards Institute.

4.3.2.DIN - Deutsche Industry Norm "German Industry Standards"

4.3.3.NFPA 70 National Fire Protection Agency; National Electrical Code (NEC)

4.3.4.IEC 529 Classification of degrees of protection provided.

4.3.5.IEC 79 Electrical apparatus for explosive gas atmospheres.

4.3.6.NEMA ICS.6 Enclosures for industrial controls and systems.

4.3.7.All calculations, conversions and corrections shall be API/ASTM compliant

4.4. Quality Assurance

4.4.1. The vendor's organization shall have ISO 9001 certification and ISO 14001.

4.4.2. Vendor's are required to submit their detailed QAP for the TFMS system being offered by them with their technical bid.

5. System Requirements

This section specifies the requirements for the tank monitoring system including field equipment, field to control room interface and man machine interface.

5.1. General

5.2. The manufacturer of the tank gauging system shall be manufacturing according to international standards ISO9001 and ISO14001. Each Radar Tank Gauge shall be individually tested for accuracy over a distance from 1 to 20 meters as minimum. The test shall be performed in a test range approved by an international accredited institute. The system shall be capable to generate, capture and provide inventory data/information for display, reporting and/or further data handling to perform inventory management.

5.3. The system shall be able to measure tank levels, temperature, pressure and Water levels in metric units. Based on the measured values the system shall provide Inventory calculations (Volumes, density and mass).

5.4. The system shall meet performance parameters as specified in the applicable OIML tank gauging documents. Vendor to provide third party approval documents on this subject.

5.5. The system shall be able to perform alarm and error handling for all system components.

5.6. As a minimum all field equipment shall be of protection class IP 65 (NEMA 4).

5.7. All TFMS field instrumentation shall have devices for protection against Lightening.

5.8. All the offered instruments shall communicate over the same field bus to save cabling costs.

5.9. All configurable devices shall have an optional hardware-based write protection, which can be sealed.

5.10. All Tank and field mounted equipment shall be designed for continuous operation in ambient temperature of 0 deg C to + 65 deg C and relative humidity of 100% condensing. For hot climates, self-ventilating sun radiation protection shall be provided. The Control room

equipment shall be designed for operations at ambient temperature of 0 to 50 deg C and a relative humidity of 95%.

5.11. All field devices, during normal operation, bench testing or field services shall be designed to be immune to radio frequency & electromagnetic interference with field strength of 15 Volts/meter or less over frequency range of 50 Hz to 450MHz.

5.12. The Radar Gauge, during normal operation, bench testing or field service, shall not generate microwave power levels hazardous to humans. The maximum power level as per API MPMS 3.1B appendix B.2.4.2 shall not exceed 2mW. The Radar gauge shall have the approval from Federal Communication Corporation (FCC, USA) and certificate should be provided on request.

5.13. The instrument enclosure surface shall be suitable for operations in harsh environment conditions.

6. Parameters

6.1. The system shall be capable to provide as minimum the following measured data.

- product level measurement
- observed product density
- volume calculation according ASTM/API tables, which includes Total Observed Volume (TOV), Gross Observed Volume (GSV), Gross Standard Volume (GSV). Available (pumpable) Volume and Available Space.
- Product Flow calculation.
- High, high-high, low, low-low alarms.
- Gauge diagnostics and status information.
- Leakage Alarm
- System Diagnostics
- Batch Handling
- Density Profiling
- Product Temperature
- Water Level measurement

7. Performance

7.1. For custody quality applications, the intrinsic or bench tested accuracy of the level gauge shall be equal to or better than +/- 1 mm over the entire measuring range. The test shall be performed in a test range approved by an international accredited institute.

7.2. The installed accuracy for the Inventory Control application shall be equal to or better than +/- 3mm. Field calibration shall be in compliance with API MPMS 3.1B.4.5. The installed accuracy shall be verified jointly by the vendor and the user during commissioning period. The verification procedure shall be in compliance with API MPMS chapter 3.1A and 3.1B.

7.3. Local level indicators integral to the field control units shall display exactly the same readings as indicated in the control room operator console.

7.4. Measuring range , strapping tables, spectrum analysis and software upgrades and modifications shall be possible to configure and monitor from the control room.

7.5. The HH & LL Level alarms shall be hardwired to the Safety PLC for trip signals.

8. Electrical

8.1. Radar / Servo type of level gauging and the control room field interface shall have full galvanic isolation by means galvanic isolation for lightning protection and surge protection at communication and power cabling connections. Transient suppression components shall include gas discharge tubes and varistors.

8.2. Radar / Servo type of level gauge shall have the capability to digitally integrate peripherals with 2-wire intrinsically safe power and communication wiring, Digital integration is a must to prevent Analog/Digital and Digital/Analog conversion tolerances.

8.3. Radar / Servo type of level gauge shall have the capability to integrate peripherals without the need for separate/external barrier circuitry units.

8.4. Applicable peripherals shall be equipped with electrical circuitry for lightning protection at interface cabling to level gauge.

9. Communication

9.1. The standard system shall provide a redundant RS-232C or RS485 communications interface for data transmission to PLC/LRC .

9.2. The system shall be provided with diagnostic features, which monitor the signal performance and hardware status.

9.3. The system shall be able to communicate with all common makes of Supervisory Control Data Acquisition packages and Programmable Logic Controllers.

10. Field instruments

This section specifies the requirements for the radar type of level gauges and field indicator.

10.1. Radar level gauge

10.1.1. Signal frequency shaping before broadcast shall be fully processed.

10.1.2. Signal monitoring and registering of product surface reflection shall provide full frequency picture for possibility of complete reflection interpretation. This should support fine-tuning, trouble shooting and antenna contamination monitoring and signaling.

10.1.3. The gauge frequency sweep must be linearised against an ULTRA-STABLE DIGITAL REFERENCE using an internal crystal oscillator.

10.1.4. To avoid excessive temperature cycling, the internal electronics shall be temperature stabilized.

10.1.5. For free space close to the tank wall installation vendor should provide antenna version which installed accuracy is not influenced by the so-called "multi-path" effect. The antenna being the only part exposed to the tank atmosphere, shall not have any electronics on it and the antenna material shall be acid proof stainless steel and Teflon.

10.1.6. The vendor shall provide a Back lighted LCD display at tank base level to show level and Temperature measurement and water interface level.

10.1.7. The Radar gauge sub – components , i.e. antennas, electronics, housing etc. must be designed such that they can freely be interchanged at site without EEPROM changes etc. either at factory or at site.

10.1.8. Each Radar Gage shall be provided with 2 No. SPDT contacts programmable for level trip signals. These SPDT contacts shall be hardwired to Safety PLC /conventional PLC for Trip /Control purposes.

10.1.9. **INSTALLATION ON FIXED ROOF TANKS**

10.1.9.1. The antenna design shall be such that minimum influence from the tank wall is provided. Both inclination and orientation of the antenna shall be adjustable.

10.1.9.2. The material of the antenna shall be proven to be compatible for the chemical composition of the tank products. The antenna design shall be rugged to withstand tank atmosphere and temperature up to 65 deg C.

10.1.10. **INSTALLATION ON STILL – PIPES FOR FLOATING ROOF TANKS**

10.1.10.1. The Radar gauge shall be equipped to fit antennas on pipe diameters of 8".

10.1.10.2. The antenna for the Still –Pipe gauge shall be equipped with a low loss circular transmission mode to operate and prevent loss of accuracy due to slots, holes, rust and deposits in the still – pipes.

10.1.10.3. The vendor shall clearly identify any potential Radar Gauge accuracy or reliability effects associated with still pipe slot area, rust or hydrocarbon deposits, as well as still pipe inconsistencies or lack of straightness.

10.1.10.4. The Radar gauge antenna shall be factory designed to be easily removable from the still – pipe to allow access for manual gauging, temperature, dipping and sampling without affecting / altering the reference height of the tank. The access to the still – pipe shall be made without special tools or extra spool piece.

10.2. Servo level gauge

10.2.1. The vendor shall provide a Back lighted LCD display at tank base level to show level and density.

10.2.2. The Servo gauge sub–components , i.e. electronics, housing etc. must be designed such that they can freely be interchanged at site without EEPROM changes etc. either at factory or at site.

10.2.3. Each Servo Gauge shall be provided with 2 No. SPDT contacts programmable for level trip signals. These SPDT contacts shall be hardwired to Safety PLC / conventional PLC for Trip / Control purposes.

10.2.4. Servo gauge shall provide spot density measurement at 10 equidistant points for entire level measurement range.

10.2.5. Density profile feature should be available to measure the average density value by using TFMS software.

10.2.6. The servo gauge shall be provided with a calibration chamber.

11. Technical Specifications :

11.1. Radar Transmitter :

Technical Specs.

Tank Details (Type/Height/Dia): To be specified by Regional E&P

Tank Service : Product to be specified by Regional E&P

Instrument accuracy : Better than + /- 1 mm over the entire measurement range at the Test Bench

Installed Accuracy : Better than +/- 3 mm over the entire measurement range

Measurement Range : 0.8 Mtr to 20 Mtr.

Measuring resolution : +/- 0.1 mm

Product temperature range : 0 to 55 Degree C

Process pressure range : Atmospheric

Repeatability : +/- 0.1mm

Measurement Principle / Type : FMCW OR Transit time of Pulse / Microwave Type

Signal Processing : Digital Signal Processing

Input capabilities :

- From the Multi spot Temperature Sensor
- From Water Interface Sensor
- 4- 20 mA HART input from Pressure TX

Output capabilities :

- To Tank side Indicator
- Serial output (RS 485) to Communication Interface unit
- Potential Free contact (relay output) for HI-HI & LO-LO Level Alarm

Antenna Type : Parabolic/ Horn/ Planer

Antenna Material : SS 316

Sealing/ O Ring : Teflon/ Viton Or Flourosilicon

Housing Material : Anodized Aluminium

Mounting : For FRVT – On Still Well pipe(at Roof top)

For CRVT – On Manhole cover (at Roof Top)

Environmental Conditions:

Ambient temperature	:	0 to 65 ^{o} C
Humidity	:	100%, Condensing (max.)
Storage temperature	:	0 to 85 ^{o} C
Protection Class	:	IP 65 (NEMA 4)

Hazardous Area Classification/Enclosure : Zone1 , Gas Group IIA, IIB, T3 Safety/ Explosion proof :

Electrical

Power Supply	:	230 VAC, (+/-) 10%, 50Hz(+/-)5%
Rating	:	vendor to specify
Lightning protection	:	Full galvanic separation via transformers

Transmission

Field communication:	:	vendor to specify
Protocol	:	vendor to specify
Common mode rejection	:	> 150 dB
Communication distance	:	4 Km max.
Baud Rate	:	9600 minimum

Approvals & Certifications

Certifications : SIL2 certification as per IEC 61508 & 61511

Approvals : Custody Transfer Approvals as per OIML R 85 from country of origin & Dept. of Weights & Measures , India

: CCOE /PESO approval for Flameproof & weatherproof enclosure

11.2. Tank Side Indicator

Display : LCD/LED

Display

Ambient temperature	:	0 to +65 ^{o} C
Protection	:	IP 65
Safety	:	Explosion proof/ Intrinsically Safe

-- EEx ib IIB T4 acc. To CENELEC

-- (Class 1, Div. 1, Group B,C and D, in acc. To ANSI/NFPA 70 (FM, USA)

Power Supply : Loop powered

Communication : Digital

Material : Cast aluminum

Finish : Vendor to specify

Cable entry : vendor to specify

- The indicator shall be loop powered.
- The indicator shall directly communicate with the Radar Transmitter.
- The level reading shall be same as shown in TFMS PC in Control room.

11.3. Servo type Level Transmitter

General	1.	Service		• Measurement of Liquid Level, Interface Level, Tank Bottom, Spot Density by Level Transmitter. • Density Profile and Volumetric Inventory Calculation by TFMS Software.	
Tank Type	2.	Type		Cone Roof / Floating Roof [Note-to be specified by E&P-Regions] [Above Ground Product Storage Tanks]	
	3.	Height	Internal Dia	XXXXX mm	XXXX mm
				[Note-to be specified by E&P-Regions]	
Haz. Loc.	4.	Electrical Area Classification		ZONE – 1, GAS GROUPS – IIA & IIB as per IS:2148/1981	
Gauge	5.	Type		Servo Operated Displacer	

	6.	Function – Indicating / Transmit	Indicate & Transmit Display of level and density shall be available on tank side indicator.
	7.	Gauge Head Location	Top of Tank
	8.	Range	0 to XXXX mm [Note-to be specified by E&P-Regions]
	9.	Level Measurement Accuracy	+/- 1mm
	10.	Interface Level Measurement Accuracy	+/- 2mm
	11.	Density Measurement Accuracy (valid for Spot Density and Average Density Measurement)	+/- 0.005 gm/cm3
	12.	Density Measurement Methodology & Associated TFMS Software requirements (in addition to TFMS software specifications provided separately)	Note: i. We require spot density measurement at 10 equidistant points for entire level measurement range. ii. Density profile feature should be available to measure the average density value by using TFMS software. iii. Tank side indicator shall have provision (eg: push button) for giving command to level transmitter for displacer movement thru the product for density measurement. iv. Density measurement command shall also be available from TFMS Software. TFMS software should use the spot density measured by Servo Gauge to show a graphical display of density variation thru the product in a tank. Multiple profiles window instances can run simultaneously on TFMS computer. User should be able to select multiple tanks and multiple

			profiles. Such density profiles shall also be stored in the TFMS computer memory.
	13.	Electrical Cable Entry	Vendor to specify
	14.	Power Supply	230 VAC (+/-)10% , 50Hz (+/-)5%, UPS
	15.	Lightning protection	Full galvanic separation via transformers
	16.	Enclosure	Weatherproof to IP-65 as per IS 13947 / IEC 60529 and flameproof / 'Exd' as per IS 2148 / IEC 60079
	17.	Gauge Head Connections & Ratings	Shall be suitable for the Process Nozzle / Still Well details (i.e. Size 200 NB, SCH. 20, SORF 150# and 8", SS304, SCH 20). Note: E&P-Regions are required to cross check above details in line with site conditions prior to finalization of tender specifications.
	18.	Gauge Head Material	SS 316
	19.	Body Material	SS 316
	20.	Float / Displacer Material	SS316
	21.	Tape / Wire Material	SS 316
Tank Side Indicator	22.	Type	Digital Electronic (local tank side indication is required for level & density measurement)
	23.	Location	Grade (Tank Side)
	24.	Graduations	mm

	25.	Enclosure		Weatherproof to IP-65 as per IS 13947 / IEC 60529 and flameproof / 'Exd' as per IS 2148 / IEC 60079	
Transmitter	26.	Outputs		- Serial - 4-20 mA (SIL2 certified) - 2 Nos. (230VAC, 2Amp or 24VDC 0.5Amp) Relay Contact Outputs (SIL2 certified)	
	27.	Enclosure Class		Weatherproof to IP-65 as per IS 13947 / IEC 60529 and flameproof / 'Exd' as per IS 2148 / IEC 60079	
	28.	Intrinsically safe		-	
	29.	Power supply		230 VAC (+/-)10%, 50Hz (+/-)5%, UPS	
	30.	Cable Entry			
		Signal	Power	Vendor to Specify	Vendor to Specify
Options	31.	Calibration Chamber		Required	
	32.	Still Well		To be provided by BPCL [Note : E&P region to provide still well drawings alongwith Tender Enquiry]	
	33.	Periodic Proof Testing Requirement		Operators shall test the servo gauge using the push buttons on the key board of the tank side indicators as well as through remote test facility of the TFMS.	
	34.	Mounting Brackets	Isolation Ball Valve	Required	BPCL to provide
	35.	Built-in Alarm contacts	Operation Checker	2 Nos. (230VAC, 2Amp or 24VDC 0.5Amp) Relay Contact Outputs (SIL2 certified)	Required
	36.	Inter connecting Cables			

		between		
		- Tank Side Indicator & gauge head		Required
		- Power Cable between gauge head & Indicator		Required
	37.	Cable Glands (FLP / WP SS cable glands)		Required
Service Conditions	38.	Fluid		MS / HSD / SKO / NAPTHA [Note-to be specified by E&P-Regions]
	39.	Pressure. (kg/cm2g)		
		Operating	Max.	[Note-to be specified by E&P-Regions] / [Note-to be specified by E&P-Regions]
	40.	Temperature (Deg. C)		
		Operating	Max.	[Note-to be specified by E&P-Regions] / [Note-to be specified by E&P-Regions]
	41.	Operating Specific Gravity		[Note-to be specified by E&P-Regions]
	42.	Viscosity		[Note-to be specified by E&P-Regions]
Certifications	43.	Statutory / Mandatory Requirement		- CCOE / PESO - Custody Transfer Approval from W&M, India conforming to OIML R117. - Custody Transfer approval certificates from NMi / PTB / Country of Origin conforming to OIML R117. - SIL2 certification as per IEC 61508 & 61511 for the level transmitter and SIL 2 certified outputs specified above.
Others	44.	Manufacturer		Vendor to Specify

	45.	Model Number	Vendor to Specify

11.4. <u>Averaging Temperature Sensor / Probe Assembly</u>

Type : RTD Pt100 Multi point; Grade A as per DIN standards

Service : Average Temperature measurement & Spot Temp. measurement

RTD spacing : 2 Meter, First Pt100 shall be 300mm from tank bottom

Mounting : On 2' or 3 " flanged Process nozzles on top of FRVT or CRVT Tanks.

Output : To RADAR Transmitter

Accuracy : (+/-) 0.25 Degree Centigrade

Sheath / Lead wires : SS316 / Copper

Measuring Range : -10 to 100 Degree Centigrade

Enclosure : Explosion proof to Zone1, Gas Group IIA, IIB , T3 and Weatherproof as per IP65

Approvals :CCOE/ PESO

Note : Average Temp. Sensor shall be integrated with Water Interface Probe

11.5. Water Interface Probe Assembly

WIP assembly integrated along with temperature sensor assembly is to be offered meeting process requirements as below along with every gauge: -

- Principle : Capacitive/ Equivalent .
- Accuracy : **Better than +/- 2 mm**
- Product temperature: 0° to +65°C
- Ambient temperature : 0° to +65°C
- Probe material : Vendor to specify
- Protection : Probe IP 68 , WIP convertor IP 65.
- Power supply : from the radar gauge
- Output/transmission : 4-20 ma with HART protocol /Digital on serial Bus.
- Probe mounting : through a 2" 150 lb. flanged tank nozzle at top of the tank.
- The sensitive length for water interface probe measurement shall be **500mm .**

11.6. High High Level Switch

Objective	Tank overfill protection
Service	ESD- Tank overfill protection
Primary Sensor	Vibrating tuning fork (intrinsically safe)
Mounting/ process connection	On tank top /2” ANSI 150 class , RF
Safety Requirement/Approvals	SIL2 certified /proven in use as per IEC 61508/61511; Approvals from TUV/ EXIDA required

Sensor Material/ other wetted parts	SS316
Enclosure Housing	Die cast aluminium / SS316
Insertion Length	Elevation difference between Process nozzle(Top) & 90% of safe filling height of tank
Area Classification	Zone1, Gas Group IIA, IIB
Enclosure Approvals	Flameproof / intrinsically safe as per IS 2148 ; Weatherproof as per IP 65 ; CCOE/ PESO / ATEX approvals
Power supply	230 V AC , 50HZ
Contact output	SPDT switch (1 NO + 1 NC) ; Potential free contact(Relay); Switch Rating-230 V Ac, 5 Amp.
Fail safe Requirement	Relay shall be in De-energized state
Cable Entry	½ " NPT , 2 Nos.
Inputs required for overall SIL calculations	SFF, HFT, PFD
WHG overfill protection	Vendor to specify
Revalidation Requirement	Testing of Level switch shall be possible without raising the Level or removing the switch

11.7. Communication Unit

This section specifies the functionality requirements for Communication Unit acting as an interface between field equipment and the TFMS Comuter.

11.7.1. General

11.7.1.1. Communication interface unit shall be Redundant (Hot Standby redundancy for Power & communication.

11.7.1.2. Radar and Servo type tank gauge field instruments should be capable to communicate over 2 wire field bus via the communication unit to the operator interface at a distance of maximum 4 Kilometers without any additional hardware.

11.7.1.3. The field bus protocol should have a baud rate of 9600 as minimum and provide maximum resistance to interference.

11.7.1.4. The communication unit shall act as an interface between field equipment and TFMS software and its task shall be to continuous polls data from field and to store in its buffer memory. Whenever a request for data is received, the communication unit can immediately send data from its updated buffer memory.

11.7.1.5. The CIU shall have 4 Field ports & 8 Level Transmitters (as a maximum) shall be multi dropped to one Field port. CIU shall have dedicated Host Ports for connectivity with TFMS computer & PLC over MODBUS RTU protocol.

11.7.1.6. The communication unit shall be capable of providing all measured values directly to Host (PLC, SCADA etc.) through a dual redundant communication link.

11.7.1.7. The operator interface shall provide network capabilities using standard LAN.

11.7.2. **Human Machine Interface (HMI)**

11.7.2.1. The HMI shall consist of a PC-based (Server grade), user configurable graphical interface. It shall perform inventory calculations, alarm handling, configuration and data storage. As a minimum, the personal computer shall be as per specifications mentioned elsewhere in the tender..

The operator Interface graphics shall be designed for normal plant operation information and shall have the following functionality :

11.7.2.1.1. All standard windows shall have the ability to be customized on demand.

11.7.2.1.2. The system interface shall have independently supported and microprocessor controlled communications on all ports.

11.7.2.1.3. An engineering function interface shall be provided for system configuration and set up. All configuration changes shall be password – protected.

11.7.2.1.4. A group configuration function shall be provided which permits the plant operator (s) to define the groupings of tanks for display on the group view screen and the group inventory screen. A similar function shall be available for alarms.

11.7.2.1.5. A value entry function shall be provided which permits the operator(s) to manually enter the process values and operating parameters for each tank.

11.8. TFMS Software

11.8.1. Enhanced inventory management and tank monitoring functionality shall be available by means of software applications running on Windows 2008 Server / Windows 7 platform, designed on industry standard open connectivity architecture.

11.8.2. The HMI shall be able to calculate tank inventory values according to the API. All values in the calculations process shall be displayed.

11.8.3. The system shall be able to accept multiple users with different privileges independently of the Windows TM operating system. The system shall have freely configurable task related privileges for operators operator managers, service managers etc. It shall be

possible to change the security level of certain function. All function shall have a preset security password level.

11.8.4. Logging on and off of different users shall be stored as event for traceability. The system administrator with the highest level of authority and password handles the assigning of user accounts.

11.8.5. The systems shall be capable of storing unique volume tables and correction factors, with at least 1000 strapping points for each tank. These tables will provide level to volume conversion of the tank.

11.8.6. The system shall provide for open connectivity for users to extract appropriate data using commercial of the shelf software e.g. MS Excel or MS Access etc.

11.8.7. The operator interface shall have full network support over standard LAN, using commercial of the shelf hardware and software.

11.8.8. In case of networking the system shall have clock synchronization for all systems operator stations.

11.8.9. The following modules/views are considered to be required as a minimum for the tank inventory system.

- Alarming; audio/visual alarms
- User configurable tank grouping
- Events
- Field commands
- Manual overwrite
- Views; tank related as well as group related
- Tank detail
- Tabular data
- Bar graph's
- Tank icons.
- Batch Handling
- Rate of Change Computation (Flow)
- System Diagnostics
- System and Data Recovery
- Leakage Alarm

11.8.10. The system shall be able to generate reports in different formats . All reports shall be publishable on printers, via e-mail or as a file. All reports shall be generated manually or automatically by user-defined schedules. Minimum required reports are :

- Tank reports
- Inventory balance reports
- Alarm Reports

11.8.11. All reports may be retrieved through on local communications.

11.8.12. The system shall have an input for ambient Air temperature. The system shall be able to use this temperature value, combined with the product temperature , for compensation of thermal tank shell expansion.

11.8.13. The system shall generate multiple High, Low and safe alarms for levels, temperature, pressure and water bottom level. Configurable time delays shall be provided for each process variable to minimize nuisance alarms.

11.8.14. The system shall have configurable static and dynamic grouping of tanks.

11.8.15. The system shall generate leak alarms based on the change in level or the Net Standard Volume of the products in the storage tanks.

11.8.16. The system shall be capable of performing self checks on each tank gauge and data collection or control units. As a minimum, the following features shall be included :

11.8.16.1. All field inputs, including level, temperature, pressure and water level shall be monitored for faults. All faults shall be annunciated and logged. The error indications shall be categorized, such as communication failure. Gauge failure or software failure**.**

11.8.16.2. All diagnostic information shall be displayed, alarmed, stored in historical files and included in reports. This diagnostic information shall include details of all types of failures, system status and configuration modifications. All diagnostic alarms shall be presented locally or distributed via e-mail.

11.8.17. The system shall have the capability for historical and real-time trending analysis.

11.8.18. The system shall have the capability to store data on hard disk for later analysis documentation and traceability.

11.8.19. The system shall have the capability to store reports on hard disk for traceability.

11.8.20. The system shall be capable of sending reports automatically using fax, email or print services.

11.8.21. It shall be possible to integrate data of other databases, residing in the same computer or network environment, in the same report audible PC alarms.

11.8.22. The system shall provide an audible and visual indication to the operator of an alarm

condition and provide the operator the ability to acknowledge the alarm and disable the audible indicator.

11.8.23. The system shall provide the operator with the ability to disable the audible portion of an

alarm but the visual alarm shall not be disabled until the alarm condition has been corrected.

11.8.24. The system shall provide a calculated volume rate of change (FLOW) based on the true

level rate from the radar gauge and the tank capacity table.

11.8.25. The system shall provide importing and exporting flow indications based on volume

movements in the tank. Indications of ‘estimated end time of batch” shall be provided based on user set points. The batch handling shall be able to handle multiple destinations and sources. The Batch function shall generate printable batch reports.

11.8.26. The system shall be able to communicate with remote station via Internet and telephone

connection for remote viewing the data. The system should be connected via OPC server link to remote station.

SPECIAL INSTRUCTIONS

- **The radar gauge / integral averaging temperature cum water interfacing probe, tank side indicator shall be from the country of origin / original equipment manufacturer of the radar gauge.**
- **The servo gauge, tank side indicator shall be from the country of origin / original equipment manufacturer of the servo gauge.**

11.9. Guided wave Radar Gauge

Description	Our requirement
Function	Measurement of Product level,
Type	Guided wave Radar/ Conventional Radar
Measurement Principle	FMCW/Transit Time Radar
Overall sensor Length	As per horizontal tank heights
Total Measuring Length	As per horizontal tank heights
Total Sensor Length	As per horizontal tank height
Pressure	As per horizontal tank height
Operating Temperature	-20 deg C to + 50 deg C
Repeatability	Better than +/- 1 mm
Tank Connection	2” size
Auto Calibration	Required
Instrument Accuracy	(+/-) 3mm
Material exposed to Tank	AISI 304/ PTFE
Power Supply to Transmitter	230 V AC
Transmitter output (0-100% Level)	4 to 20 MA
Ingress Protection	IP65
Approvals	CENELEC and PTB EExiaIIBT4 and

	CCOE/PESO
Communication to Host	Through CIU/FCU to TFMS PC
Measuring Range	Upto 6 metres max.
Make	Saab / /Magnetrol/Enraf/E&H

Notes:

1. Each level gauge shall be provided with 2 nos. SPDT contacts for level trip signals. These SPDT contacts shall be hard wired to PLC for interlock purpose. Limit switch assembly shall be rated for 5 AMPS, 230 V AC in flameproof & WP (IP 65) enclosure.
2. The sensor shall be intrinsically safe & housing shall be flameproof as per IS 2148 for hazardous area classified under Class1, Zone1 Gas Gr. 2A, 2B.

11.10. TFMS Computer/OIC

SR.NO	PARTICULARS	REQUIREMENTS
1.	PC Type	Workstation
2.	Form Factor	Tower
3.	Make / Model	Vendor to specify
4.	Processor	Intel Core 2 Duo or better
5.	Processor Chip Set	Intel Latest
6.	Display	Colour, 21" LCD Monitor (Resolution 1920x1080)

SR.NO	PARTICULARS	REQUIREMENTS
7.	Display arrangement	Single tier
8.	HDD	160 GB minimum (SCSI) (Redundant)
9.	Hard Disk Controller	Integrated Controller
10.	RAM	Minimum 2 GB DDR-2 SDRAM
11.	I/O Expansion Slots	Min Four (2PCI/ 2PCI Xi) full height
12.	CD – R/ W Drive	DVD-RW Drive
13.	Graphics	Suitable graphics adapter with 16MB of Video RAM
14.	Keyboard	USB Minimum 101 keys, Membrane type / dust proof
15.	Mouse	USB Optical
16.	NIC	support Dual Integrated 10/100/1000 Mbps Ethernet (standard) + 2 Additional 10/100/1000 Mbps NIC card with RJ45 / UTP interface with wake on LAN enabled
17.	Power Supply	Redundant
18.	Operating System	Windows 7 Professional, preloaded and on media (DVD) with paper license and recovery media
	Note : • USB / Parallel port converters shall be provided in absence of parallel ports. • USB ports to be disabled	

11.11. Signal, Control, Power & OFC CABLE

11.11.1. SIGNAL & COMMUNICATION CABLE

15	Type of cable	PVC Insulated (Fire Redundant Low Smoke) copper cable, Single Pair/ Multipair shielded copper cable
16	Construction	1.5 sq. mm multi strand/ solid annealed electrolytic copper
17	Primary insulation	Extrude PVC as per IS 5831 type A. Min thickness 0.6mm
18	Pair twist	Two cores of the pair shall be twisted. Ten number of twist per meter shall be minimum
19	Shield (Individual Pair)	Each pair shall be shielded with aluminum backed myler, tape with 100 % coverage and minimum 25 % overlap.

20	Shield (Multipair)	Same as above for individual pair shielding. Also the overall shield shall be of aluminum backed myler tape with 100 % coverage and minimum 25 % overlap
21	Shield thickness	Min. 0.05 mm for individual and overall shielding
22	Inner Jacket	Extruded PVC, type STI, Min. thickness 0.7 mm
23	Outer Jacket	Extruded PVC, type STI, Min. thickness 1.4 mm
24	Pair identification	Pair identification number shall be provided at distance of not more than 1 meter
25	Rip cord	Shall be provided
26	Drain wire	0.5 sq.mm multistrand bare tinned copper conductor in a continuous contact with aluminum side of the shield shall be provided,
27	Armour	Armour over inner jacket shall be of Galvanised steel wire as per IS 1554 Part – I. (1.4 mm. Wire for 2-pairs and 4x0.8mm strip for multipair)
28	Electrical characteristics	Maximum resistance of the conductor of the complete cable shall not exceed 26.6 ohm /Km at 20-deg. c. Mutual capacitance of the adj. cores or pair shall not exceed a Max. Of 250 pF/mtrs at a frequency of I kHz. Capacitance between any core and screen shall not exceed 400 pF/mtr at a frequency of 1 kHz. The drain wire resistance including shield shall not exceed 30 ohms/km. Electrostatic noise rejection ratio shall be over 76 dB. L/R ratio shall not exceed 25 microhenries per ohm.

11.11.2. CONTROL CABLE

11	Type of cable	PVC (FRLS) insulated armoured Cable
12	Construction	1.5 sq. mm solid bright annealed electrolytic copper conductor, insulated and sheathed.
13	Voltage Rating	Up to and including 1100 volts
14	Primary insulation	Extruded PVC compound as per IS 5381 type A. Min thickness 0.7 mm
15	Inner Sheath	Extruded PVC compound, type STI, min thickness 0.7mm as per IS 5831.

16	Outer Sheath	Extruded PVC compound, type STI, min thickness 1.4mm
17	Electrical characteristics	Max. resistance of the conductor of the complete cable shall not exceed 12.3 ohm/km at 20 deg. C
18	Armour over inner sheath	Armour over inner sheath shall be provided of galvanised steel wire/flat strip (1.4 mm. wire for 2-pairs and 4x0.8mm strip for multipair)
19	Core identification	Core identification number shall be provided at a distance of not more than 1 meter
20	Rip cord	Shall be provided

11.11.3. POWER CABLE

9	Type of cable	PVC (FRLS) insulated armoured Cable
10	Construction	Size as per actual design, multi stranded annealed bare electrolytic grade copper conductor.
11	Voltage Rating	Up to and including 1100 volts
12	Primary insulation	Extruded PVC compound as per IS 5831 type A
13	Inner Sheath	Extruded PVC compound type STI, min thickness as per table 4 of IS 1554 Part (I)
14	Outer Sheath	Extruded PVC compound, type STI, Min thickness as per table 7 of IS 1554 part (I), Colour black, Oxygen index of 29 at 27 (+/- 2) deg C.
15	Armour over inner sheath	Galvanized steel wire for UAD less than 13 mm, Galvanised steel strip for UAD greater than 13 mm Dimensions as per table 5 of IS 1554 Part I
16	Core identification	2 Core : Red & Black 3 Core : Red, Yellow & Blue

11.11.4. Fibre Optic Cable

S.No	**Item Description**	**Requirement**
32	Standard	The fibres shall fulfil latest ITU-T Recommendation G-652 & G-651 for single mode optical fibres.

33	Type	Single-mode Germanium doped silica 9/125 µm. Multitube
34	Number of fibre	Twelve (12)
	Geometrical & physical characteristics	
35	Mode field diameter	8.6 to 9.5 µm □□5% at 1310nm
36	Cladding diameter	125 µm ± 1µm
37	Mode field concentricity error	<=1 µm
38	Cladding non-circularity	<= 2%
39	Protective materials / coatings	Optical fibres shall be coated with UV cured double Acrylate Resin. It should not have any reaction with cladding or core material. The coatings should provide maximum resistance to micro bending & abrasion and ensure mechanical & optical strength. The coatings shall be easily stripped with mechanical tools.
40	Nominal Overall Thickness	250 µm □□15 µm
41	Fibre Identifcation	The coatings shall be in various colours in order to facilitate fibre identification. The colours shall correspond with standard colours and shall readily be identifiable and shall be durable. The colours should have good colourfast properties also in the presence of other materials during the lifetime of cable. The coating and the colour shall not react with surrounding jelly. Each fibre and tube shall be identifiable throughout the length of the cable as per ITU-T-652. **The colour scheme of the fibres shall be as per EIA/TIA 598A**
	Transmission characteristics	
42	Attenuation	The cabled fibre shall have the following attenuation coefficient. 0.38 dB/km maximum at 1310nm wavelength region.

		0.22 dB/km maximum at 1550nm wavelength region.
43	Chromatic dispersion	<=3.5 ps/nm.km at 1285 to 1330 nm. <=5.3 ps/nm.km at 1270 to 1340 nm. <=18 ps/nm.km at 1550 nm.
44	Zero dispersion slope	<= 0.093 ps/nm^2.km
45	Polarization mode dispersion coefficient	<=0. 5 ps/□.km .
	Construction details of cable	
46	Central Strength member	FRP Rod
47	Loose Tube & filling of Core	Fibres to be laid in tightly buffered loose tubes. The tubes shall be filled with moisture resistant non-hygroscopic jelly, which should be compatible with the coated fibre and the surroundings. The jelly shall also be flooded over the stranded tubes to ensure ingress protection.
48	Number of fibres per tube	4
49	Moisture barrier	Polymer coated Aluminium tape placed longitudinally over the cable core. The tape shall form a close fit around the cable core with a sealed overlap of 10% minimum.
50	Inner sheath	Polyethylene sheath
51	Thickness of inner sheath	1.50 mm minimum
52	Armouring (for direct burial)	Burial - (or) SWA – Steel Wire Armoured (SWA to BS-5308)
53	Thickness of steel tape	0.15 mm minimum
54	Thickness of each polymer layer	0.04 mm minimum

55	2nd PE sheath	Polyethylene sheath
56	Thickness of 2nd PE sheath	1.50 mm minimum
57	Outer Sheath /Jacket	FRLS Black LSZH (Low Smoke Zero Halogen) HDPE
58	Thickness of outer sheath	0.65 mm minimum
59	Overall diameter of cable	Bidder to specify
60	Cable weight in kg/km	Bidder to specify
61	Protection required	The cable shall have protection against damages from termite, rodent, chemicals (such as oil, natural gas and other petroleum products), moisture and water, over the lifetime of the cable. The cable shall also be flame retardant to IEC 60332
62	Cable identification	The outer surface of the cable shall be permanently & legibly marked with colour in contrast to the outer sheath at regular intervals not exceeding one meter with • Legend containing FO mark and laser symbol • Number and type of fibre eg. (36F OFC G.652) • Month & year of manufacture • Manufacture batch ID or job no. • Country of origin • Cable ID number • Sequentially numbered metric length markers spaced at regular intervals of one meter.

11.12. CABLE LAYING PROCEDURE (If Applicable)

Cables shall be laid above ground in gantry or in some road cuttings etc if required the same shall be laid underground. All above ground cables shall be laid on the cable tray with cover as per specification.

When the cable is laid above ground, it shall be laid on the perforated cable tray with cover. The cable shall be tied on the GI or Aluminium Cable tray (as per site conditions) with GI Clamps. No PVC ties or MS wire shall be used for tying the cable on the GI cable tray. The cable shall be laid on the tray with min. D spacing (D being the diameter of the thicker cable). Bunching of cables or laying cable on top of each other is not permitted.

Separate cable tray shall be used for laying Power & Signal / Communication / Control Cables.

The perforated GI or Al Cable Tray shall be supported at regular interval. The existing structural support at Gantry, Tanks may be used for supporting the cable tray. In case additional supports are required the same shall be supplied & erected by the vendor & shall be include in the cost of cable laying.

Laying of the cables underground shall be in trenches of min. 1mt depth in all types of soil both hard and soft soil including dewatering, if required. Big boulders, sharp edges of the steel sections, vegetation, growth roots etc. if encountered shall be removed completely. Only soft earth excavated shall be kept for refilling. Such earth shall be approved by the BPCL Engg-In-Charge. Excavated trench shall be in true straight line as far as possible and bends if necessary shall be provided. Such bends shall be gradual and not sharp in nature, the excavated trench shall be approved by BPCL EIC before cables. In case, during excavation hard rock is encountered which in opinion of BPCL EIC / cannot be excavated further, then additional sand bedding of 150mm shall be provided over & above the 150mm specified for the bedding. The decision of BPCL / is final & binding in this regard. Rate of cable laying shall include excavation, supply and laying of two layers (150mm thick each, below and above) of river sand conforming to IS 383 and a layer of good quality bricks of compressive strength min. 35kg/sqcm on top of the second layer of sand & backfilling with good quality excavated earth. Job shall also include cutting / excavation of RCC wherever encountered & construction of RCC Culvert / cable alley in RCC 1:1.5:3 with reinforcement as per design requirement. All care shall be taken to ensure that no underground utilities like cables, pipelines etc. gets damaged. However, in case any underground utility like cables / pipes are damaged, the same shall be repaired / replaced by the vendor immediately at no extra cost. Rate to include backfilling of the excavated earth & carting away surplus earth within the depot premise as directed by BPCL EIC / Installation Manager.

Before cutting the cables exact length as per the site conditions shall be measured and recorded. Cut ends of the cable shall be wound by insulating tape to protect them from rain water etc. Cable ends shall not be kept open for long.

The cables shall be laid with min. spacing of “D” (D being the diameter of the thicker cable) * 15mm from edge of the cable tray. Power Cable shall be laid in separate trench and Signal & Communication Cabling shall be laid different trench. The same may be laid in common trench provided physical barrier in the form of bricks are provided in such a way that both are laid min 300mm apart. Power & Signal / Communication / Control Cables shall be laid separately.

Wherever the cables have to cross the asphalt roads, the job shall include cutting of the asphalt and WBM roads including soiling and necessary excavation to the required depth and back filling the trench with river sand and restoring the asphalt / WBM roads to its original condition including compacting and rolling the surface.

Road crossing shall be done through the Hume pipe. The existing Hume pipes may be used in case sufficient space is available for laying the cables. Supply & laying of the NP2 Hume pipes, if required, shall be in the scope of the vendor.

Wherever the cables comes aboveground, a suitable size GI sleeve with bend shall be used. Such pipe shall be laid 150mm below ground level and the projecting bend shall raise to 500mm above ground level along the steel / concrete / brick columns. The sleeve shall be neatly clamped by MS clamps of adequate size and wooden bushes. Necessary precautions shall be taken to make the opening water tight by wooden bushes.

All the cables be neatly clamped on the cable tray and loose hanging cables shall not be allowed.

Required loops shall be provided at both ends of the main cables. Cable shall be laid without any joints.

Cable route markers at 20m/c and at all the bends/turnings shall be provided.

Bending radius of cables shall not be less than 12times O.D. of cable.

All cores of cable shall be identified at both ends by means of PVC ferrule.

Line drivers & all other accessories required in this regard are included in the scope of work of the vendor.

Cable laying shall also include termination of cables at both the ends. Cable leads shall be terminated at both ends by crimped type soldering.

Rate shall also include megger test by 1000V megger for establishing the healthiness of cable in the drum before removing the same, unwinding and straightening the cable & after laying of cables.

11.13. EARTHING

All junction boxes, local cabinets, field mounted instruments shall be connected to the nearby earth bus bar/earth pit through minimum 1.5 mm2 copper conductor

Earthing network shall be realized with earth electrodes and/or buried bare conductors.

Two types of earthing system shall be envisaged –

- Main earthing system (ME)

- Electronic earthing system (EE)

The electronic earth system shall be separate from main earthing system. Main earthing system (ME) shall be installed by BPCL. However, Electronic-earthing system (EE) is included in the tenderer scope.

The earth electrode(s) for EE shall be of the same type as those for the ME, but in addition shall be placed in a galvanized steel pipe line for a depth of 4m to shield the electrode from surface earth stray currents which may cause unwanted interference.

In general, the earth conductor between cabinets/instruments/junction box upto the local earth bus shall be 1.5 mm 2 insulated copper conductor.

From local earth bus to the earth pit 2.5 mm2 insulated copper conductor shall be used.

In general the following rules shall be apply for earthing:

- The metallic housing of electronic equipment/junction box/panel shall be connected to the main earthing system (ME).
- The active electronic parts of a electronic equipment/computer system shall be connected to the electronic earth (EE).
- All armors of armored cables shall be connected to the earth (ME) at both ends.
- The shield of the shielded cable shall be earthed with electronic earth at one end only i.e. at control room end.

11.14. PAINTING (If Applicable)

This part of the specification is applicable to cable ducts, cable trays, CS impulse pipes, instrument supports and all other structural supports for cable trays, ducts, impulse tubes, air lines etc.

The surface to be painted shall be thoroughly cleaned with wire brush, sandpaper to remove all scales. After cleaning, the surface is painted with one coat of red oxide zinc chromate primer conforming to IS 1074 and allowed to dry completely.

Primer coated surface is painted with one coat of synthetic enamel paint to the colour nearest to the final paint and allowed to dry. The colour number shall be from IS 5.

Final second coating, shall be with the paint of desired colors and shall be elected from IS 5.

The name of manufacturer, colour and quality of all types of primer paint shall be subject to approval of purchaser.

12. APPROVED VENDOR LIST

Refer VENDOR LIST IN DOCUMENT-I

13. INSTALLATION, COMMISSIONING , INSPECTION, FAT, SAT & OTHER REQUIREMENTS

Refer DOCUMENT -IV

PART 1 : UNINTERRUPTED POWER SUPPLY

1.0 SCOPE

1.1 The scope of work covers the design, manufacture, testing, inspection, FAT at OEM's works and subsequent installation(including cabling) & commissioning as well as Site acceptance test of Parallel Redundant Uninterrupted Power Supply System of min . 10 KVA or rated capacity with 30 Minutes Power back-up , as suitably required for the entire system whichever is higher.

The UPS are required for providing uninterrupted power to Terminal Automation System being provided by vendor at each location./POL installation of BPCL. .

1.2 The scope shall include the following :

(i) Full wave controlled rectifier
(ii) Inverter
(iii) Static switches
(iv) Storage battery
(v) Static voltage stabilizer for bypass supply
(vi) Manual bypass switches
(vii) Isolation/output transformer to achieve desired output voltage
(viii) UPS Distribution Boards
(ix) Interconnecting cabling between various units of UPS

All other items required, but not specified for safe and reliable operation of UPS system.

2.0 STANDARDS TO BE FOLLOWED

2.1 The equipment shall conform to the latest issue of the following and relevant Indian Standard specifications or equivalent specification of the country of origin or IEC specifications.

IS-13314 Solid state inverters run from storage batteries.

IS-11260 Stabilized power supplies AC output

IEC-146 Solid state inverters

2.2 The equipment shall also conform to the provision of Indian Electricity Rules. Indian Supply Act and any other statutory regulations in force from time to time.

3.0 DESIGN AND OPERATIONAL REQUIREMENTS

3.1 The UPS unit and its associated equipments shall be suitable for operating at the specified rating continuously with the specified voltage and frequency variations under the ambient conditions without exceeding the temperature rise limits specified in relevant standards and without any detrimental effect on any part.

3.2 The UPS system shall be based on latest generation of MOSFET based, pulse width modulated (PWM) design with proven performance. IGBT based design is required.

3.3 Non-redundant scheme with bypass

Under normal operating conditions, inverter should supply interrupted stable A.C power to load. ON failure of inverter, a no-break load transfer to standby power supply should take place through static switch .

3.4 Redundant scheme with by pass

Under normal operating conditions, both inverter units should run in parallel sharing 50% load in synchronism with by-pass power and supply uninterrupted A.C. power to load. On failure of one of these inverters, the faulty inverter should get automatically disconnected from the load and healthy inverter should supply 100% load in synchronism with by pass supply. In the event of second inverter also developing a fault,

a no-break load transfer to standby power supply should take place through static switch.

3.5 Output frequency of the inverters must remain synchronised to one another which in turn shall be synchronised to the standby power supply frequency provided the latter does not vary by more than + 4% to - 4%. It should be possible to change the setting of frequency range of synchronism between above limits by frequency selector switch. Outside these limits inverter should desynchronise with the bypass and run at its own frequency. When running at its own frequency, frequency variation shall be maintained less than + 1.0 %. Resynchronisation with bypass power supply must take place automatically with some time delay when frequency comes back to + 4 % to -4 % range. Change-over from inverter to bypass or bypass to inverter shall also be possible in desynchronised mode of operation. Change-over time in both synchronised and desynchronised mode operations shall be indicated.

3.6 The UPS unit shall be suitable for 0.7 lagging to unity power factor. The overall power factor may be taken as 0.8 lagging unless indicated otherwise .

3.7 The maximum wave form distortion of the output voltage shall not exceed 5% r.m.s for linear loads and 10% rms for non-linear loads. The UPS unit shall be suitable for operation for non-linear loads having crest factor of 3 :1.

3.8 The inverter steady state output voltage and frequency (free running) variation shall not exceed + 1 % for specified input power supply condition and no-load to full load condition.

3.9 Voltage dip/rise on sudden application/throw of 100% load or on changeover from inverter to bypass or vice versa shall not exceed 15% and shall be recovered within 100 msec. to rated voltage.

3.10 UPS shall be designed for overload of 125% for 10 min. and 150% for 10 sec. after which drooping characteristic shall come into operation.

3.11 ON failure of the main supply, inverter unit shall continue to supply rated load from the battery bank for 1/2 an hour duration.

3.12 Charger shall simultaneously supply entire power necessary for inverter and to keep the battery of required capacity in fully charged condition. Provision for automatic charging in both float and boost shall be made.

3.13 Battery shall be Nickel-Cadmium type .The battery capacity shall be decided considering load power factor as 0.8 de-rating factor .

3.14 The ventilation fan to be provided in each UPS and connected to the output from the inverter and an audio-visual alarm shall be provided on its failure. It should be possible to operate inverter for about half an hour even after the failure of the fan without temperature rise inside the inverter cubicle exceeding the safe operating temperature limits.

3.15 In case of inverter failure due to any reason or overload, affected unit should be isolated and changeover to other inverter ot to bypass should take place automatically.

3.16 Noise level at a distance or 1 m from UPS panels shall not exceed 60 dB.

3.17 UPS system shall be provided with necessary control protection metering indication alarm & annunciation for reliable and safe operation of the system.

3.18 All semi-conducting devices shall be protected by fast acting semi-conducting fuses. These fuses shall be co-ordinates with load side HRC fuses.

3.19 The battery may be taken out of service for maintenance during which period it shall be possible for the inverter to continue operation taking power from the rectifier. The input filter of the inverter shall be suitably designed to take care of this operational requirement.

3.20 It shall be possible to vary the output voltage steplessly within + 5% of the specified output voltage. This adjustment shall be possible to be made when UPS is in operation.

3.21 UPS system shall be suitable for both floating output or earthing of one leg in case of single phase system/star-point in case of three phase system.

3.22 The UPS system shall be provided with control room located Power Distribution cabinet with MCBs for individual isolation for distribution of 230VAC, Single Phase UPS/Non-UPS Supply to equipments / instruments in control Room & field.

3.23 Battery sizing shall be done considering the factors below. Party shall submit the battery calculation considering these factors. Selection of AH rating of the battery shall be based on the calculation.

i) Power factor = 0.8

ii) No. Of Cells = Min. Voltage/ECV

iii) Battery current = Inverter rated KVA X pf

Inverter Eff X ECV X No. of cells

iv) State of charge factor as applicable supported by manufacturer data.

v) Aging factor = 1.0

vi) Temperature derating factor = 1.0

vii) Battery type :- Ni Cd Pocket Plate

viii) ECV = 1.0

ix) Battery back-up = 30 minutes

4.0 CONSTRUCTIONAL DETAILS

4.1 The equipment shall preferably be supplied in enclosed, dust & vermin proof, floor mounted, sheet steel enclosure. In case, it is necessary to provide opening for ventilation, this should be closed by fine mesh. Minimum degree of protection for enclosure shall be IP- 31 as per IS-13997.

4.2 Enclosures shall be fabricated with cold rolled sheet annealed steel of minimum thickness 2.0 mm & doors and side panels shall be minimum 1.5 mm thick.

4.3 The door hinges shall be concealed type. The doors and the removable covers shall be provided with non-deteriorating neoprene gaskets without any discontinuities. Gaskets shall be held in position in groove in shaped sheet steel work or these shall be of U type.

4.4 All external hardware shall be cadmium plated steel. Hardware for fixing the removable parts shall be provided with retaining devices.

4.5 UPS unit shall preferably have separate panels for each rectifier, inverter units, bypass supply, distribution boards etc. Various panels of UPS except distribution boards shall be mounted side by side & bolted together to form compact assembly.

4.6 Distribution boards shall be of fixed type single front execution in fully compartmentalized design and divided into distinct panels each comprising of bus-bar chambers, individual feeder modules and vertical cable alley.

4.7 Mounting height of components requiring operation and observations shall not be lower than 300 mm and higher than 1800 mm.

4.8 All the live parts which are accessible after opening the front cover/back cover shall be properly insulated or provided with insulating barrier to prevent accidental contact. Bus bars of distribution boards shall be PVC sleeved.

4.9 All the wiring shall be properly laid and ferruled at both ends, PVC channels may be used for wiring. For control wiring, minimum 1.5 sq.-mm copper conductor shall be used.

4.10 The power connections may be made by PVC insulated flexible copper cables or taped copper / aluminum strip.

4.11 All power & control shall enter from the bottom only .

4.12 Terminal blocks shall be grouped according to circuit functions and suitably numbered. 20 % extra terminals shall be provided in the terminal block.

4.13 A suitably sized earth bus shall be provided at the bottom of panel with provision for earth connection at both ends to purchaser's earth grid.

4.14 All panels shall be of same height so as to form a bank which shall give good aesthetic appearance.

5.0 COMPONENTS DETAILS

All components shall conform to relevant IS/IEC standards and shall be of reputed make. Makes of all components shall be subject to purchaser's consultant's approval.

5.2 Thyristors, diodes and transistors

The Thyristors , diodes and transistors shall have adequate safety margins to withstand specified operating conditions. A factor of safety of minimum 4 shall be taken against voltage surges.

5.3 PCBs

All electronic control & monitoring printed circuit cards shall preferably be modular plug in type. Monitoring points shall be provided in each of the PCB, PCBs shall be firmly clamped in position so that vibration or long usage do not result in loose contacts. Failure of each PCB shall be indicated by visual alarm and indication. The visual fault diagnostic shall preferably indicate fault into various sections of the card.

5.4 Transformers and Chokes

All transformers and chokes shall be of dry type and air cooled. This shall be class 'H' insulated, vacuum impregnated. Class B insulated cast resin transformers and chokes are also acceptable.

5.5 Electrolytic Capacitors

These may be polarised aluminum type 1, suitable for long life and category 1, as per IS-4317 or equivalent IEC. The capacitor shall preferably be self healing type . These shall

be so located in inverter panels that the operating temperature does not exceed 65 degree C maximum.

5.6 Instruments

Ammeters & voltmeters shall be moving coil type of class 1.5 accuracy as per IS -1248. These shall be flush mounting type of minimum size of 96 mm x 96 mm and shall have taut band scale of 240. Frequency meter shall be of reed type having range of 45 Hz to 55 Hz. Digital LCD display shall also be acceptable.

5.7 Static Switches

Static switches shall be naturally commutated type with parallel inverse connected Thyristors. These shall be rated for continuous duty for 100% load. Short time rated static switches are not acceptable.

5.8 **Voltage Stabilizer**

Voltage stabilizer shall be static type and shall satisfy the following

requirements

(i) Maximum output voltage variation under steady state condition shall be + 3%
(ii) Maximum harmonic distortion shall be less than 5%.
(iii) The output voltage shall be restored within + 2 % of nominal value in less than 2 sec.

5.9 Battery

Battery along with accessories shall conform to Engineering Standard ES-8142.

5.10 Indication Lamps

All indication lamps shall be of LED type suitable for the specified control voltage, having minimum illumination of 40 millicandella. The colour of the LEDs shall be as follows :

ON	:	Red
OFF	:	Green
FAULT	:	Yellow

5.11 Molded Case Circuit Breakers

For isolating devices of various equipment, moulded case circuit breakers shall be used. These shall be provided with overload and short circuit protective devices and shall conform to IS-2516.

6 Painting

6.1 The enclosures after suitable pre-treatment shall be painted with two caots of anti-rust paint followed by two coats of anticorrosive paint.

6.2 All paints shall be carefully selected to withstand tropical heat and extremes of weather. The paint shall not scale off, crinkle or be removed by abrasion due to normal handling.

6.3 Electrostatic powder paint shall be preferred.

7 Tests and Inspection

The UPS units shall be subjected to test as per relevant standards. The test shall include, but not limited to the following :-

(i) Rectifier & inverter soft starting
(ii) Regulation test
(iii) Heat run test for 8 hours
(iv) Overload test
(v) Test for changeover time in synchronized and de-synchronized mode.
(vi) Test for dynamic response and transient performance
(vii) Sequence & transfer test
(viii) Noise level measurement
(ix) Test to check the selectivity of protective devices
(x) Alarm test (simulation of various fault conditions)
(xi) Measurement of harmonic distortion
(xii) Ventilation test (operation without fan)
(xiii) Insulation test
(xiv) Current division in parallel UPS

All the above tests shall be carried out in presence of purchaser's representative in addition the equipment shall be subjected to stage inspection during process of manufacture at works and site inspection.

Annexure -1

Drawings & Documents

Following drawings and documents for all equipments of UPS system shall be supplied

Sr No	Description	With BID	After Order		
			For Approval		Final
		No. of copies	No. of copies	No. of weeks	No.of Copies
1	Specification Sheet	1	3	6	3
2	Technical Particulars	1	3	6	3
3	Block Diagram	1	3	6	3
4	General Arrangement drawings and foundation plan	1	3	6	3
5	Calculation for battery sizing	1	3	6	3
6	Feeder Details for Distribution Boards	1	3	6	3
7	Descriptive literature and catalogues	-	--	--	3
8	Bill of materials	--	3	8	3
9	Schematic & Wiring Diagram	--	3	8	3
10	Installation, operation & maintenance manual	--	--	--	3
11	Spare parts list with identification	-	--	--	3
12	Test Certificates	--	--	--	3
13	Guarantee Certificates	--	--	--	3

Note :

1. Period of submission of drawings for approval shall be counted from the date of LOI.
2. All final documents shall be submitted prior to dispatch of equipment. These shall be made in bound sets.
3. In BOQ the capacity of UPS is indicative (10KVA) parallel redundant as per specification the tender. However vendor to offer a higher rating UPS in case required for the offered system. Vendor to furnish details of load calculation for the offered system. Further heat load calculation to estimate the air conditioning requirement shall also be furnished alongwith the technical offer.
4. The offered UPS shall be with 20% spare capacity. The UPS sizing / rating shall be calculated based on FULL LOAD condition.

ANNEXURE - II

METERING INDICATIONS AND ALARM SCEHDULE

A. METERING

1. Incoming Voltmeter with selector switches for each incomer
2. Ammeter with selector switches for each incomer

3. Ammeter & Voltmeter at each inverter output and bypass output
4. Frequency meter & power factor meter at one common point of output
5. Ammeter & Voltmeter at incoming of each UPS distribution boards
6. Ammeter at each rectifier output.
7. Battery charge/discharge meter

B. LED Indication

1. A.C. Mains 'ON'
2. Rectifier output 'ON'
3. Load on inverter
4. Load on bypass
5. Inverter synchronised to mains
6. Battery on float
7. Battery on boost
8. Fault (one lamp for all types of fault)

C. Audio-Visual Alarm (with Accept, Reset & Test facilities)

1. Mains failure
2. Rectifier failure
3. Inverter output over voltage
4. Inverter output under voltage
5. Inverter fuse failure
6. Rectifier fuse failure
7. Fan failure
8. Inverter temperature high
9. Static switch failure
10. Bypass input failure
11. Inverter de synchronised

NOTE : In order to protect Terminal Automation system (hardware-field & control Room) , UPS system shall be provided with TRANSIENT VOLTAGE SURGE SUPPRESSORS at all the input power supply ports of UPS.

PART 2 : NI-CD BATTERY

1.00 Scope

This standard covers the technical requirements of design, manufacture, testing at works and dispatch in well packed condition of batteries and accessories for providing 30-min. backup.

2.00 Standards to be followed

The design, manufacture and testing of the battery shall conform to the latest issue of the following standards:

IS: 10918 - Vented type Nickel Cadmium Batteries.

IEC - 623

3.00 Operating requirements

The battery shall be able to deliver rated ampere when discharged at the 1/2 hours rate of discharge to a final voltage of 1.1 V per cell for Ni-Cd battery under the ambient conditions.

4.0 General Design And Constructional Features

4.01 The battery shall be of Ni-Cd type rated for specified voltage. Each battery bank shall consist of a specified number of cells.

4.02 Each cell shall be contained in a closed top container preferably transparent and unbreakable and shall incorporate positive plates, negative plates and separators of adequate dimensions. Nickel-Cadmium battery of pocket plate type (positive plate).

4.03 The battery bank shall be complete with all necessary components such as lids, plugs, separators and buffers, inter-cell connectors, lead coated bolts and nuts cells insulators etc.

4.04 The required quantity of electrolyte plus 10% extra quantity shall be supplied in suitable non-returnable containers alongwith the battery.

5.0 Accessories

The following accessories shall be supplied with each battery bank: -

(a)	1 Set	--	For Ni-Cd battery , mild steel stand with alkali resistant paint is to be provided as per requirement.
(b)	1 Set	---	Inter-row, inter-tier and inter-stand connectors and takeoffs. These shall be sized suitably to have adequate current carrying capacity and mechanical strength.
©	1 Set	----	Cell Insulators
(d)	1 Set	---	Stand Insulators
(e)	1 No.	---	Centre zero cell testing voltmeter scaled 3-0-3 volts
(f)	2 Nos.	---	Syringe type Hydrometers for measuring the specific gravity of the electrolyte

(h)	1 set	---	Connecting bolt wrenches
(i)	1 No.	---	Rubber syringe for tapping cells
(j)	1 No.	--	Wall mounting type teak wood holder for Hydrometer and Thermometer.
(k)	1 No.	---	Acid/Alkali resisting funnel
(l)	1 No.	---	Acid/Alkali resisting jug
(m)	1 Pair	---	Rubber gloves
(n)	1 No.	---	Rubber Apron

6.0 In addition, the battery shall be subjected to stage inspection at works and inspection at site for final acceptance.

7.0 These inspections shall, however, not absolve the vendor from his responsibilities for making good any defect which may be noticed subsequently.

8.00 **Drawings and Documents**

8.01 Drawings and documents as per Annexure-1 shall be furnished by the Vendor.

8.02 All drawings and documents shall have following description written boldly

--- Name of client

--- Name of third party inspection / consultant

--- Enquiry/Order Number with Project/Plant Name

--- Code No. and Description

Annexure – 1 A

Documentation for Battery

Sr	Description	With BID	After Order	
			For Approval	Final

No		No. of copies	No. of copies	No. of weeks	No.of Copies
1	Specification Sheet	-	2	6	4
2	Technical Particulars	-	2	6	4
3	Dimensional drawings showing the cell arrangement on stand (Plan, front and side elevation) for each type of battery.	-	2	6	4
4	Illustrative and descriptive literature giving the complete details of construction of battery	--	--	--	4
5	Operation and maintenance instructions	--	---	---	4
6	Test Certificates ■ Type ■ Acceptance	 -- --	 -- --	 -- --	 4 4
7	Guarantee Certificates	---	--	--	4
8	Spare Parts list	4	--	--	4

Note :

5. Period of submission of drawings for approval shall be counted from the date of LOI.
6. All final documents shall be submitted prior to dispatch of equipments.

PART3 : GENERAL

13.1. SIGNAL, CONTROL, POWER, OFC CABLE

Refer Specs Given in DOCUMENT-I.

13.2. CABLE LAYING PROCEDURE

Refer Specs Given in DOCUMENT-I.

13.3. EARTHING

Refer Specs Given in DOCUMENT-I.

13.4. PAINTING

Refer Specs Given in DOCUMENT-I.

13.5. INSTALLATION, COMMISSIONING , INSPECTION, FAT, SAT & OTHER REQUIREMENTS

Refer DOCUMENT -II

TESTING, INSTALLATION, COMMISSIONING AND ACCEPTANCE OF SAFETY PLC AUTOMATION SYSTEM

GENERAL

On the basis of guidelines specified in this specification, vendor shall submit their own testing, installation, commissioning and acceptance procedure. For hardware, the procedures shall include purpose of test, test definition of input, procedure, results expected and acceptance criteria. For software, it shall include details of the method, list of tests, sequence of execution, results expected and acceptance criteria.

The testing and acceptance of the system shall be carried out on the mutually agreed procedures and criteria based on these guidelines and vendor standard procedures.

Following Instrumentation is to be covered for the Inspection & Testing:

a. Programmable Logic Controllers - Manufacturer's premises
b. UPS systems- Manufacturer's premises

c. Integrated Safety PLC Automation System- Manufacturer's premises
d. Hi-Hi Level Switch- Manufacturer's premises

NOTE :

- Third Party charges towards inspection of above items(excluding b above) shall be borne by vendor as part of main job.

FACTORY ACCEPTANCE TESTS (FAT) & ACCEPTANCE (OF COMPLETE SYSTEM INCLUDING FIELD UNITS)

Vendor shall demonstrate functional integrity of the system hardware and software at their factory/ premises. System is defined as 'Entire centralized instrumentation connected with field instrumentation (as per System Arch. Drawing)'. As a minimum, various type of field instruments (one each) which are to be serially interfaced with centralized instrumentation are to be made available by vendor during FAT.

No material or equipment shall be transported until all required tests are successfully completed and certified 'Ready for shipment' by BPCL.

BPCL reserves the right to involve and satisfy themselves at each and every stage of testing. They shall be free to request any specific tests on equipment considered necessary by them, although not listed in this specification. The cost of performing all tests shall be borne by the vendor.

For each test, a testing specification shall be prepared by the Vendor, to be submitted to the BPCL for approval at least six weeks prior to scheduled commencement of the test stage. This test specification should specify the system configuration, test methods, quantities, duration's etc. and criteria for success or failure of each test. Testing procedures shall be developed by Vendor based on relevant codes, international standards and practices followed for various items unless otherwise indicated separately.

Vendor to note that acceptance of any equipment or the exemption of inspection/ testing shall in no way absolve the vendor of delivering the equipment meeting all the specified requirements.

It shall be vendor's responsibility to modify and/or replace any hardware or software if the specified functions are not satisfactorily met during FAT.

FAT procedure shall be developed by the Vendor. The FAT shall include the testing and acceptance of both hardware and software systems, communications, system redundancy and interface testing. The FAT procedure shall include "pass/fail" criteria.

Vendor shall not replace any component/module/subsystem from the FAT configuration unless it has failed and a log of such failures shall be maintained during FAT. If a subsystem fails during FAT and is not repaired and made successfully operational within 4 hours of active repair time after the failure, the test shall be suspended and restarted all over again only after vendor has replaced the device and bought the system into a acceptable operational condition.

Testing and FAT shall be carried out in two phases. The minimum requirements for testing during these two phases shall be as follows:

- Under the first phase, vendor shall perform tests at his works to ensure that all components function in accordance with the specification for each type of test. A test report shall be submitted for BPCL review within two weeks of completion of this test. All subsystem shall undergo a minimum of 30 days burn in period. Following tests shall be performed by the vendor and reports shall be forwarded to BPCL/consultant (TPIA).
    a) Quality control test, which shall be carried out to ensure quality of all components and modules.
    b) System pre-test, which shall be of physical check of all modules, racks, cabinets etc.
    c) System power-up test, which functionality of all hardware and software.

- The second phase of testing shall systematically, fully and functionally test all hardware and software in the presence of BPCL. All subsystems shall be interconnected to simulate, as close as possible, the integrated system. Following minimum tests shall be carried out: -

  a) Visual and mechanical testing.
  b) High voltage and insulation testing.
  c) Functional testing.

  This shall include the simulation of each input and output to verify proper system response. The testing, as a minimum shall include:

  i) Complete system configuration loading.
  ii) Demonstration of all system builder functions including addition/deletion of an input/output, generation of dynamic graphics and other views, report generation etc. 100% checking of graphics.
  iii) 100% checking of logics configured in the tank farm system by connecting switch/lamp at input/output.
  iv) Checking of scan time.
  v) Checking of all tank farm system console displays, keyboard / printer/hard copier functions etc.
  vi) System diagnostic checking for all subsystems on local level as well as on console, including checking of the software for I/O modules/signal conditioning modules, when specified.
  vii) Checking of output status on processor failure.
  viii) Simulation of power failure and system restart self booting-up of system configuration and program after power restoration.
  ix) Hardware verification as per final BOM.
  x) Checking of correct changeover of redundant devices.

xi) Checking of communications and interface testing.

Vendor shall notify the BPCL at least three (3) weeks prior to factory acceptance test. In the event that representative arrive and the system is not ready for testing, vendor shall be liable for back charges for any extra time and expenses incurred.

INSTALLATION , TESTING AND PRE –COMMISSIONING CHECKS

Vendor shall offer the services of an installation team which would install the equipments in the field and the control room, lay the multicore / interconnecting cables at field and in the control room, check-out, test and commission the above.

Vendor's responsibility at site shall include all activities necessary to be performed to complete the job including;

a) Checking of completeness of supplies.
b) Installation of the control room mounted system including free supply equipment, if any and supervision of installation of field equipment.
c) Inter-cabinet cabling and termination
d) Check out equipment installation.
e) Checking of interconnections, hardware and software configuration, overall system functioning etc.
f) Loop checking & Termination.
g) Commissioning and on-line debugging of the system.
h) Ensuring proper installation & hydro testing of Process instrumentation subsequent to their installation in field.
i) Involvement during plant commissioning and performance of final acceptance test.

LOOP CHECKING

- Loop checking shall be carried out by vendor including checking the interconnections, configuration and overall system functioning.
- Vendor's scope of work in loop checking shall include in the control room, checking of interconnection between instrument/equipment, ferruling/tagging of interconnecting cables in control room, and performing overall loop performance check.
- Vendor shall coordinate with the field contractor for smooth and proper loop checking. Any discrepancy found during checking shall be brought to the notice of the Engineer-in-Charge. All loop checking shall be performed in his/her or his/her authorized representative's presence.
- Wherever receiver cards are used, the set point shall be generated by giving the input signal to receiver card.
- After loop checking is completed, vendor shall connect back any terminals and connections removed for loop checking.
- Loop test shall be performed after calibration of all instruments and leak test of signal lines. Loop tests shall be conducted to check the functional performance of all elements comprising the loop, thereby ensuring proper connections and operations.
- Before proceeding for loop tests the calibration results of individual elements shall be recorded and approval obtained from "Engineer In-charge" for correctness of installation,

measurements and calibration results.

a) All the components of the loop shall be checked for proper functioning. All field instruments connected to control room shall be loop checked at 0%,25%, 50% and 100% of full scale inputs (for both increasing and decreasing signals).
b) Interlocks schemes shall be checked for proper functioning, configuration and actuation.
c) All readings of loop check shall be recorded on a suitable format.

All the system functions shall be checked thoroughly for proper functioning.

a) Visual and mechanical
b) Complete system configuration loading
c) Demonstration of all system function
d) Checking of all system displays
e) Checking of correct functioning of all keyboards
f) Demonstration of all system diagnostics
g) Checking of proper functioning of all printers, hard copy unit and printing of all reports.
h) Checking of all disc drives
i) Complete checking of logic system; loading of user's program and checkout of results.

As a pre-commissioning requirement entire system(field & control Room instrumentation) is to be kept in Powered –on condition (through UPS) having dynamic displays of Process parameters at field instruments(in-built indicators) & graphics/ HMIs at OICs. All the interlocks shall also be functional as part of pre- commissionng requirement. This status is to be demonstrated by vendor to BPCL as a pre- requisite for commissioning.

COMMISSIONING

Subsequent to completion of activities referred above , commissioning activities shall be started by vendor in consultation with BPCL. Detailed commissioning procedure is to be submitted by vendor for BPCL approval.

TRIAL RUN

1. Detailed procedure for Trial Run is to be submitted by vendor for BPCL approval.
2. Trial Run of the entire integrated system shall commence after the satisfactory completion of installation , testing, pre-commissioning checks & commissioning activities (specified above). .
3. Trial Run will be conducted by Vendor for a continuous period of 60(Sixty) days to verify the satisfactory performance of the system.
4. In case of major failure in the system, the trial run shall be repeated for a period of another 60 days.
5. The Trial Run shall include testing of the full site configuration including all field devices and Interfaces to other systems. All the open/ close control loops & interlocks shall be tested during Trial run.
6. Engineering Team is to be deputed by vendor for the entire Trial Run period along with Test / calibration & other accessories required for the purpose.

SITE ACCEPTANCE TEST (SAT)

1. Detailed SAT procedure is to be submitted by vendor for BPCL approval.
2. SAT shall be started after successful completion of Trial Run. . SAT shall be conducted for a continuous period of 15(fifteen) days. During SAT, successful uninterrupted operation of the integrated system for 15 days is to be established.
3. In case of failure of SAT , same shall be repeated for another 15 days.

4. Engineering Team is to be deputed by vendor for the entire SAT period along with Test / calibration & other accessories required for the purpose.
5. The SAT shall be carried out in the presence of BPCL's representative and Engineer-in-charge or his authorised representative. The tests carried out in SAT shall be fully recorded and duly signed by all representatives participating in the testing.
6. This SAT shall include testing of the full site configuration including all field devices and interfaces to other systems. All the open/ close control loops & interlocks shall be tested during SAT. Test already performed during FAT shall be repeated during SAT.
7. The Vendor shall rectify at his own expense, all faults discovered at the SAT, to the satisfaction of the BPCL.

TRAINING :

The vendor shall undertake to train officers/ staff nominated by BPCL in following areas so as to make the participants fully versed with the system :-

- General design & system Engineering.
- Operating system software, application software, relevant RDBMS/ SQL database management system.
- Computer system hardware to be used.
- Design criterion, specification testing, functional aspects & installation of all other control room mounted & field mounted equipment.
- Operational & maintenance of individual equipment & overall system.
- Trouble shooting.

The Training period will be as follows:

a. 8 officers / staff for 5 days at vendor's works for Engineering & Operations Training.
b. 2 officers / staff for 3 days at each Site for Operations Training.

COMPREHENSIVE WARRANTY

- One year comprehensive warranty from the date of successful SAT or 18 months from the date of supply whichever is earlier. Vendor to take back to back warranty from OEMs for all equipment. All warranty documents from sub-vendors should be taken in the name of BPCL.
- During warranty, all software updates will be provided free of charge.

- During warranty, all repairs/ comprehensive maintenance (including supply of spares & consumables , quarterly preventive maintenance visits, breakdown visits by various OEMs) will be ensured by the Automation vendor.
- Vendor to take back to back warranty from respective OEMs for all bought out items from sub-vendors & submit the same to BPCL. All warranty documents from sub-vendors should be taken in the name of BPCL..
- During warranty, all repairs/ comprehensive maintenance including supply of spares & quarterly preventive maintenance visits , breakdown visits shall be made by the vendor for upkeep of the system..
- During the warranty period, vendor will take complete responsibility for any defect observed in the system. The price for this shall be also inclusive of all the cost including travel, stay, incidental expenses etc. complete.
- Vendor is required to furnish a Performance Bank Guarantee of 10% of supply order value inclusive of all taxes with a validity of 2 years. The performance bank guarantee shall be required to be extended suitably so as to provide guarantee for system performance till end of the comprehensive maintenance contract (CMC) period of 5 years. The last Bank guarantee shall be valid for 6 months after completion of CMC period.
- Expenses towards traveling /boarding/lodging of OEMs/ vendor's engineers during the warranty period are to be borne by vendor.
- Any software modification eg. making new graphics/ modifying existing graphics including installation of any hardware module in Vendor's Safety PLC System for new BPCL requirement any time is in vendor's scope of work.
- Bidder is required to quote minimum 10 % of contract value (supply part) as LUMP SUM charges towards Comprehensive maintenance contract (CMC) of 5 years post 1 year warranty period.

  In case:
  i) The vendor quotes more than 10 % of the contract value (supply part) as CMC charges, the quoted charges shall be retained as it is towards CMC charges for 5 years.
  ii) The vendor quotes less than 10 % of the contract value (supply part) as CMC charges, the Bid shall be evaluated considering 10% of the contract value (supply part) as CMC charges irrespective of vendor's quote for CMC charges. However, the quoted charges shall be retained as it is towards CMC charges for 5 years.

  The quoted rates for 5 years Comprehensive maintenance charges (CMC) as above shall be split year wise, post warranty period in the following manner for the purpose of releasing payment.

Year -1: 10 % of CMC (5 years) charges
Year -2: 15 % of CMC (5 years) charges
Year -3: 20 % of CMC (5 years) charges
Year -4: 25 % of CMC (5 years) charges
Year -5: 30 % of CMC (5 years) charges
At the end of CMC of 5 years post warranty period, BPCL shall have option to extend the Comprehensive maintenance contract for another 5 years or term as agreed at mutually agreed terms.

Any up-gradation required in hardware (Engg / Operator station etc.) shall be undertaken by BPCL through the Bidder at mutually agreed rates. However, no additional charges shall be paid towards software up-gradation.

POST WARRANTY PERIOD - COMPREHENSIVE AMC

Quarterly preventive maintenance visits by respective OEMs in addition to breakdown visits, during warranty & post warranty period for the following-

- Comprehensive AMC for 5 years (post warranty period) is an essential requirement of user.
- All the requirements mentioned during warranty period shall be applicable to these AMCs. However all the jobs as mentioned in Warranty period are required to be carried out by Automation vendor by way of deploying their Service Engineer at site. Some of the jobs are given below -
  - Service Engineer of Automation Vendor will carry out preventive maintenance for entire system as part of CAMC.
  - Breakdown maintenance (as required) will be carried out by automation vendor as part of CAMC.
  - Software/ hardware modifications required as per revised requirement of Installation during CAMC period are to be carried out by automation vendor as part of CAMC.
- The yearly AMC rates for 5 year post warranty period will be taken in main tender and same will be considered for commercial evaluation.
- Retail – Logistics will ensure award of above CAMCs under revenue budget.
- During AMC , all repairs/ comprehensive maintenance including supply of spares & quarterly preventive maintenance visits , breakdown visits by OEMs, will be ensured by the service engineer of the Automation vendor.
- During the AMC period, vendor will take complete responsibility for any defect observed in the system (i.e. in instrumentation, software, hardware, communication & networking media's/ protocol

interfacing with ISC, any minor debugging required in software for better compatibility with ISC system (in case it undergoes any changes), any other equipment & services related to the TLF system & rectify/replace the same immediately, free of cost, during start-up and on-line operation of TLF Loading facilities, within the Warranty period. The price for this shall be also inclusive of all the cost including travel, stay, incidental expenses etc. complete.

- Vendor is required to furnish a Performance Bank Guarantee of 10% of supply order value inclusive of all taxes with a validity of 2 years. The performance bank guarantee shall be required to be extended suitably so as to provide guarantee for system performance till end of the comprehensive maintenance contract (CMC) period of 5 years. The last Bank guarantee shall be valid for 6 months after completion of CMC period.
- Expenses towards Traveling /boarding/lodging of OEMs/ vendor's engineers during the AMC period are to be borne by vendor.
- Any software modification (due to addition of new product, pump, bay, valve, instrument, pipeline, tank, any batch controller as per approved makes etc., making new graphics/ modifying existing graphics) including installation of any hardware module in Vendor's SIL PLC based automation system for new BPCL requirement any time is in vendor's scope of work.

COMPLETION PERIOD:

i. 3½ Months – Delivery of Material at site

ii. 1½ Months - Installation , Power-On status of entire Terminal Automation system complete with fully functional monitoring & control systems [field & control Room instrumentation] .

iii. 1/2 Month- Commissioning

iv. 2 Months -Trial Run

v. 15 Days –Site Acceptance Test

PAYMENT TERMS :

SUPPLY PART

i. 80% of order value (Supply part) will be paid within 30 days after supply & against submission of Performance Bank Guarantee of 10% of supply order value inclusive of all taxes with a validity of 2 years. The performance bank guarantee shall be required

to be extended suitably so as to provide guarantee for system performance till end of the comprehensive maintenance contract (CMC) period of 5 years. The last Bank guarantee shall be valid for 6 months after completion of CMC period.

ii. 10% of order value (supply part) on erection. If erection is delayed for no fault of the successful contractor beyond 90 days of supply, payment shall be released by BPCL on receipt of BG for equivalent amount.

iii. 10 % order value (supply part) after commissioning & successful SAT. If commissioning is delayed for no fault of Honeywell beyond 90 days of supply, payment shall be released by BPCL on receipt of BG for equivalent amount.

ERECTION & COMMISSIONING SERVICES:

i. 90% of order value (erection & commissioning services) on completion of erection after submission of PBG equivalent to 10 % of order value towards erection & commissioning services, valid for 2 years.

ii. 10 % order value (erection & commissioning services) after commissioning & successful SAT. If commissioning is delayed for no fault of the vendor beyond 90 days of supply, payment shall be released by BPCL on receipt of BG for equivalent amount.

Annual Comprehensive AMC charges shall be paid by Installation Managers during AMC period of 5years post comprehensive warranty period quarterly.

After successful completion of 6 years (1 years comp. warranty + 5 years comp. AMC), PBG shall be returned.

LIQUIDATED DAMAGE CLAUSE

If the work does not complete in the stipulated time, the company reserves the right to recover liquidated damages at 0.5% of the total executed contract value for every week of delay or part thereof subject to maximum of 5 % of the total executed contract value until the work is satisfactorily completed.

PLACEMENT OF PURCHASE ORDER & WORKS ORDER

It is proposed to issue two nos. of orders for each location as given below :

a. Purchase Order for Supply items
b. Works order for Services [i.e Engg., erection , commissioning, testing , inspection, FAT, SAT , Training etc.]

The Purchase order & Works order referred above will be based on following duty structure-

1. For supply items as mentioned in RFQ/ BOQ , rates shall include following:
    a. Sales Tax

b. Excise Duty
c. Packing & Forwarding charges
d. Insurance & Octroi (if any)
e. Freight with FOR destination at site

2. Rates quoted for Erection jobs include the following:
   a. Works contract tax
   b. Service Taxes
3. Professional services (i.e. Engg., Documentation, Training, SAT, FAT etc.)are inclusive of Service Tax

PERFORMANCE CRITERIA / MEASURES:

System availability shall be 95 % or more during Comprehensive Warranty (1 years) & Post Warranty AMC period (5 YEARS) as per technical & operating specifications of the tender

Criteria for determining availability of proposed automation system:

- SAFETY PLC BASED CENTRALIZED AUTOMATION SYSTEM :50%
- UPS SYSTEM : 10%
- FIELD INSTRUMENTATION (VENDOR'S SCOPE OF SUPPLY) : 15%
- FIELD INSTRUMENTATION (BPCL SCOPE OF SUPPLY –INTEGRATED BY VENDOR WITH SAFETY PLC)) : 25%

PENALTY CRITERIA:

(A) <u>During comp. Warranty period :</u>

3% per week or part thereof of the 4% of contract value subject to max. of 4 % of contract value

BPCL will reserve the right to revoke PBG in following circumstances :

- If the system is performing less than 98 % continuously for more than 3 months,
- If the system is performing between 90 % continuously for more than 2 months,
- If the system is performing less than 80% continuously for more than 1 month

<u>During comp. AMC Period :</u>

3% per week or part thereof of the ANNUAL AMC value subject to 100 % of AMC

BPCL will reserve the right to revoke PBG in following circumstances :

- If the system is performing less than 98 % continuously for more than 3 months,
- If the system is performing between 90 % continuously for more than 2 months,

- If the system is performing less than 80% continuously for more than 1 month