

- Name of Work -

**EPC Contract for Providing Irrigation Water
Facility to Filling Kelamul Village Tank by Lifting
Water from KLBMC at Ch.8.20 km of Taluka
Kadana, Dist. Mahisagar.**

Tender Document

VOLUME II – [D]

Technical Specifications for Instrumentation Works

Government of Gujarat
Narmada Water Resources, Water Supply
& Kalpsar Department

Index

Chapter	Title	Page
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Index	1	
1.	GENERAL	1
1.1	GENERAL	1
1.2	TECHNICAL REQUIREMENT FOR INSTRUMENTATION AND AUTOMATION SYSTEM INTEGRATOR (SI)	2
1.3	DRAWINGS, DOCUMENTS AND SCHEDULES	2
1.4	LIST OF APPLICABLE INDIAN STANDARD AND CODE OF PRACTICE-	3
1.5	OPERATION CONTROL PHILOSOPHY OF PUMP, MOTOR AND ITS AUXILIARIES	3
1.6	PIPE AND INSTRUMENT DIAGRAM (P&ID)	6
2.	FLOW MEASURING SYSTEM	8
2.1	GENERAL	8
3.	FULL BORE ELECTRO-MAGNETIC TYPE FLOW METER	10
3.1	GENERAL	10
3.2	TECHNICAL SPECIFICATION	10
3.3	DIGITAL FLOW INDICATOR AND INTEGRATOR FOR ELECTROMAGNETIC	12
3.4	MEASUREMENT & PAYMENT	12
4.	LEVEL MEASURING SYSTEM	13
4.1	ULTRASONIC TYPE LEVEL MEASURING SYSTEM	13
4.2	CONDUCTIVITY TYPE LEVEL SWITCH	13
4.3	FLOAT AND BOARD TYPE LEVEL MEASURING SYSTEM	13
4.4	MODE OF MEASUREMENT & PAYMENT	14
5.	PRESSURE MEASURING SYSTEM	15
5.1	GENERAL	15
5.2	PRESSURE GAUGES	15
5.3	PRESSURE TRANSMITTER	15
5.4	PRESSURE SWITCH	16
5.5	MODE OF MEASUREMENT & PAYMENT	16
6.	CABINATES FOR FIELD INSTRUMENTS	17
6.1	GENERAL	17
7.	DATASHEET FOR INSTRUMENTATION	19
7.1	ELECTROMAGNETIC FLOWMETER	19
7.2	FLOAT AND BOARD TYPE LEVEL INDICATOR	20
7.3	PRESSURE GAUGES	21

1. GENERAL

1.1 GENERAL

- a. A complete instrumentation, and control system shall be provided to ensure the fully automatic control of the Pumping Station.
- b. Pumping Station instrumentation providing information relating to Pump operation and performance.
- c. Instrument & control system shall be designed, manufactured, installed and tested by the approved system integrator with proven Track Record to ensure the high standards of operational reliability. Instruments mounted in field and on panels shall be suitable for continuous operation. All electronic components shall be adequately rated, and circuits shall be designed so that change of component characteristics shall not affect plant operation.
- d. All Instrument & control equipment shall be new, of proven design, reputed make, as per approved Vendor List and shall be suitable for continuous operation. Unless otherwise specified, all instruments shall be tropicalised. The outdoor equipment's shall be designed to withstand tropical rain. Wherever necessary space heaters, dust and water - proof cabinets shall be provided. Instruments offered shall be complete with all the necessary mounting accessories.
- e. Electronic instruments shall utilize solid state electronic components, integrated circuits, microprocessors, etc., and shall be of proven design.
- f. Unless otherwise stated, overall accuracy of all measurement systems shall be $\pm 1\%$ of measured value, and repeat-ability shall be $\pm 0.5\%$.
- g. Unless otherwise specified, the normal working range of all indicating instruments shall be between 20% and 80% of the full-scale range.
- h. After a power failure, when power supply resumes, the instruments and associated equipment shall start working automatically.
- i. The instruments shall be designed to permit maximum interchange ability of parts and ease of access during inspection and maintenance.
- j. The field instruments i.e., the instruments mounted outside the control panel shall be mounted at a convenient height of approximately 1.2 m above grade platform.
- k. Unless otherwise stated, field mounted electrical and electronic instruments shall be weather proof to IP-65.
- l. The instruments shall be designed to work at the ambient conditions of temperature, humidity, and chlorine contamination that may prevail. The instruments shall be given enough protection against corrosion.
- m. Lockable enclosure shall be provided for the field-mounted instruments wherever required.
- n. All field instruments and cabinets / panel-mounted instruments shall have tag plates/name plates permanently attached to them.
- o. The performance of all instruments shall be unaffected for the $\pm 10\%$ variation in supply voltage and $\pm 5\%$ variation in frequency simultaneously.
- p. All wetted parts of sensors shall be made out of non-corrosive material capable of working with

chlorine content of 5 ppm.

- q. For all instruments (transmitting analogue signals) installed in the field (outside pump house), lightning protection units (LPU) shall be provided at both ends of the connecting cable for the protection against static discharges / lightning and electromagnetic interference.
- r. Unless otherwise specified, double compression glands shall be used for glanding the cable in field instruments and instrument control panel.
- s. Two wire transmitters shall be provided with on-line test terminals.
- t. This document does not fully describe all the components of control and instrumentation works for project components in scope but yet Contractor is responsible to build fully complete and functional system in end-to-end manner matching to the requirements of fully Automatic operation.

1.2 TECHNICAL REQUIREMENT FOR INSTRUMENTATION AND AUTOMATION SYSTEM INTEGRATOR (SI)

- a. Instrumentation and Automation system integrator called system integrator (SI) shall be in possession of minimum ISO 9001, 'Quality Management System' certification, conferred by an accredited agency.
- b. The SI must be an authorized system integrator for the PLC hardware and SCADA and Operational Database Management Software (ODMS) manufacturer.
- c. Valid authorization certificates shall be submitted for verification.
- d. The SI shall have similar kind of work experience of Instrumentation Control and Automation projects execution within India or outside India. It shall demonstrate capability and resources for integrating/interfacing control systems for different Original Equipment manufacturers products/system as well as coordination with multiple agencies for contract execution.
- e. All hardware and software proposed shall have been successfully in operation in a water application for a period of at least five (5) years and be from established and reputed OEM.
- f. The contractor shall provide and install all Instrumentation and Automation system required for proper operation of the Pumping station.

1.3 DRAWINGS, DOCUMENTS AND SCHEDULES

Contractor shall furnish following drawings / documents after award of the contract for review & approval.

- a. Process and instrumentation diagram shall comply with BS 1646 and BS 1553.
- b. General arrangement drawings of field-mounted instruments showing installation details.
- c. Instrument list & Instrument data sheets including Instrumentation range.
- d. Annunciators' arrangement and engraving details.
- e. Internal circuit and wiring diagrams for instrument and control panels.
- f. Schematic control diagrams & System architecture diagram.

- g. Instrument loop diagrams & Instrument Hook up drawings
- h. Instrument test and calibration report
- i. Instrument catalogue & operation and maintenance manual

1.4 LIST OF APPLICABLE INDIAN STANDARD AND CODE OF PRACTICE-

Sr. No	Standard no.	Title
1	API RP 551	Process measurement instrumentation
2	ISA 5.1 & ISA S5.4	Instrumentation symbols & identification & instrument loop diagrams
3	IS – 694, IS – 6346, IS – 1554 (Part I & II), IS – 5831s.	PVC insulated cables IS standards for Instrument power & signal cables
4	IS – 732 (part I)	Code of practice for electrical wiring installations
5	IS – 1651	Stationary cells and batteries, lead acid type (with tubular positive plates)
6	IS – 2147, IS13947 Part-I:	Degrees of protection provided by panel enclosures
7	IS – 3043	Code of practice for Earthing
8	IS – 4064	Switch fuse unit
9	IS – 5216.	Guide for safety procedures and practices in electrical work
10	IS – 8130	Conductors for insulated electric cables and Flexible cords.
11	IS – 8197	Terminal marking for electrical measuring instruments and their accessories.
12	IS – 8309	Compression type tubular terminal ends for aluminum conductors of insulated cables
13	IS – 10418	Specification for drums of electric cables
14	IS – 10810 s	Methods for test for cable
15	IEEE 472-1974	Surge Protection
16	IEC 61158-2	Communication Protocols
17	IEC 60381-1 & 2	Analog signal standards for voltage and current signals
18	IEC 60801-1, & IEC 61326	Electromagnetic compatibility for measuring instruments
19	IEC 60870 – 1 to 5	For Remote terminal unit (RTU), PLC & SCADA
20	ISO 6817	Flow measurement standard
21	ISO/IEC 17025	Flow meter calibration standard

1.5 OPERATION CONTROL PHILOSOPHY OF PUMP, MOTOR AND ITS AUXILIARIES

(This is given for reference and proper design of control system)

- a. Adequate and appropriate automation shall be designed and engineered using state of- art and

field proven technology to facilitate monitoring, control and all other functions associated with operation of pumping unit through user-friendly human machine interface (HMI).

- b. The automation system shall be designed with geographical & functional distribution of hardware in a multi-level hierarchy, viz. Level-0, Level-1 etc as applicable, to meet specific site requirements for monitoring, control, visualization & optimization of all major drives in the scheme unit.
- c. Interlinking of PLC panel of pumping station shall be provided with PLC- SCADA system to know feedback of all pumps start-stop-trip, Flow, level of sump, etc with GSM/GPRS communication system.
- d. Controlling of P.H parameters like Sump level, flow, pressure, etc shall be done by PLC-SCADA of pumping using GSM/GPRS modem.
- e. Operation philosophy of pumping station shall be same.
- f. Level of downstream sumps shall be controlled by regulating incoming water flow through inlet pipe using PLC-SCADA of pumping (With the increase in sump level of pumping station, pumps at main upstream pumping station shall be switched ON/OFF or by regulating valve on the inlet pipe line to sump of feeder pumping station).
- g. The automation system shall be structured in general, considering the following hierarchical levels:

Level-0: This level is also called field level. It is functionally responsible for generation, transmission & conversion of signal for input to the higher-level equipment's as well as signal-based activation for the final control/ operation. Primary sensing elements, proximity switches, converters, microprocessors based intelligent system etc, are in domain of this level.

Level-1: This level, also called supervisory level, is functionally responsible for supervision of the individual process equipment & function, control, visualization and regulation, guidance & optimization and control of process parameters to the desired level of perfection based on signals generated from field level. This level is also responsible for processing of signals for generating compatible control commands to control the process parameters by activation of the final control elements. This level is realized based on controllers & systems, input systems, data-based units, data communication, visualization system (HMI stations) and interface units for connectivity to the other levels of automation system. In addition to routine MIS functions, advanced process optimization functions comprising special control algorithms, mathematical computations etc. will be able to permit distribution of control and data acquisition functions throughout the entire pumping stations (Scheme).

The Level-1 automation shall basically comprise:

A programmable Logic Controller (PLC) based automation system. Modes of operation shall be:

Local mode: Local control Station (LCS) shall be provided for all motors/ drives & shall have required numbers of push buttons for operation of drives. HV motors shall be provided with hard-wired interlocking in MCC with fail safe operation.

Remote: In remote mode, the equipment can be started from control room only. Once the remote mode of operation is selected, then from HIM with the help of Key board/ mouse/soft keys above

three modes of operation can be selected. This mode is further divided into following three modes:

- Operator mode. • Auto mode. • Computer mode.

h. Pump starting/ closing logic and interlocks for Operating conditions, interlock protections mentioned below are indicative only however same can be modified as per OEM & client requirement

- i. Provide Local/ Remote, Automatic/ Semi auto/ manual operation of pumping station equipment including drives, actuator sequentially as predefined.
- ii. On, Off, control shall be from local Push button station, switchgear/ PMCC, PLC & SCADA with start permissive, trips, safety interlocks to optimize the operation.
- iii. Operator shall select the pumps to run/standby depending on availability of pump/motor. Pump running hours shall be displayed in HMI for respective pumps to guide operator about which pump to run.
- iv. Flow meters continuously monitors flow rate, cumulative flow which communicate with PLC/SCADA, pump operation can be controlled on water requirement.

b. Logic for pump starting:

After single push button command following operation will take place in sequence.

- i. Lubrication, cooling system shall start in case it is provided as per main pump, motor OEM recommendation.
- ii. Once start command given to main pump motors it will start through soft starter and capacitor cubicle circuit will be 'ON'. Soft starter shall get bypassed once the pump comes to normal speed.
- iii. Corresponding pump discharge valve will get open.
- iv. The pumps will be started in sequence, at an interval such that the subsequent Pump starts after the previous pump has attained full speed.

c. Logic for pump closing

After single push button command following operation will take place in sequence.

- i. Main pump motors it will stop and capacitor cubical circuit will switch off.
- ii. Corresponding pump discharge valve will get closed.
- iii. Lubrication, cooling system shall stop in case it is provided as per main pump motor OEM recommendation.

d. Control & Interlocks

- i. A minimum water level has to be maintained in the sump
- ii. Start permissive for VT pumps will be obtained when sump level is not low, which is derived from the level transmitter.
- iii. Low-Low sump level set point activation will trip all the running pump.
- iv. When motor winding temperature or pump/ motor bearing goes very high – the

corresponding pump will trip and winding temperature/ bearing temperature very high alarm will get generated. Set values shall be as per OEM recommendation.

- v. The Pressure transmitter is provided at the discharge of each pump will enable alarm at high pressure.

e. Start Permissive Interlock for VT pumps:

- i. Sump level is not low
- ii. Main header valve open.
- iii. Motor winding temperature/ Bearing temperature not High.
- iv. Electrical protection relay /Motor protection relay not operated.
- v. Pump selection feedback available.
- vi. Stop feedback from pump available.
- vii. VT Pump discharge motorized valve is closed. Supply is available to the valve.
- viii. Corresponding Lubrication, cooling system is in service and require parameters for starting of the pump are available, in case it is provided as per main pump, motor OEM recommendation.

f. VT PUMP shall trip in any of the following condition.

- i. Sump level very low
- ii. Motor winding / pump motor bearing temperature very high.
- iii. Pump discharge motorized valve closed.
- iv. Electrical protection relay /Motor protection relay operated.
- v. Corresponding Lubrication, cooling system trips or is in service and require parameters for the pump are not available, in case it is provided as per main pump, motor OEM recommendation.

g. Alarm / Indication

- i. Following audio visual alarm shall be provided local panel/ Switch gear control panel/ PLC/ SCADA Monitoring
- ii. Sump level low, very low and low very high.
- iii. Discharge header pressure high.
- iv. Motor winding temperature high and very high.
- v. Pump/ Motor bearing temperature high and very high.
- vi. Pump discharge valve jam/ trip.
- vii. Vibration monitors shall be provided at motor, should any abnormality occur; there will be audio visual alarm.

1.6 PIPE AND INSTRUMENT DIAGRAM (P&ID)

Agency has to submit complete P & ID of the pump house and water supply scheme, its system architectures. It should include following:

- a. Individual Pump, motor, discharge pipes, bellows, non-return Valves, butterfly valve, sluice valve & kinetic air valve etc & actuator where ever used. Common discharge header & valves with actuator on it. All these Should be shown with exact location including technical details of each Component Pump & motor lubrication system, water cooling system, where used in the pump house.
- b. Sump De-watering / De-silting system
- c. Instruments to be use for measuring pressure, temperature, level, flow (Gauges, switches, transmitters, monitoring system including high/ very high, low/ very low alarm & trip with hooter & annunciators.

2. FLOW MEASURING SYSTEM

2.1 GENERAL

- a. Flow measuring system shall consist of flow sensor/ transducers, flow computer & flow transmitter, digital flow indicator & integrator and any other item required to complete the system. The flow sensor and Transmitter should be separated by a corrosion resistant material.
- b. Flow sensors / transducers shall be rugged in construction and shall be suitable for continuous operation. Flow transducers shall have waterproof construction and shall be suitable for installation on underground /above ground pipelines. In line type/removal of flow sensors shall be possible when pipelines are pressurized and should be leak-proof at 1.5 times the working pressure at that location. This is not applicable if electromagnetic in line flow meter is considered.
- c. To avoid the effects of disturbances in the velocity profile, a straight and uninterrupted run, upstream as well as downstream from the location of the flow sensor shall be provided, as required by the flow meter manufacturer.
- d. The exact location of flow transducers shall be finalized in consultation with Engineer-in-charge Representative.
- e. The flow transmitter shall be suitable for field mounting and shall accept input from the flow transducer. It shall process the input signal and provide 4- 20mA DC output proportional to flow rate. Flow transmitters shall have LCD display to indicate instantaneous flow rate. The flow range shall be adjustable. The flow meters shall be suitable for measuring flow at velocities of water from 0 to 4 m/sec.
- f. Flow measurement shall not be affected by physical properties of water viz., temperature, pressure, viscosity, density etc., within given limits. Contractor shall provide compensating electronic circuits, if required.
- g. Contractor shall construct a suitable concrete chamber for enclosing flow transducer to be mounted on underground pipelines. A concrete cabin shall be constructed above the chamber for housing the flow transmitter. A concrete cabin shall be constructed for housing the flow transducer and the flow transmitter to be mounted on surface pipelines.
- h. The flow transmitter shall be microprocessor based and shall have self-diagnosis facility.
- i. Measurement of flow at site will be by full bore Electromagnetic type flow meter.
- j. Electromagnetic Flow Meter shall be installed on discharge header pipeline and tail end for flow measurement.
- k. Flow meters shall be suitable for the water turbidity at site during various seasons.
- l. A lockable enclosure shall be provided for the flow transmitter cum computing unit.
- m. The technical details are as under.

Sr.No.	Description	Particulars
A	Process Liquid	

1	Liquid Type	Raw water
2	Type of solid	To be ascertained
3	Size	As per price bid
B	Operating Condition	
1	Operating pressure	Max. up to 20 kg/cm ²
2	Operating temperature	0°C to 50°C.
C	Flow Sensor	
1	Type	Pulsed DC excitation
2	End Connections	Flanges of carbon steel
3	Electrode Material	SS 316 (Stainless steel) /Platinum /Tantalum
4	Meter Tube	SS 304 (Stainless steel)
5	Electrode type	Round Head electrodes (Bullet Nose)
6	Lining Material	Hard Rubber (SBR/EPDM)/Neoprene
7	Coil Housing	SS 304 with fully welded construction/CS/Diecast with anticorrosive Painting.
D	Flow transmitter cum computer	
1	Type	Multi-channel microprocessor based with facility to input pipe size, engineering units, measuring span etc.
2	Power supply	240 V AC, 50 Hz, Zero and span adjustment, battery backup for totalized flow.
3	Communication	RS-485/Modbus
4	Protection category	IP 68
5	Measuring accuracy	Measuring accuracy +/-0.5% of Measured Value inclusive of Linearity, repeatability.
E	Digital Flow Indicator	
1	Type	Microprocessor based combined unit, 12.5mm or higher digit height, Input: from level transmitter trough RS-485/Modbus, Accuracy: ±0.25% of span or better
2	Display	Min. 2 line back lit LCD for indication of actual flow rate, forward, reverse, sum totalizes
3	Protection Category	IP67
4	Enclosure	Die Cast Aluminum with polyurethane finish with glass window
5	Power Supply	240 V AC, 50 Hz
6	Mounting	Panel mounted

3. FULL BORE ELECTRO-MAGNETIC TYPE FLOW METER

3.1 GENERAL

SITC of Full Bore Electromagnetic flow meter with factory calibrated, Regular Power Operated, flanged connection, Flow sensor, Indicator, transmitter and totalizer with all accessories viz. surge arrestor, associated cables, cabinets, hardware, etc. complete as per following specifications: a) Flow Meter/ Sensor- DC pulsed type, IP 68 Protection, Flanged process connection as per IS 1538 or equivalent standard, SS304/ Metallic Alloy Flow Tube, SS316/ SS 316 L/ Hastelloy Sensor, SS316/ Hastelloy Grounding Ring/ Inbuilt Grounding Electrode, Neoprene/ Polyurethane/ Hard Rubber/ Rilsan lining, SS304/ Die Cast Aluminium/ Carbon steel with Anticorrosive Paint Coil Housing with Junction Box, CS flanges. b) Flow Transmitter/ Converter (Remote Field Mounted): Microprocessor based, Modular design, 2 line LCD for indication of actual flow rate, forward, reverse, sum totalizer display, $\pm 0.5\%$ accuracy at 0.3 to 4 m/sec velocity, 4 to 20 mA with HART/Modbus output, one scalable pulse, one status output, IP 67 protection, Die cast aluminium/ polycarbonate/ SS316 with Anticorrosive Paint/ PU finish with glass window enclosure, Inbuilt EEPROM and Data Logger, 20 meters cable length for sensor to transmitter communication etc. along with wall mounted/ stand mounted cabinet. (As per site conditions sensor cable) with required accessories, erection hardware, necessary mounting support etc. The control cable shall be required up to LT panel from Flow meter.

Size: - as per price bid of tender document.

3.2 TECHNICAL SPECIFICATION

Inline electromagnetic flow meter shall be as per following specs:

- a. Electromagnetic Flow Meter shall be a velocity sensing electromagnetic type, microprocessor-based signal converter, sealed housing, flanged tube meter for 1.6 Mpa working pressure.
- b. EM type flow meter shall be manufactured as per BS EN ISO 6817 Standard measurement of conductive liquid flow in closed conduits.
- c. Full bore electromagnetic flow meters shall be calibrated according to ISO standard.
- d. The flow meter shall be capable of measuring bi-directional flow.
- e. Electromagnetic Flow meters shall withstand maximum working temperature of about 50 d C and working pressure of 16 kg/cm² (1.6 Mpa), unless specified otherwise.
- f. Full bore electromagnetic flow meter shall consist of flow sensor (i.e., flow tube), flow transmitter, flow computing unit and flow indicator and integrator and any other item required to complete the system.
- g. Flow meter shall have waterproof construction and shall be suitable for installation on underground pipe lines with the protection of IP 68 and submerged condition.
- h. To avoid the effect of disturbances in the velocity profile a straight and uninterrupted run, upstream as well as downstream from the location of the flow meter shall be provided as required by the

flow meter manufacturer. Its installation shall be such to ensure flow meter & pipe remains filled with water.

- i. Taper pieces required for installation of flow meter shall not exceed an angle of 8° in order to avoid disturbance in flow profile.
- j. Flow tube flanges and transmitter housing shall be properly earthed. Earthing Ring/ Electrode shall be provided.
- k. Accuracy of electromagnetic flow meter shall be within $\pm 0.5\%$ at site including instrument accuracy and installation & other errors. This is to be measured and verified by OEM after installation at site. The accuracy should be inclusive of linearity, hysteresis, repeat-ability, temperature and pressure effects. In case of overall accuracy error more than $\pm 0.5\%$ after installation then necessary changes in installation and recalibration shall be done to achieve above accuracy.
- l. Flow meter shall have empty pipe line alarm facility.
- m. Zero span adjustment facilities shall be providing in flow meter.
- n. Flow tube shall be rugged in construction and shall be suitable for continuous operation.
- o. Flow tube shall have waterproof construction and shall be suitable for installation on underground /above ground pipe lines.
- p. The distance between transmitter and flow tube shall be maximum 250 meters.
- q. The flow transmitter shall be mounted separate from the flow tube, connected by a cable. The flow transmitter and flow computation/ evaluation unit shall be mounted in field mounted enclosure/ Cabinet with open/ close monitoring device
- r. The flow computer shall be microprocessor-based signal converter with self-diagnostic feature, high speed signal processing communication protocol like HART, mod bus RS-485, RS-232 and transmitter shall be a single unit suitable for panel mounting.
- s. It shall accept inputs from flow tube process the signals and shall provide an output proportional to the flow rate.
- t. The flow meter shall be suitable for measuring flow at velocities of water from 0.25 m/sec to 5 m/sec (10 m/sec maximum).
- u. Electromagnetic flow meter shall be compatible to GSM/GPRS connectivity.
- v. Power supply to the electromagnetic flow meter and transmitter shall be 240v Ac, 50Hz. It shall have UPS battery back up at pump house and solar operated panel with rechargeable battery backup for remote location.
- w. The flow transmitter shall be suitable for field mounting and shall accept input from the flow meter. It shall process the input signal and provide 4-20 mA DC output proportional to flow rate.
- x. Flow transmitters shall have LCD display to indicate instantaneous flow rate. The flow range shall be adjustable. Control and power cable from flow measuring unit to transmitter panel and any other item required to complete the system cabinets & hardware shall be provided.

- y. Contractor shall construct a suitable concrete chamber for enclosing flow transducer to be mounted on underground pipelines. A concrete cabin shall be constructed for housing the flow transducer and the flow transmitter to be mounted on surface pipelines.
- z. Concrete chamber size shall be to provide housing of flow meter, possibility to carry out maintenance & accuracy checking of flow meter with ladder for approach to flow meter, provide proper sealing to prevent water accumulation and theft proof panel enclosure with necessary mounting arrangements for Flow transmitter, battery, GSM modem and all required accessories shall be provided as per client requirement.

Note: Digital Flow indicator and flow integrator shall be a combined unit mounted on panel.

3.3 DIGITAL FLOW INDICATOR AND INTEGRATOR FOR ELECTROMAGNETIC

- a. Digital flow indicator & integrator shall be Microprocessor based combined unit, 12.5mm or higher digit height, Input: 4-20 mA DC (isolated) from flow transmitter, Accuracy: $\pm 0.25\%$ of span or better and Min. 2 line back lit LCD for indication of actual flow rate, forward, reverse, sum totalizes, etc.
- b. It shall have facility for retaining flow totalizer data even if the power supply fails.
- c. Digital flow indicator & integrator for flow meter shall be installed immediate after Header and panel mounted with IP 52 protection or better as per application.
- d. Power supply to the digital indicator shall be 240v ac, 50Hz.
- e. Flow indicator cum totalizer shall have UPS of required capacity with battery backup.

3.4 MEASUREMENT & PAYMENT

Unit of Measurement: Per complete flow meter set installed and commissioned

The Payment shall be made on Number basis.

Includes:

- a. Flow meter (sensor + transmitter)
- b. Accessories (surge arrestor, cables, hardware etc.)
- c. Installation and support fabrication
- d. Testing, calibration, and documentation submission

4. LEVEL MEASURING SYSTEM

4.1 ULTRASONIC TYPE LEVEL MEASURING SYSTEM

- a. Ultrasonic type level measuring devices shall comprise a transducer, a transmitter, remote level indicator and all other items required to complete the control system.
- b. The level sensor and the field-mounted transmitter shall be separate and interconnected by integral cable of sufficient length.
- c. The transducer shall be suitable for flange or bracket mounting as required and shall be environmentally protected as per IP 65. It shall have ambient temperature compensation and adjustable datum setting facilities.
- d. The design and application of this ultrasonic level meters shall take into account the vessel or channel construction, the material size, shape, environment, process fluid or material, the presence of foam, granules, size etc.
- e. The installation shall avoid any degradation of performance from spurious reflections, absorption, sound velocity variations, sensor detection area, temperature fluctuations, specific gravity changes and Condensation. For application where spurious reflections are unavoidable the control unit shall be provided with facilities for spurious reflection rejection.
- f. The transmitter will provide an isolated 4-20mA 2 wire o/p and compatible to GSM/GPRS modem connectivity for sending data to PLC-SCADA or MPS.
- g. To remove the effect of water turbulence in reservoirs averaging facility should be provided in the transmitter unit.
- h. Level transmitter is also required on the sump for sump level High / Low alarm & very high/ Very low trip and sequential operation purpose.

4.2 CONDUCTIVITY TYPE LEVEL SWITCH

- a. The electrodes used for conductivity level switches shall be of stainless steel (SS316).
- b. The electrodes shall be insulated such that only the tip of each electrode is exposed to the liquid at the operating level.
- c. Control unit (IP 65) operating with level electrodes shall have adjustable sensitivity. Separate potential free contacts shall be provided in the control unit for each level of detection.
- d. Level switches are required for level High / Low alarm & very high/ Very low trip and sequential operation purpose.

4.3 FLOAT AND BOARD TYPE LEVEL MEASURING SYSTEM

- a. Float board type Level measuring system shall be provided for Sump/ Fore-bay.
- b. Float and board type level measuring system shall be provided with all necessary accessories like anchor plate, bracket, fasteners, etc. for complete the system.

- c. MOC of float, guide wire rope and float wire rope shall be SS316 and calibrated board shall be AL white powder coating with black graduations and numerical.

4.4 MODE OF MEASUREMENT & PAYMENT

Unit of Measurement: Per complete set installed, tested, and commissioned.

The Payment shall be made on Number basis.

5. PRESSURE MEASURING SYSTEM

5.1 GENERAL

- a. Pressure measuring system shall consist of pressure transmitter and digital Pressure indicator and any other items required to complete the pressure measuring system.
- b. It shall be diaphragm type and provided with impulse tubing, fittings, two valve manifolds with drain cock and calibration valve.
- c. Local & remote unit shall be provided.

5.2 PRESSURE GAUGES

- a. Pressure gauges shall comply with IS 3624/ BS 1780. Glycerin filled dial shall be provided where the gauge is subjected to pressure pulsation and / or vibrations. The internal parts of pressure gauge shall be stainless steel.
- b. The minimum diameter for round pressure gauges shall be 150 mm unless specified otherwise or where the gauge forms part of a standard item of equipment.
- c. Accuracy of pressure gauge $\pm 0.1\%$ of the full scale. The zero and span of pressure gauge shall not change by more than 0.1 % of the span per °C changes in ambient temperature.
- d. The internal parts of pressure gauge shall be stainless steel.
- e. Weather protection shall be IP65 or better as per application.
- f. Vented part shall be of SS 316.
- g. Pressure gauge shall be provided on discharge of each pump, discharge header & compound pressure gauge shall be provided on suction side of pump.
- h. All pressure gauges to be provided with isolation valve.

5.3 PRESSURE TRANSMITTER

- a. Pressure transmitter shall be rugged in construction and shall be suitable for continuous operation.
- b. Pressure gauge & transmitters shall be designed for operation over 130% of full range.
- c. Pressure transmitters shall be suitable for field mounting. They shall provide 4-20 mA DC output proportional to pressure and compatible to GSM/GPRS modem connectivity for sending data to PLC-SCADA of MPS.
- d. Transmitter output shall be isolated and shall be suitable for transmitting over long distance.
- e. Pressure transmitters shall have high degree of weatherproof protection as specified in technical particular.
- f. Transmitter will be mounted on a 2" pipe stand installed near the process tapping with first isolation valve to provide operator convenient height from floor level of 1.2 meters from floor level.

- g. Required SS valve manifold and SS impulse to be provided.
- h. FRP enclosures shall be provided for the transmitters mounted outside the pump house.

5.4 PRESSURE SWITCH

The working length of socket and spigot pipes shall be 5 m, 5.5 m, or 6 meters.

- a. Electro mechanical pressure switch shall be provided to detect high pressure in the surge vessel & discharge header of the pumping station.
- b. Pressure switch shall have manually adjustable set point and differential pressure switching level.
- c. Pressure switch shall be complete with impulse tubing, fittings, two valve manifolds with drain cock and calibration valve.
- d. Pressure switch are required on discharge line pressure High alarm.

5.5 MODE OF MEASUREMENT & PAYMENT

Unit of Measurement: Per complete set installed, tested, and commissioned.

The Payment shall be made on Number basis.

6. CABINATES FOR FIELD INSTRUMENTS

6.1 GENERAL

- a. A Cabinet shall be provided for enclosing instruments and associated accessories such as transmitter, SPDS, terminal blocks, Flow transmitter, Batteries, GPRS modem etc. mounted at all FM locations.
- b. It shall be fabricated from Glass fiber plastics (GRP) as per CSA Standard C22.2 and shall be suitable for wall mounting or pedestal mounting as required.
- c. 304 stainless steels shall be used on all external hardware and Bosses utilize threaded brass inserts accepting 10-32 screws.
- d. It shall be light weight, Water-tight, dust-tight, Non-conductive, impact resistant, UV resistant type.
- e. Size of panel shall be as per requirement and installation layout and location shall be decided by Engineer in Charge.
- f. The cabinet shall conform to IP-65 protection and shall have built in locking facility. The cabinet shall be earthed properly. Rain shield protection against incidental water ingress for NEMA 3R enclosures and temperature range shall be (-76°F to +250°F) (-60°C to +120°C) with Non-flame propagating.
- g. Material cuts, drills, punches, and saws on panel shall be easy and accurately.
- h. A GRP plate/pipe, as per the requirement, shall be provided in the cabinet for mounting and connecting cables etc. Entire arrangement shall be corrosion proof.
- i. Unauthorized opening panel door detection or theft proof system shall be provided.

Technical specifications	
Material	GRP (Glass Fiber Reinforced Plastic)
Raw Material	Sheet Molding Compound (SMC)
Base Color	RAL7035 (other colors available on request)
Cover Color	RAL7035 (other colors available on request)
Gasket Material	Neoprene / PU
Lock (If Applicable)	Cast Aluminum / SS
Cover Fixing Hardware	MS / SS
Toxicity	Halogen Free
Water Absorbance	Max. 0.7 %, ASTM D 570
Insulation Resistance	>100 M ohm
Protection Classification	
Thermal Ageing (70.c / 96 hrs.)	Withstood

Ingress Protection	IP 65
Impact Resistance	≥IK 07
Rating	
Flammability Rating	Low Flammability (UL-94)
Glow Wire Test @ 960°C	Withstood
Impact Resistance	> 7 Nm, EN 50014

7. DATASHEET FOR INSTRUMENTATION

7.1 ELECTROMAGNETIC FLOWMETER

SR NO.	DISCRIPTION	PARTICULARS
A	Process Liquid	
1	Liquid Type	Raw water
2	Type of Solid	To be ascertained
B	Operating condition	
1	Operating Pressure	Max. up to 20 kg/cm ²
2	Operating temperature	0°C to 50°C.
3	Operating Range	Bidder to Furnish
4	Size & quantity	As per price bid
C	Flow Sensor	
1	Type	Pulsed DC excitation
2	Wetted parts	SS 316
3	Sensor Output	4-20 mA
4	End connections	Flanges of Carbon steel
5	Electrode Material	SS316/Platinum
6	Coil Housing	SS 304 with Fully Welded / Anti corrosive painting
7	Meter Tube	SS304
8	Electrode Type	Round Head Electrodes
9	Lining Material	Hard Rubber (SBR or EPDM)/Neoprene
10	Protection Category	IP 68
D	Flow Transmitter	
1	Type	Multi-channel microprocessor based with facility to input pipe size, engineering units, measuring span etc.
2	Power supply	240 V AC, 50 Hz, Zero and span adjustment, battery backup for totalized flow.
3	Communication	RS-232, Modbus, Ethernet
4	Protection category	IP 67
5	Measuring accuracy	Measuring accuracy +/- 0.5% of Measured Value inclusive of Linearity, repeatability.

6	Output contacts	2 SPDT Potential free changeover contacts @ 240V, 5A AC / 220V, 0.5A DC
E	Digital flow indicator & integrator	
1	Type	Microprocessor based combined unit, 12.5 mm or higher digit height, Input: 4-20 mA DC (isolated) from flow transmitter, Accuracy: $\pm 0.25\%$ of span or better
2	Display	Min. 2 line back lit LCD for indication of actual flow rate, forward, reverse, sum totalizes
3	Protection category	IP 52
4	Enclosure	Die Cast Aluminum with polyurethane finish with glass window
5	Power supply	240 V AC, 50 Hz
6	Mounting	Panel mounted

7.2 FLOAT AND BOARD TYPE LEVEL INDICATOR

Sr. No.	DESCRIPTION	PARTICULARS
A	Process Fluid	
	Liquid Type	Raw water
	Type of solid	To be ascertained
B	Operating Condition	
	Operating temp	0°C to 50°C
C	Make	As per approved vendor list
D	General	
1	Service	Level measurement in sump/Forebay
2	Quantity & Size	As per price bid
3	Resolution/Accuracy	$\pm 10\text{mm}$
4	Scale colour	White
5	Numerals colour	Black
6	Measuring Range	As per price bid
E	Material	
1	Float	SS316
2	Guide Wire	SS316

3	Spring Assembly	Spring Steel
4	Board	Aluminium white powder coating with black graduation.
F.	Mounting	Underground sump
G	Local Indication (Direct)	Powder coated Red CI pointer with Nylon Rollers
H	Accessories	Anchor plate, Bracket, fastener etc.

7.3 PRESSURE GAUGES

Sr. No.	DESCRIPTION	PARTICULARS
A	Process Condition	
1	Process Fluid	Raw water
2	Type of solid	To be ascertained
B	Operating temp	0°C to 50°C
C	Make	As per approved vendor list
D	Type	Bourdon type glycerin filled
E	Range	0-20 kg/cm ²
1	Scale	Black lettering on white in 270 Degree
F	Dial Size	150 mm dia.
G	Accuracy	± 1 % full scale and weather protection class IP 67
H	MOC Body and wetted part	SS 316
I	Over-range protection	125% of max range
J	Adjustment	Micro-meter screw for zero. Internal micro-meter screw for range
K	Accuracy	±1% full scale
L	Safety feature	Blow out disc
M	Dial Type	White background on scale in black
N	Pointer	SS with micro zero adjustment
O	Applicable Standard	IS-3624 / 1996
P	Process connection	As per site requirement
Q	Switch Contact	1 NO + 1 NC
R	Switch Rating	24 VDC, 2A
S	Switch Type	Micro Switch