

**Measurement Instruments:**

All the primary Instruments like Microprocessor based (Smart Type) transmitters including temperature transmitters employing HART protocol, thermocouples & RTDs, Transducers, Ultrasonic / Guided Radar type level transmitters, Pressure/Diff. Pressure/Flow/Level transmitters & Gauges, Flow Sensing Elements (Orifice Plates, Flow Nozzles, Venturi, Coriolis Type Mass Flow Measuring System etc.) , Ultrasonic Flow Transmitters, Density meter, Magnetic Flow meter, control valves, on-off valves, analyser etc. shall be provided on as required basis meeting functional redundancy, availability and reliability requirements of the specification as indicated in enclosed tender specifications.

1. All the instruments which are required to implement the control philosophy as specified in this document and as finalized during detailed engineering shall be provided by the Contractor within his quoted price.
2. All Instruments which are Integral to equipment like pumps, motors etc. / skid mounted instruments and are not indicated in specification, shall include in relevant sub-sections, but are required for control, monitoring and operation of the equipment/plant/ Systems are to be provided by the Contractor to meet process requirements.
3. Type of Instruments: For sequence, protection, control and alarm circuits, electronic transmitters, temperature elements with temperature transmitters etc. are to be provided. Process actuated switches may be accepted if the same is as per the standard practice of equipment supplier.
4. All weather Local Panel fitted with integral Air Conditioner shall be provided for housing analysers etc. if the same are not kept in AC rooms.
5. Minimum specifications mentioned below. The remaining other instruments which is not specified in the tender shall be followed as per the OEM standards with the approval of Employer/NTPC.
6. Contractor to note that (Wherever applicable as per HAZOP study) wherever single transmitter is indicated in P&ID for both interlock and indication / control, it shall be replaced with two transmitters, one 4-20 mA + HART transmitter for interlock and one additional 4-20 mA + HART transmitter for indication / control.
7. Handheld communicators/calibrators, Universal type intrinsically safe dust-proof along with battery and battery charger shall be suitable for all make / model nos. of transmitters and positioners. Otherwise, 1 no. handheld configurators shall be provided for each different type of instrument.
8. FRP canopies for field mounted electronic/ electrical instruments e.g., transmitters, positioners, temperature element heads and junction boxes etc.
9. Accessibility of instrument: Any instruments not accessible from grade / platform, those instruments shall be provided with accessing platform.

S. No	Features	Essential/Minimum Requirements
<b>Electronic Transmitter for Pressure, DP, DP based Flow &amp; Level Measurement</b>		
1	Type of Transmitter	Microprocessor based 2 wire (loop powered) type, Hart protocol compatible.

2	Accuracy	$\pm 0.1\%$ of calibrated span (minimum).
3	Output signal range	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol).
4	Turn down ratio minimum)	10:1 for vacuum/very low-pressure applications (i.e. pressure $\leq 200\text{mmWC}$ ). 5:1 for very high-pressure applications (i.e. pressure $\geq 200 \text{ Kg/cm}^2$ ). 30:1 for other applications.
5	Stability	$\pm 0.1\%$ of calibrated span for six months for Ranges up to and including $70 \text{ Kg/cm}^2$ . $\pm 0.25\%$ of calibrated span for six months for Ranges more than $70 \text{ Kg/cm}^2$
6	Zero and span drift	+/- 0.015% per deg.C at max span. +/- 0.11% per deg.C at min. Span.
7.	Load impedance	500 ohm (minimum).
8.	Housing	Weather proof as per IP-65, metallic housing with durable corrosion resistant coating.
9.	Over Pressure	150% of max. Operating pressure.
10.	Connection (Electrical)	Plug and socket type.
11.	Process connection	1/2 inch NPT (F).
12.	Span and Zero	Continuous, tamper proof, Remote as well as manual adjustability from instrument with zero suppression and elevation facility.
13.	Accessories	-Diaphragm seal, pulsation dampeners, siphon etc. as required by service and operating condition. -2 valve manifold for absolute & Gauge pressure transmitters, 3-valve and 5 valve manifold for DP/Level/Flow applications. The valve manifold shall be non-integral type (except Fuel Oil area) -For hazardous area, explosions proof enclosure as described in NEC article 500.
14.	Diagnostics & display	Self-Indicating feature and digital display on transmitter.
15.	Power supply	24V DC $\pm 10\%$ .
16.	Adjustment/ Calibration/ Maint	Using handheld HART calibrator

- 1) LVDT type is not acceptable.
- 2) Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.

Electronic Smart Transmitters and Measuring Instruments		
1	Temperature Transmitter	<p>A. Element Input  Element Type - RTD (Pt-100)/Metal  Sheathed Type tolerant class - IEC751  Wire Configuration - 3 wire RTD</p> <p>B. Transmitter  Type - Smart Type Transmitter</p> <p>C. Mounting Type (Remote/Integral)-Remote Accuracy - The Temperature transmitters with RTD shall have an accuracy of 0.075% of URV as a minimum for range above 3500 C, 0.15% of URV for temperature range 3500 C to 1500 C and 0.25% for calibrated range below 1500 C.</p>
2	Temperature Transmitter	<p>A. Element Input [20AWG]  Element Type - Thermocouple (K-Type)  Sheathed Type tolerant class - IEC751  Wire Configuration - 3 wire RTD</p> <p>B. Transmitter  Type - Smart Type Transmitter  The Temperature transmitters with cold junction compensation for thermocouple shall have an accuracy of 0.25% of URV as a minimum for range above 3500 C, 0.5% of URV for temperature range between 3500 C to 1500 C and 0.75% for calibrated range below 1500 C.</p>
3	Positioner	<p>Type - 4-20 mA + Smart HART type.  Output - Actual valve stem travel, input current, actuator pressure, travel direction, accumulated travel, cycle counter etc.  Diagnostic information - Valve signature data with seat load, bench set and valve friction, dynamic error and dynamic linearity of control valve, diagnostic graphics with adequate resolution shall be provided.  Vibration effect - Shall have minimum vibration effect when mounted on the control valve, which shall be less than 1% of output span as per SAMA PMC 31.1.  Positioner enclosure - Metallic  Advanced diagnostic software PLC/DCS compatibility.</p>

		Control valve position (in 4 – 20 mA) shall be made available in programmable Controller.
4	Rotameter	Rotameter shall be metal tube type. Rotameter shall have an accuracy class of 1.6 or better as per VDI/VDE 3513/2.
5	Ultrasonic flow meter	For Process Applications: a) Liquids: Accuracy: $\pm 0.5\%$ of reading Repeatability: $\pm 0.3\%$ of reading b) Gases: Accuracy: $\pm 0.5\%$ of reading Repeatability: $\pm 0.3\%$ of reading
6	Radar Level Transmitter	Type- Microprocessor based 2 wire (loop powered) type, HART protocol compatible Guided wave Radar transmitter. Probe type & Material- i) Coaxial probe of SS316/316L. If required, probe shall be suitable for overfill prevention. (ii) Rod probe, cable probe of SS316 can be used for applications wherever coaxial probe is not suitable. Output Signal- 4-20mA DC along with superimposed digital signal (based on HART protocol), suitable for overfill prevention. Accuracy- $+\text{-} 0.5\%$ of calibrated span or minimum 5mm. Housing - Weather proof as per IP-65, metallic hosing with durable corrosion resistance coating.
7	Gas Detectors	Contractor shall design and provide hazardous gas detection system (sensors/ transmitters) for alarm and shutdown to protect personnel and equipment from hazardous gas infiltration. The gas detectors shall be 3 wire, SMART type with 4-20 mA HART output wired to plant PLC. 20% / 60% LEL for HC and 10 ppm / 15 ppm for H2S alarms are to be generated in PLC. However audible/visual alarms (hooters and beacons) in field shall be provided by contractor. Gas detectors to be supplied as per P&ID & other specification. In addition to that three (3) nos. of portable calibration kit for HC gas detectors and two (2 nos.) number of portable calibration kit for each other type of gas detectors (if applicable) shall be provided.

8	Gas Analyzer	<p>Process Analyser along with Shelters/ cabinets as indicated in approved P&amp;IDs/ Equipment layout/ Process pkg., along-with carrier gas, calibration gas cylinders/ reagents required for minimum 6-month operation after commissioning.</p> <p>Output Signal: 4-20 mA.</p> <p>Repeatability/Accuracy: As per the technology licensor.</p> <p>Sampling system shall be provided along with instruments.</p>
9	Solenoid valves	<p>Solenoid valves shall be intrinsically safe type for 24V DC (<math>\leq</math>700 M cable length) and flameproof type for 110V AC (<math>&gt;</math>700 M cable length). Field switches, wherever applicable, shall be flameproof. Limit switches shall be intrinsically safe type.</p>
10	Earthing	<p>Complete field earthing including GI / Copper earthing strip, earth pits &amp; earthing cables for earthing of all Instrumentation items including junction boxes, field instruments, local panel, analyzers, cabinets etc.</p> <p>GI copper earthing wire, earthing lugs in bidders supplied panels / cabinets in Control Room to main earth pit system shall be scope of vendor.</p> <p>Earth pit for system earth (e.g., for PLC System, CCTV system, UPS System) and general earthing for instruments, equipment etc., as required as per bidder's system Bidder's recommendation.</p>
11	Junction Boxes	<p>Separate Junction Boxes for signals for Intrinsically safe &amp; flameproof instruments.</p> <p>Junction boxes, cable glands and accessories required for flameproof instruments shall also be certified flameproof.</p> <p>All junction boxes shall have bottom cable entry only.</p> <p>Junction Boxes for <b>Intrinsically Safe</b> instruments shall be of SS316 and same shall be certified weatherproof.</p> <p>All nuts &amp; Bolts used for the mounting of Instruments &amp; Junction Boxes shall be of SS.</p> <p>For instruments and junction boxes including cable glands, increased safety/ non-incentive concept not acceptable.</p> <p>All Intrinsically Safe junction boxes shall be with self-locking type Allen screws (SS 316 make) type fasteners and hinges.</p> <p>All Junction boxes shall have tag numbers engraved on the front cover with PESO certificate nos.</p>