SPORADIC WORK OUTSOURCING CONTRACT FOR INSTRUMENTATION ACTIVITIES OF EARTH STORABLE TEST FACILITIES

A. WORK DESCRIPTION

The Instrumentation activities under this Sporadic work contract consists of Command system, Measurement system, Display & Data acquisition system for Earth storable test facilities PTS, ATS, RCS, PET, LAM, STTF, SPTF & NLTF. The activities are described below with numbers 1 to 38. In each activity, the work shares are given under Part-A, Part-B and Part-C (whichever is applicable) in the following manner.

Part-A : Works to be executed by Senior Technician.

Part-B : Works to be executed by Technical Assistant.

Part-C : Works to be executed by Junior Technician

1. Technical reports & Specifications typing, editing and formatting works: 5000 pages

PART B:

- Preparation of Contract document.
- Formatting and alignment of documents with finalized requirement and specifications.

2. Preparation of wiring diagrams, block diagrams & schematic diagrams: 1000 pages

PART B:

- All the Instrumentation system includes four sub systems namely Measurement System, Safety System, Command System diagrams.
- For various types of data acquisition systems such as Medium speed and High speed, these diagrams are to be prepared on CAD or MS word software.

3. Inward inspection of major electronic equipments & tools: 1000 nos.

PART B:

- Inspection/testing of items such as, tubes, fittings, function Relays, Power supply etc
- Verification of serial nos., Part nos. and quantity after receiving the indented items.

4. **Inward inspection of sensors: 500 nos.**

   PART B:

   - Preparation of detailed in section & quality surveillance plan for all the sensors.
   - Maintenance of an in dependent comprehensive database system containing inspection & testing and performance records for each sensor.

5. **Inward inspection of signal conditioners & DAS: 600 nos.**

   PART B:

   - The signal conditioners & DAS shall be tested and inspected as per the given quality assurance plan.

6. **Stock entry, maintenance and verification of instrumentation items: 600 nos.**

   PART B:

   - Maintenance of log books after verification and testing of instrument
   - Facility maintenance activities

7. **Filing and Maintenance of calibration charts of sensors, test and measuring equipments: 1000 nos.**
   PART B:

8. **Filing and Maintenance of test facility documents: 1000 nos.**
   PART B:

   - Preparation and maintenance of various reports related to various systems present in the facility

9. **Filing and Maintenance of ISO documents: 400 nos.**
   PART B:

10. **Maintenance of instrumentation system database which includes tags, equipment serial no, rack no, I/O card details etc : 500 tables.**
    PART B:

11. **Maintenance of spare availability list for all instrumentation equipments: 200 nos.**
    PART B:

    - Maintenance of inventory and concerned log books in Control room
    - Replacement of items in case of any defect/malfunctioning of equipment

12. **Functional checking of electronic equipments: 200 nos.**

    PART B:

    - Inspection/testing of items such as function generator, source meter etc
    - Verification of serial nos., Part nos. and quantity after receiving the indented items

13. **Functional checking of sensors, transmitters and other field devices: 800 nos.**

    PART B:

    - Part no. and quantity verification after receiving the procured sensors, transmitters etc
    - Checking of various temperature, pressure sensors and transmitters along with HART communicators in the field

14. **Functional checking of signal conditioners & DAS: 500 nos.**

    PART B:

    - Functional verifications and maintenance of signal conditioners which are used in data acquisition systems

15. **Continuity and insulation resistance checking of cables: 500 nos.**

    PART C:

    - Cable continuity checking from control room to Test stand/Field

16. **Continuity checking between all termination points in instrumentation rack: 20000 point.**

    PART C:

    - Checking and maintenance of wiring in all the data acquisition and PLC racks.

17. **Continuity checking and cable colour code verification between all termination points in field junction boxes, SOVs and transmitters: 7000 nos.**

    PART A:

18. **Continuity checking and colour code verification of inter rack interface cables: 1000 nos.**

    PART A:

19. **Checking and verification of ferruling details of wired instrumentation racks: 1000 nos.**

    PART A:

20. **2 core/4 core cable laying and wiring works: 2000 mtrs.**

    PART C:

    - Laying of various cables from control room to test stand/field

21. Equipment mounting and wiring works: 500 nos.

PART A:

- Mounting and wiring of equipments such as mass flow meters, Pressure and transmitters etc in the test stand/field.
- Mounting of mobile data logger systems on the tanker for continuous monitoring of parameters while propellant transfer

22. Testing of E/P valves: 500 Nos.

PART B:

- Removing of cables from Terminal blocks of field SOV cubicle junction box and valve driver racks
- Cable resistance, coil resistances (2 coils) and insulation resistances to be measured and recorded.
- Re-connection of all cables at the respective terminal blocks after measurements
- ON/OFF status to be tuned physically at each valve.
- Verification of valve operation at valve end
- Sealing of electrical connectors with rubber compound or silicone sealant
- Voltage at rack and at coil to be measured and recorded.
- Operation of valve from operator console to be verified.
- Verification status recording at data acquisition system and digital recording system.
- Test results to be recorded in the Test and Evaluation format.

23. Testing of Control valves: 200 nos.

PART B:

- Removing of cables from Terminal block of smart valve positioner, junction box and control valve isolator racks
- Cable resistance and insulation to be measured and recorded.
- Re-connection of all cables at the respective terminal blocks after measurements
- If the valve operation and position feedback deviates for more than 0.5%, the valve has to be re-tuned and repeat the valve operation as specified above.
- Sealing of electrical connectors with rubber compound or silicone sealant.
- Valve is to be operated in manual mode to open 0%, 25%, 50%, 75% and 100% and verification of valve opening and closing physically at valve end and measurement of valve status current output from I/P converter. The position detector output current is to be recorded in the T&E format and to be acquired in the data acquisition system.
- T&E report is to be prepared and updated.

24. Testing of Test Article Pressure Measurements: 800 nos.

PART B:

- Preparation of cables and termination of cables at sensor connectors
- Termination of pig tail cables at terminal blocks at field junction boxes
- Laying of pig tail cable from field junction box to sensor.
- Tagging of pig tail cables
- Removing of cables at the terminal blocks on the racks.
- Re-connecting the sensor with the connector.
- Harnessing of cables with fiber glass cloth.
- Sealing of electrical connectors with rubber compound or silicone sealant
- Measurement of cable continuity resistance and insulation resistance of cables connecting from Instrumentation rack to field connector end and recorded.
- The signal conditioner to be calibrated by zero input and full scale input.
- Programming of signal conditioners gain, zero offset, span offset and bandwidth
- The measurement channels are to be calibrated using DC calibrator in four steps from field junction boxes/sensor connector.
- Estimate of measurement channel accuracy
- Measurement of sense voltage and adjust the power supply accordingly.
- Removing of cables at isolator rack and record the bride resistance of the sensor
- The test results are to be recorded in Test and Evaluation format.
- Entering 4th order constants up to 6 decimal places at init file and verification of the constants.
- Checking and recording the excitation voltage and ambient output.

25. Testing of Test Article Temperature Sensor Measurements: 500 nos.

PART B:

- Preparation of cables and termination of cables at sensor connectors
- Termination of pig tail cables at terminal blocks at field junction boxes
- Laying of pig tail cable from field junction box to sensor.
- Tagging of pig tail cables.
- Removing of cables at the terminal blocks on the racks.
- Re-connecting the sensor with the connector.
- Harnessing of cables with fiber glass cloth.
- Sealing of electrical connectors with rubber compound or silicone sealant
- Measurement of cable continuity resistance and insulation resistance of cables connecting from instrumentation rack to field connector end and recorded.

- The signal conditioner to be calibrated by zero input and full scale input.
- Programming of signal conditioners with 20 calibration points, filter constants and output range.
- The measurement channels are to be calibrated using DC calibrator/decade resistance box in 5 steps from sensor connector.
- Estimate of measurement channel accuracy
- Removing of cables at isolator rack and record the RTD/TC resistance of the sensor
- The test results are to be recorded in Test and Evaluation format.
- Entering 1st order constants up to 6 decimal places at Aimast file and verification of the constants.
- Checking and recording the ambient output.
- Functional verification of Thermocouple channels with ice.

26. Testing of Test Article Vibration Measurements: 350 nos.

PART B:

- Preparation of cables and termination of cables at sensor connectors
- Termination of pig tail cables at terminal blocks/ BNC connectors at field junction boxes
- Laying of pig tail cable from field junction box to sensor.
- Tagging of pig tail cables
- Removing of cables at the terminal blocks on the racks.
- Sensor is to be removed from the test article and mounted on the 1 g calibrator using proper tools.
- Sealing of electrical connectors with rubber compound or silicone sealant
- Sensor is mounted back on the test article with the defined torque.
- Measurement of cable continuity resistance and insulation resistance of cables connecting from instrumentation rack to field connector end and recorded.
- The signal conditioner to be calibrated by zero input and full scale input with function generator.
- Sensor is to be vibrated at 1 g rms level and the data is to be recorded.
- FFT plot for the data recorded is to be carried out to verify the chain calibration / integrity.
- AC signal is to be fed at the input of signal conditioner in 5 steps viz. 0%, 25%, 50%, 75% and 100%. The data is to be recorded. The linearity of measurement chain is to be verified.
- Hammer tap test is to be carried out and data recorded and processed.
- Configuration of remote nodes [Main and Redundant] with necessary coefficients, filter settings, gains etc.
- Acquiring data through remote nodes[Main & Redundant] and local nodes [Main & Redundant]
- Processing data from all four nodes with respect to time domain, FFT and water fall graphs for each channel.
- Transferring the graphs to presentation form in power point.

- Taking hard copy of the plots.
- The tests to be carried out periodically and data measured and recorded.
- Necessary tools and equipments will be provided by the Department.

27. Testing of Facility Pressure transmitters measurements: 800 nos.

PART B:

- Pressure transmitters are to be removed from the facility lines and sent to calibration laboratory for calibration. The pressure ports are to be closed with protective covers.
- After calibration, the pressure transmitter is to be reinstalled in the facility line. (Calibration of pressure transmitters is not in the scope of contractor.)
- Pneumatic pressure test at 1.1 times rated pressure is to be carried out for leak check.
- The Cabling is to be done to the Pressure Transmitter and is to be terminated properly.
- Sealing of electrical connectors with rubber compound or silicone sealant
- Measurement of cable continuity resistance and insulation resistance of cables connecting from instrumentation rack to field connector end and recorded.
- The transmitter is to be powered and measurement chain calibration is to be carried out by simulating 4, 8, 12, 16, and 20 mA current in transmitter output. The output of signal conditioner is to be monitored and recorded.
- The display on the MIMIC at Control room is to be monitored and recorded.
- The measurement chain calibration of data is to be entered in the Test and Evaluation format

28. Testing of Facility Temperature measurements: 400 nos.

PART B:

- Temperature transmitters are to be removed from the facility lines and sent to calibration laboratory for calibration.
- After calibration, the Temperature transmitter is to be reinstalled in the facility line. (Calibration of pressure transmitters is not in the scope of contractor.)
- The Cabling is to be done to the Temperature Transmitter and is to be terminated properly.
- Sealing of electrical connectors with rubber compound or silicone sealant
- Measurement of cable continuity resistance and insulation resistance of cables connecting from instrumentation rack to field connector end and recorded.
- The transmitter is to be powered and measurement chain calibration is to be carried out by simulating 4, 8, 12, 16, and 20 mA current in

transmitter output. The output of signal conditioner is to be monitored and recorded.
- The display on the MIMIC at Control room is to be monitored and recorded.
- The measurement chain calibration of data is to be entered in the Test and Evaluation format

29. Testing of Facility Flow/speed measurements: 300 nos.

PART B:

- Preparation of cables and termination of cables at sensor connectors
- Termination of pig tail cables at terminal blocks at field junction boxes
- Laying of pig tail cable from field junction box to sensor.
- Tagging of pig tail cables
- Removing of cables at the terminal blocks on the racks.
- Patching of direct coil output to the high speed vibration measurement system
- Sealing of electrical connectors with rubber compound or silicone sealant
- The sensor integrity checks, resistance and insulation to be measured and recorded.
- The measurement channels are to be tested using frequency calibrator from junction box once in three months.
- The tests to be carried out periodically and data to be measured and recorded.
- Functional testing of flow measurement chain with function generator by simulating frequency, for speed measurement chain, spare sensor, excitation coil & function generator.

30. Verification and validation of auto & abort sequence software with hardware by electrical simulation: 5000 nos.

PART B:

- Estimation of counts for analog parameters of three controllers.
- Validation of abort groups by electrical stimulation.

31. Generation of process and monitoring mimics: 200 nos.

PART B:

- Animation of valves
- Animation of pipe lines
- Drawing of special objects
- Animation of interlock controls
- Animation of analog parameters
- Copying & preparation of icons in runtime server
- Updation of animated records

32. Control system Parameters logging and processing: 10000 nos.

PART B:

- The analog and digital parameters in the mimics are to be logged and to be processed.

33. **Facility Data acquisition logging & processing: 10000 nos.**
    PART B:

34. **Test article Data acquisition logging & processing: 10000 nos.**
    PART B:

35. **Digital Data acquisition logging & processing: 19000 nos.**
    PART B:

36. **High speed Data acquisition logging & processing: 1000 nos.**
    PART B:

37. **T&E sheets generation: 5403 nos.**
    PART B:
    - Updation of sensor constants in AIMAST file
    - Updation of Digital events
    - Test and Evaluation reports

38. **CD backup for raw data and processed files: 1030 nos.**
    PART B:
    - Recording of process parameters and events on CD's and DVD's

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B. WORK CONTENT & QUANTITY

Sl. No	Description of work	Qty. nos.
1	Technical reports & Specifications typing, editing and formatting works	5000
2	Preparation of wiring diagrams, block diagrams and schematic diagrams	1000
3	Inward inspection of major electronic equipments & tools	1000
4	Inward inspection of sensors	500
5	Inward inspection of signal conditioners & DAS	600
6	Stock entry, maintenance and verification of instrumentation items	600
7	Filing and Maintenance of calibration charts of sensors, test and measuring equipments	1000
8	Filing and Maintenance of test facility documents	1000
9	Filing and Maintenance of ISO documents	400
10	Maintenance of instrumentation system database which includes tags, equipment serial no, rack no, I/O card details etc	500
11	Maintenance of spare availability list for all instrumentation equipments	200
12	Functional checking of electronic equipments	200
13	Functional checking of sensors, transmitters and other field devices	800
14	Functional checking of signal conditioners & DAS	500
15	Continuity and insulation resistance checking of cables	500
16	Continuity checking between all termination points in instrumentation rack	20000
17	Continuity checking and cable colour code verification between all termination points in field junction boxes, SOVs and transmitters	7000

18	Continuity checking and colour code verification of inter rack interface cables	1000
19	Checking and verification of ferruling details of wired instrumentation racks	1000
20	2 core/4 core cable laying and wiring works	2000
21	Equipment mounting and wiring works	500
22	Testing of E/P valves	500
23	Testing of Control valves	200
24	Testing of Test Article Pressure Measurements	800
25	Testing of Test Article Temperature Sensor Measurements	500
26	Testing of Test Article Vibration Measurements	350
27	Testing of Facility Pressure transmitters measurements	800
28	Testing of Facility Temperature measurements	400
29	Testing of Facility Flow/speed measurements	300
30	Verification and validation of auto & abort sequence software with hardware by electrical simulation	5000
31	Generation of process and monitoring mimics	200
32	Control system Parameters logging and processing.	10000
33	Facility Data acquisition logging & processing	10000
34	Test article Data acquisition logging & processing	10000
35	Digital Data acquisition logging & processing	19000
36	High speed Data acquisition logging & processing	1000
37	T&E sheets generation	5403
38	CD backup for raw data and processed files	1030

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C. WORK CONTRACT CONDITIONS - TECHNICAL:

1. The period of contract is two years from the date of issue of Purchase order. However, the department reserves the right to extend the contract with the consent of the contractor, till the completion of the specified activities included in this contract with the same rates and the same Contract conditions.
2. The work is related to Typing work, wiring diagram preparation, cable laying, wiring work, Testing of E/P valves, control valves, Validation of Test Article & Facility measurement chains, Data acquisition, Data processing, generation of process mimics, T&E checking, T&E sheet generation and test support supervised by ETIG Engineers.
3. Engineer-in charges will be identified as focal points. The focal points will be responsible for intimating the work load prevailing time to time, monitoring the work execution and certification of bills for work executed. Payment will be made as per the actual quantum of work executed and certified. Billing is permitted on monthly basis.
4. The Safety and other regulations of IPRC should be complied with during the execution of work. Entry into areas/facilities at IPRC without proper authorization from the focal points will not be entertained. The contractor is responsible for any injury or loss to their personnel.
5. To carry out the works mentioned under 'Work content & Quantity', personnel should have educational qualifications as min. **ITI in Electronics/Electrical /Fitter trade, min. Diploma in Electronics & Communication or Electrical & Electronics branches of Engg.**
6. Based on our past experiences, the average number of personnel required for carrying out the works mentioned under **Part-A, Part-B and Part-C of Work content & Quantity are:**

   Part-A 5 persons in Senior ITI category (Highly skilled worker)

   Part-B 14 persons in Diploma/Degree in Engineering

   Part-C 1 person in ITI category (Skilled worker)

   However, depending on the work load intimated by the focal point, the number may vary and the contractor has to supply the workforce accordingly.
7. The work shall be carried out without any damage or loss to IPRC property/equipment. The responsibility for loss, if any, occurring due to negligence of contract personnel solely rests on the contractor and contractor is liable to compensate IPRC for any such loss/damage.
8. The Contractor should produce Police Verification Certificate to The Senior Administrative Officer, IPRC for all the personnel engaged to execute the works

under this contract within one month of issue of Purchase order. Only Indian national are eligible to be engaged to execute the work.

9. Sub contracting of works mentioned in this contract should not be made by the Contractor.
10. The contract personnel shall also attend the work on holidays and beyond office hours, if required.
11. The rate shall be fixed till the completion of entire quantum of the job.
12. The work shall be executed at IPRC, Mahendragiri.
13. The original certificate for qualification and experience shall be produced for all the personnel for verification after receipt of Purchase order and the documents will be returned.
14. Personnel with earlier experiences in similar fields are preferred. The personnel once approved and identified shall not be changed.
15. All the materials, tools and essential safety accessories required for the work shall be supplied by the department. Expenses towards travel up to IPRC, Food & Medical shall not be provided.
16. Split ordering of the works mentioned under work content is not possible, since every work is interconnected.