

ANNEXURE - 5

Calibration/testing of Instruments and control devices

1.0 CONTRACTOR'S SCOPE OF WORK

CONTRACTOR'S Scope of job involves removing instrument if needed, calibration/testing, rectification/ minor repair, fixing back and retesting, recalibrate if required and report generation. Instruments and control devices need to be calibrated and/or repaired Jobs shall be carried out at designated sites scattered across the **GEL** operations.

2.0 Specific terms and condition

Testing & Calibration contract for CGD Network will consist but not limited to;

- 2.1 **CONTRACTOR** shall carry out Calibration & Testing of instruments installed at **GEL's** CGD premises including Pressure Gauge, Pressure Transmitter, Differential Press Gauge, Temperature Gauge, Temperature transmitter/Indicator/Controller, RTD Sensor, Gas Detector, Flame Detector, CO2 flooding system etc. and adjustment of errors and minor repair if found during calibration as per the **GEL's** requirement & satisfaction.
- 2.2 **CONTRACTOR** shall have traceability to NABL (National Accreditation Board for Testing and Calibration Laboratories) accredited laboratories for all the master instruments/Master meters used for Calibration of Owner's instruments. If there is any deviation in NABL accreditation, **CONTRACTOR** shall inform & get the approval from **GEL** for any other international laboratories authorized for testing & calibration against particular standard.
CONTRACTOR shall submit the list of Calibration Facility with master calibrator instruments/Master meters with calibration certificates of each instrument along with tender document.
- 2.3 **CONTRACTOR** shall, with due care & diligence, execute the work in compliance with all laws, by laws, ordinances, regulation etc. and provide all services and labour inclusive of supervision thereof.
- 2.4 **CONTRACTOR** shall take prior approval from **GEL/GEL** representative before start of execution. **CONTRACTOR** shall carry out calibration of instruments as per the schedule and standard procedure of **GEL/OEM** calibration instructions issued from time to time.
- 2.5 **CONTRACTOR** shall adhere to HSE guidelines and procedures of **GEL**.
- 2.6 **CONTRACTOR** shall submit- Calibration Procedure/Guidelines to **GEL** and get the same approved before commencement of Job.
- 2.7 All the equipments, experienced manpower, Tools and tackles and other things of whatsoever nature required in or about the execution of the work, whether of temporary or permanent nature shall be provided by the **CONTRACTOR**.
- 2.8 Travelling, Transportation, Boarding & Lodging etc will be in the **CONTRACTOR's** scope.
- 2.9 **CONTRACTOR** shall get the work execution i.e. calibration / repair etc... verified / witnessed by **GEL/GEL** representative.
- 2.10 **CONTRACTOR** shall provide the detailed calibration Certificate and Calibration

- Report i.e. information in report like manufacturer, Type, Range, Accuracy, Position, master instrument details, tested lab details, Traceability (National or international), allowable limits and calibration status.
- 2.11 **CONTRACTOR** shall put the Calibration Status Sticker on the instruments after calibration indicating testing date and due date.
- 2.12 **CONTRACTOR** has to submit reports & certificate (both in hard & soft copies) for all calibrated instruments to **GEL/GEL** representative.
- 2.13 **CONTRACTOR** also submits the details of calibration in **GEL** prescribed soft copy in Excel format.
- 2.14 If required for repair/calibration purpose any instrument is handed over to **CONTRACTOR** after due approval of **GEL/GEL** representative, then **CONTRACTOR** shall ensure upkeep of the same for the period remains with them. **CONTRACTOR** shall be responsible for any loss or damage of the **GEL's** instruments.
- 2.15 **CONTRACTOR** needs to perform his job within duty hours. If it is required to perform job other than duty hours, then they should get prior approval from **GEL/GEL** representative well in advance.

3.0 Detailed Scope of Work:

A. Work Instruction for Calibration of Pressure/Differential pressure Gauges:

- a. Check and get validated by **GEL EIC**, and record the following calibration record of dead weight tester / master calibrator that will be used as master equipment for
 - Instrument serial no.
 - Validity of the calibration
 - Lab at which it is calibrated.
 - Authorization of lab as per the NABL
- b. Isolate, depressurize and remove the Gauge under calibration from process line by operating isolation/tap off valves/instrument manifold.
- c. Connect the Gauge under calibration with dead weight tester / master calibrator.
- d. Verify the Pressure range of the Gauge under calibration and note down the parameters of the pressure gauge observed against master gauge.
- e. Slowly increase the pressure by applying the minimum 5 point of incremental reading with respect to full scale gauge span and check the reading of the gauge under calibration with respect to master gauge for 0%, 25%, 50%, 75% and 100%.
- f. Note the Difference in reading between master calibrator and gauge under calibration and derive the result.
- g. Take the downward pressure readings with respect to span and note the difference in reading between master calibrator and gauge under calibration for 100%, 75%, 50%, 25%, and 0%.
- h. Adjust error if any and recalibrate the Gauge under calibration.
- i. Reinstall and put it in process line.
- j. Stick the label of calibration on the Gauge under calibration from the date of calibration to the due date.
- k. Maximum range of pressure gauge is 0-400 Barg

B. Work Instruction for Calibration of Pressure transmitter/ Differential Pressure Transmitters:

- a. Check and get validated by **GEL EIC**, and record the following calibration record of dead weight tester / master calibrator that will be used as master equipment for

1. Instrument serial no.
2. Validity of the calibration
3. Lab at which it is calibrated.
4. Authorization of lab as per the NABL
- b. Isolate, depressurize and remove the transmitter under calibration from process line by operating isolation/tap off valve/instrument manifold.
- c. Connect the transmitter under calibration with dead weight tester / master calibrator. Connect the output of the pressure transmitter under calibration with multimeter and existing output of transmitter to check the display output at the system on which it is installed in line with multimeter output.
- d. Verify the Pressure range of the transmitter under calibration and note down the parameters of the transmitter under calibration.
- e. Slowly increase the pressure by applying the minimum 5 point of incremental reading with respect to Transmitter span and check the reading of the multimeter and existing system display output connected to transmitter under calibration with respect to master gauge and record readings for 0%, 25%, 50%, 75% and 100%.
- f. If the transmitter is transmitting pressure through 4-20 MA signal cable
 - Check the output of the transmitter under calibration with no pressure (or equal to the low calibration range). The output should be 4 mA.
 - Apply full scale range pressure to the transmitter under calibration and note the output. It should be 20 mA.
- g. Note the Difference in Reading between master calibrator and transmitter under calibration and derive the result.
- h. Now take the downward pressure readings with respect to span and note the difference in reading between master calibrator and transmitter under calibration for 100%, 75%, 50%, 25%, and 0% and derive result.
- i. Adjust error if any and recalibrate the transmitter under calibration.
- j. Reinstall and put it in process line.
- k. Stick the label of calibration on the transmitter under calibration from the date of calibration to the due date.

C. Work Instruction for Calibration of Pressure Switches:

- a. Check and get validated by GEL EIC, and record the following calibration record of dead weight tester / master calibrator, Pressure gauge, multimeter that will be used as master equipment for
 1. Instrument serial no.
 2. Validity of the calibration
 3. Lab at which it is calibrated.
 4. Authorization of lab as per the NABL
- b. Remove the pressure switch under calibration from impulse line.
- c. Mount the pressure switch under calibration on dead weight tester/master calibrator and connect it with pressure source. Connect multimeter at pressure switch terminal for checking contact change over.
- d. Note down the pressure switch set point.
- e. Slowly pressurize / depressurize the pressure switch sensor 3 times up to set point.
- f. Note the pressure set point and corresponding multimeter reading at which contact changeover is made and repeat the process.
- g. Any deviation from set point may be adjusted by nut/screw provided in pressure

switch under calibration.

- h. After the required adjustment apply the same procedure for the same set point pressure for 3 times.
- i. Remove the pressure switch under calibration from calibration set up and install it in its location and connect the impulse line.
- j. Stick the label of calibration on the pressure switch under calibration from the date of calibration to the due date.
- k. Calibration of the Pressure switch needs to be performed as specified below, If the pressure switch is set for single pressure, then single point testing is enough. In case pressure switch is being set for minimum and maximum pressure then 3-point calibration is needed.

D. Work Instruction for Calibration of RTD sensor/Temperature gauge/TT:

- a. Check and get validated by GEL EIC, and record the following calibration record of dry temperature bath, multimeter and temperature gauge that will be used as master equipment for
 - 1. Instrument serial no.
 - 2. Validity of the calibration.
 - 3. Lab at which it is calibrated.
 - 4. Authorization of lab as per the NABL.
- b. Check the sensor/gauge type and wiring connection.
- c. Note down the details of sensor/gauge/transmitter under calibration and connect the multi-meter to the sensor/transmitter terminal.
- d. Slowly increase the temperature of temperature bath by applying minimum 4 point of incremental reading with respect to temperature range starting from 15°C to the maximum operating range for span of 0%, 25%, 50% and 100% and check the reading of the RTD sensor/temperature gauge/transmitter under calibration with respect to master gauge. In case of RTD sensor note resistance value with multimeter & for temperature transmitter note mA output for the set range.
- e. Note the difference in reading between master calibrator and sensor/gauge under calibration.
- f. Adjust error if any and recalibrate the sensor/gauge/Transmitter under calibration.
- g. Remove the gauge/sensor under calibration from calibration setup and install it at its location.
- h. Stick the label of calibration on the transmitter under calibration from the date of calibration to the due date.

E. Work Instruction for Calibration of flame detector:

- a. First of all, check the wiring connections for the flame detector to panel.
- b. Remove the Solenoid Operated Valves (SOV) mounted on the Cylinder of CO2 Flooding system.
- c. Verify that the supply voltage is correct, grounding and cabling is proper.
- d. Clean the sensor of the flame detector if needed.
- e. Check if the specs of test lamp is meeting test conditions specified by OEM for the FD under calibration. After that apply the UV/IR Test lamp as per the specifications issued by OEM for the FD.
- f. Verify that the Contact change over and alarm on the PLC Panel.

- g. Check whether signal generated from PLC due to UV/IR test lamp activates the SOV (magnetism in SOV for operation) removed from CO2 cylinder of flooding system. Activation of SOV will confirm the operation of plunger and bursting of disc on CO2 cylinder.
- h. Using a test lamp is the only non –hazardous and safe method to test any flame detector.
- i. Stick the calibration label on the flam detector from the date of calibration & the due date.

F. Work Instruction for Calibration of Gas detector:

- a. Check and get validated by **GEL** EIC, and record the following calibration record of Gas cylinder that will be used as master equipment for
 - Instrument serial no.
 - Validity of the calibration.
 - Lab at which it is calibrated.
 - Authorization of lab as per the NABL.
- b. First of all, check the wiring connection for the Gas detector to panel.
- c. Verify that the supply voltage is correct, grounding and cabling is proper.
- d. Clean the sensor of the Gas detector if needed.
- e. Apply the gas from 0% LEL to the 100% LEL and check the different Alarm points on the panel.
- f. Verify that at the set points of the PLC Panel whether the alarm is activated or not.
- g. Slowly open the valve of calibrator with gas supply check for 0%, 40% and 80% LEL Standard Gas at specified flow rate at the Gas detector inlet part.
- h. After the calibration is completed close the valve of the gas and let the sensor be free from gas.
- i. Stick the calibration label on the Gas detector from the date of calibration & the due date.

G. Frequency of Calibration for Instruments

Frequency of calibration for the instruments shall be as below. However, **CONTRACTOR** shall refer and carry out the activity as per the **GEL** approved AOMP.

Sr. No	Instruments	Calibration Frequency
1	Pressure Gauge (PG)	Once in year
2	Pressure Transmitter (PT)	Once in year
3	Differential Pressure Gauge (DPG)	Once in year
4	RTD Sensor (RTD)	Once in year
5	Temp Indicator/Controller (TT)	Once in year
6	Gas Detector (GD)	Once in year
7	Flame Detector (FD)	Once in year
8	Temperature Gauge (TG)	Once in year
9	Pressure Switch (PS)	Once in year

- **GEL** shall provide calibration schedule with the list of instruments and site address.
- **GEL/GEL** representative shall witness/verify the calibration process.
- **GEL** shall provide 230 V electrical supply point and taking of electrical connection is in **CONTRACTOR**'s scope.
- **GEL** shall provide permit to carry out the work.
- **GEL** shall provide technical assistance and approve deviation if any when required.