HINDUSTAN PETROLEUM CORPORATION LIMITED

Pipelines SBU

INSTRUMENTATION

Standard Operating Procedures

Reviewed By	Approved By
Management Representative	General Manager-VVSPL

	Prepared By	**Verified By**	**Authorized By**
Signature with date			
Name			
Designation			**GM-PIPELINE**

2. Table of Contents:

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3. List of Formats

S.No	Format Name	Format No	Rev No	Frequency
1	Maintenance and Calibration of Pressure Transmitter	ISF/INT/01	00	Yearly
2	Maintenance and Calibration of Differential Pressure Transmitter	ISF/INT/02	00	Yearly
3	Maintenance and Calibration of Temperature Transmitter	ISF/INT/03	00	Yearly
4	Maintenance of Level transmitter	ISF/INT/04	00	Yearly
5	Maintenance of Density Meter and Density Convertor	ISF/INT/05	00	Half-Yearly
6	Maintenance of Online Vibration Monitoring System	ISF/INT/06	00	Yearly
7	Maintenance of Control Valve Actuators	ISF/INT/07	00	Quarterly
8	Maintenance of Unit Control Panel	ISF/INT/08	00	Yearly
9	Maintenance of Turbine Flow Meter and Flow Computer	ISF/INT/09	00	Yearly
10	Maintenance of Pressure Switch	ISF/INT/10	00	Half-Yearly
11	Maintenance of Pressure Gauge	ISF/INT/11	00	Half-Yearly
12	Maintenance of Fire Alarm System	ISF/INT/12	00	Monthly
13	Maintenance of Clean Agent System	ISF/INT/13	00	Yearly
14	Maintenance of Open Path Hydro Carbon Detector	ISF/INT/14	00	Quarterly
15	Maintenance of Point Type Detector	ISF/INT/15	00	Quarterly
16	Maintenance of Station PLC	ISF/INT/16	00	Yearly
17	Maintenance of Mass Flow Meter and Flow Computer	ISF/INT/17	00	Yearly
18	Maintenance of Sulphur Analyzer	ISF/INT/18	00	Yearly
19	Maintenance of Thermal Safety Valve	ISF/INT/19	00	Yearly
20	Maintenance of Ultra Violet(Flame) and Heat(IR) Detectors	ISF/INT/20	00	Yearly
21	Maintenance of Interlock Checking	ISF/INT/21	00	Yearly
22	Calibration Record	ISF/INT/22	00	As per Instrument

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4. Revision and Amendment sheet:

Page No.	Clause No.	Revision No.	Revision Date	Amendment Details

Note: - As per the procedure for control of document procedure can be revised up to maximum 10 revisions and after 10th revision, new issue of the document with new issue number shall be issued to all the controlled copy -holders.

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5. Introduction:

a. Purpose:

Preventive Maintenance of Instrumentation equipment by adopting detailed maintenance procedures and Troubleshooting of this equipment for reducing the downtime of equipment.

b. Scope:

Responsibility of carrying out Instrumentation related maintenance activities among different sections of pipeline. Defining procedures for operation and maintenance Instrumentation system

c. Responsibility:

Responsibility is with the controlling location of respective pipeline

d. Work permit:

For maintenance activities at one of the main stations, take cold work permit from the respective control room. If work is to be carried out at MOV/SV stations, then information has to be provided to respective controlling locations and take cold work permit from respective controlling location.

e. AMC and OEM Details:

S. No	Purchase Order Number and dated	Party Name and Contact Details	P.O Expiry Date

f. OEM Contact Details :

S. No	Contact Person Name	Primary Contact No	Secondary Contact No

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g. **Instrumentation System Description:**

Instrumentation plays a major role in plant operations and for ensuring safety of process and equipment. In plant automation, Instrumentation plays a major role. Instrumentation is divided into two sections:

a. Operations and Maintenance of field equipment
b. Station PLC

Different types of Instruments and Sensors are installed at various locations of the Pipeline Stations for measuring the various Parameters. These include Pressure Transmitters, Differential Pressure Transmitters, Temperature Transmitters, Flow Meters, Density Meters, Vibration measuring sensors etc. Majority of this equipment are SMART type instruments, which work on 24 V DC, 4-20 mA two-wire loop. The data from these sensors are converted into electrical form i.e. 4-20 mA using Transducers and this electrical signal is transmitted by Transmitters to Station PLC in the form of Analog or Digital Inputs. This Electrical form of signal received at PLC end is again converted into earlier form for display in Human Machine Interface (HMI) Screen. Commands or Outputs from Station PLC to field equipment are transmitted in from of Digital or Analog Output. Station PLC consists of both Graphics Part for display through HMI and Logic Part where programming is being done. This logic part includes Handling of Analog, Digital Inputs & Outputs, and design of Safety Interlocks for ensuring operation of various equipment within safe limits.

h. Safety Precautions and PPE Usage:

Majority of instrumentation equipment are related to safety of process and equipment. The Inputs and outputs of this equipment are included in station interlocks. Hence utmost care to be taken while carrying out preventive maintenance of instrumentation equipment. Following are the safety precautions to be followed and PPE to be used while carrying out preventive maintenance of instrumentation equipment:

- Ensure that maintenance of equipment will not affect the normal operations.
- Proper isolation of field equipment to be carried out.
- Proper Work Permit System to be followed
- Intimation to be provided to control room prior start and after completion of activity.
- Proper PPE such as Safety helmets, Safety gloves, goggles are to be used.

6. PROCEDURE FOR PREVENTIVE MAINTENANCE AND CALIBRATION OF PRESSURE TRANSMITTER:

6.1 Purpose:

To provide guidelines for Preventive Maintenance, Calibration & Trouble Shooting of Pressure Transmitter.

6.2 Scope:

Scope of work includes Preventive Maintenance, Calibration & Trouble Shooting of Pressure Transmitter provided at the location.

6.3 Applicability:

This SOP is applicable to the entire pipeline SBU.

6.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

6.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

6.6 Usage:

For Sensing, Measuring and transmitting the pressure.

6.7 Importance:

Pressure is one of the important parameters in pipeline operations. It is guideline for monitoring critical parameters, for maintaining healthiness of equipment with in safe limits. It is used as one of the inputs to Leak Detection System, which is used for maintaining the integrity of pipeline.

6.8 Location of Installation:

At SV stations, Suction and Discharges of pumps, Station inlets and outlets, receipt lines etc.

6.9 Integration with PLC or SCADA (at SV Stations):

All pressure transmitters are integrated with station PLC in station and with SCADA system in SV stations. Process values of these transmitters are transmitted to station PLC, SCADA Server from

RTU and these are further fed as inputs to safety interlocks. These interlocks help in maintaining the safety of the station.

6.10 Parts:

Pressure Transmitters consists of sensing equipment, Transducer, Local Display and Transmitter.

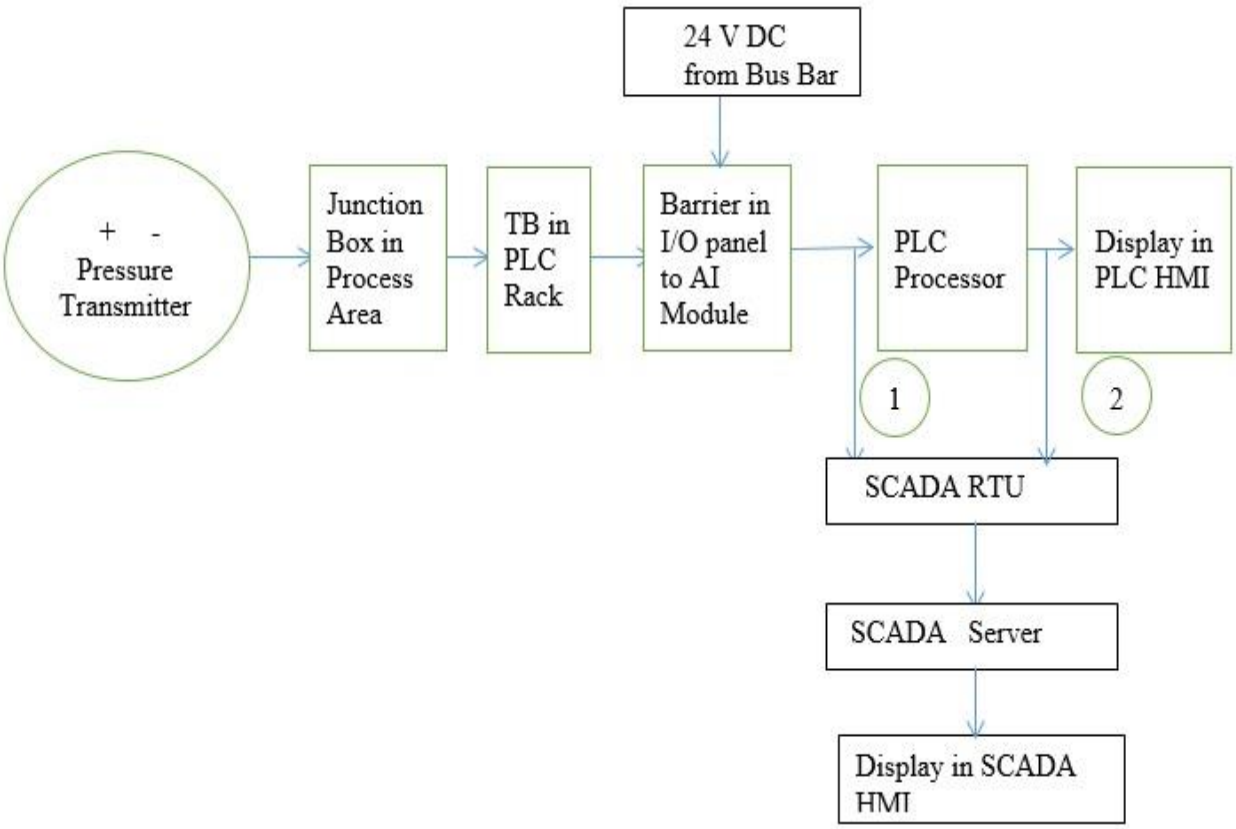
6.11 Working Principle:

Sensing equipment of transmitter senses the pressure in form of displacement, this is further converted to electrical signal, which is transmitted to station PLC through transmitter, and same value is transmitted to local display unit. Transmitter gets the 24 V DC supply from station PLC through two wire loop. Using this loop only pressure value is transmitted in form of 4-20 mA to Analog Input module of station PLC. This current is further converted to Pressure value in PLC as per range/span settings.

6.12 Electrical Connections:

24 V DC supply from station PLC and 4 to 20 mA is transmitted to station PLC through this 2-wire loop.

6.13 Block Diagram:



Note:
1: At SV Stations
2: At Main Stations through Modbus interface

6.14 Procedure for Preventive Maintenance and Calibration of Pressure Transmitter:

Before carrying out Preventive Maintenance & Calibration of Pressure Transmitter please ensure the following:

a. Ensure that maintenance of equipment will not affect the normal operations.
b. Proper Work Permit System to be followed

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c. Intimation to be provided to control room prior start and ensure this activity will not affect the operations.
d. Proper PPE such as Safety helmet s, Safety gloves, goggles are to be used.
e. Completion of activity to be informed to control room.
f. If this PT is linked to any interlock/ESD then this particular activity should be carried out during shutdown of the specific system.

6.15 Procedure for Preventive Maintenance of Pressure Transmitter:

a. Check DC Voltage at terminals of Transmitter. Under normal conditions, it has to be in range of 16 to 22 V DC.
b. Check for proper connection of Instrument Ground Wire. It has to be tight and intact.
c. Check the Transmitter for proper installation.
d. Check the condition of impulse tubing and its Connections. Ensure no seepage of product.
e. Check for proper display indication in local display unit.
f. Check for proper cable glanding. These are to be of proper size and double compression type for ensuring flameproof ness.
g. Check the condition of canopy and ensure nil corrosion
h. Check for proper cable tags, which are to be legible and clear.

Note: Observations has to be filled in Maintenance format.

6.16 Procedure for Calibration of Pressure Transmitter:

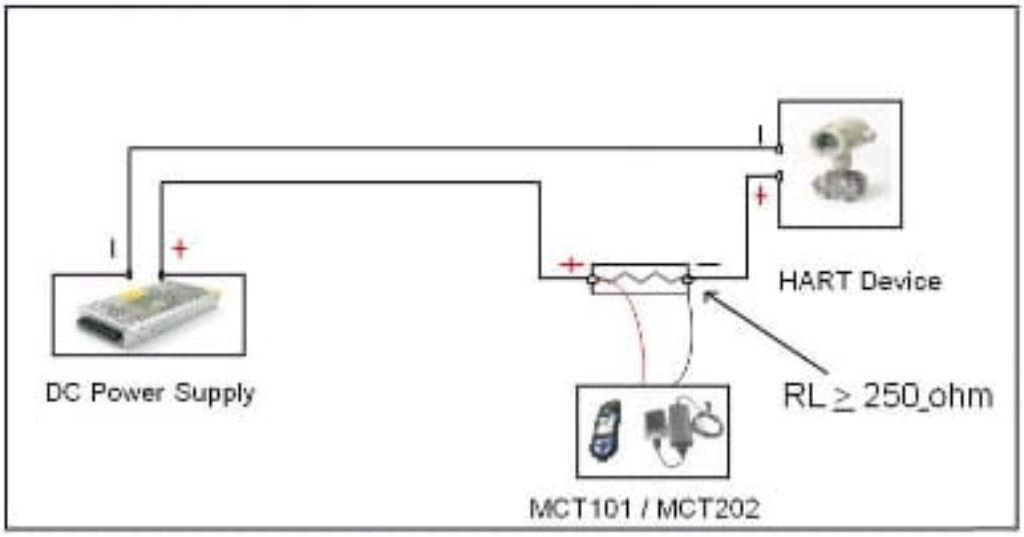
Following equipment to be kept ready before start of activity:

a. Portable Pressure calibrator
b. Power supply unit (24VDC).
c. 250-ohm resistor
d. Hand held communicator (HHC) HART/Universal Calibrator, Digital multi-meter
e. Tools and Tackles, Empty jar for collecting the drained product.

Note: Test pressure can be provided to PT by using Portable Pressure Calibrator calibration can be carried out in process area itself.

a. Obtain cold work permit.
b. Isolate 24 VDC power supply from the Control panel to Pressure Transmitter (PT), which is in the field.
c. Isolate the impulse line from process connections.
d. . Depressurize the impulse line by draining.

e. Connect the PT to the Portable Pressure Calibrator
f. Power up the 'PT' by 24VDC from regulated power supply unit or multifunction calibrator and connect the HART calibrator keeping the resistor in circuit as shown in below diagram.
g. Check the 'PT' current output by applying pressure in increasing and decreasing order of 0%, 25%, 50%, 75% and 100% of the range.
h. If required carry out the zero adjustment manually or through Multi- Function or by HART Calibrator by draining the oil from pressure pump.
i. In case of zero error, zero adjustment has to be done prior to span adjustment.
j. If required carry out the span adjustment by using HART Calibrator by applying pressure of 100% range.
k. Calculate hysteresis error. The hysteresis error is maximum difference in output at any measurement value within equipment's pressure range when approaching the point first with increasing and then with decreasing pressure.
l. After error adjustments again note down mA output by applying pressure in increasing and decreasing order as per Point No 7 and record the readings.
m. Install, restore the process connection, signalling and power supply at the panel end and make it online.
n. An acceptance criterion of Pressure Transmitter is +/- 2 % error or as per OEM recommendations whichever is lower.
o. Set up for Calibration of Pressure Transmitter:
    I. DC external power supply can be provided through Multi-function calibrator or Hand Held Communicator.
    II. HART Calibrator is used for modification of any settings.



Note: Observations has to be filled in calibration format.

6.17 Trouble Shooting Procedure:

a. Issue 1: No display in PT and PLC end:

At barrier check the input DC Voltage it has to be 24 V DC. If Input power supply is not ok check its connection from 24 V DC bus bar and rectify it. If Power Supply is OK then check barrier Input signal voltage it has to be in range of 16 to 22 V DC. If Barrier Input signal voltage is ok then Check Barrier Out put voltage

If barrier Output Voltage is not ok then isolate the barrier and inject the voltage in input end using Multifunction calibrator. If Output voltage is still not ok then replace the barrier with new one.

Check the transmitted current at output of barrier. It has to be in range of 4 to 20 mA for span of transmitter (4 mA for lower limit and 20 mA for higher limit). If it is not in the range then,

If barrier Input and Output Voltages are not ok then isolate the barrier and inject the voltage in input end using Multifunction calibrator. If Output voltage is still ok then make the connections as earlier

Check the fuse connection at TB end if fuse is blown out then check the probable cause and replace the blown fuse. If fuse connection is ok then check the 24 V DC supply at incoming of TB from barrier.

Check the power supply at TB of PLC. If power supply is available then check the cable connections and continuity between TB and Junction box, if power supply is not available then,

↓

Check the power supply at corresponding terminals of respective junction box. If power supply is available then check the cable connections and continuity between junction box and transmitter, if power supply is not available then,

↓

Check the input supply to transmitter it has to be around 16 to 20 V DC. If power supply is not available then,

Note: If power supply is ok but still there is no display in PT & PLC end then replace the PT.

b. Issue 2: Wrong display in PLC:

Check the transmitted current at output of barrier. It has to be in range of 4 to 20 mA for span of transmitter (4 mA for lower limit and 20 mA for higher limit). If it is not in the range then,

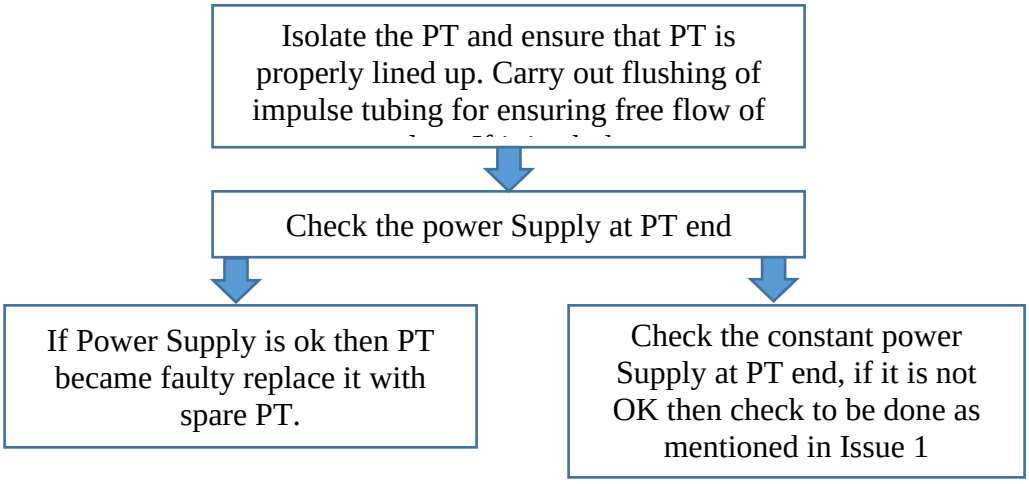
↓

Check the range of that particular pressure transmitter in PLC. If it is wrongly mentioned, then correct it. If it is correctly mentioned, then

↓

Carry out calibration of the transmitter for rectification of error.

c. Issue 3: PT value got stuck and not updating properly:



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6.18 Pressure Transmitter Maintenance Format:

Location : Department: Instrumentation

Month: **Frequency: Yearly**

Doc No: ISF/INT/01

क्रमांक S. No.	**निर्देश Instructions**	**परिणाम Observation**	**टिप्पणी Remarks**
1	Check the DC power supply at Pressure Transmitter		
2	Check for proper connection of instrument ground wire.		
3	Calibrate the Transmitter across the Span. Record in calibration sheet.		
4	Check the Pressure Transmitter for proper installation		
5.	Check the condition of the impulse tubing and its connection		
6.	Check the proper functionality of the isolating valve.		
7.	Clean the Drain line by flushing the product.		
8.	Check for the proper display indication in the local unit.		
9.	Check for the proper cable glanding.		
10.	Check for the canopy condition & corrosion effects if any.		
11.	Check for the proper cable tags.		
12.	Carry out calibration in increasing & decreasing order		
13.	Carry out Zero Error rectification if reqd.		
14.	Note down Span Error		

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15.	Note down Hysteresis Error		
16.	Record acceptable operating range post calibration		
17	Note Work Permit No		

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6.19 Calibration Format:

Location : Department: Instrumentation

Month: **Frequency: Yearly**

Doc No: ISF/INT/22

क्रमांक **Sl. No.**	इनपुट **Input Pressure(kg/cm2g)**	आउटपुट **Output Current (mA) (Expected) (A)**	आउटपुट **Output Current (mA) (Observed) (B)**	% गलती **% Error (B-A)* 100/(A-4 mA)**	टिप्पणी **Remarks**

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6.20 Relevant Records:

Maintenance of Pressure Transmitter: ISF/INT/01 & Calibration Report : ISF/INT/22

6.21 Frequency:

Maintenance of Pressure Transmitter: Yearly

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7. PROCEDURE FOR PREVENTIVE MAINTENANCE AND CALIBRATION OF DIFFERENTIAL PRESSURE TRANSMITTER:

7.1 Purpose:

To provide guidelines for Preventive Maintenance, Calibration & Trouble Shooting of Differential Pressure Transmitter.

7.2 Scope:

Scope of work includes Preventive Maintenance, Calibration & Trouble Shooting of Differential Pressure Transmitter provided at the location.

7.3 Applicability:

This SOP is applicable to the entire pipeline SBU.

7.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

7.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

7.6 Usage:

For Sensing, Measuring and transmitting the differential pressure.

7.7 Importance:

Differential Pressure is measured across Pump T-Strainers, Basket Filters. This is important parameter for assessing the healthiness/choking of Strainer/Filter element. Basis this input value cleaning of Strainer/Filter element is planned.

7.8 Location of Installation:

Across T-Strainers of Pumps, Basket Filters etc.

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7.9 Integration with PLC or SCADA (at SV Stations):

Differential pressure transmitters are integrated with station PLC. Process values of these transmitters are transmitted to station PLC and these are used for assessing the healthiness/choking of Filters and T-strainers.

7.10 Parts:

Pressure Transmitters consists of sensing equipment, Transducer, Local Display and Transmitter.

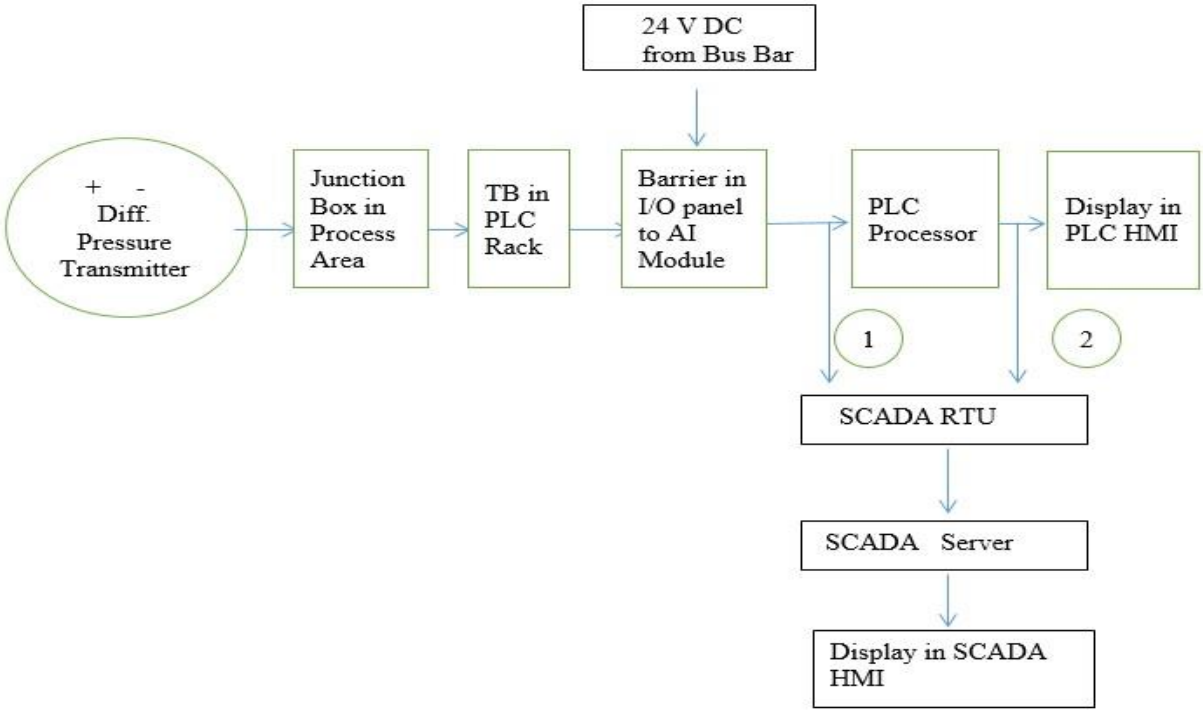
7.11 Working Principle:

Sensing equipment of transmitter senses the differential pressure across the equipment (Strainer/Filter) in form of displacement, this is further converted to electrical signal, which is transmitted to station PLC through transmitter, and same value is transmitted to local display unit. Transmitter gets the 24 V DC supply from station PLC through that two wire loop pressure value is transmitted in form of 4-20 mA.

7.12 Electrical Connections:

24 V DC supply from station PLC and 4 to 20 mA is transmitted to station PLC through this 2-wire loop.

7.13 Block Diagram:



Note:

1: At SV Stations

2: At Main Stations through Modbus interface

7.14 Procedure for Preventive Maintenance and Calibration of Differential Pressure Transmitter:

Before carrying out Preventive Maintenance & Calibration of Pressure Transmitter please ensure the following:

a. Ensure that maintenance of equipment will not affect the normal operations.
b. Proper Work Permit System to be followed

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c. Intimation to be provided to control room prior start and ensure this activity will not affect the operations.
d. Proper PPE such as Safety helmet s, Safety gloves, goggles are to be used.
e. Completion of activity to be informed to control room.

7.15 Procedure for Preventive Maintenance of Pressure Transmitter:

a. Check DC Voltage at terminals of Transmitter. Under normal conditions, it has to be in range of 16 to 22 V DC.
b. Check for proper connection of Instrument Ground Wire. It has to be tight and intact.
c. Check the Transmitter for proper installation.
d. Check the condition of impulse tubing and its Connections. Ensure no seepage of product.
e. Check for proper display indication in local display unit.
f. Check for proper cable glanding. These are to be of proper size and double compression type for ensuring flameproof ness.
g. Check the condition of canopy and ensure nil corrosion
h. Check for proper cable tags, which are to be legible and clear.

Note: Observations has to be filled in Maintenance format.

7.16 Procedure for Calibration of Pressure Transmitter:

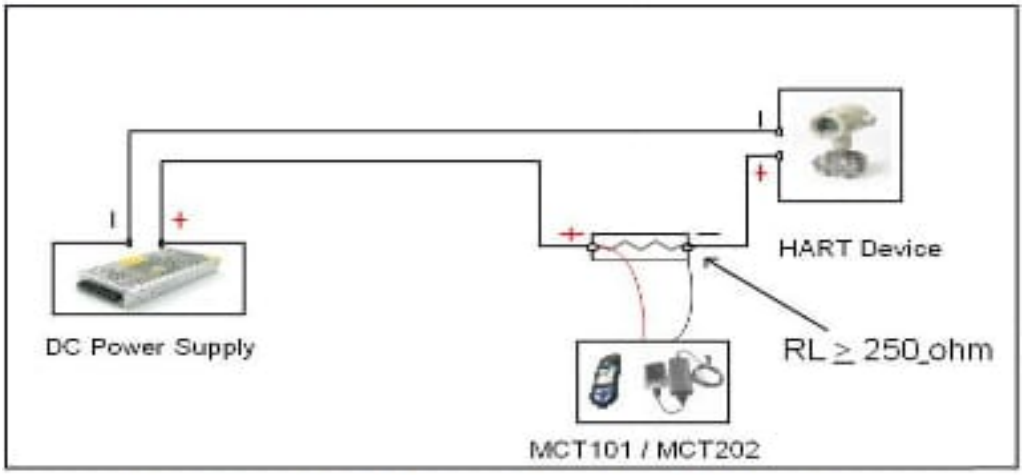
Following equipment to be kept ready before start of activity:

a. Portable Pressure calibrator
b. Power supply unit (24VDC).
c. 250-ohm resistor
d. Hand held communicator (HHC) HART/Universal Calibrator, Digital multi-meter
e. Tools and Tackles, Empty jar for collecting the drained product.

Note: Test pressure can be provided to PT by using Portable Pressure Calibrator calibration can be carried out in process area itself.

a. Obtain cold work permit.
b. Isolate 24 VDC power supply from the Control panel to Pressure Transmitter (PT), which is in the field.
c. Isolate the impulse line from process connections.
d. . Depressurize the impulse line by draining.

e. Connect the PT to the Portable Pressure Calibrator Install Positive side of 'DPT' on Portable Pressure Calibrator second end is left open for atmospheric pressure.
f. Power up the 'PT' by 24VDC from regulated power supply unit or multifunction calibrator and connect the HART calibrator keeping the resistor in circuit as shown in below diagram.
g. Check the 'PT' current output by applying pressure in increasing and decreasing order of 0%, 25%, 50%, 75% and 100% of the range.
h. If required carry out the zero adjustment manually or through Multi- Function or by HART Calibrator by draining the oil from pressure pump.
i. In case of zero error, zero adjustment has to be done prior to span adjustment.
j. If required carry out the span adjustment by using HART Calibrator by applying pressure of 100% range.
k. Calculate hysteresis error. The hysteresis error is maximum difference in output at any measurement value within equipment's pressure range when approaching the point first with increasing and then with decreasing pressure.
l. After error adjustments again note down mA output by applying pressure in increasing and decreasing order as per Point No 7 and record the readings.
m. Install, restore the process connection, signalling and power supply at the panel end and make it online.
n. An acceptance criterion of Pressure Transmitter is +/- 2 % error or as per OEM recommendations whichever is lower.
o. **Set up for Calibration of Differential Pressure Transmitter:**
    I. DC external power supply can be provided through Multi-function calibrator or Hand Held Communicator.
    II. HART Calibrator is used for modification of any settings.
    III. Positive end of Differential Pressure Transmitter is used for applying the test pressure and negative end of DPT is kept open for atmospheric pressure. This will help in generating effective differential pressure.



Note: Observations has to be filled in calibration format.

7.17 Trouble Shooting Procedure:

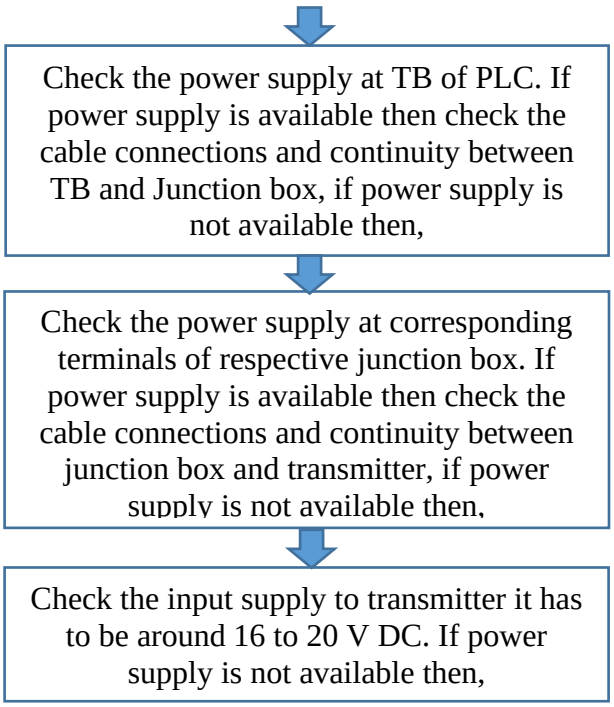
a. Issue 1: No display in DPT and PLC end.

At barrier check the input DC Voltage it has to be 24 V DC. If Input power supply is not ok check its connection from 24 V DC bus bar and rectify it. If Power Supply is OK then check barrier Input signal voltage it has to be in range of 16 to 22 V DC. If Barrier Input signal voltage is ok then Check Barrier

If barrier Output Voltage is not ok then isolate the barrier and inject the voltage in input end using Multifunction calibrator. If Output voltage is still not ok then replace the barrier with new one.

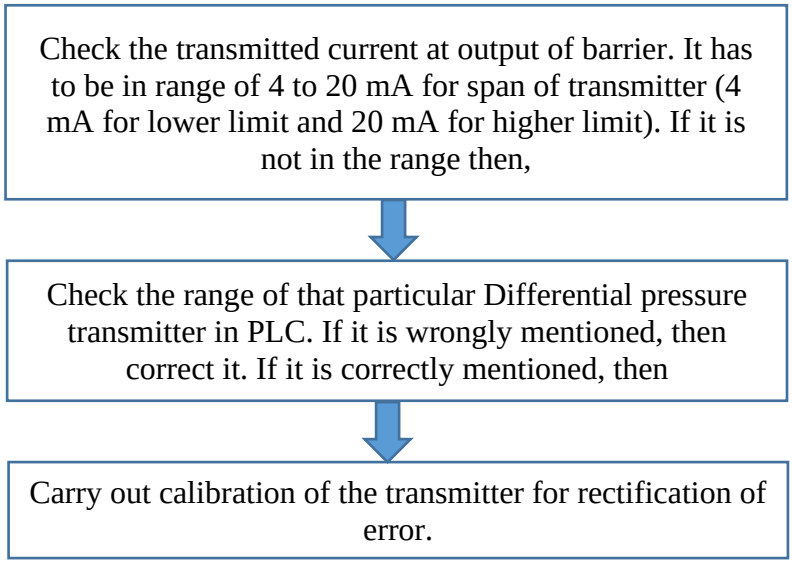
If barrier Input and Output Voltages are not ok then isolate the barrier and inject the voltage in input end using Multifunction calibrator. If Output voltage is still ok then make the connections as earlier

Check the fuse connection at TB end if fuse is blown out then check the probable cause and replace the blown fuse. If fuse connection is ok then check the 24 V DC supply at incoming of TB from barrier.

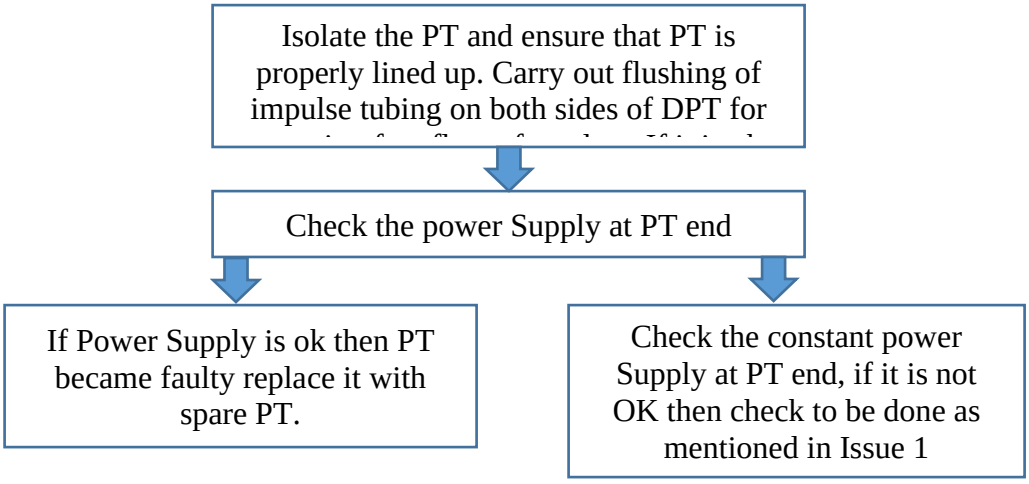


Note: If power supply is ok but still there is no display in PT & PLC end then replace the PT.

a. Issue 2: Wrong display in PLC:



b. Issue 3: PT value got stuck and not updating properly:



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7.18 Maintenance Format:

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/02

क्रमांक S. No.	**निर्देश Instructions**	**परिणाम Observation**	**टिप्पणी Remarks**
1	Check the DC power supply at Pressure Transmitter		
2	Check for proper connection of instrument ground wire.		
3	Calibrate the Transmitter across the Span. Record in calibration sheet.		
4	Check the Pressure Transmitter for proper installation		
5.	Check the condition of the impulse tubing and its connection		
6.	Check the proper functionality of the isolating valve.		
7.	Clean the Drain line by flushing the product.		
8.	Check for the proper display indication in the local unit.		
9.	Check for the proper cable glanding.		
10.	Check for the canopy condition & corrosion effects if any.		
11.	Check for the proper cable tags.		
12.	Carry out calibration in increasing & decreasing order		
13.	Carry out Zero Error rectification if reqd.		

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14.	Note down Span Error		
15.	Note down Hysteresis Error		
16.	Record acceptable operating range post calibration		
17	Note Work Permit No		

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7.19 Calibration Format:

Location :

Department: Instrumentation

Month:

Frequency: Yearly

Doc No: ISF/INT/22

क्रमांक **Sl. No.**	इनपुट **Input Pressure(kg/cm2g)**	आउटपुट **Output Current (mA) (Expected) (A)**	आउटपुट **Output Current (mA) (Observed) (B)**	% गलती **% Error (B-A)* 100/(A-4 mA)**	टिप्पणी **Remarks**

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Designation :
Date :

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7.20 Relevant Records:

Maintenance of Differential Pressure Transmitter: ISF/INT/03 & Calibration Report : ISF/INT/22

7.21 Frequency:

Maintenance of Differential Pressure Transmitter: Yearly

	Prepared By	Verified By	Authorized By
Signature with date			
Name			
Designation			**GM-PIPELINE**

8. PROCEDURE FOR PREVENTIVE MAINTENANCE AND CALIBRATION OF TEMPERATURE TRANSMITTER:

8.1 Purpose:

To provide guidelines for Preventive Maintenance, Calibration & Trouble Shooting of Temperature Transmitter.

8.2 Scope:

Scope of work includes Preventive Maintenance, Calibration & Trouble Shooting of Pressure Transmitter provided at the location.

8.3 Applicability:

This SOP is applicable to the entire pipeline SBU.

8.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

8.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

8.6 Usage:

For Sensing, Measuring and transmitting the temperature of product.

8.7 Importance:

Temperature is one of the important parameters in pipeline operations. Since Petroleum, products expand/contract according to temperature. Hence, this parameter has to be monitored. Inputs of these transmitters are also provided to density meter and flow computer for conversion of density and flow values to standard ones. These are used in protection system of pumps and moors. It is also used as one of the inputs to Leak Detection System, which is used for maintaining the integrity of pipeline.

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8.8 Location of Installation:

At SV stations, Suction and Discharges of pumps, Station inlets and outlets, receipt lines etc.

8.9 Integration with PLC:

Field Temperature transmitters are integrated with station PLC, Flow meter assembly Temperature Transmitters are integrated with flow computer, Density meter skid with density convertor, Pump and Motor transmitters are integrated with Vibration Monitoring system in station and with SCADA system in SV stations. Process values of these transmitters are transmitted to station PLC. Process values of transmitters of motor and pump are transmitted to vibration monitoring system and these are further fed as inputs to safety interlocks of pumps and motors. These interlocks help in maintaining safety of these equipment.

8.10 Parts:

Temperature Transmitters consists of sensing equipment (RTD) inside a thermowell, Local Display and Transmitter.

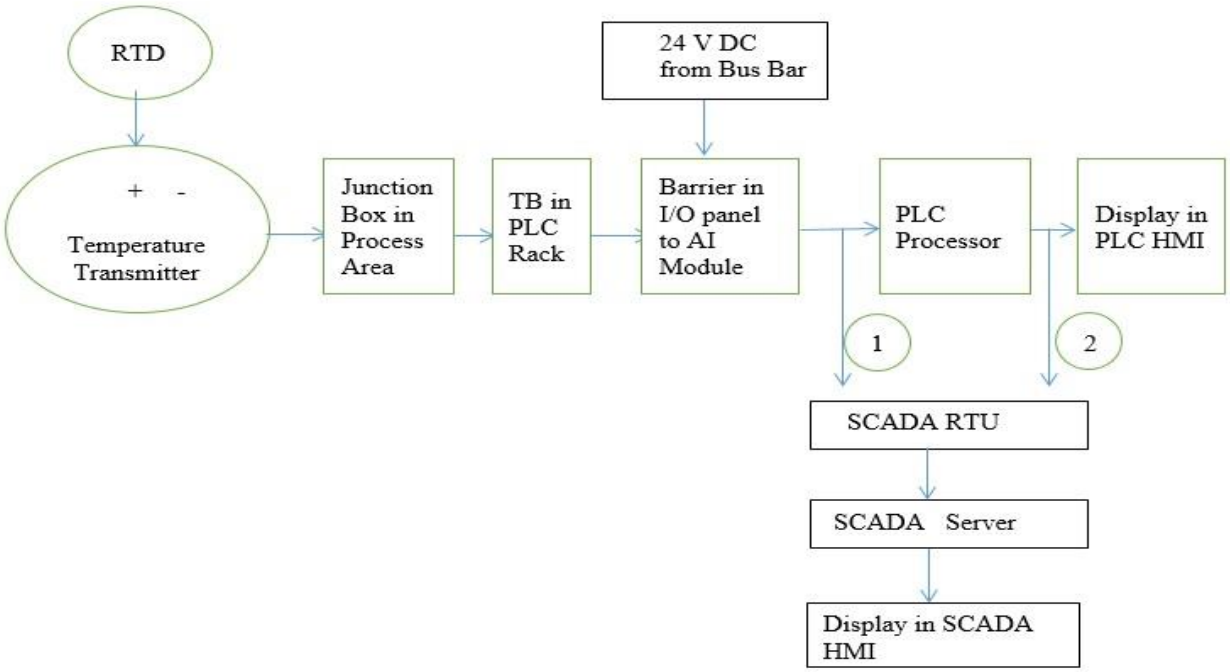
8.11 Working Principle:

Resistance Temperature Detector (RTD) is used as the sensing element in Temperature Transmitters. PT100 sensors in three wire or 4 wire connections are used. RTDs are placed within thermowells, which are used to guard against damage from excessive pressure, material velocity and corrosion. These sense the temperature and convert it to corresponding resistance. This electrical resistance is converted into current by transmitters, which is transmitted and fed to PLC. At PLC, this current is converted to temperature as per defined range for display and further usage.

8.12 Electrical Connections:

24 V DC supply from station PLC and 4 to 20 mA is transmitted to station PLC through this 2-wire loop.

8.13 Block Diagram:



Note:

1: At SV Stations

2: At Main Stations through Modbus Interface

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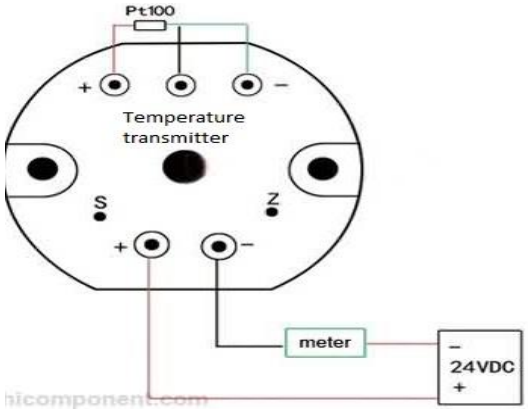
8.14 Wiring Diagram of Temperature Transmitter:



8.15 Procedure for Preventive Maintenance and Calibration of Temperature Transmitter:

Before carrying out Preventive Maintenance & Calibration of Temperature Transmitter please ensure the following:

a. Ensure that maintenance of equipment will not affect the normal operations.
b. Proper Work Permit System to be followed
c. Intimation to be provided to control room prior start and ensure this activity will not affect the operations.
d. Proper PPE such as Safety helmet s, Safety gloves, goggles are to be used.
e. Completion of activity to be informed to control room.

Procedure for Preventive Maintenance of RTD/Temperature Transmitter:

a. Check DC Voltage at terminals of Transmitter. Under normal conditions, it has to be in range of 16 to 22 V DC.
b. Check for proper connection of Instrument Ground Wire. It has to be tight and intact.
c. Check the Transmitter for proper installation
d. Check the condition of thermowell fixture and its Connections. Ensure no seepage of product.
e. Check for proper display indication in local display unit.

f. Check for proper cable glanding. These are to be of proper size and double compression in nature.
g. Check the condition of canopy and ensure no corrosion
h. Check for proper cable tags, which are to be legible and clear.

Note: Observations has to be filled in Maintenance format.

Calibration of Temperature Transmitter

a. Disconnect the power supply to 'RTD' / Temperature Transmitter from the panel end.
b. Remove RTD along with Temperature Transmitter (If applicable).
c. Fill the high temperature bath with the suitable grade of heat transfer oil or water or use Dry Type Temperature block for calibration.
d. Keep the RTD in the temperature bath.
e. Set the temperature controller as per the requirement and note down the resistance in ohms by digital multi-meter for 'RTD' and note down the readings on Temperature Transmitter (If applicable)
f. Repeat the procedure for temperatures as listed in the calibration sheet. Note down all the readings in the calibration sheet.
g. After calibration install the RTD / Temperature Transmitter and restore the process connections.
h. Compare the readings of the RTD ie; resistances recorded against the standard temperature read out sheet of the RTD and check for acceptability criteria equivalent to -/+ 1 deg C.
i. Acceptability criteria for RTD & TT are +/- 1 deg C.
j. Completion of activity to be informed to control room.

8.16 Trouble Shooting Procedure:

a. Issue 1: No display in TT and PLC end.

At barrier check the input DC Voltage it has to be 24 V DC. If Input power supply is not ok check its connection from 24 V DC bus bar and rectify it. If Power Supply is OK then check barrier Input signal voltage it has to be in range of 16 to 22 V DC. If Barrier Input signal voltage is ok Then Check Barrier Out put voltage

If barrier Output Voltage is not ok then isolate the barrier and inject the voltage in input end using Multifunction calibrator. If Output voltage is still not ok then replace the barrier with new one.

If barrier Input and Output Voltages are not ok then isolate the barrier and inject the voltage in input end using Multifunction calibrator. If Output voltage is still ok then make the connections as earlier

Check the fuse connection at TB end if fuse is blown out then check the probable cause and replace the blown fuse. If fuse connection is ok then check the 24 V DC supply at incoming of TB from barrier.

Check the power supply at TB of PLC. If power supply is available then check the cable connections and continuity between TB and Junction box, if power supply is not available then,

Check the power supply at corresponding terminals of respective junction box. If power supply is available then check the cable connections and continuity between junction box and transmitter, if power supply is not available then,

Check the input supply to transmitter it has to be around 16 to 20 V DC. If power supply is not available then,

Note: If power supply is ok but still there is no display in TT & PLC end then replace the TT.

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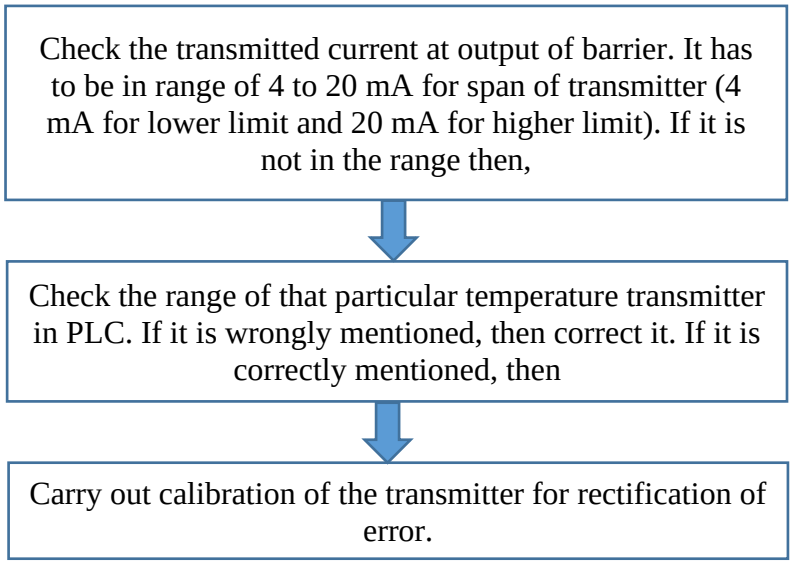
b. Issue 2: Wrong display in PLC:



Note: In Temperature Transmitter we can calibrate transmitter only. For PT-100 type 3-Wire RTDs check resistance across each two terminals. One combination it has to be short (continuity) and in balance two combinations it has to provide resistance of (100+(Ambient Temperature/2.8)).If RTD is not providing any resistance output then it has to be replaced.

8.17 Maintenance Format:

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/03

क्रमांक S. No.	**निर्देश Instructions**	**परिणाम Observation**	**टिप्पणी Remarks**
1	Check the DC power supply at temperature Transmitter		
2	Check for proper connection of instrument ground wire.		
3	Calibrate the Transmitter across the Span. Record in calibration sheet.		
4	Check the temperature Transmitter for proper installation		
8.	Check for the proper display indication in the local unit.		
9.	Check for the proper cable glanding.		
10.	Check for the canopy condition & corrosion effects if any.		
11.	Check for the proper cable tags.		
12.	Carry out calibration in increasing & decreasing order		
13.	Carry out Zero Error rectification if reqd.		
14.	Note down Span Error		
15.	Note down Hysteresis Error		
16.	Record acceptable operating range post calibration		
17	Note Work Permit No		

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Name			
Designation			**GM-PIPELINE**

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Date :

8.13 Calibration Format:

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/22

क्रमांक **Sl. No.**	इनपुट **Input Temperature**	**Resistance**	आउटपुट **Output Current (mA) (Expected) (A)**	आउटपुट **Output Current (mA) (Observed) (B)**	% गलती **% Error (B-A)* 100/(A-4 mA)**	टिप्पणी **Remarks**

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Designation :
Date :

8.18 Relevant Records:

Maintenance of Temperature Transmitter: ISF/INT/03 & Calibration Report: ISF/INT/22

8.19 Frequency:

Maintenance of Temperature Transmitter: Yearly

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Name			
Designation			**GM-PIPELINE**

9. PROCEDURE FOR PREVENTIVE MAINTENANCE OF LEVEL TRANSMITTERS

9.1 Purpose:

To provide guidelines for Preventive Maintenance, Calibration & Trouble Shooting of Level Transmitter.

9.2 Scope:

Scope of work includes Preventive Maintenance, Calibration & Trouble Shooting of Level Transmitter provided at the location.

9.3 Applicability:

This SOP is applicable to the entire pipeline SBU.

9.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

9.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

9.6 Usage:

Level Transmitters are used for measuring the product levels of the tanks.

9.7 Importance:

These level transmitters are used for viewing the level of storage tanks, which helps in ascertaining the quantity of product in the storage tanks

9.8 Location of Installation:

Sump Tanks, C.I Dosing Tanks, DRA tanks, Pump Seal POT etc.

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9.9 Integration with PLC:

All level transmitters are integrated with station PLC in main stations. Process values of these transmitters are transmitted to station PLC and these are further fed as inputs to safety interlocks. These interlocks help in maintaining safety of the station.

9.10 Parts:

Level Transmitters consists of sensing equipment, Transducer, Local Display and Transmitter

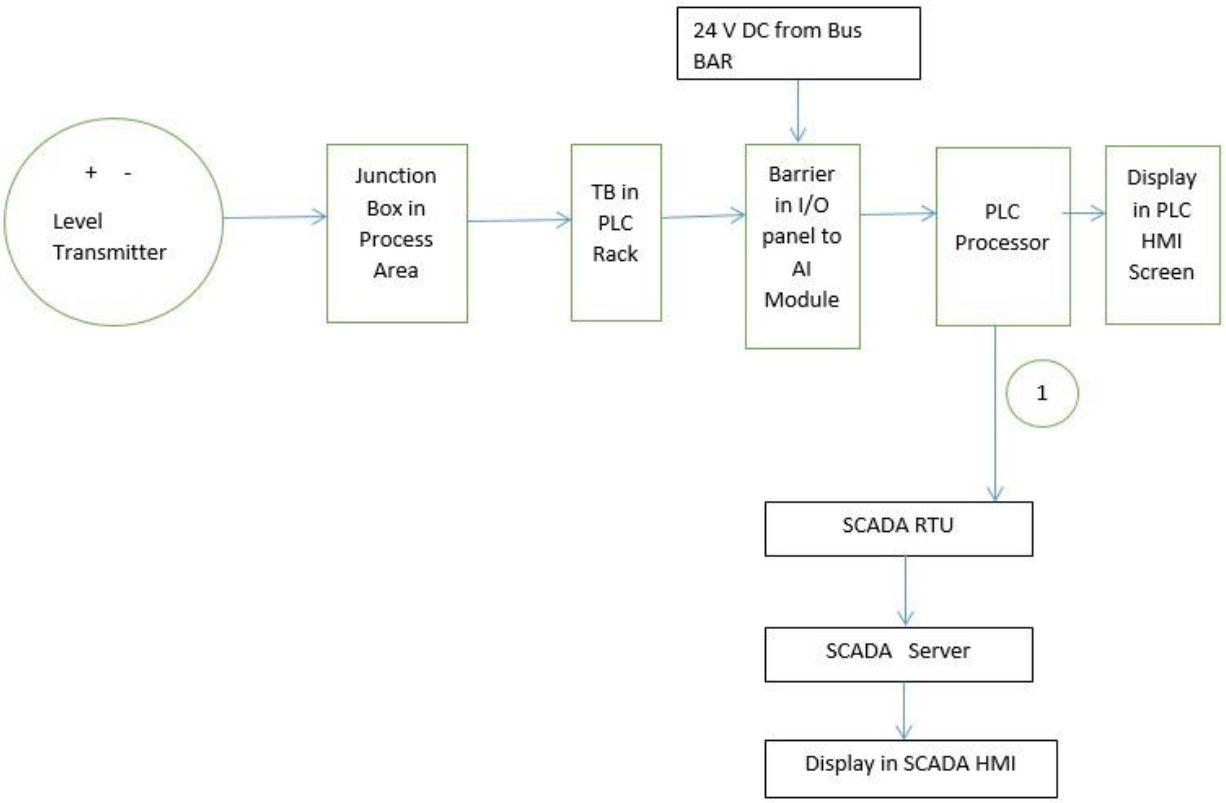
9.11 Working Principle:

Ultrasonic transducer mounted to or near the top of the tank sends out an ultrasonic pulse. When the pulse hits the surface of the liquid, it is reflected, and the sensor calculates fill level based on the time between the pulse and the return signal.

9.12 Electrical Connections:

24 V DC supply from station PLC and 4 to 20 mA is transmitted to station PLC through this 2-wire loop.

9.13 Block Diagram:



Note:

1: At Main Stations through Modbus interface

9.14 Preventive Maintenance/Calibration of Level Transmitter:

a. Obtain cold work permit.
b. Check and tighten all terminations after isolating the power supply.
c. Check for proper connection of instrument ground wire.
d. Check the DC power supply. Normal input is 24V DC.

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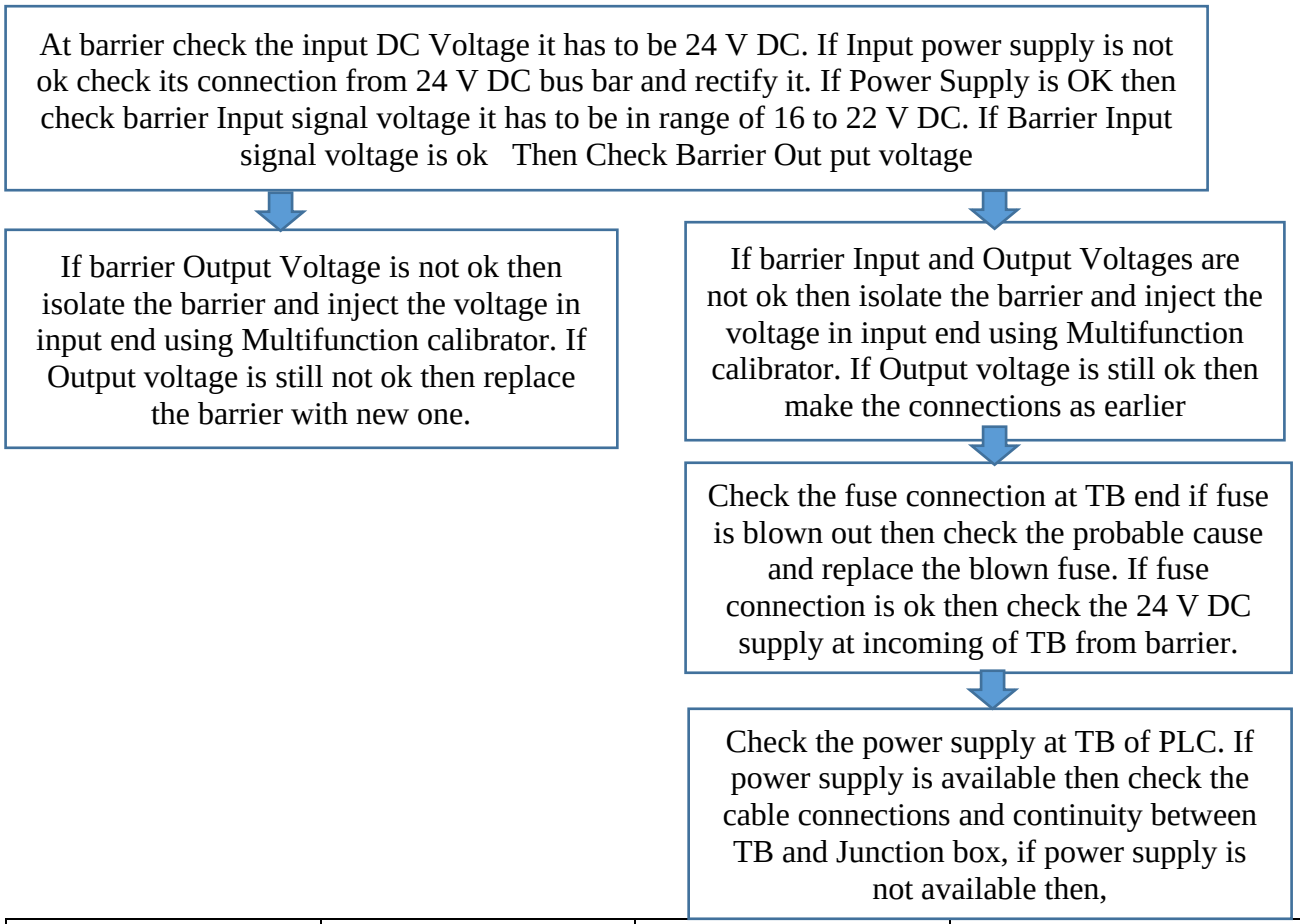
e. Stimulate low level by emptying out sump tank and check for 0% in the local indicator and 4mA output from the level transmitter.
f. Simulate maximum level by drawing product / water into sump tank and check for 100% in the local indicator and 20 mA output from the level transmitter.
g. Sump tank level cannot be completely empty out or filled out.
h. Cross check the sump tank actual dip, using the dip rod which has to be calibrated.
i. While emptying out sump tank note down the dip at readings and Level Transmitter readings at suitable intervals and record in calibration sheet.

9.15 Trouble shooting of Level Transmitters:

a. **Issue 1: No display in LT and PLC end.**



Check the power supply at corresponding terminals of respective junction box. If power supply is available then check the cable connections and continuity between junction box and transmitter, if power supply is not available then,

Check the input supply to transmitter it has to be around 16 to 20 V DC. If power supply is not available then,

Note: If power supply is ok but still there is no display in LT & PLC end then replace the LT.

b. **Issue 2: Wrong display in PLC:**

Check the transmitted current at output of barrier. It has to be in range of 4 to 20 mA for span of transmitter (4 mA for lower limit and 20 mA for higher limit). If it is not in the range then,

Check the range of that particular level transmitter in PLC. If it is wrongly mentioned, then correct it. If it is correctly mentioned, then

Send the Level Transmitter for calibration to OEM

c. **Issue 3: LT value got stuck and not updating properly:**

Isolate the LT, Check the functionality of Radar Gauge and ensure that radar probe is free from impurities and is having clear path. If it is ok then, check the current at the interface between probe and transmitter it has to be in range of 4-20 mA, if it is ok then

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LT is malfunctioning; Send the Level Transmitter for calibration to OEM or replace it

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Maintenance Format for Level Transmitter:

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/04

PR**क्रमांक** **S. No.**	**निर्देश Instructions**	**परिणाम** **Observation**	**टिप्पणी** **Remarks**
1	Check the DC power supply. Normal input is 24 V +/- 10% DC		
2	Check for the proper display in the Local display panel.		
3	Check for proper connection of instrument ground wire.		
4	Empty out the Sump Tank and check for 0% level. If not adjust Zero setting.		
5	Fill the Sump Tank with water/product and check for 100% level. If not adjust Span setting.		
6	Calibrate Transmitter across the span by emptying out the water/product. Cross check the sump tank actual dip, using the dip rod. Record all the data in the calibration sheet.		
7	Check the transmitter for proper installation.		
8	Check for the proper cable glanding.		
9	Check for the canopy condition & corrosion effects if any.		
10	Check cables for the proper cable tags.		
11	Cold Work Permit No		

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Designation			**GM-PIPELINE**

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Date	:	Date	:

9.16 Relevant Records:

Maintenance of Level Transmitter: ISF/INT/04

9.17 Frequency:

Maintenance of Level Transmitter: Yearly

10. PROCEDURE FOR PREVENTIVE MAINTENANCE OF DENSITY METER AND DENSITY CONVERTOR:

10.1 Purpose:

To provide guidelines for Preventive Maintenance, Calibration & Trouble Shooting of Density Meter and Density Convertor

10.2 Scope:

Scope of work includes Preventive Maintenance, Calibration & Trouble Shooting of Density Meter and Density Convertor provided at the location.

10.3 Applicability:

This SOP is applicable to the POL pipelines.

10.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

10.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

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10.6 Usage:

For measuring density of product.

10.7 Importance:

Density is one of the most important parameter for tracking the different products in multi-product pipeline operations. It is used as one of the inputs to APPS server for batch tracking application.

10.8 Location of Installation:

Near Station Inlet and in receipt side.

10.9 Integration with PLC:

Frequency from density meter is transmitted to density convertor. In density convertor this received frequency is converted to density for display. This density is further transmitter to station PLC through hard wiring or Modbus interface.

10.10 Parts:

Density meter skid consists of motor, pump, Density Meter (Consisting of tubes, amplifier circuit and temperature element for temperature compensation) and Density Convertor.

10.11 Working Principle:

The sensor assembly consists of two parallel tubes connected by two manifolds. One manifold supports an assembly which locates electromagnetic coils at a suitable distance from magnetic pole pieces attached to each of the tubes (each tube has one drive and one pick up coil). By exciting each of the drive coils the tubes are caused to oscillate. A magnetic amplifier, located in the terminal box amplifies the signal from the pick-up coils, corrects the phase of the signal and feeds it to drive coils. The magnetic excitation of the sensor tubes maintains them in oscillation at their natural resonance. As the resonant frequency of the tubes depends on their length, stiffness and mass and the volume of tube sis fixed by their physical dimensions, the density of the fluid in the tubes has a direct effect on the mass of the tubes. This causes a change in frequency. Since the entire sensor assembly is under common conditions. The density of the process fluid is therefore the major factor influencing the instrument. Frequency from sensor assembly is fed to density convertor. In this convertor frequency is converted to density for display. This density is further fed to station PLC through Modbus serial interface.

10.12 Electrical Connections:

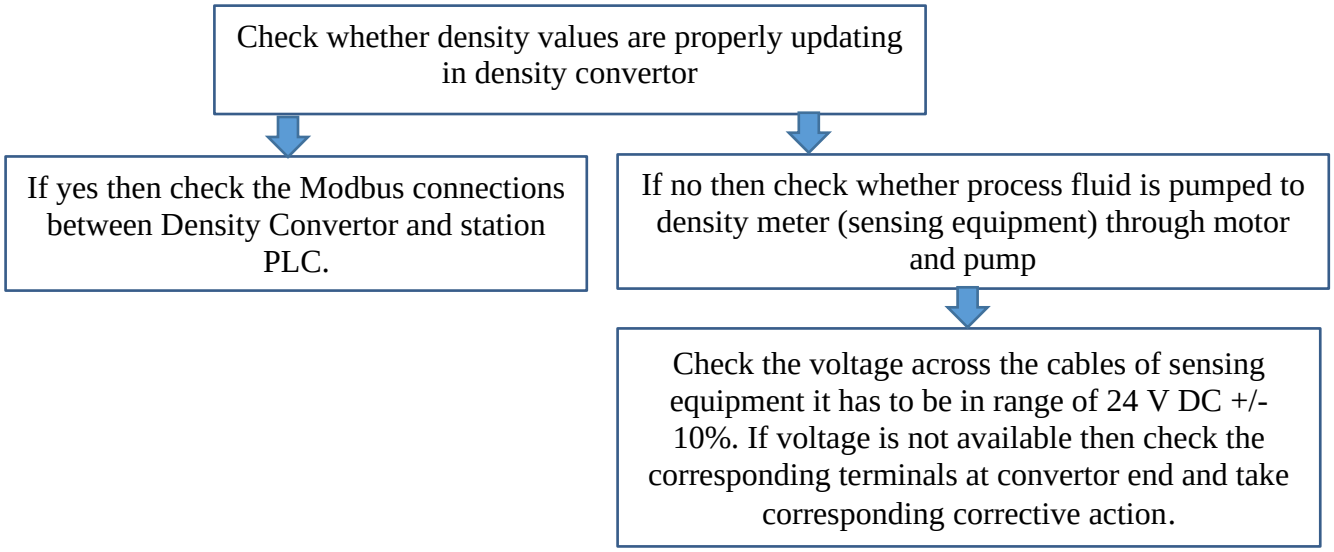
24 V DC from density convertor to sensor assembly for transmitting frequency.

10.13 Preventive Maintenance of Density Meter:

a. Obtain cold work permit.
b. Check the receiver power and signal wiring. Also check signal output to other instruments.
c. Check for proper and legible marking of cable from field.
d. Check for proper connection of instrument ground wire in the receiver
e. Check and tighten all terminations.
f. Check power supply to receiver. It shall be 24V DC.
g. Using a calibrated hydrometer cross check density indication. Difference shall be within +/- 0.003 gm/cc.

10.14 Trouble shooting of Density Meter and Density Convertor:

a. **Issue 1: Non updation of density data in station PLC.**



b. **Issue 2: Wrong updation of density data**

Ensure the flow of process fluid through sensing element. If it is ok then

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Ensure proper functionality of temperature element. Ensure RTD connections are proper and tight. If internal RTD is not functioning properly then outside RTD can be connected for temperature compensation. If it is ok then

↓

Cross check the constants (especially Density Conversion Factor) are correctly fed into density convertor as per factors provided on cover of density meter.

10.15 Maintenance format for density meter:

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/05

क्रमांक S. No.	**निर्देश Instructions**	**परिणाम Observation**	**टिप्पणी Remarks**
1	Check the Receiver Power and Signal wiring. Also check signal output to other instruments.		
2	Check for proper and legible marking of cable from field.		
3	Check for proper connection of instrument ground wire in the receiver.		
4	Check and tighten all terminations.		
5	Check the power supply to receiver. DC supply is 24 V DC.		
6	Using a calibrated hydrometer cross check density indication. Accuracy limit +/- 0.002 gm/c.c. Master Hydrometer reference number and calibration due date		
7	Check the Transmitter and Receiver interconnection wiring on		
8	Cold Work Permit Number		

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Designation			**GM-PIPELINE**

10.16 Relevant Records:

Maintenance of Density meter: ISF/INT/05

10.17 Frequency:

Maintenance of Density meter: Half-Yearly

11. PROCEDURE FOR PREVENTIVE MAINTENANCE OF ONLINE VIBRATION MONITORING SYSTEM:

11.1 Purpose:

To provide guidelines for Preventive Maintenance, Calibration & Trouble Shooting of Online Vibration Monitoring System.

11.2 Scope:

Scope of work includes Preventive Maintenance, Calibration & Trouble Shooting of Online Vibration Monitoring System provided at the location.

11.3 Applicability:

This SOP is applicable to the entire pipeline SBU.

11.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

11.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

11.6 Usage:

For measuring vibrations of the pump and motor.

11.7 Importance:

Vibrations of the rotating equipment like pump and motor are the key parameters for ensuring this equipment are working with in safe limits.

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11.8 Location of Installation:

Drive End and Non Drive Ends of Pump, Motor

11.9 Integration with PLC: These vibration monitoring equipment are integrated with vibration monitoring system of the pump. From this system these are integrated with station PLC through hard wiring or through Modbus over serial interface.

11.10 Parts:

Vibration measuring equipment, Transducer and connecting wires.

11.11 Working Principle:

Vibration is measured either in form of displacement or velocity or acceleration. These are proximity type sensors in which a constant gap voltage of -10 V is maintained as reference. This negative voltage is used because noise level is very less in negative voltage compared to positive voltage and this will not affect the sensitive range of vibration measurement. Transducer converts this gap voltage to displacement or velocity or acceleration for indicating vibration.

11.12 Electrical Connections:

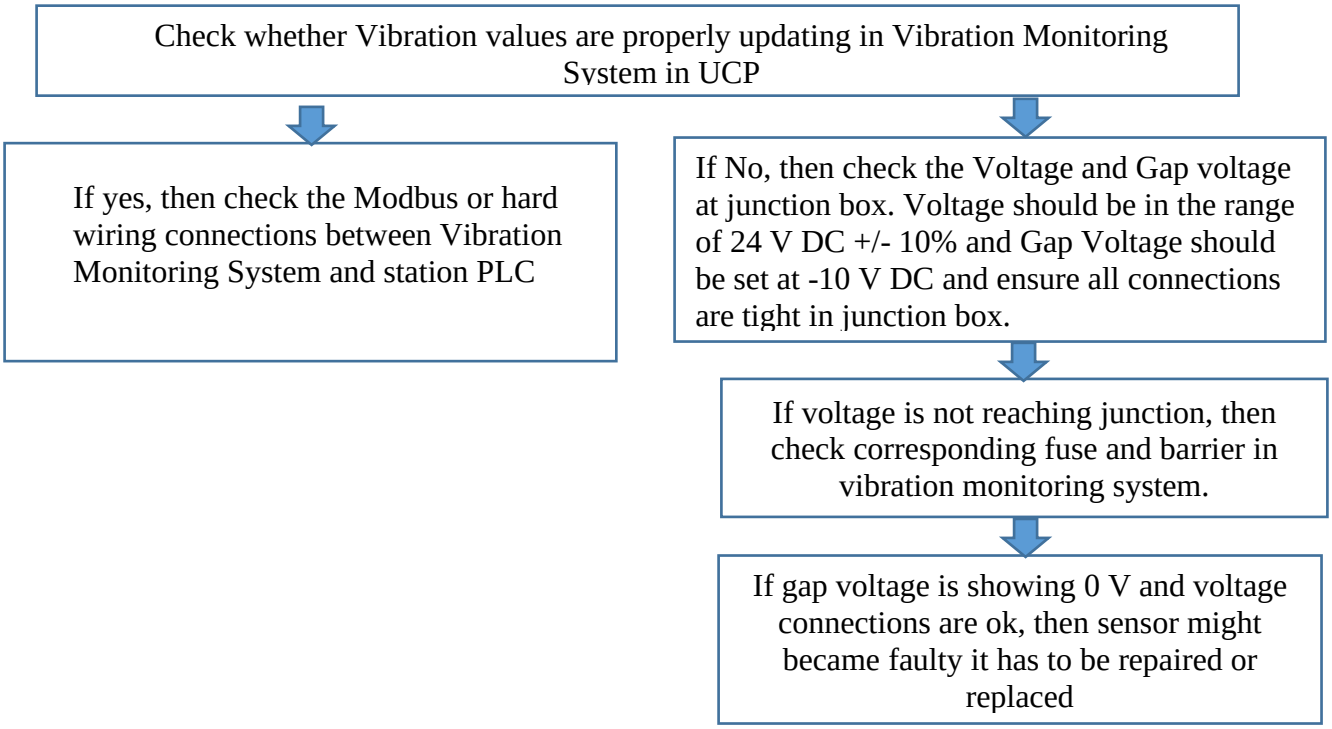
24 V DC supply through Barrier and feedback of 4 to 20 mA is transmitted to Vibration Monitoring Controller by 2-wire loop.

11.13 Preventive Maintenance of Online Vibration Monitoring System:

a. Obtain cold work permit.
b. Check Vibration sensor on pump or motor for physical damages and tightness.
c. Check for proper feruling at sensor and junction box.
d. Check Cable continuity of sensor to junction box.
e. Check supply voltage across transducer terminals in junction box, it has to be in range of 24 V DC+/-10 %
f. Check output gap voltage across transducer terminals in junction box it has to be in range of -9.5 to -10.5 V DC for all sensors.
g. Cross verify values at UCP controller HMI.
h. Check and tighten all terminations.

***11.14* Trouble shooting of Vibration Measuring Equipment:**

a. **Issue 1: No display in Vibration Monitoring System at PLC end.**



b. **Issue 2: Wrong display in PLC:**

Ensure that sensor connections are tight and proper at Field Junction Box and Vibration Monitoring System end.

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If Connections are proper then check the gap voltage of this particular sensor at junction box and it has to be in range of -10 V DC. If it low or high, then adjust the check nut of probe for getting -10 V DC. After adjusting check nut for getting -10 V DC then tight the check nut.

↓

After ensuring proper connections and gap voltage at field junction box. Check for assigned ranges of sensor in vibration monitoring system. This range has to match with range provided by OEM. If not, then correct the range of equipment.

11.15 Maintenance format for Online Vibration Monitoring System

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/06

क्रमांक S. No.	**निर्देश Instructions**	**परिणाम Observation**	**टिप्पणी Remarks**
1	Check Vibration sensor on pump or motor for physical damages and tightness		
2	Check supply voltage across transducer terminals in junction box it has to be in range of 24 V DC+/- 10 %		
3	Check output gap voltage across transducer terminals in junction box it has to be in range of -9.5 to -10.5 V DC :		
	PNDE X		
	PNDE Y		
	PNDE Z		
	PDE X		
	PDE Y		
	MDE X		
	MDE Y		
	MNDE X		
	MNDE Y		
	MNDE Z		
4	Carry out adjustment of sensor if gap voltage is not in range		

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Name			
Designation			**GM-PIPELINE**

5	Check the corresponding vibration signal in UCP Controller HMI		
6	Cold Work Permit Number		

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Date :

Approved By
Signature :
Name :
Designation :
Date :

11.16 Relevant Records:

Maintenance of Online Vibration Monitoring System: ISF/INT/06

11.17 Frequency:

Maintenance of Online Vibration Monitoring System: Yearly

12. PROCEDURE FOR PREVENTIVE MAINTENANCE OF CONTROL VALVE ACTUATORS

12.1 Purpose:

To provide guidelines for Preventive Maintenance & Trouble Shooting of Control valve actuator

12.2 Scope:

Scope of work includes Preventive Maintenance & Trouble Shooting of Control valve actuator

12.3 Applicability:

This SOP is applicable to the entire pipeline SBU.

12.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

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Name			
Designation			**GM-PIPELINE**

12.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

12.6 Usage:

Control Valves are used for regulating Flow and Pressure in pipeline operations. These parameters have to be regulated basis the requirement. These valves are driven by actuators for remote operations.

12.7 Importance:

For remote operations of control valves actuators are used. These actuators are used for incremental opening or closing of the valve. These actuators are having additional feature as fail open or fail close for holding as open or close respectively during power failure.

12.8 Location of Installation:

Pumping Side and Receipt side.

12.9 Integration with PLC:

These control valves are integrated with station PLC through hardwiring. From these actuators for Incremental opening or closing of valve analog output is used, for feedback of opening percentage analog input is used, for local/remote and open/close feedbacks digital inputs are used.

12.10 Components:

Electrically driven hydraulic unit for supplying pressurized fluid (hydraulic oil), Hand Wheel for manual operations, Local Display, Hydraulic Oil Chamber, Hand pump for developing pressure manually, AC to DC convertor (415 V AC to 24 V DC Convertor)

12.11 Working Principle:

These actuators work on Electro-Hydraulic actuation. Electrical signals from controller are used to operate a DC stepper motor in the actuator which creates hydraulic pressure for precision movement of valve stem.

12.12 Electrical Connections:

3-phase, 415 V AC supply for operating motor, For analog inputs and outputs 24 V DC supply from station PLC and 4 to 20 mA is transmitted to station PLC through this 2-wire loop, For digital inputs and outputs 24 V DC from station PLC as an interrogation power supply.

12.13 Preventive Maintenance of Control Valve & Actuator:

Frequency : Quarterly

a. Obtain Cold work permit.
b. Keep following equipment ready for use:
   I. Infra-red controller
   II. Multi-Function calibrator
   III. Digital Multi meter
c. Inspect actuator for any oil leaks.
d. Check the level of oil in actuator. Check the condition of oil visually for dirt. Refill the oil if level is low or change the oil if old oil is dirty.
e. Check the oil filter: Remove the oil filter and clean it by blower and check the filter for permeability.
f. To carry out permeability check, fill the filter with operating oil and check for free flow of oil through it.
g. Check for proper enclosure installation of Power/ Control Terminals.
h. Check stem gland for proper tightness.
i. Check the AC power supply to the actuator @ 415V +/- 10% AC phase to phase
j. Check for any undue temperature rise during running of motor.
k. Check the stroking of the control valve by feeding 4-20mA signal to the input terminals using digital calibrator. Adjust the fully closed and fully open conditions at appropriate signal levels.
l. Check response time of the control value at various input signals.
m. Check the position feedback corresponding to the step position for Fully Open and Fully Closed positions.
n. Check for Gland leaks and tighten bolts to requisite torque, if necessary.
o. Check operation of hand pump for manual valve stroking.
p. Check functioning of accumulator for valve stroking and for fully closing the valve.

12.14 Trouble shooting of Control Valve Actuators:

a. **Issue 1 : Non-operating of motor**

Check incoming power supply at terminals between phase to phase and phase to neutral of actuator. Between phase to phase it has to be in range of 415+/-10% V AC and between Phase to neutral it has to be in range of 230+/-10% V AC for all three phases.

↓

If Power Supply is not available, then check the incoming connections from corresponding feeder in MCC panel of Sub-station.

↓

If outgoing voltages are not available at substation, check the outgoing fuses. If fuses are blown out, after thorough checking replace the blown out fuses.

↓

After ensuring proper electrical connections, check the output of AC to DC convertor. It has to be in range of 24 V DC. If this convertor is not working, then it has to be replaced.

↓

If convertor is ok then check the continuity of thermostat connections of motor. It indicates whether motor is tripped on over load or not. If continuity is not there then check for appropriate reasons and reset the thermostat.

b. **Issue 2: Control Valve Actuator not taking commands from Station PLC:**

Check the proper cable connections and availability of 24 V DC at corresponding input terminals of actuator. If it is not available then check the same at junction box, PLC TB end, Check the fuse and barrier connections at PLC end.

↓

Ensure that drain valve is not opened and while giving command motor has to start for developing the pressure and pressure is built.

c. **Issue 3: Control Valve Actuator not providing correct feedbacks to Station PLC:**

Check the proper cable connections and availability of 24 V DC at corresponding output terminals of actuator. If it is not available then check the same at junction box, PLC TB end, check the fuse. If fuse is blown out, then replace the same.

↓

For analog connections in addition to above ensure that range was correctly mentioned for 4 to 20 mA.

12.15 Maintenance format for Control Valve Actuator:

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/07

क्रमांक **S. No.**	निर्देश **Instructions**	परिणाम **Observation**	टिप्पणी **Remarks**
1	Check for oil leaks from Electro-Hydraulic Actuator.		
2	Check the level of oil (level of oil must be between the mark and end of dip stick attached)		
3	Check the filter for any blockage with dirt. Clean if required. Check the filter for permeability before installing.		
4	Change the operating oil of the actuator. Check the filter for blockages. Clean the filter or if required, change the filter. Check the filter for permeability before installing.		
5	Check the pressure gauge for pressure in accumulator and pressure developed by pump.		
6	Check for proper enclosure installation of Motor and Power and Control Terminals.		
7	Check Fail safe position of actuator during power/signal failure		
8	Check the power supply to the actuator		
9	Check for any undue temperature rise during running of motor.		
10	Check the stroking of the control valve by feeding 4-20mA signal to the input terminals using digital calibrator. Adjust the fully closed and fully open conditions at appropriate signal levels.		
11	Check response of the control value by giving a step input to input signal for terminals note the time for stroking for full open and full closed.		

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12	Check the signal retransmission corresponding to the step position for Fully Open and Fully Closed positions.		
13	Check for Gland leaks and tighten bolts to requisite torque, if necessary.		
14	Check operation of hand pump for valve stroking.		
15	Check operation of accumulator for valve stroking and for fully closing the valve.		
16	Cold Work Permit Number		

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12.16 Relevant Records:

Maintenance of Control Valve Actuator: ISF/INT/07

12.17 Frequency:

Maintenance of Control Valve Actuator: Yearly

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13. PROCEDURE FOR PREVENTIVE MAINTENANCE OF UNIT CONTROL PANEL

13.1 Purpose:

To provide guidelines for Preventive Maintenance & Trouble Shooting of Unit control panel.

13.2 Scope:

Scope of work includes Preventive Maintenance & Trouble Shooting of Unit control panel provided at the location.

13.3 Applicability:

This SOP is applicable to the entire pipeline SBU.

13.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

13.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

13.6 Usage:

Unit Control Panel consisting of Vibration Monitoring System, Temperatures of Pumps, Motors and Seal POT levels as inputs to its PLC.

13.7 Importance:

This entire unit takes care of healthiness of Pump and Motor. After assessing the parameters of pump and motor. If both systems are healthy then it provides ready to start signal to both station PLC and VFD.

13.8 Location of Installation:

Control Room.

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13.9 Integration with PLC:

Data from Unit Control Panel are integrated with PLC through hard wiring or through Modbus interface.

13.10 Components:

Vibration Monitoring System, UCP PLC, Field Inputs and Outputs to PLC and VFD, Display of Vibration Monitoring System.

13.11 Working Principle:

Field Units Viz. Vibration, Temperature, Seal POT levels and process parameters from PLC are fed as inputs to the UCP PLC. Basis these inputs after processing and analyzing these parameters UCP PLC will declare the healthiness of pump and motor.

13.12 Electrical Connections:

230 V AC UPS Supply.

13.13 Preventive Maintenance of UCP:

a. Obtain cold work permit.
b. Check the panel lighting.
c. Check panel doors for smooth operation.
d. Check the operation of instrument cooling fans in the panel.
e. Check for proper installation of the power supply units in the panel.
f. Check for proper and legible marking of cable from field.
g. Check for proper connection of instrument ground wire.
h. Check for proper connection of panel earthing strip.
i. Check for proper ferruling in the control panel wiring.
j. Check for loose termination strips loose wiring terminations.
k. Clean the panel using vacuum cleaner.
l. Check the power supply 230 V AC.
m. Check the operation of annunciator by actuating lamps and the hooter.
n. Check for any fused indicator lamps and replace the same.
o. Check for correct indications of Motor Winding Temperatures, Pump Casing, Temperature, Vibrations parameters.

13.14 Trouble shooting of UCP:

Issue 1: UCP not generating "Ready to Start" signal

Ensure that incoming power supply of 230 V AC is available. Ensure that Control Transformer of UCP is working. Ensure that control supply is available for UCP PLC and for Vibration Monitoring System.

↓

Check for alarms in Vibration Monitoring System related to Temperatures, Vibrations, Seal POT seal levels etc. If any alarms are there, then cross check the same parameter in the field. If condition is false, then reset the same in UCP or if condition is true then take the corresponding corrective action.

↓

Check the cable connections which are acting as digital output from UCP to VFD. Ensure that corresponding cable connections are tight.

13.15 Maintenance format for Unit Control Panel

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/08

क्रमांक **S. No.**	निर्देश **Instructions**	परिणाम **Observation**	टिप्पणी **Remarks**
1	Check the panel lighting.		
2	Check the panel doors for smooth operation.		
3	Check operation of instrument cooling fans in the panel.		
4	Check for proper installation of the Power supply units in the panel.		
5	Check for proper and legible marking of cable from field.		
6	Check for proper connection of instrument ground wire.		
7	Check for proper connection of panel earthing strip / wire.		
8	Check for proper ferruling in the control panel wiring.		
9	Check for loose termination strips / loose wiring terminations.		
10	Clean the panel using vacuum cleaner.		
11	Check the power supply 230 V AC		
12	Check operation of the annunciator and lamps by actuating Test Push button.		
13	Check power supply to Bently-Neveda System.		

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14	Check the operation of Local / Manual / Auto Switch.		
15	Check for correct display of Motor winding Temperatures, Pump Casing Temperatures and Vibration Parameters		
16	Check the functionality of various auxiliary equipment from UCP.		
17	Check the bump less PLC switch over from primary & secondary or vice versa.		
	PDB panel for UCP		
18	Check healthiness of the metering (Ammeter /Voltmeter)		
19	Check the proper earthing of the panel.		
20	Check the healthiness of the various power supply units.		
21	Check the working of the cooling fans.		
22	Check the smooth closing & opening of the panel doors.		
23	Check the proper illumination inside the panel		
24	Ensure firm connection of all the wires & terminations.		

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13.16 Relevant Records:

Maintenance of Unit Control Panel: ISF/INT/08

13.17 Frequency:

Maintenance of Unit Control Panel: Yearly

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14. PROCEDURE FOR PREVENTIVE MAINTENANCE OF TURBINE FLOW METER AND FLOW COMPUTER:

14.1 Purpose:

To provide guidelines for Preventive Maintenance & Trouble shooting of turbine flow meter and flow computer.

14.2 Scope:

Scope of work includes Preventive Maintenance & Trouble Shooting of turbine flow meter and flow computer provided at the location.

14.3 Applicability:

This SOP is applicable to the POL pipelines.

14.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

14.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

14.6 Usage:

Turbine Flow meters are used for Sensing, Measuring and Transmitting the Flow in form of pulses to flow computer. At flow computer these pulses are converted into flow rate (Gross, Net and Mass) for display. Gross and Batch totalizers are calculated using these data of flow meters.

14.7 Importance:

Flow Rate is one of the critical parameters in pipeline operations. It is used for evaluating the performance of pipeline. It is used for measuring dispatch and receipt quantities. It is used as one of the inputs to Leak Detection System, which is used for maintaining the integrity of pipeline.

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14.8 Location of Installation:

Pumping Side and Receipt Side.

14.9 Integration with PLC or SCADA:

Data from flow meters fed to flow computer in form of pulses. These pulses are converted to corresponding gross flow rates as per K-Factors of flow meter (which are obtained during calibration of Flow Meter). Net flow rates and Mass Flow rates are calculated basis of temperature and density inputs from field. These flow rates are transmitted to station PLC and SCADA RTU through Modbus serial interface or through hardwired.

14.10 Parts:

Turbine flow meter consists of: a. Rotating Element-Turbine; b. Pick Off coils; c. Pre-Amplifiers and Flow Computer.

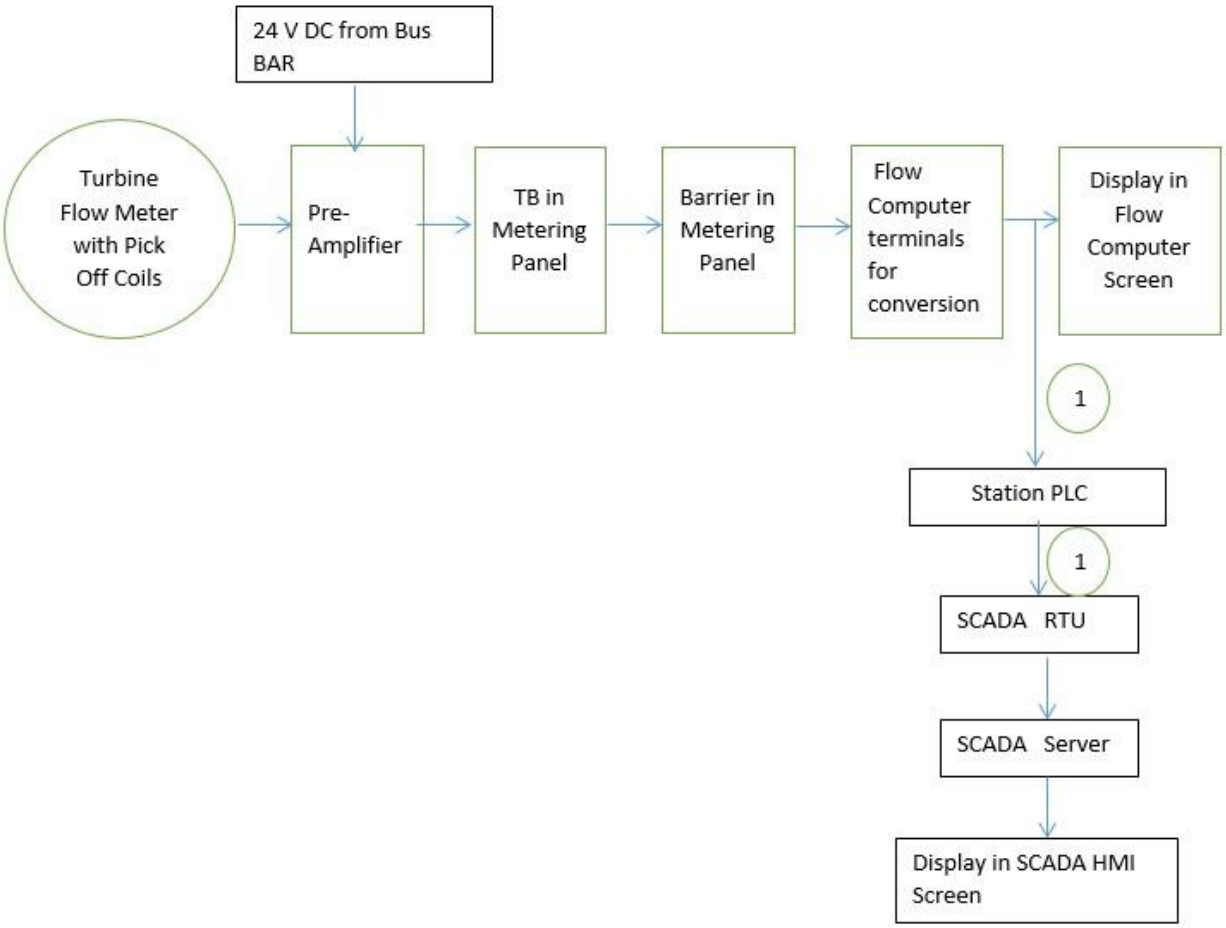
14.11 Working Principle:

During the flow of liquid turbine rotates and Pick off coil picks the pulses and these pulses are fed to pre-amplifier for amplification and transmitting it to flow computer. These generated pulses are proportional to each unit volume of flow. At flow computer (normally located in control room) these pulses are converted to corresponding flow rates as per K-factors. These flow values further transmitted to station PLC and SCADA using hard wire/ Modbus protocol.

14.12 Electrical Connections:

24 V DC from flow computer to Pre-Amplifier circuit.

14.13 Block Diagram:



1: Through Modbus/TCP-IP Communication

14.14 Procedure for Preventive Maintenance of Flow Computer:

a. Ensure cold work permit.
b. Check proper wiring with identification and ferruling.
c. Check for proper connection of precision resistors in terminals.
d. Check for proper identification on the cables from the field.

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e. Check for proper connection of instrument ground wire.
f. Check and tighten all terminations.
g. Check power supply input for 230 V AC.
h. Check the preamplifier power supply for 24VDC
i. Take the backup of flow computer program
j. After every calibration of flow meter ensure that pulses per second as per calibration certificate for corresponding flow rates are to be updated in flow computer.

Note: Observations has to be filled in maintenance format.

14.15 Procedure for Preventive Maintenance of Flow Meter:

Frequency: Yearly

a. Obtain cold work permit.
b. Isolate 24VDC power supply from control panel end.
c. Isolate the motor operated valves (MOV) on either side of the flow meters.
d. Dismantle the flow meter.
e. Carry out cleaning of flow meter including the shaft and rotor.
f. Check internals for any damage and dirt if any abnormal sound is observed.
g. Check junction boxes for water ingress.
h. Check pick up coil resistance. It shall be a DC resistance of approximately 1K ohms and resistance between any coil lead and housing should be more than 100M ohms.
i. Check for the proper condition of both the preamplifiers.
j. Assemble the turbine flow meter and restore the wiring and power supply.

14.16 Calibration of Turbine Flow meter:

Frequency: Once in four years

a. Obtain cold work permit.
b. Isolate 24VDC power supply from control panel end.
c. Isolate the motor operated valves (MOV) on either side of the flow meters.
d. Dismantle the flow meter.
e. Install the spool piece in place of flow meter.
f. Pack the flow meter appropriately and send it to external agency (NABL Certified laboratory) for calibration in accordance with API 2531.

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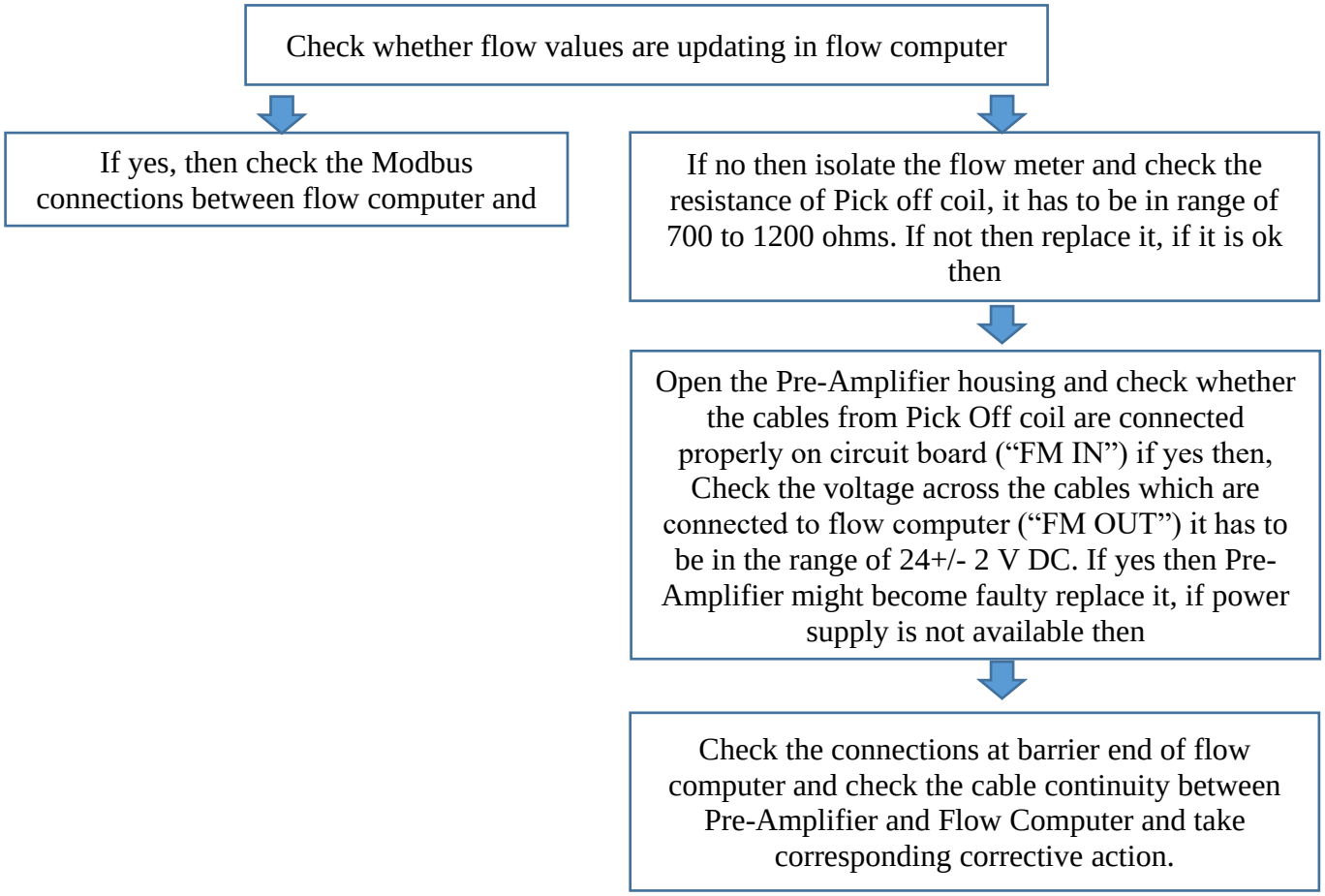
14.17 Trouble Shooting:

a. **Issue 1: Non updation of flow data in station PLC**.



Note: If Electrical connections, Pre-Amplifier and Pick off coils found to be healthy and still flow data is not updating both in Flow computer and station PLC. Then turbine might be jammed, in that case isolate the flow meter and drop the flow meter from piping. Clean the turbine part and ensure turbine is free from foreign particles and free movement of turbine.

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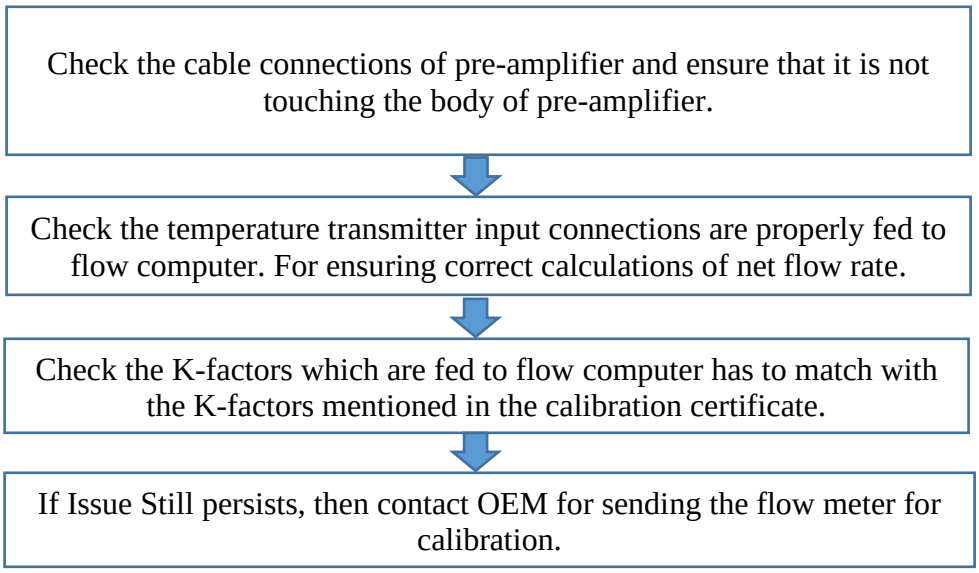
b. **Issue 2: Wrong updation of flow in flow computer and PLC. Less or more flow indication than actual flow.**



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14.18 Maintenance Format for Flow Computer:

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/09

क्रमांक **S. No.**	निर्देश **Instructions**	परिणाम **Observation**	टिप्पणी **Remarks**
1	Check the power supply. Normal input is 230VAC		
2	Check for proper connection of instrument ground wire		
3	Check and tighten all terminations		
4	Check the current in the loop circuits using multi-meter		
5	Check the Pre-Amplifier power supply for DC 24 V		
6	Cross check with dip Flow Rates.		
	Metering Panel		
7	Check the panel for the illumination		
8	Check the proper opening & closing of the doors		
9	Check the proper connection of the instrument & electrical earthing.		
10	Check the functionality for the zener barrier.		
11	Check the functioning of the cooling fans.		

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Name			
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Designation			**GM-PIPELINE**

14.19 Maintenance Format for Turbine Flow Meter:

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/09

क्रमांक **S. No.**	निर्देश **Instructions**	परिणाम **Observation**	टिप्पणी **Remarks**
1	Check the Turbine meter physical appearance, painting		
2	Check internals for any physical damage.		
3	Check Junction box for water ingress.		
4	Check coil resistances		
5	Check for health of both preamplifiers		
6.	Check for the Resistance between two leads of the pick off coil. (The resistance shall be around 700 -1200 Ohms).		
7.	Check the resistance between the one lead of pick off coil and the housing of the same. (The resistance shall be more than 100 M ohms).		

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Designation			**GM-PIPELINE**

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Designation	:	Designation	:
Date	:	Date	:

14.20 Relevant Records:

Maintenance of Flow Computer and Turbine Flow meter: ISF/INT/09

14.21 Frequency:

Maintenance of Flow Computer: Half-Yearly and Turbine Flow meter: Yearly

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15. PROCEDURE FOR PREVENTIVE MAINTENANCE, CALIBRATION & TROUBLESHOOTING OF PRESSURE SWITCH:

15.1 Purpose:

To provide guidelines for Preventive Maintenance, Calibration & Trouble Shooting of Pressure switch.

15.2 Scope:

Scope of work includes Preventive Maintenance, Calibration & Trouble Shooting of Pressure switch provided at the location.

15.3 Applicability:

This SOP is applicable to the entire pipeline SBU.

15.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

15.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

15.6 Usage:

Senses the pressure and activates if process value of pressure reaches its set point. The switch may be designed to make contact either on pressure rise or pressure fails.

15.7 Importance:

These are used to automatically supervise and control the systems. These are fed to station PLC as digital inputs which are further used in safety interlocks for protecting the equipment. These switches provide an additional safety for protecting the equipment.

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15.8 Location of Installation:

These are used to automatically supervise and control the systems. These are fed to station PLC as digital inputs which are further used in safety interlocks for protecting the equipment.

15.9 Integration with PLC :

These pressure switches are directly fed as the digital inputs to station PLC. NO/NC contacts are used for integration with station PLC. In case of activation NO is converted to NC contact and vice-versa.

15.10 Parts:

Sensor for sensing the pressure and operating piston for activating the contact if pressure reaches the set point.

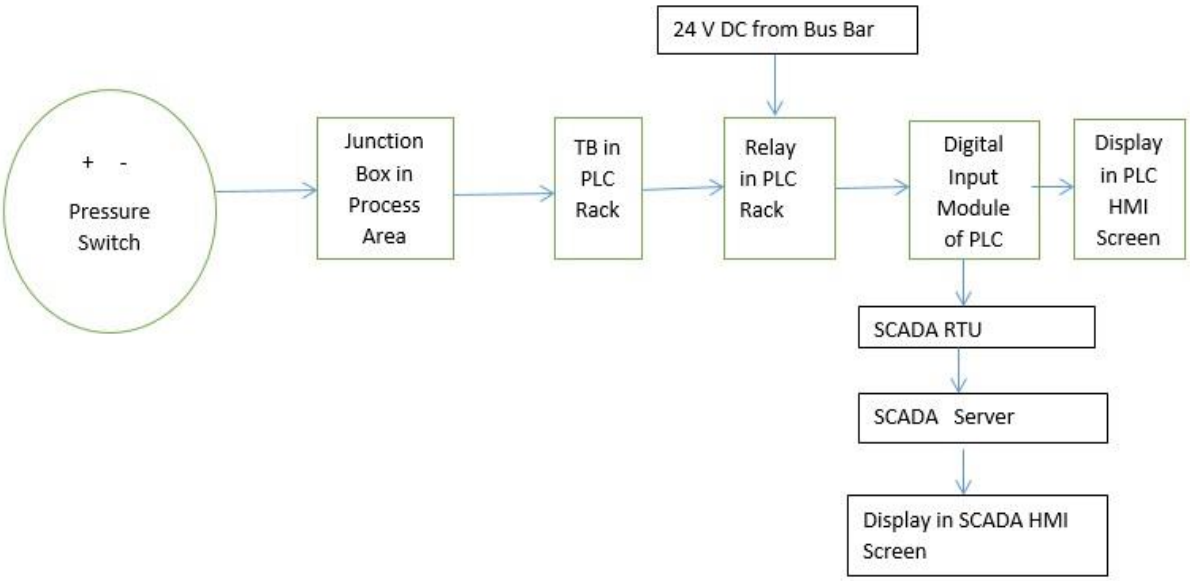
15.11 Working Principle:

Sensor senses the line pressure and its contact gets activated if the line pressure reaches the set point.

15.12 Electrical Connections:

24 V DC as an interrogation power supply from station PLC

15.13 Block Diagram:



15.14 Procedure for Preventive Maintenance and Calibration of Pressure Switch:

Before carrying out Preventive Maintenance & Calibration of Pressure Switch please ensure the following:

a. Ensure that maintenance of equipment will not impact the normal operations.
b. Proper Work Permit System to be followed
c. Intimation to be provided to control room prior start and ensure this activity will not impact the operations.
d. Proper PPE such as Safety helmet s, Safety gloves, goggles are to be used.
e. Completion of activity to be informed to control room.

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f. If this Pressure Switch input is going to carry out tripping of pumps or triggering of interlocks then this activity has to be carry out during respective pump/equipment shutdown only. If it is triggering any ESD then this activity has to be carry out during Plant Shutdown only.

15.15 Procedure for Calibration of Pressure Switch:

Following equipment to be kept ready before start of activity:

a. Portable Pressure calibrator
b. Power supply unit (24VDC).
c. Digital multi-meter

Note: Test pressure can be provided to PT by using Portable Pressure Calibrator calibration can be carried out in process area itself.

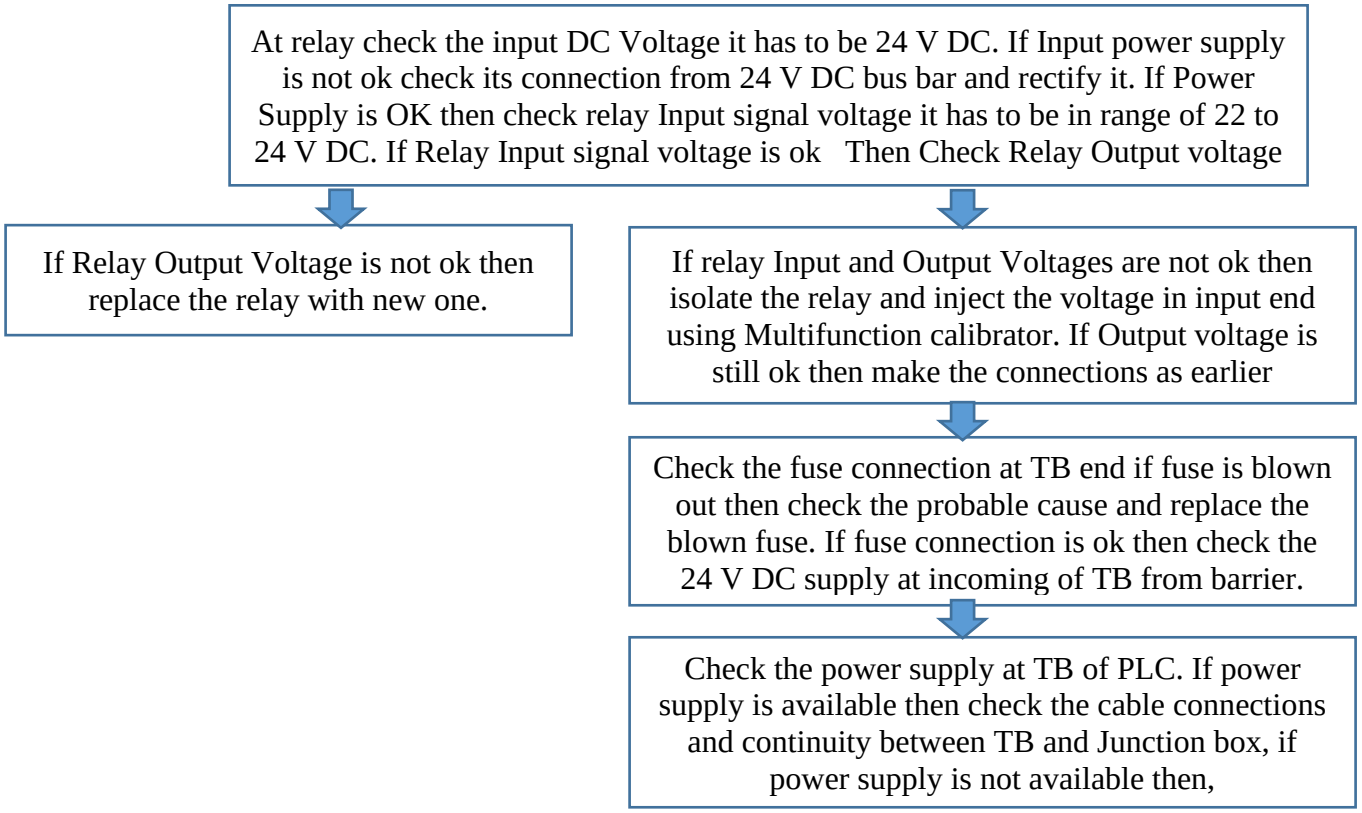
a. Obtain cold work permit.
b. Check DC Voltage at terminals of Transmitter. Under normal conditions, it has to be in range of 22 to 24 V DC.
c. Check for proper connection of Instrument Ground Wire. It has to be tight and intact.
d. Check the Transmitter for proper installation.
e. Check the condition of impulse tubing and its Connections. Ensure no seepage of product.
f. Check for proper display indication in local display unit.
g. Check for proper cable glanding. These are to be of proper size and double compression in nature.
h. Check the condition of canopy and ensure nil corrosion
i. Check for proper cable tags, which are to be legible and clear.
j. Isolate the valve on the process connections.
k. Depressurize the impulse line by draining.
l. Disconnect the wiring carefully and tape it by insulation tape.
m. Install pressure switch on Portable Pressure calibrator.
n. Check the set point by using digital multi-meter and applying pressure by increasing pressure and note down the pressure at which the switch actuates (Pick up pressure).
o. Now gradually reduce the pressure and note down the value at which switch resets to original state (drop off point).

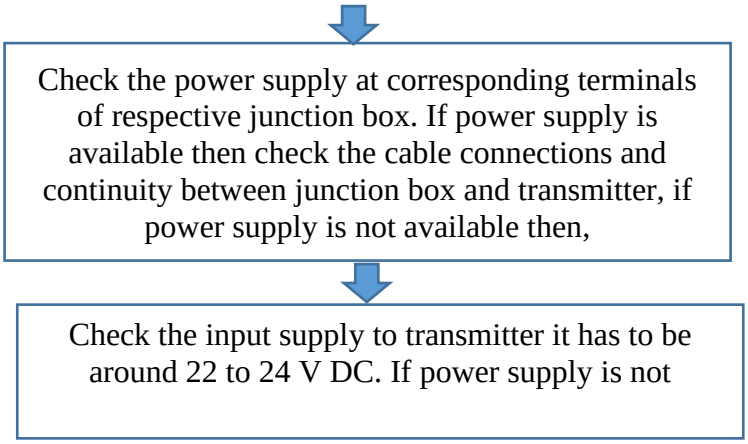
p. If set point is drifted, adjust the set point, by adjusting the locknut arrangement for increasing and decreasing the pressure setting and again check actuation by applying pressure.
q. Measure the contact resistance of the switch contacts (not to exceed 0.5ohms).
r. Measure the DC power supply (the acceptance limits are 24 V DC+/- 10%).
s. Complete the calibration record.
t. Install, restore the process connection, rewire the switch, and make it online.

Note: Observations has to be filled in maintenance format.

15.16 Trouble Shooting Procedure:

a. **Issue 1: Improper Functioning of Pressure Switches.**





Note: If power supply is ok but still the pressure switch is not working then replace it.

15.17 Maintenance Format:

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/10

क्रमांक **S. No.**	निर्देश **Instructions**	परिणाम **Observation**	टिप्पणी **Remarks**
1	Check the DC power supply. Normal input is 24V DC +/-10%		
2	After bypassing interlocks, if required, check as found set point by applying pressure. Note down the pressure at which the switch actuates.		
3	If set point of actuation has changed, adjust the set point. Again check actuation by applying pressure. Note adjusted pick up (actuated) pressure.		
4	Note down the drop off (reset) pressure		
4	Measure the contact resistance of the switch contacts (not to exceed 0.5 Ohms)		
5	Check the pressure switch for proper installation.		
6.	Check the condition of the impulse tubing and its connection		
7.	Check the proper functionality of the isolating valve.		
8.	Clean the Drain line by flushing the product.		
9.	Check for the proper cable glanding.		
10.	Check for the canopy condition & corrosion effects if any.		
11.	Check for the proper cable tags.		

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Designation			**GM-PIPELINE**

12.	Check body earthing		
13.	Cold Work Permit No		

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Name :
Designation :
Date :

Approved By
Signature :
Name :
Designation :
Date :

15.18 Relevant Records:

Maintenance of Pressure Switch ISF/INT/10

15.19 Frequency:

Maintenance of Pressure Switch: Half - Yearly

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Signature with date			
Name			
Designation			**GM-PIPELINE**

16. PROCEDURE FOR PREVENTIVE MAINTENANCE, CALIBRATION & TROUBLE SHOOTING OF PRESSURE GAUGE:

16.1 Purpose:

To provide guidelines for Preventive Maintenance, Calibration & Trouble Shooting of Pressure gauge.

16.2 Scope:

Scope of work includes Preventive Maintenance, Calibration & Trouble Shooting of Pressure gauge provided at the location.

16.3 Applicability:

This SOP is applicable to the entire pipeline SBU.

16.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

16.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

16.6 Usage:

Pressure Gauges are used for measuring line pressure.

16.7 Importance:

These are used for indicating line pressure.

16.8 Location of Installation:

These are installed in process area and are used for cross checking the pressure value with Pressure Transmitters.

16.9 Integration with PLC:

NA.

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Name			
Designation			**GM-PIPELINE**

16.10 Parts:

Needle, Gauge

16.11 Working Principle:

Pressure gauge uses the principle that a flattened tube tends to straighten or regain its circular form in cross-section when pressurized.

16.12 Electrical Connections:

NA

16.13 Procedure for maintenance of Pressure Gauge:

a. Obtain cold work permit.
b. Isolate the valve on the process connections.
c. Depressurize the impulse line by draining.
d. Keep ready Portable Pressure calibrator for calibration purpose
e. Install 'PG' on Portable Pressure Calibrator.
f. If required carry out the zero adjustment manually by draining the oil from pressure pump calibrator
g. Monitor "PG' value by applying pressure in increasing and decreasing order of 0%, 25%, 50%, 75% and 100% of the range.
h. Install, restore the process connection, signaling and power supply at the panel end and make it online.
i. Acceptance accuracy of Pressure Gauge is +/- 1.5 % of full scale value.
j. Replace PG if found accuracy not within the allowable limit.

16.14 Maintenance Format:

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/11

क्रमांक **S. No.**	निर्देश **Instructions**	परिणाम **Observation**	टिप्पणी **Remarks**
1	Check proper mounting of gauge for any leakage		
2	Calibrate the Gauge across the Span. Record in calibration sheet		
3	Adjust zero with mechanical knob if required.		
4	Check the condition of the impulse tubing and its connection for any leakage		
5	Check the proper functionality of the isolating valve.		
6	Clean the Drain line by flushing the product.		
7	Check for the proper display indicator and condition of liquid filled indicator.		
8	Cold Work Permit No		

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Name			
Designation			**GM-PIPELINE**

16.15 Relevant Records:

Maintenance of Pressure Gauge: ISF/INT/11

16.16 Frequency:

Maintenance of Pressure Gauge: Half-Yearly

17. PROCEDURE FOR PREVENTIVE MAINTENANCE OF FIRE ALARM SYSTEM

17.1 Purpose:

To provide guidelines for Preventive Maintenance & Trouble Shooting of Fire Alarm System.

17.2 Scope:

Scope of work includes Preventive Maintenance & Trouble Shooting of Fire Alarm System provided at the location.

17.3 Applicability:

This SOP is applicable to the entire pipeline SBU.

17.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

17.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

17.6 Usage:

Fire Alarm System will help in detecting the fire/emergency like situations. All Fire detection equipment viz. Smoke Detectors, Heat Detectors, Manual Call Points etc. and hooters are connected to this system.

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17.7 Importance:

Fire Alarm System is one of the most critical equipment of safety system. It will detect fire/emergency situations of the remote and all places of the location.

17.8 Location of Installation:

Detectors are installed at all places of the location. Fire Alarm Control Panel is installed in control room.

17.9 Integration with PLC:

Fire alarm system is integrated with station PLC for indication of alarm (digital signal).

17.10 Parts:

Smoke Detectors, Heat Detectors, Manual Cal Points, Hooters, Fire Alarm Control Panel

17.11 Working Principle:

All detectors are connected in loop as per zones. For these zones an interrogation power supply of 24 V DC is being sent from panel. Under normal conditions this 24 V DC is returned to panel whereas under activation of detector this interrogation supply will not be returned. This is sensed as fire in that particular zone leading to triggering of alarm in fire alarm panel.

17.12 Electrical Connections:

230 V AC UPS Supply.

17.13 Maintenance of Fire Alarm System:

a. Verify that the AC supply is available for fire alarm siren.
b. Check 24VDC supply to the panel.
c. Check healthiness of the cards.
d. Disconnect the siren from the control panel. Put a suitable indicator (after relay) to indicate the status of siren.
e. Open the manual call point. The zone alarm LED and indicator should glow. Note down the details.
f. Smoke/heat detectors shall be simulated and checked monthly by randomly simulating any one detector in each zone. Observation to be noted in maintenance format.

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g. For testing LHS (Liner Heat Sensing) cable, connect end point of cable and note down the response of alarm panel as per ISF/INT/16.

17.14 Trouble shooting of Fire Alarm System:

a. **Issue 1: Fire Alarm System is not working**

Check the input power supply to Fire Alarm Panel it has to be in the range of 230 +/-10% V AC. If it is not available, then check the fuses of the corresponding feeder from UPS distribution board If fuse is blown out then after carrying out thorough checking replace the fuse. If power supply is ok then,

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Check the functionality of transformer and rectifier section of the panel. Rectifier section is used to generate the control supply of the panel. If these are not working, then take the corrective action by replacing or rectifying the faulty equipment

b. **Issue 2: Fire Alarm System generating false alarms**

Identify the particular zone for which system is generating false alarms, after identification of zone check the cable connections of that particular zone in panel it has to be tight. If it is ok then,

↓

Check the functionality of all detectors of that particular zone under normal conditions LEDs of detectors must be in blinking mode for every 10 seconds. If any detector is not blinking then switch off the hooter and open the detector. Clean the detector and connect it in the loop properly. Then reset the panel. If issue is still not resolved then check all the detectors of

↓

If still that earlier detector is not working, then detector became faulty. Hence replace the same.

c. **Issue 3: Particular Zone Detectors are not working**

Identify the particular zone which is not working after identification of zone check the cable connections of that particular zone in panel it has to be tight. Output Voltage from those terminations has to be 24 V DC If it is ok then,

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Check the detectors of that zone serially, each detector has to get the 24 v DC at their input and output terminals. End Resistance has to be connected at the last detectors. If after any particular detector 24 V DC is not transmitting to the next detector then check the cable connections between these two detectors and it has to be tight and should not be grounded.

↓

If still that earlier detector is not working then detector became faulty. Hence replace the same.

17.15 Maintenance Format for Fire Alarm System:

Location: **Department: Instrumentation**

Month: **Frequency: Yearly (**In each zone, 1 detector to be checked every month. All detectors to be covered in a year **)**

Doc No: ISF/INT/12

क्रमांक **S. No.**	निर्देश **Instructions**	परिणाम **Observation**	टिप्पणी **Remarks**
1	Verify that the A/C supply is available for fire alarm siren. Check 24V dc supply for panel. Check healthiness of cards.		
2	Disconnect the siren from control panel.		
3	Put a suitable indicator (after relay) to indicate the status of siren.		

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Name			
Designation			**GM-PIPELINE**

4	Simulate the heat detector / smoke detector and note down the response of fire alarm system. One from each zone				
5	Cold Work Permit No				
Sl. No.	Type of detector	Location	Zone alarm status	Actuation of siren	Remarks

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Signature :
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Approved By
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Designation :
Date :

17.16 Relevant Records:

Maintenance of Fire Alarm System: ISF/INT/12

17.17 Frequency:

Maintenance of Fire Alarm System: Yearly (In each zone, Minimum One detector to be checked every month. All detectors to be covered in a year**)**

18. PROCEDURE FOR PREVENTIVE MAINTENANCE OF CLEAN AGENT SYSTEM

18.1 Purpose:

To provide guidelines for Preventive Maintenance & Trouble Shooting of Clean Agent System.

18.2 Scope:

Scope of work includes Preventive Maintenance & Trouble Shooting of Clean Agent System provided at the location.

18.3 Applicability:

This SOP is applicable to the entire pipeline SBU.

18.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

18.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

18.6 Usage:

Clean Agent System is used for protecting the critical equipment such as PLC, SCADA panels and control room equipment by flooding clean agent during fire/emergency like situations.

18.7 Importance:

Clean Agent System is one of the most critical equipment of safety system. It will activate during fire/emergency situations of the control room and telecom room and will prevent the damage of PLC, SCADA, Telecom and critical equipment during these situations.

18.8 Location of Installation:

Clean Agent Gas Cylinders are installed in separate room and these are connected to control room and telecom room through hoses. Clean Agent Control Panel is installed in control room.

18.9 Integration with PLC:

Clean Agent system is integrated with station PLC for indication of alarm (digital signal).

	Prepared By	**Verified By**	**Authorized By**
Signature with date			
Name			
Designation			**GM-PIPELINE**

18.10 Parts:

Clean Agent Cylinders, Pressure Gauges, Clean Agent Control Panel

18.11 Working Principle:

This system has three modes of operation they are Auto, Remote and Manual modes. In Auto mode these are activated basis on activation of any two detectors(Smoke/Heat) of that particular zone, In Remote mode this system can be activated through break glass units Installed at various places of control room), In Manual mode it can be activated by operating the clean agent cylinders.

18.12 Electrical Connections:

230 V AC UPS Supply to the panel.

18.13 Maintenance of Clean Agent System:

18.13.1Back Ground

The clean Agent system protects two areas

a. Area 1- Control room (Racks, Consoles & telecommunication area)
b. Area-2 UPS Room

Each area is divided in to two zones as listed in the table below

S.no	Area	Zones	Description
1	Area-1	Zone -1	Control room below false ceiling & on true ceiling
2		Zone -2	Control room below false flooring
3	Area-2	Zone -3	UPS room below false ceiling
4		Zone-4	UPS room above false ceiling

a. In case of the fire in Area -1(consists of Zone 1& 2), 24 V DC supply will be given to solenoid RSOV-2 or RSOV-4 on the master cylinder which subsequently operates 24 cylinders or as the case may be, (Main or Stand by) pneumatically through actuation hose. The same time supply will be given to PSOV-1 which gets actuated electrically and part of gas through solenoid valve operates Directional Valve DRV-1 pneumatically and gas will be released to the hazard through respective pipe network. Prior to discharge of gas warning shall be given through pre-discharge indicator PDI-1 and after discharge Indicator DI-1

b. In case of fire in Area-2 (consists of Zone 3 & 4), 24 VDC supply will be given to solenoid RSOV-1 or RSOV-3 on master cylinder which subsequently operates 07 cylinders (Main or stand By) pneumatically through actuation hose. The same time supply will be given to PSOV-2 which gets actuated electrically and as a result directional valve DRV-2 get opened pneumatically and gas will be released to the hazard through respective pipe network. Prior to discharge of gas warning shall be given through pre-discharge indicator PDI-2 and after discharge through Discharge Indicator DI-2

18.13.2Automatic Release

Automatic release is accomplished via detectors installed in the protected area (detectors are programmed on cross zone principle to avoid accidental release of the gas due to the malfunction/false alarm). As soon as a fire is detected from both the detectors, signal is sent to the fire alarm panel cum gas release panel. At the same time signal is provided to pre discharge (audio/visual) signal unit from the panel to allow personnel evacuation prior to discharge of the gas. A time delay is set (30 secs). Which can be varied from the inter panel relay for the release of the gas after the detection of the cross zone signal. After 30 sec the solenoid valve will be energised on the master cylinder of the respective zone. If the main Bank fails to release the gas the solenoid valve of the stand by bank gets energised after a certain time delay for the respective Zone.

18.13.3Manual Remote Release (break glass type)

Remote release is accomplished by pressing the push button at “Manual release push button station”.

18.13.4Master & Slave Cylinders

Every Area does have one master and other slave cylinders. The master cylinder has release unit consisting of solenoid actuator. This solenoid when actuated opens the cylinder discharge valve of the master cylinder and also of all the slave cylinders connected to this master cylinder and the gas is released. In case of Area 1, which requires 24 cylinders, 1 no. of master cylinder either from main or standby bank, will be released. For Area-2, Respective master cylinder will be released and in turn it will release 7 nos of slave cylinders. Operation of slave cylinder valves shall be from the gas release tapped from master cylinder.

18.13.5Testing Procedure

1 no LED shall be installed on each solenoid actuator for checking supply to the solenoid during fire/smoke simulation.

a. Solenoid actuator of the master cylinder for Area 1 for Main cylinder bank.
b. Solenoid actuator of the master cylinder for Area 1 for the Stand by cylinder bank
c. Solenoid actuator of the master cylinder for Area 2 for the main cylinder bank
d. Solenoid actuator of the master cylinder for Area 2 for the stand by cylinder bank

Following scenarios shall be created for the proper checking of the system.

a. **Scenario no. 1**

S.no	Area	Zones	Action	Observations	Remarks
1	Area 1	Zone 1	Fire simulated	Alarm will sound.	No gas will be released. LED will not glow as there is no cross zone actuation.
2		Zone 2			
3	Area 2	Zone 3			
4		Zone 4			

In the above scenario only the alarm shall sound and there shall not be any gas release. The above procedure shall be repeated for each individual Zones and the result will be same.

S.no	Area	Zones	Action	Observations	Remarks
1	Area 1	Zone 1	Fire simulated	Alarm will sound. There will be indication of Fire in the Zone -1 & Zone-2. There will be indication of the gas release through pre- discharge indicator PD-1. LED on the solenoid valve will glow after the 30 sec time gap of the alarm. This shows that gas is being released. There will be indication of Gas release through DI-1.	
2	Area 2	Zone 3			
3		Zone 4			

b. **Scenario no. 2**

There is gas release abort switch provided to stop the gas release in case of the false alarms. This switch can also be tested by pressing the button after there is indication in PD-1. After pressing this button, the solenoid will not get actuated and LED will not glow in that case.

Precaution: Since in the above simulation the solenoid valve will be actuated through the 24v. The supply to the solenoid actuator should be removed and given to LED only.

c. **Scenario no. 3**

S.no	Area	Zones	Action	Observations	Remarks
1	Area 1	Zone 1			
2		Zone 2			
3	Area 2	Zone 3	Fire simulated	Alarm will sound. There will be indication of fire in Zone 3 & 4. There will be indication of the gas release through pre- discharge indicator PD-1. LED on the solenoid valve will glow after the 30 sec time gap of the alarm. This shows that gas is being released. There will be indication of Gas release through DI-1.	
4		Zone 4	Fire simulated		

There is gas release abort switch provided to stop the gas release in case of the false alarms. This switch can also be tested by pressing the button after there is indication in PD-1. After pressing this button, the solenoid will not get actuated and LED will not glow in that case.

Precaution: Since in the above simulation the solenoid valve will be actuated through the 24v. The supply to the solenoid actuator should be removed and given to LED only.

Note: If the pressure in argonite cylinder falls below 160 bar (for 200 bar operating pressure), arrange for refill.

18.13.6Manual Operation of the Clean Agent System

Clean agent system can be activated by manual pull over lever on the release unit located on the respective master cylinder valves in case of fire in Control Room area & in case of the UPS room area.

Direction valve for the respective areas shall be operated manually through handle. For stopping the gas release directional valve shall be closed manually through the handle.

NOTE: Warning shall be given to the occupants in the protected room before manual emergency release

18.14 Trouble shooting of Clean Agent System:

a. **Issue 1: Clean Agent System is not working**

Check the input supply to transmitter it has to be around 24+/-2 V DC. If power supply is not available then, Check the input power supply to Fire Alarm Panel it has to be in the range of 230 +/-10% V AC. If it is not available, then check the fuses of the corresponding feeder from UPS distribution board If fuse is blown out then after carrying out thorough checking replace the fuse. If power supply is ok then,

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Check for loose cable terminations and ensure that no cable is short.

b. **Issue 2: Clean Agent System generating false alarms**

Check the functionality of transformer and rectifier section of the panel. Rectifier section is used to generate the control supply of the panel. If these are not working, then take the corrective action by replacing or rectifying the faulty equipment

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False detector actuation in control room or UPS room.

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Ensure that solenoid is properly connected at the clean agent cylinders.

	Prepared By	**Verified By**	**Authorized By**
Signature with date			
Name			
Designation			**GM-PIPELINE**

18.15 Maintenance Format of Clean Agent System:

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/13

क्रमांक **S. No.**	निर्देश **Instructions**	परिणाम **Observation**	टिप्पणी **Remarks**
1.	Carry out the general housekeeping of the Clean Agent Bank Room.		
2.	Check the Gas pressure in all the cylinders.		
3.	Check the Clean Agent Panel for proper input supply.		
4.	Check for the back up power for the Clean Agent Panel.		
5.	Check firmness of all the wiring & termination of the Panel.		
6.	Check for earthing of the Panel.		
7.	Check functioning of all the fire alarm sensors in the Control Room & UPS Room.		
8	Cold Work Permit No		

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Date :

18.16 Relevant Records:

Maintenance of Clean Agent System: ISF/INT/13

	Prepared By	**Verified By**	**Authorized By**
Signature with date			
Name			
Designation			**GM-PIPELINE**

18.17 Frequency:

Maintenance of Clean Agent System: Yearly

19. PROCEDURE FOR PREVENTIVE MAINTENANCE OF OPEN PATH HYDROCARBON DETECTOR

19.1 Purpose:

To provide guidelines for Preventive Maintenance & Troubleshooting open path hydrocarbon detector.

19.2 Scope:

Scope of work includes Preventive Maintenance & Trouble Shooting open path hydrocarbon detector provided at the location.

19.3 Applicability:

This SOP is applicable to the POL pipelines.

19.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

19.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

19.6 Usage:

Open Path Hydrocarbon detectors are used for detecting the product cloud during spillage or any emergency situation in process area.

19.7 Importance:

These are used for detection of product spillage and vapor cloud.

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Signature with date			
Name			
Designation			**GM-PIPELINE**

19.8 Location of Installation:

These detectors are installed in process area viz. Pump Houses, Manifold Area, Scrapper Area etc**.**

19.9 Integration with PLC:

The output of these detectors is transmitted to station PLC in form of analog input (4-20 mA). This analog input is configured as LEL limits in station PLC for generating warnings and alarms.

19.10 Parts:

IR Source and Detector

19.11 Working Principle:

IR beam of rays are being emitted from source and these rays will meet the detector which is installed in line of sight of source. Under normal conditions all these rays will be collected at detector thus detector generating this signature as normal condition. In case of any product spillage leading to vapor cloud formation all the rays emitted from source will not be collected at detector some of the rays gets scattered. Detector detects this signature as abnormal situation and basis on intensity of rays scattered detector generates the output in form of 4- 20 mA

19.12 Electrical Connections:

24 V DC from PLC panel and 2-wire loop for transmitting the output signal.

19.13 Maintenance of Hydrocarbon Detectors:

a. Obtain Cold work permit.
b. Clean glass surface of receiver and detector to remove any dust particle
c. Use calibration filters of 1-100 % range to check response of HCDs and record corresponding 4 to 20 ma signal to PLC.
d. Check power supply of HCD and its earthing.
e. If response of HCD is not accurate then check alignment of detector and receiver with help of OEM.

19.14 Trouble shooting of Open Path Hydrocarbon Detectors.:

a. **Issue 1: No Response of detection System**

Check the input power supply at Detector and Transmitter it has to be 24 V DC.

If Power supply is not available, then check the corresponding connections at field JB end and at PLC end.

If fuse is blown out then replace the same.

If 24 V DC is available, then check the alignment between transmitter and received.

If alignment is not ok the carry out alignment using alignment kit.

If fuse is blown out then replace the same.

If alignment and power supply are ok still, there is no response then measure the current at signal end of transmitter it has to be 4 mA under normal conditions.

If Current generated is ok then check necessary TB connections at PLC and check the blown fuse and barrier.

b. **Issue 2: Malfunctioning of detection System**

Check the cable connections of detector and transmitter. If cables are loose then tightening the same

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Ensure that no interference of cables at transmitter end

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Check the functionality of barrier at PLC end. If it is faulty then replace the same

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Check the range of this detector mentioned in PLC if it is wrong then correct the same.

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Carry out calibration of detectors using filter. If Values are deviating then dispatch the detector and transmitter to OEM

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If current is not generated by transmitter, then dispatch the transmitter and receiver to OEM for repair/calibration.

	Prepared By	**Verified By**	**Authorized By**
Signature with date			
Name			
Designation			**GM-PIPELINE**

19.15 Maintenance Format

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/14

S. No.	Instructions	Observation	Remarks
1	Check the power supply. Normal input is 24 VAC		
2	Check for proper connection of instrument ground wire		
3	Check and tighten all terminations		
4	Check the current in the loop circuits using multi-meter it shall be between 4-20mA		
5	Check detector LED status.		
6	Check Source LED status.		
7	Use Filter1 (20% filter) and record detector output as well as status in PLC		
8	Use Filter2 (40% filter) and record detector output as well as status in PLC		
9	Check zero calibration by measuring detector output in normal condition. If output is not 4mA, perform zero calibration and record it.		
10	Check the alignment of source and detector		
11	Check for the proper cable glanding.		
12	Check for the canopy condition & corrosion effects if any		

	Prepared By	Verified By	Authorized By
Signature with date			
Name			
Designation			**GM-PIPELINE**

13	Check cables for the proper cable tags		
14	Check status of loop power indicator.		

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Approved By
Signature :
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Designation :
Date :

19.16 Relevant Records:

Maintenance of Open Path Hydrocarbon Detector: ISF/INT/14

19.17 Frequency:

Maintenance of Open Path Hydrocarbon Detector: Quarterly

20. PROCEDURE FOR PREVENTIVE MAINTENANCE, CALIBRATION & TROUBLESHOOTING OF POINT TYPE HYDROCARBON DETECTOR

20.1 Purpose:

To provide guidelines for Preventive Maintenance, Calibration & Trouble Shooting of Point type Hydrocarbon detector.

20.2 Scope:

Scope of work includes Preventive Maintenance, Calibration & Trouble Shooting of Point type Hydrocarbon detector provided at the location.

20.3 Applicability:

This SOP is applicable to the entire Pipelines SBU.

20.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

20.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

20.6 Usage:

Point type Hydrocarbon detectors are used for detecting the presence of product at concentrations comparable to the lower flammable limit during spillage or any emergency situation in process area.

20.7 Importance:

These are used for detection of product spillage and vapor cloud.

	Prepared By	**Verified By**	**Authorized By**
Signature with date			
Name			
Designation			**GM-PIPELINE**

20.8 Location of Installation:

These detectors are installed in process area viz. Pump Houses, Manifold Area, Scrapper Area, Basket fiter, Mass flow meter, Cold Flare area etc**.**

20.9 Integration with PLC:

The output of these detectors is transmitted to station PLC in form of analog input (4-20 mA). This analog input is configured as LEL limits in station PLC for generating warnings and alarms.

20.10 Parts:

IR Source and Detector, optical windows

20.11 Working Principle:

The principle is the absorption of infrared (IR) radiation at certain wavelengths as it passes through a volume of gas. Hydrocarbon detectors have a infrared source and a infrared detector and measure its intensity at two specific wavelengths, one at an absorption (active) wavelength and one outside of the absorption (reference) wavelength. If a volume of gas passes between the source and detector, the amount of light in the active wavelength falling on the detector is reduced, while the amount of light in the reference wavelength remains unchanged. The gas concentration is determined from the relative difference between the intensity of the two received beams and is transmitted over 4-20 mA signal. In this case, the absorption path length is fixed, and is determined by the instrument design to be a few inches.

20.12 Electrical Connections:

24 V DC from PLC panel and 2-wire loop for transmitting the output signal.

20.13 Procedure for maintenance of Point Type Hydrocarbon Detectors:

a. Obtain cold work permit.
b. Keep ready, the calibration kit required for conducting calibration/ testing. The calibration kit contains a canister of mixture of propane/butane and air and its valve and tubing. The concentration of propane/butane is known as a percentage of volume and certificate of concentration is obtained from a NABL accredited lab.
c. Check the DC voltage available at transmitter and receiver.
d. Check 4-20 mA at the receiver.

e. Check the alignment transmitter and receiver.
f. Selecting the correct calibration value in the gas detector module as a percentage of LEL. Spray the calibration gas on the detector. Check if the instrument shows calibration pass or fail. Record the readings with different limits. If the calibration shows fail, clean the optical windows and try again.
g. Normalize after calibration.
h. Acceptance criteria of hydrocarbon detector +/- 0.1 %.

20.14 Trouble shooting of Point type Hydrocarbon Detectors.:

a. **Issue 1: No Response of detection System**

Check the input power supply at Detector and Transmitter it has to be 24 V DC.

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If Power supply is not available, then check the corresponding connections at field JB end and at PLC end.

↓

If fuse is blown out then replace the same.

↓

If 24 V DC is available, then check the alignment between transmitter and received.

↓

If alignment is not ok the carry out alignment using alignment kit.

↓

If fuse is blown out then replace the same.

↓

If alignment and power supply are ok still, there is no response then measure the current at signal end of transmitter it has to be 4 mA under normal conditions.

↓

If Current generated is ok then check necessary TB connections at PLC and check the blown fuse and barrier.

b. **Issue 2: Malfunctioning of detection System**

Check the cable connections of detector and transmitter. If cables are loose then tightening the same

↓

Ensure that no interference of cables at transmitter end

↓

Check the functionality of barrier at PLC end. If it is faulty then replace the same

↓

Check the range of this detector mentioned in PLC if it is wrong then correct the same.

↓

Carry out calibration of detectors using filter. If Values are deviating then dispatch the detector and transmitter to OEM

↓

If current is not generated by transmitter, then dispatch the transmitter and receiver to OEM for repair/calibration.

20.15 Maintenance Format:

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/15

GD No.	LOCATION	Calibration Gas concentration (% LEL)	Reading observed in the GD	Difference	Reading after adjustment	GD No.

Prepared by
Signature :
Name :
Designation :
Date :

Approved By
Signature :
Name :
Designation :
Date :

20.16 Relevant Records:

Maintenance of Point type Hydrocarbon Detector: ISF/INT/15

20.17 Frequency:

Maintenance of Point type Hydrocarbon Detector: Quarterly

	Prepared By	**Verified By**	**Authorized By**
Signature with date			
Name			
Designation			**GM-PIPELINE**

21. PROCEDURE FOR PREVENTIVE MAINTENANCE OF STATION PLC:

21.1 Purpose:

To provide guidelines for Preventive Maintenance & Trouble Shooting of Station PLC.

21.2 Scope:

Scope of work includes Preventive Maintenance & Trouble Shooting of Station PLC provided at the location.

21.3 Applicability:

This SOP is applicable to the entire pipeline SBU.

21.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

21.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

21.6 Usage:

Station PLC is used for monitoring and control of process data and variables remotely from control room.

21.7 Importance:

Station PLC is very critical equipment in pipeline operations. All safety interlocks related to station equipment are embedded in station PLC. For ensuring safe and proper operations functioning of station PLC is very critical.

21.8 Location of Installation:

Control Room.

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21.9 Integration with PLC:

NA

21.10 Parts:

Hardware viz. power supply modules, processors, I/O Modules, barriers, relays etc., Logic and graphics.

21.11 Working Principle:

24 V DC for all field equipment (Transmitters) is being transmitted from PLC panel and it receives 4 to 20 mA (for analog) and 24 V DC interrogation supply from field equipment. These inputs were further fed to barriers and relays which are in turn connected to I/O Modules. These I/O modules are connected to processor through interface units. Logic is written in processor and this logic in linked with station graphics. Man Machine interface is used for viewing and controlling the process parameters through graphics.

21.12 Electrical Connections:

230 V AC UPS Supply to the panel.

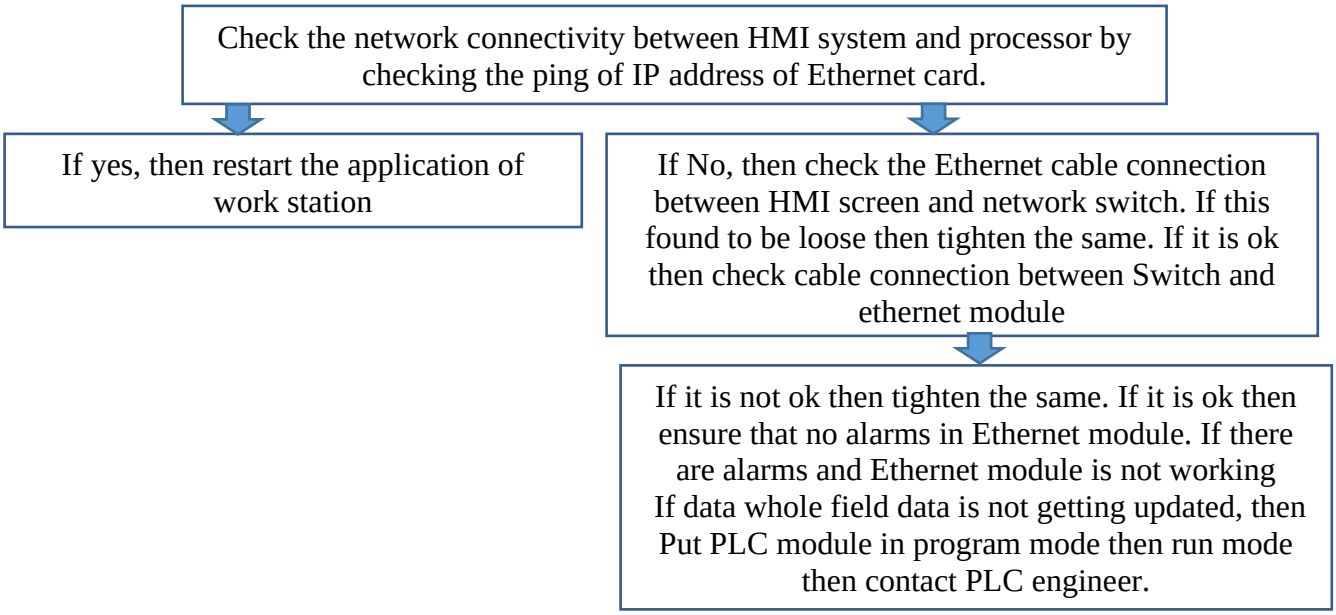
21.13 Maintenance of Station PLC:

a. Obtain the cold work permit.
b. Keep the breakers of all the pumps/MOV's in test position.
c. Check the panel lighting and indicator Lamps.
d. Check the panel doors for smooth operation.
e. Check operation of instrument cooling fans in the panel.
f. Check for proper installation of power supply units in the panel.
g. Check for proper connection of end terminations terminators of Control net.
h. Check for any alarms in System Configuration screens in PLC MMI workstations.
i. Check and clean all relay contacts after isolation of supply
j. Check for proper connection of instrument ground wire.
k. Check for proper connection of panel earthling strip.
l. Check for loose termination strips / loose wiring terminations.
m. Check for any loose relay installations in the panel.
n. List out the by passed terminations in the bypass register.

o. Clean the panel using vacuum cleaner.
p. Check installation of the PC / MMI connected to PLC
q. Check the communication cord from 'PC' / MMI to PLC.
r. Check and clean the color monitor connected to 'PC' / MMI.
s. Check the power supply 110VDC, 230VAC, 24VDC.
t. Check for low battery indication. If required replace the battery.
u. Check the relay contact resistance of relays in the panel.
v. Check operation of the 'PC' / MMI.
w. Check operation of the color monitor and printer.
x. Copy the program, to keep as back-up.
y. Prepare updated drawings after each modification in panel wiring.

21.14 Trouble shooting of Station PLC System:

a. **Issue 1: PLC data not updating in graphics screen**



Location wise TB list has to be prepare and easily available for all type of I/Os (Both digital and analog). This will help in trouble shooting and reducing the down time of equipment.

a. Updated IO list to be kept in IMS format.

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b. Proper ferruling should be done in PLC panel

21.15 Maintenance Format for PLC Panel :

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/16

S. No.	Instructions	Observation	Remarks
1	Check the panel lighting.		
2	Check the panel doors for smooth operation.		
3	Check operation of instrument cooling fans in the panel.		
4	Check for proper installation of the Power Supply units in the panel.		
5	Check and clean all relay contacts after isolating supply.		
6	Check for proper connection of instrument ground wire.		
7	Check for proper connection of end terminators of Controlnet.		
8	Check for any alarms in System Configuration screens in PLC MMI workstations.		
9	Check for proper connection of panel earthing strip/wire.		
10	Check for proper identification on the cables from the field.		
11	Check for the loose terminations strips/loose wiring termination.		
12	Check for any loose relay installations in the panel.		

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13	List out the bypass in the panel.		
14	Clean the panel using vacuum cleaner.		
15	Check installation of the PC/MMI connected to PLC		
16	Check the communications cord from PC/MMI to PLC		
17	Check and clean the color monitor connected to PC/MMI		
18	Check the power supply output for 110V DC, 230V AC, 24 V DC metering in the PDB		
19	Check for Low Battery indication on PLC processor.		
20	Check the PLC for operation in Program / Run / Test Mode.		
21	Run the PLC in auto I/O test mode and check for functioning of all interlocks.		
22	Check the relay contact resistance of relays in the control panel.		
23	Check for operation of the PC/MMI.		
24	Take a copy of logic program for back up.		
25	Prepare updated drawings after each modification in panel wiring.		
26	Check the healthiness of all the MODBUS modules		
27	Check for the functioning of the GIS synchronization.		
28	Check for the bumpless switchover of the primary to secondary processor and vice versa.		
29	Check the functioning of the process ESD		
	Common Check for processor, Remote I/O Panel, Local I/O Panel		
30	Check smooth opening & closing of the panel doors		
31	Check firmness of all the wires & terminations.		

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32	Check working of the cooling fans.		
33	Check the panels for proper illumination		
34	Check for the electrical & instrument earthing of the panel.		
35	Cold Work Permit Number		

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Signature :
Name :
Designation :
Date :

Approved By
Signature :
Name :
Designation :
Date :

21.16 Relevant Records:

Maintenance of Station PLC: ISF/INT/16

21.17 Frequency:

Maintenance of Station PLC: Yearly

22. PROCEDURE FOR PREVENTIVE MAINTENANCE, CALIBRATION & TROUBLESHOOTING OF MASS FLOW METER AND FLOW COMPUTER:

22.1 Purpose:

To provide guidelines for Preventive Maintenance, Calibration & Trouble Shooting of Mass flowmeter and Flow Computer.

22.2 Scope:

Scope of work includes Preventive Maintenance, Calibration & Trouble Shooting of Mass flowmeter and Flow Computer provided at the location.

22.3 Applicability:

This SOP is applicable to the entire pipelines SBU.

22.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

22.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

22.6 Usage:

Mass flow meters are used for Sensing, Measuring and Transmitting the mass flow in form of pulses to flow computer. It also measures the density of the product being transferred. At flow computer these pulses are converted into flow rate (Gross, Net and Mass) for display. Gross and Batch totalizers are calculated using these data of flow meters.

22.7 Importance:

Flow Rate is one of the critical parameters in pipeline operations. It is used to measure the amount of product transferred to the tanks via pipeline for accounting of product and for evaluating the performance of pipeline. It is used for measuring dispatch and receipt quantities. It is used as one of the inputs to Leak Detection System which is used for maintaining the integrity of pipeline.

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Name			
Designation			**GM-PIPELINE**

22.8 Location of Installation:

Pumping Side and Receipt Side.

22.9 Integration with PLC or SCADA:

The mass flow rate as measured by the flow meters is fed to flow computer in form of pulses and the density is fed to the flow computer via 4-20 mA signal. These pulses are converted to corresponding gross flow rates as per K-Factors of flow meter (which are obtained during calibration of Flow Meter). Net flow rates and Mass Flow rates are calculated basis of temperature and density measured. These flow rates are transmitted to station PLC and SCADA RTU through Modbus serial interface or through hardwired signals.

22.10 Parts:

Mass flow meter consists of: a. Two flow tubes; b. Drive coil and Pick Off coils; c. Pre-Amplifiers and Flow Computer.

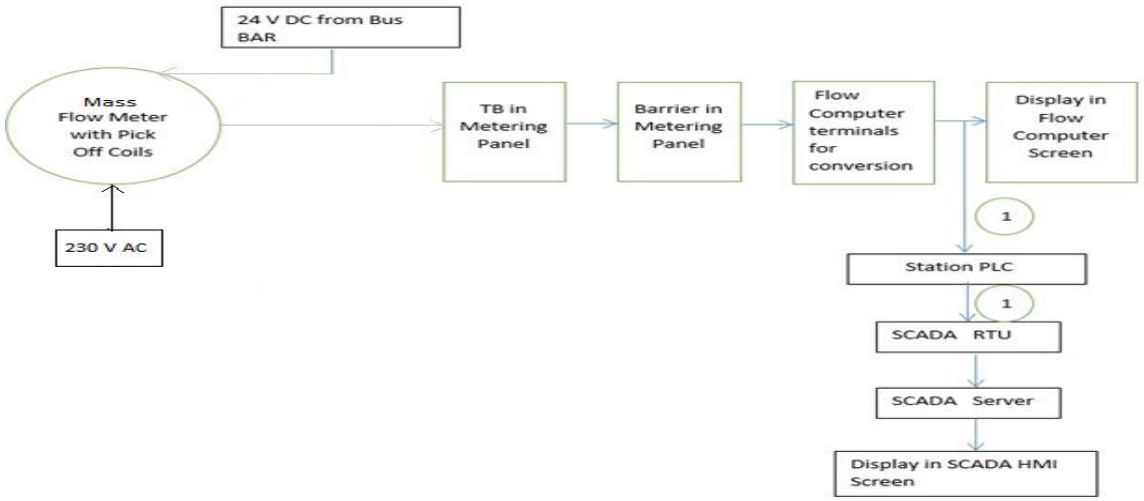
22.11 Working Principle:

The mass flow meter has dual parallel flow tubes. During the operation, a drive coil stimulates the tubes to oscillate in opposite directions. Two pick off coils mounted at the inlet and the outlet of the flow tubes generate a sinusoidal voltage. In no flow condition, both voltages are in phase and oscillates at a particular frequency. In flow condition, the two flow tubes twist with respect to each other and this results in a phase difference between the two voltages. This phase difference is proportional to mass flow rate of product. The frequency if the voltage indicates the density of the product. Pulse output corresponding to mass flow rate and 4-20 mA output corresponding to density is fed to flow computer. At flow computer (normally located in control room) these pulses are converted to corresponding flow rates as per K-factors. These flow values further transmitted to station PLC and SCADA using hard wire/ Modbus protocol.

22.12 Electrical Connections:

24 V DC and 230 V AC from flow computer to flow meter.

22.13 Block Diagram:



1: Through Modbus/TCP-IP Communication

22.14 Procedure for Preventive Maintenance of Flow Computer:

a. Ensure cold work permit.
b. Check proper wiring with identification and ferruling.
c. Check for proper connection of precision resistors in terminals.
d. Check for proper identification of the cables from the field.
e. Check for proper connection of instrument ground wire.
f. Check and tighten all terminations.
g. Check power supply input for 230 V AC.
h. Check the power supply input for 24VDC
i. Take the backup of flow computer program
j. After every calibration of flow meter ensure that pulses per second as per calibration certificate for corresponding flow rates are to be updated in flow computer.

Note: Observations has to be filled in maintenance format.

22.15 Procedure for Preventive Maintenance of Flow Meter:

Frequency: Once in a year

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Designation			**GM-PIPELINE**

a. Obtain cold work permit.
b. Check internals for any damage and dirt and if any abnormal sound is observed.
c. Check junction boxes and flow meter for water ingress.
d. Check the flow and density ranges configured in the flow meter and compare with flow computer.

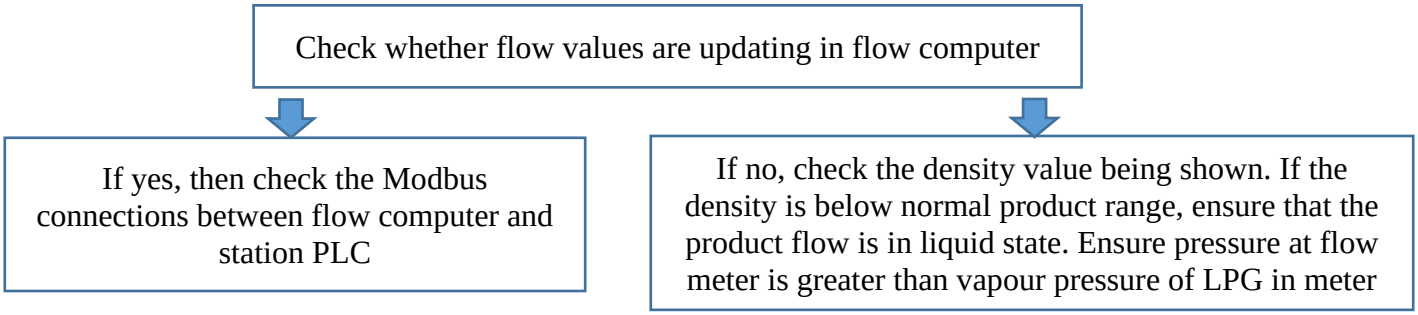
22.16 Calibration of Mass Flow meter:

Frequency: Once in a year

a. Obtain hot work permit.
b. Isolate 24VDC power supply from control panel end.
c. Isolate the motor operated valves (MOV) on either side of the flow meters.
d. Evacuate the LPG present in the section via cold flare and continuously monitor LEL values.
e. Dismantle the flow meter.
f. Pack the flow meter appropriately and send it to external agency (NABL Certified laboratory) for calibration in accordance with API 2531.

22.17 Trouble Shooting:

a. **Issue 1: Non updation of flow data in station PLC**.

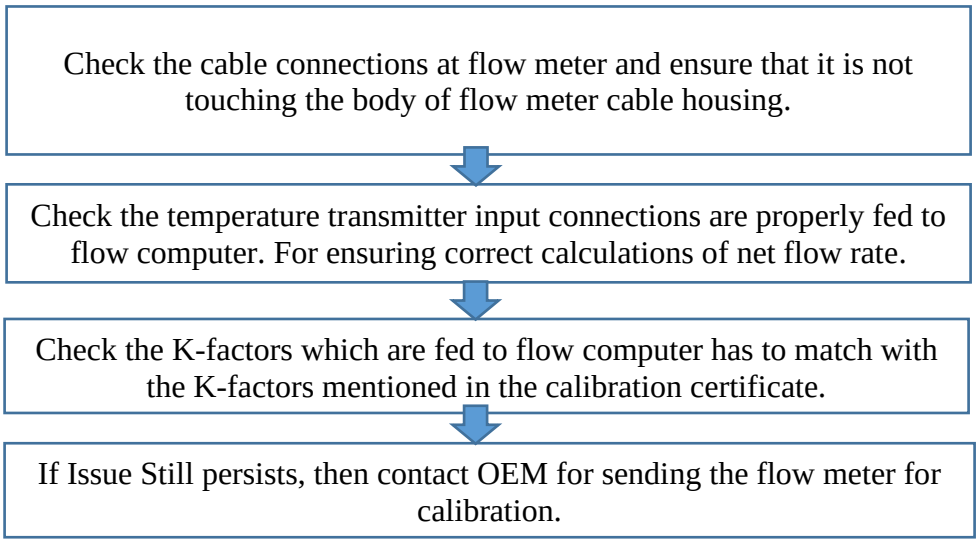


If the density is also not being updated, Open the flow meter cable housing and check whether the cables at the flow meter are properly connected for 4-20 mA density output, pulse output and the Modbus pair cable. Check the input voltage range of 24+/- 2 V DC and 230 V.

Carry out simulation of 4-20 mA density output. Check if the values are matching at input of flow computer. If yes, Check the connections at barrier end of flow computer and check the cable continuity between Pre-Amplifier and Flow Computer.

If 4-20 mA density output from flow meter is not matching or is not being obtained at flow computer input, then contact OEM for support. .

b. **Issue 2: Wrong updation of flow in flow computer and PLC. Less or more flow indication than actual flow.**



22.18 Maintenance Format for Flow Computer:

Location: **Department: Instrumentation**

Month: **Frequency: Half – Yearly**

Doc No: ISF/INT/17

S. No.	Instructions	Observation	Remarks
1	Check the power supply. Normal input is 230VAC		
2	Check for proper connection of instrument ground wire		
3	Check and tighten all terminations		
4	Check the current in the loop circuits using multi-meter		
5	Check the Pre-Amplifier power supply for DC 24 V		
6	Cross check with dip Flow Rates.		
	Metering Panel		
7	Check the panel for the illumination		
8	Check the proper opening & closing of the doors		
9	Check the proper connection of the instrument & electrical earthing.		
10	Check the functionality for the zener barrier.		
11	Check the functioning of the cooling fans.		

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Signature :
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Designation :
Date :

Approved By
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Name :
Designation :
Date :

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Name			
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22.19 Maintenance Format for Mass Flow Meter:

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/17

S. No.	Instructions	Observation	Remarks
1	Check the physical appearance and condition of painting of MFM		
2	Check internals for any physical damage.		
3	Check Junction box and flow meter cable housing for water ingress.		
4	Check the range of density and flow rate configured at flowmeter and cross check with flow computer.		

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Designation :
Date :

22.20 Relevant Records:

Maintenance of Mass Flow Meter and Flow Computer: ISF/INT/17

22.21 Frequency:

Maintenance of Mass Flow Meter: Yearly and Flow Computer: Half-Yearly

23. PROCEDURE FOR PREVENTIVE MAINTENANCE OF SULPHUR ANALYZER:

	Prepared By	Verified By	Authorized By
Signature with date			
Name			
Designation			**GM-PIPELINE**

23.1 Purpose:

To provide guidelines for Preventive Maintenance of Sulphur analyzer.

23.2 Scope:

Scope of work includes Preventive Maintenance of Sulphur analyzer provided at the location.

23.3 Applicability:

This SOP is applicable to the POL pipelines.

23.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

23.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

23.6 Usage:

Sulphur analyzer is used for online measurement of the sulphur content in Process fluids

23.7 Importance:

Sulphur is critical quality parameter which needs to be checked and it has to be within specific limits as per approved standards (BSIV/BSVI). Hence this device is used for tracking the interface of products.

23.8 Location of Installation:

Near Station Inlet Valve.

23.9 Integration with PLC or SCADA:

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Name			
Designation			**GM-PIPELINE**

Sulphur value measured by system is fed into PLC in the form of analog input (4 to 20 mA) for remote monitoring of current process value.

23.10 Parts:

Sulphur analyzer system consists of following systems:

c. Air compressor system
d. Sample handling system
e. Sample recovery system
f. Analyser system
g. UPS system
h. Electrical system

23.11 Working Principle:

It is based on UV fluorescence. it is an analytical method using fluorescence in the ultraviolet region.

23.12 Electrical Connections:

24 V DC supply from station PLC and 4 to 20 mA is transmitted to station PLC through this 2-wire loop.

23.13 Procedure for Preventive Maintenance of Sulphur Analyzer:

Before carrying out Preventive Maintenance of Sulphur Analyzer, please ensure the following:

a. Ensure that maintenance of equipment will not impact the normal operations.
b. Proper Work Permit System to be followed
c. Intimation to be provided to control room prior start and ensure this activity will not impact the operations.
d. Proper PPE such as Safety helmet s, Safety gloves, goggles are to be used.
e. Completion of activity to be informed to control room

23.13.1Procedure for Preventive Maintenance of Sulphur Analyzer:

	Prepared By	**Verified By**	**Authorized By**
Signature with date			
Name			
Designation			**GM-PIPELINE**

a. Checks for Air Compressor System
b. Check lube oil level of compressor.
c. Apply Grease for bearing lubrication.
d. Tighten all the assembly bolts.
e. Check all the Pressure Gauge.
f. Check auto start and auto stop control system. Mention the cut off & restart pressure.
g. Check for abnormal sound.
h. Check for alignment of motor pulley and compressor pulley.
i. Check for any leakage.

23.13.2Checks for Heatless Drier System

a. Drain the water droplets if any from Primary air regulator and secondary air regulator.
b. Check for the color of silica gel.
c. Check for any leakage through the tubings.
d. Checks for Sample Handling System
e. Check for functioning of the sample pump.
f. Check for any abnormal sound from the sample pump.
g. Clean the sample inlet filter.
h. Check for the working of pressure gauge and flow meter.
i. Check for general cleanliness.
j. Check for any leakage.

23.13.3Checks for Sample Recovery System

a. Check for working of pressure gauge.
b. Check for auto start and auto trip of the recovery pump. Note the start and stop level of the recovery pump.
c. Check for any abnormal sound from recovery pump.
d. Check for the functioning of level gauge.
e. Check for tightness of bolt.
f. Check for any leakage

23.13.4Checks for Sulphur Analyzer

	Prepared By	**Verified By**	**Authorized By**
Signature with date			
Name			
Designation			**GM-PIPELINE**

a. Check for the functioning of the Purge System. Purge system indicators should be green.
b. Check for proper functioning of vortex cooler. Vortex cooler should start when inside analyzer cabinet temperature reaches its pre-set value.
c. Check for O2 & N2 mass flow settings.
d. Replace O2 or N2 cylinder if empty
e. Replace transfer line tube if plug percentage more than 70%

Note: - Transfer line replacement is a specialized job. Must be done by trained person with prior experience.

a. Check for detector and furnace temperature settings
b. Check for proper instrument air settings
c. Check for any leakage from analyzer cabinet.
d. Check for proper exhaust of hot air from furnace chamber.
e. Check for proper functioning of detector fan for cooling.
f. Open furnace chamber carefully and check for any shoot deposition at the end of pyro tube.
g. Check for proper updating of Modbus data to Rockwell PLC.
h. Check for proper density received from Rockwell PLC in density sub menu in settings menu.
i. Check for any alarm status.
j. Run analyzer in process mode.
k. Check for analysis results. Note sulfur ppm. Compare with known sample sulfur content.
l. Calibrate analyzer if required.
m. Check analyzer base line voltage: should not be less than 300 mv. Increase detector setting if required.

Note: - analyzer must be calibrated after change in detector setting.

a. Check analyzer peak voltage. It should correspond to sulfur content of online sample.

Note- If proper peak is not coming check for following:

a. Check proper functioning of sample injection valve.
b. Ensure proper sample flow to analyzer.
c. Check output of high voltage DC card. It should be typically -600 V DC which can be adjusted.
d. If all above parameters are OK, then check detector for any coking. Clean detector if required.

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Designation			**GM-PIPELINE**

Note: - cleaning of detector is a specialized job. Must be done by trained person with prior experience.

a. Check for N2 & O2 cylinder pressure.
b. Check for any leakage from the cylinder.
c. Check for functioning of the rotary switches

23.14 Maintenance Format:

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/18

SI No	INSTRUCTIONS	OBSERVATION	REMARKS
1	AIR COMPRESSOR SYSTEM- a) Check lube oil level of compressor. b) Apply Grease for bearing lubrication. c) Tighten all the assembly bolts. d) Check all the Pressure Gauge. e) Check auto start and auto stop control system. Mention the cut off & restart pressure. f) Check for abnormal sound. g) Check for alignment of motor pulley and compressor pulley. h) Check for any leakage.		
2	HEATLESS DRIER SYSTEM a) Drain the water droplets if any from Primary air regulator and secondary air regulator. b) Check for the colour of silica gel.		

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Name			
Designation			**GM-PIPELINE**

	c) Check for any leakage through the tubing's.		
3	SAMPLE HANDLING SYSTEM a) Check for functioning of the sample pump. b) Check for any abnormal sound from the sample pump. c) Clean the sample inlet filter. d) Check for the working of pressure gauge and flow meter. e) Check for general cleanliness. f) Check for any leakage.		
4	SAMPLE RECOVERY SYSTEM a) Check for working of pressure gauge. b) Check for auto start and auto trip of the recovery pump. Note the start and stop level of the recovery pump. c) Check for any abnormal sound from recovery pump. d) Check for the functioning of level gauge. e) Check for tightness of bolt. f) Check for any leakage.		
5	SULPHUR ANALYZER SYSTEM a) Check for the functioning of the Purge System. Purge system indicators should be green. b) Check for proper functioning of vortex cooler. Vortex cooler should start when inside analyzer cabinet temperature reaches its pre set value. c) Check for O2 & N2 mass flow settings.		

	d) Replace O2 or N2 cylinder if empty e) Replace transfer line tube if plug percentage more than 70% Note:- Transfer line replacement is a specialized job. Must be done by trained person with prior experience. f) Check for detector and furnace temperature settings g) Check for proper instrument air settings h) Check for any leakage from analyzer cabinet. i) Check for proper exhaust of hot air from furnace chamber. j) Check for proper functioning of detector fan for cooling. k) Open furnace chamber carefully and check for any shoot deposition at the end of pyro tube. l) Check for proper updating of Modbus data to Rockwell PLC. m) Check for proper density received from Rockwell PLC in density sub menu in settings menu. n) Check for any alarm status. o) Run analyzer in process mode. p) Check for analysis results. Note sulfur ppm. Compare with known sample sulfur content. q) Calibrate analyzer if required. r) Check analyzer base line voltage: should not be less than 300 mv. Increase detector setting if required. Note: - analyzer must be calibrated after change in detector setting.		

	Prepared By	**Verified By**	**Authorized By**
Signature with date			
Name			
Designation			**GM-PIPELINE**

	s) Check analyzer peak voltage. It should correspond to sulfur content of online sample. Note- If proper peak is not coming check for following: 1) Check proper functioning of sample injection valve. 2) Ensure proper sample flow to analyzer. 3) Check output of high voltage DC card. It should be typically -600 V DC which can be adjusted. 4) If all above parameters are OK, then check detector for any coking. Clean detector if required. Note:- cleaning of detector is a specialized job. Must be done by trained person with prior experience.		
6	MISCELLANEOUS a) Check for N2 & O2 cylinder pressure. b) Check for any leakage from the cylinder. c) Check for functioning of the rotary switches		

23.15 Relevant Records:

Maintenance of Sulphur Analyzer: ISF/INT/18

23.16 Frequency:

Maintenance of Sulphur Analyzer: Yearly

	Prepared By	**Verified By**	**Authorized By**
Signature with date			
Name			
Designation			**GM-PIPELINE**

24. PROCEDURE FOR PREVENTIVE MAINTENANCE & TESTING OF THERMAL SAFETY VALVE:

24.1 Purpose:

To provide guidelines for Preventive Maintenance & Testing of Thermal Safety Valve.

24.2 Scope:

Scope of work includes Preventive Maintenance, Calibration & Trouble Shooting of Online Vibration Monitoring System provided at the location.

24.3 Applicability:

This SOP is applicable to the entire pipeline SBU.

24.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

24.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

24.6 Usage:

These are installed on process equipment piping for within station for release of excess pressure resulting from operational upsets and increase in ambient temperature etc.

24.7 **Importance**:

These are safety relief valves which will discharge the excess pressure developed in pipeline due to operational upsets or due to thermal expansion. These are very critical for maintaining the pipeline safety limits.

	Prepared By	**Verified By**	**Authorized By**
Signature with date			
Name			
Designation			**GM-PIPELINE**

24.8 Location of Installation:

These are installed in process area above ground piping on receipt side, pump discharge side, pump suction side etc.

24.9 Integration with PLC:

NA.

24.10 Parts:

Safety Valve, Drain Connections, HOV etc.

24.11 Working Principle:

This type of valve is automatic pressure relieving device actuated by the static pressure upstream of the valve. The valve opens in proportion to the increase over the opening pressure. Thermal Safety Valves are meant to take care of pressure increase resulting from thermal expansion of fluid. Following terms are used in functioning of TSV:

24.12 Set Pressure:

In a relief or safety relief valve on liquid service, set pressure is the inlet pressure at which the valve starts to discharge under service conditions. Set pressure should not exceed the maximum allowable working pressure

24.13 Relieving Pressure:

Relieving Pressure is the operating pressure increased by the amount of over pressure at full lift of relief valve.

24.14 Over Pressure:

Over Pressure is the pressure increase over the set pressure of the relieving device. It is the same as the accumulation if the device is set at maximum allowable working pressure. It may be greater than the accumulation if the valve is set at a lower pressure than MAWP or vice versa.

24.15 Blow Down:

Blow down is the difference between the set pressure and reseating pressure and normally expressed as percentage of the set pressure.

24.16 Lift:

The rise of the disc in a pressure relief valve is called lift.

24.17 Electrical Connections:

NA.

24.18 Block Diagram:

24.19 Procedure for Preventive Maintenance of Thermal Safety Valve (TSV):

a. Obtain cold work permit.
b. Isolate the valve and dismantle 'TSV'.
c. Clean the internal parts and remove dirt.
d. Check the condition of internal parts.
e. Verify the actuation mechanism by using hydrostatic test pump. Carry out the adjustment if required.
f. It shall be ensured that correct calibrated test gauge is used. All safety relief valves shall be tested in accordance with the relevant code to which the protected equipment is designed. After final adjustment the valve shall be popped at set pressure at least once to prove the accuracy of setting. PSV test pressure tolerance shall be 0.5% of the set pressure.
g. The set pressure adjustment shall be sealed. Reseat pressure shall be checked during testing of safety valve. The spring in a pressure relief valve in service for pressures up to and including 250 psi (shall not be reset for any pressure more than 10% above or 10% below that for which the valve is marked. For higher pressures, the spring shall not be reset for any pressure more than 5% above or 5% below that for which the safety or relief valve is marked. Perform leak test at reset pressure and record the same. OISD 132 may be referred for details.
h. Check for proper installation and make it online.
i. Acceptability criteria for TSV is + 3% for TSV of set pressure 5 Kg/CM2 or more and 2% for less than 5 Kg/CM2 set pressure.

Note: Observations to be maintained in Preventive Maintenance Format

	Prepared By	**Verified By**	**Authorized By**
Signature with date			
Name			
Designation			**GM-PIPELINE**

24.20 Maintenance Format:

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/19

S. No.	Instructions	Observation	Remarks
1	Verify the actuation mechanism by using hydrostatic test pump.		
2	Check and clean the internal parts.		
3	Record if any adjustment is done.		
4	Check for pop-up at Set Pressure		
5	Check for no leak at Reset Pressure		
6	Check for proper installation.		
7	Ensure No Leaks after installation		
8	Set Pressure		
9	Reset Pressure		
10	CWP No		

Prepared by
Signature :
Name :
Designation :
Date :

Approved By
Signature :
Name :
Designation :
Date :

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Signature with date			
Name			
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24.21 Relevant Records:

Maintenance of Temperature Safety Valve: ISF/INT/19

24.22 Frequency:

Maintenance of Temperature Safety Valve: Yearly

25. PROCEDURE FOR PREVENTIVE MAINTENANCE OF ULTRA VIOLET (FLAME) AND IR(HEAT) DETECTORS:

25.1 Purpose:

To provide guidelines for Preventive Maintenance of Ultra Violet (Flame) and IR (Heat) Detectors.

25.2 Scope:

Scope of work includes Preventive Maintenance of Ultra Violet (Flame) and IR (Heat) Detectors provided at the location.

25.3 Applicability:

This SOP is applicable to the entire pipeline SBU.

25.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

25.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

25.6 Usage:

These detectors are installed in Pump Houses for detecting the presence of Flame and Heat.

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Name			
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25.7 Importance:

These are safety devices which will detect and initiate the alarm during presence of flame and heat in pump houses.

25.8 Location of Installation:

These are installed in product pump houses.

25.9 Integration with PLC:

These are integrated into a separate panel (if they are in large numbers) or integrated directly to station PLC in form of digital inputs.

UV/FLAME Detector

IR/Heat Detector

Fig. 1 MODEL 302
For interior mounting in any atmosphere that is compatible with terminal screw type connections.

25.10 Working Principle:

UV Detectors:

a. This fire detector senses the radiant energy emitted by flaming fires in the Ultra Violet Spectrum (185 nm to 260 nm wavelength).
b. Its field of view is 120 deg cone of vision.
c. These are sensitive to Type-A,B & C flaming fires
d. It consists of twin UV sensors which senses the radiant energy this information is passed on to micro computer

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e. This Microcomputer compares the data with pre-defined fire signature and False alarm models

Heat/IR Detectors:

a. It works on the principle of a rate Compensation Detector.
b. It raises the alarm if temperature increases beyond 57 deg C
c. The detector consists of a high expansion aluminum tube which encases two insulation struts with opposing open constant points (see cut-away view). The high expansion sensing shell and the expansion struts have a different coefficient of expansion.
d. A slow rate of temperature rise allows the heat to penetrate the inner expansion struts. Therefore, the tubular shell and the struts expand slowly until the total device has been heated to its rated temperature level of 57 deg C .At this point, the silver contact points close which initiates the alarm.
e. When subjected to a rapid rate temperature rise there is not as much time for heat to penetrate the inner strut. The rapid lengthening of the shell allows the struts to come together at a lower level which compensates for thermal lag inherent in conventional fixed temperature detectors.
f. When the surrounding air temperatures goes below the rated temperature level, the shell contracts which forces contacts to open, thus automatically resetting the detector.

25.11 Procedure for Preventive Maintenance of UV/IR Detectors:

a. Ensure to take Cold Work Permit before starting of the maintenance job.
b. 1Check the Input UPS power supply and battery voltage of Panel in control room. Input power supply must be in the range of 230-240 V AC and Battery voltage must be 23-24 V DC under healthy conditions.
c. Check the healthiness of panel by viewing the LED indications. Under normal conditions all LED indications of panel must be in green color. In-case of any deviation then take the corresponding corrective action.
d. Check the earthing connections of the panel. Earthing must be tight and intact.
e. Simulate the UV and IR detectors in the pump houses using testing kits and cross check the results (Type of detector, address, location etc.) of panel with the actual ones. Both should be identical.

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f. Check the healthiness of all remaining detectors by viewing the LED indications in their respective response indicators and status of detectors will be predicted based on observations as mentioned below:
g. Under Normal Conditions: Dual LEDs blink for every 10 seconds.
h. Under faulty conditions: One LED turns ON solid until the fault is occurred.
i. Under activated condition: Both LEDs ON solid.
j. If re-calibration is required: Both LEDs flash ON & OFF rapidly

25.12 Preventive Maintenance Format of UV/IR Detectors:

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/20

S. No.	Instructions	Observation	Remarks
1	Check the input power supply and battery voltage of the control panel		
2	Check the healthiness of Panel		
3	Check the earthing connections of the panel		
4	Simulate the heat detector and Flame detector (min one from each pump house) using testing kit and compare the results of control panel with actual ones.		
5	Check the healthiness of all detectors by viewing the LED visual indications in their respective response indicators.		
6	Cold Work Permit Number		

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Prepared by		Approved By	
Signature	:	Signature	:
Name	:	Name	:
Designation	:	Designation	:
Date	:	Date	:

Note: Minimum one from each type of pump houses of both UV and IR detectors to be checked. In a year all detectors to be covered.

25.13 Relevant Records:

Maintenance of UV/IR Detectors: ISF/INT/20

25.14 Frequency:

Maintenance of UV/IR Detectors: Yearly

26. PROCEDURE FOR PREVENTIVE MAINTENANCE OF INTERLOCK CHECKING:

26.1 Purpose:

To provide guidelines for Preventive Maintenance & Checking of Interlocks.

26.2 Scope:

Scope of work includes Preventive Maintenance & Checking of Interlocks System provided at the location.

26.3 Applicability:

This SOP is applicable to the entire pipeline SBU.

26.4 Responsibility:

Officer In-Charge-Instrumentation/Maintenance In-charge

26.5 References:

- **OEM Manuals**
- **OISD-152 Safety Instrumentation For Process System in Hydrocarbon Industry**

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26.6 Usage:

Safety interlocks are programmed in station PLC for safeguarding the equipment and for ensuring safe operations within allowable critical parameters.

26.7 Importance:

Safety interlocks are very crucial ones for ensuring safe operating process parameters within the limits. These are programmed in station PLC and doesn't require any manual intervention.

26.8 Location of Installation:

NA

26.9 Integration with PLC or SCADA:

These are included in the programming part of station PLC and will work on CAUSE-EFFECT Principle.

26.10 Procedure for checking Safety Interlocks:

a. Necessary HOT/COLD Work permit to be taken.
b. Register all the "force on/off" or by pass of logic / points / alarms / equipment in the Bypass Register prior to starting of the testing.
c. After testing is completed, all bypass to be removed and recorded in Interlock Bypass Register.
d. Pipeline shutdown must be ensured.
e. All Capacitor, Mainline Pump & Booster Pump feeders of stations to be kept in TEST mode.
f. Necessary draining of product from pipeline & manifold lines to be done prior to the testing of manifold interlocks, to avoid product contamination.
g. All the Tank Outlet Valves to be kept in closed & local position.
h. Do not carry out inter lock checking when the main line product is MS.
i. Note down discrepancy if any.
j. In case of discrepancy, Control wiring/program logic to be checked for necessary correction.
k. Note that Manifold MOV interlock will not allow opening of two product manifold valves at the same time.

l. Check all Interlock logics for Low Suction/High discharge pressure trip, Sump Tank Low level tripping, Product switch over, accidental closure of station MOVs and Activation of ESD.

m. After testing is completed, ensure release of all "force on/off" or by pass of logic / points/ alarms/ equipment and register the same in the Bypass Register.

26.11 Maintenance Format for Interlock Checking:

Location: **Department: Instrumentation**

Month: **Frequency: Yearly**

Doc No: ISF/INT/21

List of Interlocks:

Sl. No.	Interlock	Actuated By	Action	Remarks

Prepared by
Signature :
Name :
Designation :
Date :

Approved By
Signature :
Name :
Designation :
Date :

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26.12 Relevant Records:

Checking of Interlocks: ISF/INT/21

26.13 Frequency:

Checking of Interlocks: Yearly

----------END OF THE REPORT----------

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