Procedure for Installation, Operation and Maintenance Manual Sensors SDP-6 / SDP-8 / SDP-9 RevN

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Restricted

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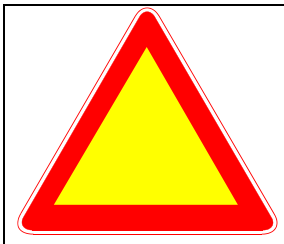
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1 GENERAL



WARNING: Ensure that this Installation, Operation and Maintenance manual is appropriate for the instrument / sensor(s).

2 PURPOSE

2.1 GENERAL

The purpose of this Manual is to ensure that the Installation, Operation and Maintenance are conducted properly to ensure the customer of the Subsea sensor's conformance to the specifications given in The Procurement Specification.

This is a generic procedure covering several different types and combinations of Omterra AS, Subsea differential pressure sensors hereafter called SDP.

2.2 PACKING AND TRANPORTATION

Avoid excessive shock and vibrations during transport and handling, even though the equipment itself is resistant towards shock and vibration, this is only true when the units are properly fixed and secured.

The SDP-6 and SDP-8 series sensor consists of 1 sensor body and 2 flanges connected by a capillary tube. A special transport case is prepared for packing, storing and transport of the SDP. Inside the box the sensor 3 parts are bolted onto a metal plate, and we strongly advise that the units are kept secured in this box/metal plate until the final installation destination is reached.

The SDP-9 is manufactured and shipped in kits consisting of two SDP-9 main bodies with two remote seals, accompanied by a shared temperature probe connected through a wire harness. It is crucial to note that these kits are calibrated as a complete set, and it is advised not to mix units from different sets without prior consultation with Omterra. This precaution is necessary to maintain the integrity and functionality of the product.

The transportation case must always be in its upright position (see marking on the case).

The SDP considerable high weight makes a dangerous combination if the transportation case is handled roughly (dropped, turned from upright positions, et cetera).

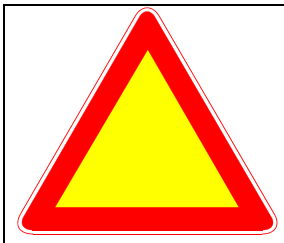
When the unit is to be lifted from the transportation case, use a lifting crane and the supplied hooks, never attempt to lift the unit by hand.

Due to the weight difference between the vulnerable capillary tubes, remote seals and the main body of the sensor, the capillary tubes are at considerable risk for damage during installation and handling, special care is therefore required.

Be sure that the SDP is stored in clean environment and preferably at room temperature. If the sensor is stored more than six - 6 - months before installation, a test of the sensor signal at ambient pressure and temperature should be conducted.

If the results from the testing show any unexpected readout from the sensor contact Omterra for assistance.

2.2.1 SAFETY



WARNING: Only personnel deemed qualified shall operate equipment involving high pressures and temperature. Protection glasses, gloves and shoes are required.

Other PPE to be used as appropriate for the area and work to be performed, see company safety instructions.

3 HEALTH AND SAFETY STATEMENTS

It is recommended that the Client performs a “Risk Assessment” for all aspects of the Sensor Installation from initial delivery to final dispatch, to identify the hazards associated with the work.

Because of the considerable high weight of each Sensor Unit, the staff preparing to move a Sensor Unit from the Delivery Box must make sure that they “Assess the Identified Hazards” for each movement of the Sensor.

The Sensors do not contain any chemicals or compositions that could be hazardous upon exposure. Electrical jumpers can contain silicon oil or similar, although this oil is not hazardous to health, any spillage should be removed immediately to avoid slip hazards.

During Soldering Operations, it is recommended that fumes are removed from the immediate working area to avoid inhalation by the operator.

Care in the selection of the correct tools for the final “Torque Setting of the Bolts” is important to avoid accidents through damaged/poorly maintained tooling.

Manual Handling, Lifting and Carrying are known to be the largest contributors to accidents. Ensure that mechanical handling aids are used whenever possible to avoid manual handling. Where manual handling is considered appropriate for the task, safe lifting guidelines must be followed, e.g., adopt correct posture, consider team lifting, employ safe lifting technique, et cetera. Make sure position of lifting eyes keeps assembly in balance.

Figure 1 shows the correct slinging method for an SDP-6 with Remote Seal Flanges.

Figure 1.



4 TESTING

4.1 FUNCTIONAL TESTING

During site receive check, perform a Functional Test to ensure the SDP is working properly. Perform visual verification of capillary tubes and remote seal membranes and verify no damage to either.

Note that for the SDP-9 series, the temperature probe must be connected to get a temperature read out from the sensor.

4.2 EQUIPMENT

For analogue 4–20 mA output, a loop calibrator can be used.

For HART Protocol, a standard handheld HART Communicator can be used.

For other digital outputs such as Modbus or CANopen, a control system or a laptop with software package and a converter is necessary to be able to read the sensor.

There are numerous commercial software and converter units available on the market.

Examples of software tools:

- CANopen: CANopenTester.exe
- RS485 Modbus: Win-Tech Modscan32.exe, http://www.win-tech.com/html/modscan32.htm
- RS485 KOS: KosViewer.exe

Examples of converters:

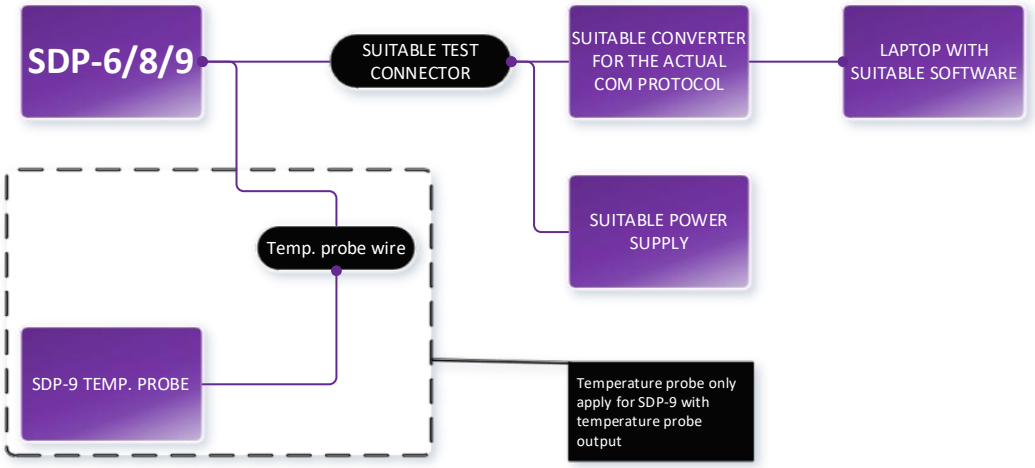
- CANopen: Ixxat converter for high speed or fault tolerant CAN: http://www.ixxat.com
- Rs485: MOXA interface converter RS232-Rs485 http://www.moxa.com/product/tcc-100.htm

A suitable test connector, a test cable and power supply are also needed.

Figure 3 shows the different elements needed to hook up a test loop with SDP-6.

SDP-8 hook up is identical. SDP-9 transmitters are equipped with a separate temperature probe which must be connected to get temperature readout.

Figure 3.



4.3 HOOK UP

Hook up the sensor according to the information given in the GA drawing.

4.4 VERIFICATION OF SENSOR READINGS

Verify that the readings from the sensor are in accordance with the criteria given in the Specification sheet for the actual project.

Note:

The SDP is calibrated and tested at a calibration laboratory in a controlled environment and the reference instruments used are of high accuracy. The SDP could also have been subject to High Static Calibration and therefore calibrated with specific pressure and temperature applied.

It can be difficult or even impossible to recreate these conditions (e.g., pressure and temperature) during testing at site and therefore this needs to be taken into consideration during evaluation of the sensor readings.

The acceptance criteria for measurements taken onsite in ambient conditions needs to reflect the expected offset of the SDP in ambient condition.

If more clarification is needed contact Omterra for further information.

5 INSTALLATION

5.1 GENERAL

This section will address key aspects of the design and installation process for a Omterra SDP series dP transmitter.

5.2 SDP USED FOR FLOW MONITORING

When the SDP is used for Flow monitoring, the sensor will be assembled to a Flow meter, e.g., a Venturi or a V-Cone. The H- port of the SDP will be assembled to the High-Pressure port and the L- port will be assembled to the Low-Pressure port of the Flowmeter. The GA drawing approved for the actual project will show the details of the assembly.

5.3 SDP USED FOR LEVEL MONITORING

5.3.1 INTRODUCTION

The SDP can be used for Level Monitoring of tanks and similar equipment. The high-pressure port must be connected to the low-level position of the tank and the low-pressure port must be connected to the high-level position of the tank. The weight of the actual fluid in the tank will generate a differential pressure between high and low position of the tank. The SDP will measure this difference pressure which can be used as a measurement for the fluid level in the tank.

5.3.2 REQUIRED INFORMATION

The height difference between high- and low-pressure port must be specified, see illustration 1 below. This information is to be found in the Procurement specification.

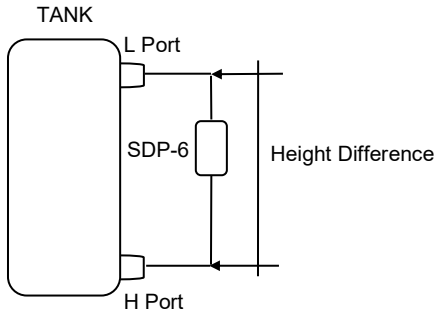


ILLUSTRATION 1

5.3.3 ZERO ADJUSTMENT

For projects where the SDP will be used for Level Monitoring, Vertical Flowmeter measuring gas or others where H&L ports are at different height, a Zero adjustment needs to be considered.

For Flowmeter and other applications where the height difference is specified the adjustment can normally be completed as a part of the FAT.

When the SDP is used for Level Monitoring on vessels where the high difference is significant, the best result is achieved by performing the zero adjustment “on site” after the sensor is installed.

Note:
Functional Test of SDP, which is Zero adjusted according to item 5.8, with the high- and low-pressure port placed at the same level will have an offset reading representing the specified height difference.

5.4 INSTALLATION POSITION AND DIRECTION

The main SDP body can be installed in any direction or any position with respect to the Remote Seals.

The SDP pressure inlets and the remote seals are marked with "L" and "H" for Low-pressure side and High-pressure side, respectively. Be sure to route capillary tubes and install remote seal to their correct pressure side.

5.4.1 INSTALLATION OF REMOTE SEALS

The Remote Seals will either be bolted or welded to the meter body or the tank, ref GA drawing for the project. If the Remote Seals are welded, a welding procedure will be stated for the project. If the Remote Seals are bolted, the assembly must be according to the flange standard defined by the actual project.

5.4.2 ROUTING OF THE CAPILLARY TUBES

Packing, handling, and transport, require the capillary tubes to be coiled. During installation, this coil must be straightened to enable the remote seals to reach their installation position.

Straightening out the coils must be done with care to avoid a sharp bend.

The capillary tubes must be routed and fixed such that the environmental influences become equal for the entire length of the tubes (both high pressure- and low-pressure side). Failing to do so will degrade the total accuracy of the sensor.

It is advised that the capillary tubes are supported and fixed every 200mm. Make sure that the supporting bracket does not introduce temperature to the capillary tube from other parts of the construction. This may have a departmental effect to the sensor readout accuracy.

5.4.3 CAPILLARY TUBES

The Capillary tubes must be handled with extreme care, do not:

- Lift or carry the Remote Seal or the Housing by the capillary tubes.
- Bend the capillary tubes more than absolutely necessary / required for facilitating the installation.
- Make any bend on the capillary tubes with radius less than 30mm and always use appropriate tool when making bends.
- Do not climb on, step on, or use the capillary tube as a climbing aid.

Damaging the capillary tubes may cause permanent damage to the complete sensor or degrade the sensor accuracy.

5.4.4 Membrane system

The Membrane system must be handled with extreme care, do not touch, or come near the membrane surface by hand or any object.

Note that the membrane is very thin and fragile, even the slightest contact with sharp object may permanently damage the complete sensor.

5.4.5 FIXING TOOLS

Never use air tool when fixing the Remote Seal and Main body bolts. Avoid other types of shock and vibration impacts.

5.4.6 WELDING

At any time during any type of welding operations on or in vicinity of the dP-sensor the SDP need to be grounded.

Best practice for grounding the SDP is:

For SDP supplied with no flying leads the sensor is grounded by placing a spring between the pins and the sensor housing. This spring is supplied and mounted by Omterra before shipping.

For SDP with flying leads, twist the end of the cables together and ensure that they are adequately connected to the sensor housing.

For SDP supplied with connector best practice is to use a test connector with flying leads.

Twist all leads of the test connector and ensure that they are adequately connected to the sensor housing.

5.5 SDP-9 TEMPERATURE PROBE

The temperature probe is positioned between two SDP-9 instruments, and these three items are calibrated and delivered in kits. A two-legged wire harness must be properly routed from the temperature probe location to each instrument. The temperature probe holds two pt1000 elements, and the SDP-9 temperature probe penetrator keyway pin and wire harness marking are designed to ensure accurate temperature calibration. Hence, it is crucial to verify that the correct wire harness leg is connected to its corresponding instrument.

5.6 PAINTING ON STRUCTURE

If the sensor is supplied un-painted, the sensor can be prepared and painted along with the host structure. During surface preparation, e.g., blasting, Pin Hole Tests or other test methods that utilizes an electrical method, the SDP needs to be grounded as described in section 5.12.

Special consideration should be taken towards masking of the electrical connector.

6 OPERATION INSTRUCTION

The operating of the unit is straight forward. The output from the SDP is an industry standard of 4- 20 mA signal/HART or digital outputs as MODBUS or CANopen.

The SDP will work together with the supply/receiver circuitry in the receiving module. If the receiving module is not available the SDP can communicate via PC software and interface hardware, see section 4.2. For more information contact Omterra.

For 4-20 mA, a standard loop tester can be used. For HART Communicator, a standard handheld communicator can be used.

After installation subsea, the signal from the SDP will form a part of the client's main system, and all operational instructions should be according to the client's procedures.

7 MAINTENANCE

No maintenance is required on stored assemblies. However, assemblies that have been in storage should be inspected prior to installation.

After installation subsea, it will normally not be possible to conduct any maintenance of the dP-transmitter.

If the SDP for any reason should be retrieved after installation, the sensor should be controlled and/or considered returned to the manufacturer for a complete check/recalibration.

8 STORAGE

8.1 GENERAL CONDITIONS

Be sure that the SDP is stored in clean and air-dry environment and preferably at room temperature.

Humidity:	Normal - up to 100%.
Chemicals:	Avoid contact with mineral oils, Corrosive gas, or acid.
Mechanical:	Avoid impacts, footsteps, or sharp edges.
Others:	Avoid storage near electrical motors, batteries, or welding equipment. Necessary measures should be taken to avoid that dust, or any other foreign particles accumulate on the assemblies. Assemblies should also be protected against rodents if necessary.

8.2 STORAGE

It is recommended during storage that the assemblies are stored in the original packing crate. Connectors, sensors, and transmitters must be protected with bubble plastic or equivalent wrapping. If there is sunlight present in the storage area, cover the assemblies with black plastic or similar protection.

- Recommended temperature: -40 to +70°C
- Light: No direct sunlight, preferably dark