EU RO Mutual Recognition Technical Requirements

DIFFERENTIAL PRESSURE SWITCHES	Version	0.0
	Adoption Date:	1 January 2019
	Application Date:	1 July 2019
	Tier	7
This document is subject to controlled issue and can be found here: http://www.euromr.org/technical-requirements ***** Uncontrolled if downloaded or printed *****		

1. PRODUCT DESCRIPTION 1
2. DESIGN EVALUATION 2
3. PRODUCTION REQUIREMENTS 6
4. MARKING REQUIREMENTS 6
5. TYPE APPROVAL CERTIFICATE CONTENT 6
6. APPROVAL DATE AND REVISION NUMBER 6
7. BACKGROUND INFORMATION / REFERENCES 7
8. MAINTENANCE & CLARIFICATION OF TECHNICAL REQUIREMENTS 7

1. PRODUCT DESCRIPTION

1.a General description of the product

A differential pressure switch is simply a device capable of detecting a pressure change and, at a predetermined pressure, opening or closing an electrical switch and is used in applications to signal that a predetermined pressure difference has been reached.

A conventional differential pressure switch is generally a simple electro-mechanical device that operates on the basic principles of lever and opposing forces connected with the diaphragm, metallic or elastomeric elements deformable due to pressure acting on the elements. The pressure difference creates a force which then overcomes that of a pre-tensioned spring and in the process, moves a balancing arm or mechanism to effect the minimal movement required to actuate the micro-switch of the switch.
Through their movement, they directly act on the opening and closing of an electrical switch (without requiring any power supply).

Electronic differential pressure switches which are microprocessor-controlled, with pressure sensors, such as piezo-electric pressure sensor, potentiometric pressure sensor, differential capacitance, etc. are also available. Internal electronic circuitry is used to activate one or more electronic switch outputs. With electronic switches, an external power supply is necessary to power the electronic circuitry inside the switch.

EU RO MR Group Secretariat
Email: secretariat@euromr.org

DIFFERENTIAL PRESSURE SWITCHES	Version	0.0
	Adoption Date:	1 January 2019
	Application Date:	1 July 2019
	Tier	7
This document is subject to controlled issue and can be found here: http://www.euromr.org/technical-requirements ***** Uncontrolled if downloaded or printed *****		

1.b Application limitations†

a) These technical requirements are applicable to differential pressure switches for control or alarm device of plant or system on board with rated voltage in electric circuit not exceeding 1000 V a.c. or 1500 V d.c.;
b) 'Ex' certification is not within the scope of these Technical Requirements;
c) Not applicable for a mobile offshore drilling unit (MODU);
d) Not applicable for fishing vessels;
e) Cannot be used to accomplish safety functions or simultaneously safety and control/monitoring functions.

†The EU MR type approved product is generally not used as a stand-alone product, but integrated as component in a sub-system or system. When a product is presented with an EU RO MR Type Approval Certificate for given application, its acceptability with regards to conditions defined in 1b, 1c and 1d of this Technical Requirement will be evaluated by the EU RO in charge of classing the ship or being in charge of the unit/system certification.

1.c Intended use

Switches functioning under the condition that a predetermined set point has been reached as a result of widening or narrowing difference between the two pressure sources within piping systems or machinery.

1.d System context

Refer to item 1c.

2. DESIGN EVALUATION

2.a Engineering evaluation requirements

2.a.i. Technical Requirements

a) The materials shall be suitable for intended service and location, and the material being in contact with process media (the pressure connection and sensor) material shall be compatible with the process media. Process media temperature should also be considered as each of the different wetted materials would have different operating properties;

EU RO MR Group Secretariat
Email: secretariat@euromr.org

b) Reliable operation of electrical and electronic part shall be ensured at relative air humidity of 100% under following ambient temperature conditions:

- 0˚C to +55˚C in enclosed spaces,
- 0°C to +70°C (minimum) close to combustion engines, boilers and similar; in case of components intended to be mounted on machinery associated with, or in spaces subject to, higher temperature, the relevant ambient temperature range is to be in accordance with specific machinery and installation, or with specific ambient temperature
- -25˚C to +45˚C on open deck. (-25°C to +55°C for electronic equipment)

No damage to electrical and electronic parts shall be caused by temperature up to +70˚C;

c) Reliable operation shall be ensured under the conditions of shocks having an acceleration of ±5,0 g and at a frequency of 40 to 80 shocks per minute;

d) Pressure components and devices shall not be damaged by overloads due to a working medium pressure rise equal to 2,0 times of the maximum working pressure;

e) Reliable operation of switches shall be ensured at vibrations having a frequency of 2 to 100 Hz, namely, with shift amplitude of ± 1 mm where the vibration frequency is between 2 and 13,2 Hz, and with an acceleration of ±0,7 g where the vibration frequency is between 13,2 and 100 Hz;

f) Reliable operation of switches mounted upon vibration sources (engines (ICE), compressors, etc.) or installed in steering flats shall be ensured at vibration frequencies of 2 to 100 Hz, namely, with a shift amplitude of ± 1,6 mm where the frequency is between 2 and 25 Hz, and with an acceleration of ±4,0 g where the frequency is between 25 and 100 Hz. For more severe conditions which may exist, for example, on exhaust manifolds of high speed ICE, 40 Hz to 2000 Hz – acceleration ± 10.0 g at 600 °C;

g) Reliable operation of switches shall be ensured at long term heel up to 22,5° and at motions of 22,5° with a period of 10 s;

h) The protective enclosure of electrical and electronic sensors shall be chosen in accordance with IEC 60529.

i) Switches having electric or electronic parts shall operate reliably in case of deviation of the power source parameters listed in Table 1 from nominal values:

EU RO MR Group Secretariat
Email: secretariat@euromr.org

Parameter	Deviation from nominal value		
	Long-term, %	Short-term	
		%	Time, s
Voltage (a.c.) Frequency	+6…-10 ±5	±20 ±10	1,5 5
Voltage (d.c.)	±10	5 10	Cyclic deviation Ripple

Table 1

j) Switches having electrical and/or electronic parts and supplied from accumulator batteries shall operate reliably with the following voltage variations from the nominal value:
- from +30 to —25 per cent for the equipment, which is not disconnected from the battery during battery charging;
- from + 20 to —25 per cent for the equipment, which is disconnected from the battery during battery charging.

k) Provision shall be made to ensure the electromagnetic compatibility of electrical and electronic parts of switches as specified IEC Publication 61000-4-2, IEC Publication 61000-4-3, IEC Publication 61000-4-4, IEC Publication 61000-4-5, IEC Publication 61000-4-6;

l) Switches to be installed in locations with specific operating conditions (high or low temperature, excessive mechanical loads, etc.) shall be designed and tested with regard to the conditions;

m) Electrical and electronic sensors shall be made of materials resistant to the marine environment or shall be reliably protected from its harmful effects;

n) Provision shall be made to prevent incorrect connection of plug-in-sockets to the switches outputs;

o) The devices shall be capable of being tested during normal operation;

p) Replaceable components, which require adjustment, as well as check-up points (terminals, monitoring jacks) shall be so arranged that easy access is possible at any time;

EU RO MR Group Secretariat
Email: secretariat@euromr.org

q) The minimum degree of protection, as applicable, shall be in accordance with the requirements set forth by the EU RO in charge of the vessel's classification, as a function of the intended location;
r) Anti-loosing means shall be provided to pressure setting devices.

2.a.ii. Technical documents to be submitted

a) General view drawings, structural units, appliances and instruments;
b) Technical description of working principle and operation;
c) Electrical/electronic diagrams and connections, etc.;
d) Relevant data and specifications, etc. in accordance with the requirements of EU RO TR for "SENSORS"(Tier 1), as required to the extent of applicable functionalities.

2.b Type testing requirements

a) Type tests shall be carried out in accordance with IACS UR E10;
b) Pressure test for pressure sensing parts at 150% of the design pressures with duration of 2 minutes is required;
c) The accuracy of the product should be documented before and after the static pressure test;
d) Impact test under the following conditions shall be carried out at working condition, in three mutually perpendicular planes. Sinusoidal shape of the impact momentum is recommended:
   - acceleration: -5g,
   - duration: 10 to 15 ms,
   - No. of impacts: 20,
   - frequency of impacts: 40 to 80 impacts /min.,

   The equipment is considered to have passed the test, if during and after the test it complies with the requirements specified in the technical documentation;
e) Additional tests in accordance with EU RO TR for "SENSORS"(Tier 1) shall be carried out, as required to the extent of applicable functionalities;
f) Test specimens shall be taken from the production line or from stocks*;
g) Tests shall be carried out in the presence of the EU RO Surveyor. In case where the tests are conducted at a Nationally Accredited Laboratory, the presence of the EU RO's Surveyor may be omitted*.

*For further clarification of witnessing of tests and sampling the test specimen(s),

EU RO MR Group Secretariat
Email: secretariat@euromr.org

refer to paragraph 6, 7 and 8 of the EU RO "Design Evaluation Scheme" procedure (Appendix V of EU RO Framework Document for the Mutual Recognition of Type Approval found on https://www.euromr.org/technical-requirements)

3. PRODUCTION REQUIREMENTS

Refer to EU RO "Product Quality Assurance (PQA)" procedure (Appendix VI of EU RO Framework Document for the Mutual Recognition of Type Approval) found on https://www.euromr.org/technical-requirements)

4. MARKING REQUIREMENTS

Manufacturers of the approved equipment are, in principle, to mark the product before shipment for identification of approved equipment as per referenced standard. In addition, and as a minimum, the following items to be marked at the suitable place:

a) Manufacturer's name or equivalent;
b) Type No. or symbol;
c) Serial No. and date of manufacture;
d) Particulars or ratings including IP grade.

5. TYPE APPROVAL CERTIFICATE CONTENT

The EU RO MR Type Approval Certificate shall contain the minimum information as defined in the EU RO Framework Document for the Mutual Recognition of Type Approval - see Appendix I of EU RO MR Type Approval Certificate Information.

The following information is specifically applicable to products relevant to this technical requirement and shall be included on the EU RO MR Type Approval Certificate:

a) Environmental test items and test levels applied, if any;
b) Name and version/revision of hardware, firmware and software, as applicable;
c) Approval conditions including limitations, if any.

6. APPROVAL DATE AND REVISION NUMBER

Date	Revision	Comment
2018-07-01	0.0	Approved by EU RO MR Steering Committee

EU RO MR Group Secretariat
Email: secretariat@euromr.org

DIFFERENTIAL PRESSURE SWITCHES	Version	0.0
	Adoption Date:	1 January 2019
	Application Date:	1 July 2019
	Tier	7
This document is subject to controlled issue and can be found here: http://www.euromr.org/technical-requirements ***** Uncontrolled if downloaded or printed *****		

7. BACKGROUND INFORMATION / REFERENCES

a) EU RO Framework Document for the Mutual Recognition of Type Approval;
b) IACS UR E10;
c) IACS UR P2.7;
d) EU RO TR for "SENSORS" (Tier 1).

8. MAINTENANCE & CLARIFICATION OF TECHNICAL REQUIREMENTS

Anyone wishing to propose changes to this document or request clarification of technical issues should contact the EU RO MR Group Secretariat in the first instance: Secretariat@euromr.org.

Review and approval of change requests shall follow the EU RO MR Maintenance Process detailed in the EU RO Framework Document for the Mutual Recognition of Type Approval: https://www.euromr.org/technical-requirements

- END -

EU RO MR Group Secretariat
Email: secretariat@euromr.org