EU RO Mutual Recognition Technical Requirements

PRESSURE SWITCHES	Version	0.0
	Adoption Date:	1 January 2019
	Application Date:	1 July 2019
	Tier	7
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1. PRODUCT DESCRIPTION

1.a General description of the product

A pressure switch is simply a device capable of detecting a pressure change and, at a predetermined pressure, opening or closing an electrical switch. There are two basic types of pressure switches: electromechanical and electronic/solid state. The electromechanical pressure switches are composed of a sensing element and an electrical switch. A number of different types of sensing elements can be used but they have one thing in common: they move in response to changes in the system pressure. Through their movement, they directly act on the opening and closing of an electrical switch (without requiring any power supply).

Electronic/solid state pressure switches use the same technology found in analogue pressure transmitters to sense changes in pressure. Rather than harnessing the energy of the pressure changes to mechanically operate a switch (as with electromechanical pressure switches), electronic/solid state pressure switches electrically measure pressure change and internal electronic circuitry is used to activate one or more electronic switch outputs. With electronic/solid state switches, an external power supply is necessary to power the electronic circuitry inside the switch.

1.b Application limitations†

a) These technical requirements are applicable to pressure switches for control, safety 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.;

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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.

†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

Pressure switches intended to be used in all control, alarm, and monitoring systems necessary for the applications mentioned in 1.b subject to classification.

1.d System context

Installation on board a ship within different locations with all climatic, chemically active and mechanically active surrounding and atmosphere for which is tested.

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 the process media (the pressure connection and sensor) 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;
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

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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 (8 ± 1) 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:

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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 shall be reliable at shocks having an acceleration of ±5,0 g and at a frequency of 40 to 80 shocks per minute;

m) 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;

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

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

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

q) 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;

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r) 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;

s) Anti-loosing means shall be provided to pressure setting devices.

2.a.ii. Technical documents to be submitted

a) Proposed test program and test schedule;

b) Description of the test specimens and explanation of the selected test sample(s) providing evidence that the selected sample meets the most rigorous and demanding requirements;

c) Product descriptions, manuals, data sheets, assembly drawings, dimension drawings, etc. clearly identifying the product;

d) Documents shall be submitted for electronic/solid state pressure switch – for reference purposes see EU RO MR Technical Requirements for "Sensors" (Tier 1) paragraph 2.1.2, and "Pressure gauges/transmitters" (Tier 5), paragraph 2.a.ii;

e) Details of the production site(s), production facility inspection report, production specifications and a valid QM certificate according to ISO 9001;

f) After the completion of the testing, the report shall contain:

- an identification number;
- all relevant data and test results including the place, date and names of personnel responsible for conducting the test;
- type references and serial numbers of the products tested;
- details of the test equipment used including the calibration certificates and serial numbers;

g) Test reports shall be signed and dated by the person(s) responsible for conducting the test and by the attending EU RO witnessing the test.

2.b Type testing requirements

a) Type tests shall be carried out in accordance with IACS UR E10 and selected suitable recognized standard;

b) Pressure test at 150% of design pressure with duration of 2 minutes is required. The accuracy of the equipment should be documented before and after the static pressure test;

c) For Pressure switches type testing shall be carried out as per the EU RO MR Technical Requirements for "Switches" (Tier 1), paragraph 2.b;

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d) For electronic/solid state pressure switches, type testing shall be carried out as per the EU RO MR Technical Requirements for "Sensors" (Tier 1) paragraph 2.2 or according to "Pressure gauges/transmitters" (Tier 5), paragraph 2.b;
e) Test specimens shall be taken from the production line or from stocks;
f) 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), 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 Max. Working Pressure (or rated pressure), operating temperature and 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 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:

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a) Technical data which adequately express the basic article's features assuring its functional usage;
b) Environmental test items and test levels applied, if any;
c) Details of the EMC test level applied (as applicable);
d) Name and version/revision of hardware, firmware and software (as applicable);
e) 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

7. BACKGROUND INFORMATION / REFERENCES

a) EU RO Framework Document for the Mutual Recognition of Type Approval;
b) IACS UR E10 – ''Test Specification for Type Approval'';
c) BS 6134: 1991 – ''Specification for Pressure and vacuum switches'';
d) MR TR for ''SWITCHES'' (Tier 1);
e) MR TR for ''SENSOR'' (Tier 1);
f) MR TR for ''PRESSURE GAUGES/TRANSMITTERS'' (Tier 5);
g) ISO 9001.

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

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