

EU RO Mutual Recognition Technical Requirements

DUAL TEMPERATURE AND 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

Dual Temperature and Pressure Switches (hereinafter switches) have both temperature and pressure measurement capabilities with relevant output change-over and combined within the same device. Switches may have electric and/or electronic parts and be externally power supplied.

Temperature sensors may be based on several working principles: bi-metallic (BM), liquid expansion (LE), gas-expansion (GE), thermo-resistors (RTD), thermocouples (TC), infrared (IR), etc.; the relevant features of which vary accordingly. According their working principle the movement directly act on the opening and closing of an electrical switch or the sensor respond to temperature by changing the electrical performance.

Pressure sensors 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 sensors 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).

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Electronic/solid state pressure sensors electrically measure pressure change and internal electronic circuitry is used to activate one or more electronic switch outputs.

1.b Application limitations[†]

- a) These technical requirements are applicable to dual temperature and pressure switches for control, safety or alarm device of plant or system on board with rated voltage in electric circuit not exceeding 1000V 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.

[†]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 intended to be used in all control, monitoring and instrumentation systems necessary for the applications mentioned in 1.b.

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 wetted parts (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
The material of sensor shall be compatible with the fluid whose temperature is intended to be sensed and have high thermal conductivity;

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- b) Reliable operation shall be ensured under the following ambient temperatures:
- 0°C to +55°C in enclosed spaces,
 - +5°C to +70°C close to combustion engines, boilers and similar.
 - -25°C to +45°C on open deck.
- No damage to electrical and electronic parts shall be caused by temperature up to +70°C;
- c) Reliable operation of electrical and electronic parts shall be ensured at relative air humidity of 100% with 55°C;
- d) Reliable operation shall be ensured under the conditions of shocks having an acceleration of $\pm 5,0$ g and at a frequency of 40 to 80 shocks per minute;
- e) 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;
- f) 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 $\pm 0,7$ g where the vibration frequency is between 13,2 and 100 Hz;
- g) 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 $\pm 1,6$ mm where the frequency is between 2 and 25 Hz, and with an acceleration of $\pm 4,0$ 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;
- h) 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;
- i) R The protective enclosure of electrical and electronic sensors shall be chosen in accordance with IEC 60529.;
- j) 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.)	+6...-10	±20	1,5
Frequency	±5	±10	5
Voltage (d.c.)	±10	5 10	Cyclic deviation Ripple

Table 1

- k) 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.
- l) 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;
- m) Switches shall be reliable at shocks having an acceleration of ±5,0 g and at a frequency of 40 to 80 shocks per minute;
- n) 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;
- o) Electrical and electronic sensors shall be made of materials resistant to the marine environment or shall be reliably protected from its harmful effects;
- p) S Provision shall be made to prevent incorrect connection of plug-in-sockets to the switches outputs;
- q) The devices shall be capable of being tested during normal operation;
- r) 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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- s) 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;
- t) Anti-loosing means shall be provided to pressure setting devices;
- u) Switches used for measuring temperature of fire-hazardous, toxic liquids, vapors and gases, liquids, vapors and gases under pressure shall be isolated from the medium tested;
- v) The damage of temperature measurement channel shall not influence ability to measure the pressure and vice versa.

2.a.ii. Technical documents to be submitted

IMPORTANT: The English Language shall be used for all submitted documents.

- a) Technical specifications, data sheets, drawings, installation sheets, description of working principles of the switches and showing compliance with the relevant technical requirements as per above point 2.a.i, proposed test programs and type test reports done previously if available.

2.b Type testing requirements

- a) The tests shall be carried out in accordance with IACS UR E10 except those that are differ as well as additional tests for confirmation of special features of switches indicated in the technical documentation as per Table 2:

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Test	Normative document, test parameters	Test conditions	Test purpose, performance criteria
Protective enclosure	IEC 60529	The test is applicable for enclosures of the articles with operating voltage up to 1000V.	The equipment is considered to have passed the test, if it satisfies the Performance Criterion A and the requirements of IEC 60529.
Impact	-Acceleration-5g, -Duration: 10-15ms, -No. of impacts: 20, -Frequency of impacts: 40-80 impacts/min	The tests shall be carried out in operating condition under effect of shock load in each of the three mutually perpendicular directions in relation to the item, in turn. The form of the shock pulse is recommended to be close to sine one.	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.
Exposure to solar radiation	-Temperature in the chamber: +55°C -Radiation intensity: 1120W/m ² ±10% (Including flux density of the ultra violet portion of spectrum with a wave length of 280-400nm shall be not less than 42 W/m ²) The switches are subjected to irradiation from infra-red and ultra-violet radiation sources during 120 h	The tests are carried out in a special chamber at an air temperature of 55 ± 2 °C in the chamber shade. The product or its part is subjected to irradiation from infra-red and ultra-violet radiation sources during 120 h. The radiation plant intensity shall provide the total heat-flux density not less than 1125 W/m ² , the flux density of the ultra-violet part of the spectrum with a wave length of 280 to 400 nm shall be at least 42W/m ² .	The equipment is considered to have passed the test, if: -No deformation, cracking, stratification, buckling, ungluing of plastic pieces and other materials has taken place -No degradation of readability of inscriptions and signs on the instrument scales has not been detected Parameters and resistance of insulation have remained normal.

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Test	Normative document, test parameters	Test conditions	Test purpose, performance criteria
Pressure test	200% of the switch max. working pressure. Duration 2 minutes.	The test shall be carried out under working condition.	During and after the pressure test the switches shall be in good working order.
Inclination test	Limiting inclination angle 22,5°. Motions period 7..9 seconds.	Conditioning of equipment sequentially in two mutually perpendicular positions at an angle of 22,5° to the horizontal and measurement of parameters. Duration of tests: any which is sufficient for measuring parameters, but not less than 15 min in each position. Parameters shall be read at least 3 times in each position.	During and after the test the switches shall be in good working order.
Cold test	As per UR E10 Cold test requirements except the duration. Duration is 16 hours.	As per UR E10 Cold test, but duration -16 hours	As per UR E10

Table 2

- b) Tests shall be carried out in the presence of the EU RO Surveyor. In cases where the tests are conducted at Nationally Accredited Laboratories, the presence of the EU RO surveyor may be omitted;
- c) The type tests shall be conducted on the test specimen(s) selected from production line or at random from stock in the presence of an EU RO surveyor in accordance with the agreed type test program. *

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* 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 <http://www.euomr.org/Guidance%20for%20Mutual%20Recognition>)

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 <http://www.euomr.org/Guidance%20for%20Mutual%20Recognition>

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) Particulars or ratings;
- d) Date of Manufacture.

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:

- a) Environmental test items and test levels applied, if any;
- b) Approval conditions including limitations, if any.

6. APPROVAL DATE AND REVISION NUMBER

Date	Revision	Comment
2019-01-01	0.0	Approved by EU RO MR Steering Committee

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7. BACKGROUND INFORMATION / REFERENCES

- a) EU RO Framework Document for the Mutual Recognition of Type Approval;
- b) IEC 60529;
- c) IACS UR E10 Rev.6;
- d) Regulation (EC) No 391/2009 of the European Parliament and of the Council of 23 April 2009 "on common rules and standards for ship inspection and survey organizations".

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@euomr.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: <http://www.euomr.org/Guidance%20for%20Mutual%20Recognition>

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