

EU RO Mutual Recognition Technical Requirements

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| TACHOMETER | Version | 0.1 |
| | Adoption Date | 1 April 2016 |
| | Application Date | 1 October 2016 |
| | Tier | 4 |
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1. PRODUCT DESCRIPTION

1.a General description of the product

Rotational speed indicator of marine diesel engines, steam and gas turbines, which indicate revolutions per minute and rotating direction.

a) Mechanical (Centrifugal, Electromagnetic) tachometer

The types by drive system are shown below:

- Direct drive;
- Flexible shaft drive;
- Belt drive;

b) Electric tachometer

The types of revolution detectors by drive system are shown below:

- Non-contact type (Detecting system: Frequency);
- Direct type (Detecting system: Frequency, AC voltage or DC voltage);
- Flexible shaft type (Detecting system: AC voltage).

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Generally composed of:

- Non-contact type detector (Revolution detector);
- Signal converter; and
- Receiver.

Or:

- Driving unit;
- Direct type/Flexible shaft type detector (Transmitting device);
- Junction box; and
- Receiver.

1.b Application limitations

- a) This technical requirement shall not be applied to propeller revolution indicators required by SOLAS Chapter V;
- b) Applicable for installation on ships as defined by Art. 2 of EU Regulation (EC) No. 391/2009, for the purposes of Art. 10 of the same.

1.c Intended use

Local/Remote indicating and monitoring systems.

1.d System context

See 1.c.

2. DESIGN EVALUATION

2.a Engineering evaluation requirements

2.a.i. Technical Requirements

- 1) For mechanical tachometers, the tolerable deviations shall be $\pm 1\%$ of the maximum graduation, and the pointer run-out shall be within 1% of the maximum graduation;

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2) For electric tachometers:

- a) The enclosures of the transmitting device, signal converter and the receiver are subject to individual ROs' requirements for the degree of protection of enclosure and shall be rigid and of such construction that adjustments and maintenance can be easily carried out;
- b) The receivers with illumination lamps, those dimmer switches and signal converters in case of non-contact type shall be provided with an earthing terminal or shall be of such construction so as to be capable of earthing;
- c) **Driving unit:**
 - The driving unit shall smoothly transmit the revolutions to the transmitting device without any slip;
 - The clutch mechanism shall be provided so as to stop or drive the transmitting device optionally during the shaft running;
 - The coupling between driving unit and shaft shall be of gear type;
 - The driving gear shall be fitted easily and securely on the shaft;
- d) **Transmitting device:**
 - The transmitting device shall have a generator, which is driven by the shaft through the driving unit and transmits the revolutions per minute and direction of revolution of the shaft;
 - The transmitting device shall have sufficient capacity to operate all receivers simultaneously according to the number of connected receivers. When the generator is designed to supply a power necessary for the automation equipment and instrumentation, the capacity for them shall be taken into consideration;
- e) **The junction box** shall be capable of connecting the number of receivers required and shall be equipped with a compensator which prevents an error of each receiver from arising even when the number of receivers changes;
- f) **The revolution detector** shall be of such a construction that pulses can be securely detected using the turning gear of engine or a disc with slits.
- g) **Receiver:**
 - The receiver shall be electrically connected to the transmitting device and shall be capable of indicating the rational speed (in the number of revolutions per minute) and the direction of rotation;

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- The receiver shall be capable of adjusting the indications and zero position by an adequate method;
 - The receiver shall be of such construction as to be capable of providing easy and clear reading;
 - The illumination device should be of an EL plate or a LED type, and it shall be arranged so that it does not hinder an operator's vision at night and makes a scale, a pointer and letters as evenly legible as possible, even in the dark and low light conditions;
- h) When the receiver is tilted up to an angle of 30 degrees, in any direction from the normal fitting condition without current, the deviation of pointer from zero point shall be within $\pm 1\%$ of the sum of the maximum scale of both ahead and astern directions for 150 mm and upwards size of dial diameter, and within $\pm 2\%$ for less than 150 mm size of dial diameter;
- i) When the pointer of receiver is moved slowly from zero point to the maximum scale and vice versa for both ahead and astern directions by inducing a variable voltage on the receiver, and the reading at a corresponding voltage to each revolution of 0%, 25%, 75% and 100% of the maximum scale shall be measured. The difference between readings of going and returning shall be within $\pm 0.5\%$ of the sum of the maximum scale of both directions for 150 mm and upwards size of dial diameter, and within $\pm 1\%$ for less than 150 mm size of dial diameter;
- j) When the reading at each corresponding revolution to 0%, 25%, 50%, 75% and 100% of the maximum graduation of receiver is measured, the error of each reading in terms of 20°C shall be within $\pm 0.5\%$ of the sum of the maximum graduation of both directions for 150 mm and upwards size of dial diameter, and within $\pm 1\%$ for less than 150 mm size of dial diameter;
- k) When a current corresponding to half of the maximum scale is suddenly applied to the receiver, the pointer shall not over-run the position of 2/3 of the maximum scale;
- l) When a voltage correspondence to the maximum scale is induced on the receiver for 30 minutes and then the voltage is changed to zero, the deviation of reading from zero position immediately after changed to zero with a light tap at outer case, shall be within $\pm 0.25\%$ of the sum of the maximum scale of

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both directions for 150 mm and upwards size of dial diameter, and within $\pm 0.5\%$ for less than 150 mm size of dial diameter;

m) **Signal converter:**

- The accuracy of the output voltage shall be within 0.2% in terms of the percentage to the output voltage corresponding to the maximum graduation of the receiver;
- When the number of input pulses per second to the signal converter is suddenly switched from that corresponding to half of the maximum rational speed to that corresponding to the maximum rational speed, the time required for the output voltage to reach voltage corresponding to the maximum rational speed shall be 1 second or less;

n) See also EU RO MR technical Requirement for "SENSORS" (tier 1).

2.a.ii. Technical documents to be submitted

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

- a) Technical specifications, drawings, installation sheets and type test reports, describing the type and working principles of tachometer for which approval is requested, and showing compliance with the relevant requirements;
- b) Documents shall be submitted for electric tachometer: see also EU RO MR technical requirements for "SENSORS".

2.b Type testing requirements

1) **For the mechanical tachometers:**

- a) **Visual inspection**
Conformity with drawings, design data, etc.;
- b) **Performance test**
Confirmation that operation is in accordance with this technical requirement;
- c) **Vibration test**
See EU RO MR technical requirements for "SENSORS" for the test procedure, test parameter and other information;
- d) **Durability test**

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When continuously operated at the maximum rational speed graduated on the scale for 10 hours, the tachometers shall satisfy the performance specified in item 2.a.i. paragraph 1).

2) For electric tachometers:

- a) See EU RO MR technical requirement for "SENSORS". The following performances shall be verified:
- Balancing (See 2.a.i.1)h));
 - Friction error (See 2.a.i.1)i));
 - Calibration accuracy (See 2.a.i.1)j));
 - Damping efficiency (See 2.a.i.1)k));
 - Zero position (See 2.a.i.1)l));
 - Response speed of signal converter (See 2.a.i.1 m));

Test specimens shall be selected from production line or at random from stocks†. 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†.

† For further clarification of witnessing of tests and sampling the test specimen(s), refer to paragraphs 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.euromr.org/Guidance%20for%20Mutual%20Recognition>)

3. PRODUCTION REQUIREMENTS

- a) Refer to EU RO "Product Quality Assurance (PQA)" procedure (Appendix VI of EU RO Framework Document for the Mutual Recognition of Type Approval);
- b) Every tachometer shall be certified by the Manufacturer, subject to satisfactory performance of routine test(s) as per applicable standard or specification.

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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;
- b) Model Name / Type / Version;
- c) Serial Number;
- d) Rating (rated voltage, current and frequency of required power supply, rated pressure and temperature of sensing device, rated measurement range);
- e) 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.

6. APPROVAL DATE AND REVISION NUMBER

| Date | Revision | Comment |
|--------------|----------|--|
| 2015-01-31 | 0.0 | Accepted by EU RO MR Advisory Board |
| 1 April 2016 | 0.1 | CRF025 – Updated to new MR TR document format incl. par. 8; CRF026/026a – Witness testing & control of test specimen; CRF028 – addition of 6 month application clause. |

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7. BACKGROUND INFORMATION / REFERENCES

- a) IACS UR E10 "Test Specification for Type Approval";
- b) IEC 60092-504 "Electrical Installations in Ships - Special Features, Control and Instrumentation";
- c) IEC 60533 "Electrical and Electronic Installations in Ships - Electromagnetic Compatibility";
- d) ISO 22554:2007 Ships and marine technology - Propeller shaft revolution indicators - Electric type and electronic type;
- e) EU RO MR Technical Requirements for SENSORS (Tier 1);
- f) EU RO Framework Document for the Mutual Recognition of Type Approval.

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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