



RULES

PUBLICATION 79/P

TYPE TESTING PROCEDURE FOR CRANKCASE OIL MIST DETECTION AND ALARM EQUIPMENT

July
2016

Publications P (Additional Rule Requirements) issued by Polski Rejestr Statków complete or extend the Rules and are mandatory where applicable.

GDAŃSK

A decorative graphic at the bottom of the page consisting of several overlapping, wavy blue lines that create a sense of movement and depth.

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CONTENTS

	Page
1 Scope	5
2 Environmental Tests	5
3 Purpose	5
4 Test Facilities	5
5 Equipment Testing	5
6 Functional Tests	6
7 Detectors and Alarm Equipment to be Tested	7
8 Method	7
9 Assessment	8
10 Design Series Qualification	8
11 The Report	8
12 Acceptance	9

1 SCOPE

1.1 The present Publication specifies the tests required to demonstrate that crankcase oil mist detection and alarm equipment intended to be fitted to diesel engines satisfies PRS requirements.

Note:

This test procedure is also applicable to oil mist detection and alarm equipment intended for gear cases.

2 ENVIRONMENTAL TESTS

2.1 Environmental tests are to be carried out according to *Publication No. 11/P – Environmental Tests on Marine Equipment*.

3 PURPOSE

3.1 The purpose of type testing crankcase oil mist detection and alarm equipment is seven fold:

- .1 to verify the functionality of the system;
- .2 to verify the effectiveness of the oil mist detectors;
- .3 to verify the accuracy of oil mist detectors;
- .4 to verify the alarm set points;
- .5 to verify time delays between oil mist leaving the source and alarm activation;
- .6 to verify functional failure detection;
- .7 to verify the influence of optical obscuration on detection.

4 TEST FACILITIES

4.1 Test houses carrying out type testing of crankcase oil mist detection and alarm equipment are to satisfy the following criteria:

- .1 a full range of facilities for carrying out the environmental and functionality tests required by this procedure shall be available and be acceptable to PRS;
- .2 the test house that verifies the functionality of the equipment is to be equipped so that it can control, measure and record oil mist concentration levels in terms of mg/l to an accuracy of $\pm 10\%$ in accordance with this procedure.
- .3 When verifying the functionality, test houses are to consider the possible hazards associated with the generation of the oil mist required and take adequate precautions. IACS will accept the use of low toxicity, low hazard oils as used in other applications, provided it is demonstrated to have similar properties to SAE 40 monograde mineral oil specified.

5 EQUIPMENT TESTING

5.1 The range of tests is to include the following:

- .1 for the alarm/monitoring panel:
 - functional tests described in Section 6;
 - electrical power supply failure test;
 - power supply variation test;
 - dry heat test;
 - damp heat test;
 - vibration test;
 - EMC test;
 - insulation resistance test;
 - high voltage test;
 - static and dynamic inclinations, if moving parts are contained;

- .2 for the detectors:
- functional tests described in Section 6;
 - electrical power supply failure test;
 - power supply variation test;
 - dry heat test;
 - damp heat test;
 - vibration test;
 - EMC test where susceptible;
 - insulation resistance test;
 - high voltage test;
 - static and dynamic inclinations.

6 FUNCTIONAL TESTS

6.1 All tests to verify the functionality of crankcase oil mist detection and alarm equipment are to be carried out in accordance with 6.2 to 6.6 with an oil mist concentration in air, known in terms of mg/l to accuracy of $\pm 10\%$.

6.1.1 The concentration of oil mist in the test chamber is to be measured in the top and bottom of the chamber and these concentrations are not to differ by more than 10%.

See also 8.1.1.

6.2 The oil mist **detector** monitoring arrangements are to be capable of detecting oil mist in air concentrations between 0 and 10% of the lower explosive limit (LEL) or between 0% and a percentage of **oil weight in air determined by the Manufacturer based on the sensor measurement method (e.g. obscuration or light scattering) that is acceptable to the Society, taking into account the alarm level specified in 6.3.**

Note:

The LEL corresponds to an oil mist concentration of approximately 50 mg/l (~4.1% weight of oil in air mixture).

6.3 The alarm set point for oil mist concentration in air is to provide an alarm at a maximum level corresponding to not more than 5% of the LEL or approximately 2.5 mg/l.

6.4 Where alarm set points can be altered, the means of adjustment and indication of set points are to be verified against the equipment manufacturer's instructions.

6.5 **The performance of the oil mist detector in mg/l is to be demonstrated. This is to include: its range, resolution and sensitivity.**

Note:

Sensitivity of a measuring system: quotient of the change in an indication of a measuring system and the corresponding change in a value of a quantity being measured.

Resolution: smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.

6.6 Where oil mist is drawn into a detector via piping arrangements, the time delay between the sample leaving the crankcase and operation of the alarm is to be determined for the longest and shortest lengths of pipes recommended by the manufacturer. The pipe arrangements are to be in accordance with the manufacturer's instructions/recommendations. **Piping is to be arranged to prevent pooling of oil condensate which may cause a blockage of the sampling pipe.**

6.7 It is to be demonstrated that the openings of detector equipment does not become occluded or blocked under continuous splash and spray of engine lubricating oil, as may occur in the crankcase atmosphere. Testing is to be in accordance with arrangements proposed by the manufacturer and agreed by the classification society. The temperature, quantity and angle of impact of the oil to be used is to be declared and their selection justified by the manufacturer.

6.8 Detector equipment may be exposed to water vapour from the crankcase atmosphere which may affect the sensitivity of the equipment, therefore it is to be demonstrated that exposure to such conditions will not affect the functional operation of the detector equipment. Where exposure to water vapour and/or water condensation has been identified as a possible source of equipment malfunctioning, testing is to demonstrate that any mitigating arrangements such as heating are effective. Testing is to be in accordance with arrangements proposed by the manufacturer and agreed with PRS.

6.9 It is to be demonstrated that an indication is given where lenses fitted in the equipment and used in determination of the oil mist level have been partially obscured to a degree that will affect the reliability of the information and alarm indication.

Note:

This testing is in addition to that required by 5.1.2 and is concerned with the effects of condensation caused by the detection equipment being at a lower temperature than the crankcase atmosphere.

7 DETECTORS AND ALARM EQUIPMENT TO BE TESTED

7.1 The detectors and alarm equipment used in type testing are to be selected from the manufacturer's normal production line by the PRS Surveyor witnessing the tests.

7.2 Two detectors are to be tested. One is to be tested in clean condition and the other in a condition representing the maximum level of lens obscuration specified by the manufacturer.

8 METHOD

8.1 The following requirements are to be satisfied at type testing:

- .1** The ambient temperature in and around the test chamber is to be at the standard atmospheric conditions defined in *PRS Publication 11/P* before any test run is started;
- .2** oil mist is to be generated with suitable equipment using an SAE 40 monograde mineral oil or equivalent and supplied to a test chamber. The selection of the oil to be used is to take into consideration risks to health and safety, and the appropriate controls implemented. A low toxicity, low flammability oil of similar viscosity may be used as an alternative. The oil mist produced is to have an average droplet size not exceeding 5 µm. The oil droplet size is to be checked using the sedimentation method or an equivalent method to a relevant international or national standard. If the sedimentation method is chosen, the test chamber is to have a minimum height of 1m and having a volume of not less than 1m³

Note:

The calculated oil droplet size using the sedimentation method represents the average droplet size.

- .3** the oil mist concentrations used are to be ascertained by the gravimetric deterministic method or equivalent. Where an alternative technique is used its equivalence is to be demonstrated.

Note:

For this test, the gravimetric deterministic method is a process where the difference in weight of a 0.8 µm pore size membrane filter is ascertained from weighing the filter before and after drawing 1 litre of oil mist through the filter from the oil mist test chamber. The oil mist chamber is to be fitted with a recirculating fan;

- .4 samples of oil mist are to be taken at regular intervals and the results are to be plotted against the oil mist detector output. The oil mist detector is to be located adjacent to where the oil mist samples are drawn off;
- .5 the results of a gravimetric analysis are considered invalid and are to be rejected if the resultant calibration curve has an increasing gradient with respect to the oil mist detection reading. This situation occurs when insufficient time has been allowed for the oil mist to become homogeneous. Single results that are more than 10% below the calibration curve are to be rejected. This situation occurs when the integrity of the filter unit has been compromised and not all of the oil is collected on the filter paper;
- .6 the filters are to be weighed to a precision of 0.1 mg and the volume of air/oil mist is to be sampled to 10 ml;
- .7 for type approval by PRS, the testing is to be witnessed by authorized person from PRS;
- .8 oil mist detection equipment is to be tested in the orientation (vertical, horizontal or inclined) in which it is intended to be installed on an engine or gear case as specified by the equipment manufacturer;
- .9 type testing is to be carried out for each type of oil mist detection and alarm equipment for which the manufacturer seeks classification approval. Where sensitivity levels can be adjusted, testing is to be carried out at the extreme and mid-point level settings.

9 ASSESSMENT

- 9.1 Assessment of oil mist detection equipment after testing is to address the following:
- .1 the equipment to be tested is to have evidence of design appraisal/approval by PRS witnessing tests;
 - .2 Details of the detection equipment to be tested are to be recorded and are to include: name of manufacturer, type designation, alarm settings and oil mist concentration assessment capability, the maximum percentage level of lens obscuration;
 - .3 after completing the tests, the detection equipment is to be examined and the condition of all components is to be ascertained and documented. Photographic records of the monitoring equipment condition are to be taken and included in the report.

10 DESIGN SERIES QUALIFICATION

10.1 The approval of one type of detection equipment may be used to qualify other devices having identical construction details. Proposals are to be submitted for consideration.

11 THE REPORT

11.1 The test house is to provide a full report which includes the following information and documents:

- .1 test specification;
- .2 details of equipment tested;
- .3 results of tests – they shall include a declaration by the manufacturer of the oil mist detector of its: performance, in mg/l, accuracy of oil mist concentration in air, precision of oil mist concentration in air, range of oil mist detector, resolution of oil mist detector, response time of oil mist detector, sensitivity of oil mist detector, obscuration of sensor detection, declared as percentage of obscuration – 0% totally clean, 100% totally obscure, detector failure alarm.

12 ACCEPTANCE

12.1 Acceptance of crankcase oil mist detection equipment is at the discretion of PRS, based on the appraisal plans and particulars and the test house report of the results of type testing.

12.2 The following information is to be submitted to PRS for acceptance of oil mist detection equipment and alarm arrangements:

- .1 description of oil mist detection equipment and system including alarms;
- .2 copy of the test house report identified in 11;
- .3 schematic layout of engine oil mist detection arrangements showing location of detectors/sensors and piping arrangements and dimensions;
- .4 maintenance and test manual which is to include the following information:
 - intended use of equipment and its operation;
 - functionality tests to demonstrate that the equipment is operational and that any faults can be identified and corrective actions taken;
 - maintenance routines and spare parts recommendations;
 - limit setting and instructions for safe limit levels;
 - where necessary, details of configurations in which the equipment is and is not to be used.

List of amendments effective as of 1 July 2016

<i>Item</i>	<i>Title/Subject</i>	<i>Source</i>
Color indications in paragraphs 6, 8, 9, 11	Testing stations, examination methods, etc.	UR M67(Rev.2)