TÜRK LOYDU

TYPE TESTING PROCEDURE FOR CRANKCASE EXPLOSION RELIEF VALVES

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TÜRK LOYDU

Head Office Postane Mah. Tersaneler Cad. No:26 Tuzla 34944 İSTANBUL / TÜRKİYE
Tel : (90-216) 581 37 00
Fax : (90-216) 581 38 00
E-mail : info@turkloydu.org
http://www.turkloydu.org

Regional Offices

Ankara Eskişehir Yolu Mustafa Kemal Mah. 2159. Sokak No : 6/4 Çankaya - ANKARA / TÜRKİYE
Tel : (90-312) 219 56 34
Fax : (90-312) 219 68 25
E-mail : ankara@turkloydu.org

İzmir Atatürk Cad. No :378 K.4 D.402 Kavalalılar Apt. 35220 Alsancak - İZMİR / TÜRKİYE
Tel : (90-232) 464 29 88
Fax : (90-232) 464 87 51
E-mail : izmir@turkloydu.org

Adana Çınarlı Mah. Atatürk Cad. Aziz Naci İş Merkezi No:5 K.1 D.2 Seyhan - ADANA / TÜRKİYE
Tel : (90- 322) 363 30 12
Fax : (90- 322) 363 30 19
E-mail : adana@turkloydu.org

Marmaris Atatürk Cad. 99 Sok. No:11 Kat:4 Daire 6 Marmaris - MUĞLA / TÜRKİYE
Tel : (90- 252) 412 46 55
Fax : (90- 252) 412 46 54
E-mail : marmaris@turkloydu.org

TYPE TESTING PROCEDURE for CRANKCASE OIL MIST DETECTION and ALARM EQUIPMENT

1. Scope

1.1 To specify the tests required to demonstrate that crankcase oil mist detection and alarm equipment intended to be fitted to diesel engines satisfy classification society requirements.

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

2. Recognised Standards

2.1 IACS Unified Requirement E10 Test Specification for Type Approval.

3. Purpose

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

3.1.1 To verify the functionality of the system.

3.1.2 To verify the effectiveness of the oil mist detectors.

3.1.3 To verify the accuracy of oil mist detectors.

3.1.4 To verify the alarm set points.

3.1.5 To verify time delays between oil mist leaving the source and alarm activation.

3.1.6 To verify functional failure detection.

3.1.7 To verify the influence of optical obscuration on detection.

Note:
(1) *Engines are to be fitted with crankcase oil mist detection and alarm equipment complying with this UR when:*
(i) *an application for certification of an engine is dated on/after 1 January 2007; or*
(ii) *installed in new ships for which the date of contract for construction is on or after 1 January 2007.*
(2) *Rev.2 of this UR is to be uniformly implemented by IACS Societies from 1 July 2016.*
(3) *The "contracted for construction" date means the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. For further details regarding the date of "contract for construction", refer to IACS Procedural Requirement (PR) No. 29.*

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:

4.1.1 A full range of facilities for carrying out the environmental and functionality tests required by this procedure shall be available and be acceptable to the classification societies.

4.1.2 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 ± 10% in accordance with this procedure.

4.1.3 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:

5.1.1 For the alarm/monitoring panel:
(a) Functional tests described in Section 6.
(b) Electrical power supply failure test.
(c) Power supply variation test.
(d) Dry heat test.
(e) Damp heat test.
(f) Vibration test.
(g) EMC test.
(h) Insulation resistance test.
(i) High voltage test.
(j) Static and dynamic inclinations, if moving parts are contained.

5.1.2 For the detectors:

(a) Functional tests described in Section 6.
(b) Electrical power supply failure test.
(c) Power supply variation test.
(d) Dry heat test.
(e) Damp heat test.
(f) Vibration test.
(g) EMC test where susceptible
(h) Insulation resistance test.
(i) High voltage test.
(j) 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 an accuracy of ±10%.

6.2 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 8.1.1.1.

6.3 The oil mist detector monitoring arrangements are to be capable of detecting oil mist in air concentrations of between

(a) 0 and 10% of the lower explosive limit (LEL) or
(b) between 0 and a percentage of weight of oil 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 6.4.

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

6.4 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 2.5mg/l.

6.5 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.

6.6 The performance of the oil mist detector in mg/l is to be demonstrated. This is to include the following:

- range (oil mist detector)
- resolution (oil mist detector)
- sensitivity (oil mist detector)

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.

6.7 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 over time.

6.8 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.

6.9 Detector equipment may be exposed to water vapour from the crankcase atmosphere which may affect the sensitivity of the equipment and 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 by the classification society.

Note:

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

6.10 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 as required by M10.16.

7. Detectors and alarm equipment to be tested

7.1 The detectors and alarm equipment selected for the type testing are to be selected from the manufacturer's normal production line by the classification society 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:

8.1.1 Oil mist generation is to satisfy 8.1.1.1 to 8.1.1.5.

8.1.1.1 The ambient temperature in and around the test chamber is to be at the standard atmospheric conditions defined in IACS Unified Requirement E10 Test Specification for Type Approval before any test run is started.

8.1.1.2 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 (or arithmetic mean) 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 volume of not less than $1m^3$.

Note:

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

8.1.1.3 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.

8.1.1.4 Samples of oil mist are to be taken at regular intervals and the results 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.

8.1.1.5 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.

8.1.1.6 The filters require to be weighed to a precision of 0.1mg and the volume of air/oil mist sampled to 10 ml.

8.1.2 For type approval by a classification society the testing is to be witnessed by authorised personnel from the classification society.

8.1.3 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.

8.1.4 Type testing is to be carried out for each type of oil mist detection and alarm equipment for which a 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:

9.1.1 The equipment to be tested is to have evidence of design appraisal/approval by the classification society witnessing tests.

9.1.2 Details of the detection equipment to be tested are to be recorded and are to include:

- name of manufacturer;
- type designation;
- oil mist concentration assessment capability and alarm settings;
- The maximum percentage level of lens obscuration used in 7.2.

9.1.3 After completing the tests, the detection equipment is to be examined and the condition of all components 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:

11.1.1 Test specification.

11.1.2 Details of equipment tested.

11.1.3 Results of tests.
To 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 individual classification societies 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 classification societies for acceptance of oil mist detection equipment and alarm arrangements:

12.2.1 Description of oil mist detection equipment and system including alarms.

12.2.2 Copy of the test house report identified in 11.

12.2.3 Schematic layout of engine oil mist detection arrangements showing location of detectors/sensors and piping arrangements and dimensions.

12.2.4 Maintenance and test manual which is to include the following information:

(a) Intended use of equipment and its operation.
(b) Functionality tests to demonstrate that the equipment is operational and that any faults can be identified and corrective actions notified.
(c) Maintenance routines and spare parts recommendations.
(d) Limit setting and instructions for safe limit levels.
(e) Where necessary, details of configurations in which the equipment is and is not to be used.