Guideline No.M-20 (201510)

M-20 Oil Mist Concentration Detection and Alarm Device

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Foreword

This Guideline is a part of CCS Rules, which contains technical requirements, inspection and testing criteria related to classification and statutory survey of marine products.

This Guideline is published and updated by CCS and can be found through http://www.ccs.org.cn. Comments or suggestions can be sent by email to ps@ccs.org.cn.

Historical versions and release date:

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Oil Mist Concentration Detection and Alarm Device

1 Application

This Guideline applies to the approval and product inspection for oil mist concentration detection and alarm device of crank case fitted to marine diesel engine and also applies to oil mist concentration detection and alarm device of gearbox.

2 Basis for approval and inspection

2.1 *CCS Rules for Classification of Sea-Going Steel Ships*

2.2 IACS/UR/M67 *Iacs Type Test Procedure for Oil Mist Detection Monitoring and Alarm Device of Crank Case*

2.3 IACS/UR/M10 *Explosion Proof for Crank Case of Internal Combustion Engine*

2.4 *CCS Guideline on Type Approval Test of Electric and Electronic Products*

3 Terms and definitions

3.1 The relevant definitions of CCS *Rules for Classification of Sea-going Steel Ships* apply to this Guideline.

4 Plans and documents

4.1 When applying for approval, applicants are to submit the plans and documents as described below to CCS for approval:

4.1.1 Main product performance specification table;

4.1.2 General assembly plan;

4.1.3 Main parts plan;

4.1.4 Electrical schematic diagram;

4.1.5 Factory test program;

4.1.6 Type test program.

4.2 Plans/documents to be submitted to CCS for information:

4.2.1 Technical standards applicable to products;

4.2.2 Performance test report of first product (if any);

4.2.3 Product Operation Instructions;

4.2.4 Samples of product nameplate, certificate of inspection, etc.

5 Materials and components

5.1 Materials and components mainly include phototube, controller, etc.

6 Design and technical requirements of products

6.1 The detector exposed to the air inside the crank case and diesel engine lubricating oil splash is to be designed and installed in such a way that the suction port of the detector is not covered or blocked under the working condition of continuous splash and spray of the lubricating oil. This design is to be as recommended by the manufacture and approved by CCS, and then expressly indicated in the Operation Instructions to inform the diesel engine manufacturer.

6.2 For the detector exposed to vapor (may affect the sensitivity of the detector) in the air of crank case, verification is to be made to ensure the functions of the detector are not impaired under this working condition. The effectiveness of improvement measures such as heating, etc. is to be tested provided that the exposure to vapor and/or condensate water has been proved to be a possible factor causing malfunction of the detector. Test is to be carried out according to the procedure recommended by the manufacturer and agreed by CCS.

Note: This test is done to mainly take into consideration the effect of vapor condensation on the detection on condition that the temperature of detector is lower than that of air in the crank case.

6.3 The detector has connectors connected to the auxiliary devices (e.g. remote display, control relay, etc.), provided that the open-circuit or short-circuit fault of these connectors are not to affect the normal operation of detector.

6.4 The products are to have the function of being tested on board whether they work normally.

6.5 The sampling pipeline and device are to have enough mechanical strength and the capability of high temperature resistance and oil resistance.

6.6 Where the lens are under the worst condition of contamination specified by the manufacturer, the normal use of oil mist concentration detector is not to be affected and functions normally, and appropriate measures are to be taken to clean the lens.

6.7 The equipment for verifying the function of the device is to be provided to control, measure and record oil mist concentration (mg/l) required in this Guideline with an accuracy to ± 10%. The weighing of the filter is to be accurate to 0.1 mg, and the volume of air/oil mist sample is to be accurate to 10 ml.

7 Selection of typical samples

7.1 The oil mist concentration detection and alarm device is generally to be selected from the production line of the manufacturer for the first approval. Two sets of devices are to be selected for the test. One is tested under the condition of clean environment, and the other is tested under the condition representing the worst contamination state of the lens specified by the manufacturer. The sample is to be a representative of the plant in terms of processing capability and manufacturing level, with the same fundamental principle, electrical arrangement and basic functions.

8 Type test

8.1 The oil mist concentration detection and alarm device consists of oil mist detector and monitoring/alarm device. Although the test procedures are intended for oil mist detector, they are also applicable to monitoring/alarm device.

8.2 Type test items are to include:

8.2.1 Appearance inspection

8.2.2 Functional test

8.2.3 Power variation test

8.2.4 Power failure test

8.2.5 Dry heat test

8.2.6 Damp heat test

8.2.7 Vibration test

8.2.8 High voltage test

8.2.9 Insulation resistance test

8.2.10 Static and dynamic inclining tests

8.2.11 Enclosure protection test

8.2.12 Electromagnetic compatibility test

8.2.13 Other test items as considered necessary by CCS or specified in the plans/documents.

8.3 The test condition is to meet the following requirements:

8.3.1 Where the plant laboratory/test bench is used as the site of approval test, the Surveyor of CCS is to check and confirm whether it is satisfactory according to relevant requirements. Otherwise, all tests are to be carried out at the certification/test organization recognized by CCS.

8.3.2 The measuring instrument/meter for the test is to have valid metrological calibration certificate

8.4 Test methods and requirements are to include:

8.4.1 The type test is to meet the following requirements:

(1) SAE 80 single-viscosity-grade mineral oil or other similar product is to be selected for oil mist. And an appropriate device is to be used as test container with after supply volume not less than 1 m^3. The maximum size of the oil drop is not to exceed 5 μm.

Note: The size of oil drop is to be checked with precipitation method.

(2) The oil mist concentration is to be confirmed with weighing method or other equivalent methods.

Note: For this test, the difference of weight before and after filtration of 1 $m^3$of oil mist by 0.8-μm millipore filter is measured with weighing method to determine the concentration of oil mist. The container of oil mist test is to be fitted with circulating fan.

(3) The oil mist is to be sampled according to the specified time interval. And the relationship curve is to be plotted for the measurement result and the output of detector. The oil mist detector is to be close to the place where the oil mist sample is taken out.

(4) In the analysis of the oil mist concentration with weighing method, where the calibration curve gradient ascends with the reading of oil mist detection, which is resulted from the incomplete uniform diffusion of oil mist, the measurement result is regarded as invalid and is to be abandoned. All single results lower than 10% below the calibration curve, which is resulted from the destruction of the integrality of filter and not all oil is collected on the filter paper, are to be abandoned.

(5) The weighing of the filter is to be accurate to 0.1 mg, and the volume of air/oil mist sample is to 10 ml.

(6) The oil mist concentration is to be measured respectively at the top and the bottom of test container. The deviation of results measured at the two positions is not to exceed 10%.

(7) The oil mist monitoring equipment is to be able to measure the oil mist concentration within 0 ～ 10% (or *x*%, corresponding to a percentage not less than two times the setting value for maximum oil mist concentration alarm) lower explosive limit (LEL).

Note: LEL corresponds to the oil mist concentration of about 50 mg/l (mass concentration of 4.1%).

(8) Oil mist concentration alarm is to be set to give an alarm with the maximum concentration not exceeding 5% LEL or about 2.5 mg/l.

(9) Each type of oil mist detection and alarm device applied for approval by the manufacturer is to be type-tested. Where the detection sensitivity level is adjustable, the test is to be performed at the minimum, middle and maximum set value within the detection range.

(10) The oil mist detector is to be installed and tested according to the directions (vertical, horizontal or inclined) on the diesel engine or gearbox in practice.

(11) Where the alarm setting value is adjustable, the methods of adjusting and showing the setting point are to be verified according to the Operation Instructions of the manufacturer.

(12) Where type approval is required by CCS, the Surveyor or CCS authorized personnel is to witness the test.

(13) Multiple tests are to be carried out to verify the repeatability of calibration curve.

(14) The following functional tests may be conducted provided that the above requirements have been met and the oil mist concentration gradient curve has been calibrated.

8.4.2 Functional tests are to include:

(1) Multi-cylinder detection time interval test

The test is conducted to verify whether the multi-cylinder sampling time interval stated by the manufacturer complies with the design requirements. The test environment is to simulate the actual environment of the crank case as applicable.

(2) Verification test of deviation between bottom and top oil mist concentration

The test is conducted to verify whether the deviation of oil mist concentration at the bottom and the top of test container meets the requirement that “the deviation of concentration measured at the two positions is not to exceed 10%”.

(3) Basic functional test

Oil mist or equivalent smoke is generated and input into the oil mist detector, with the concentration controlled to be gradually increased from normal value to alarm point. Check whether the alarm system has early warning and whether it works at the alarm point.

(4) Alarm gain adjustment test

Change the alarm setting value. Verify adjustment and displaying methods according to the instructions of the equipment manufacturer. Record and confirm whether the oil mist

concentration (or the measured value by standard detector) in the test container at the time is within the range stated by the equipment manufacturer.

Note 1: The oil mist monitoring equipment is to be able to detect the oil mist in the air concentration with 0 ~ 10％ LEL.

Note 2: LEL equals to about 50 mg/l oil concentration (mixture of 13％ oil and air).

Note 3: Verify that the oil mist concentration alarm device in the air gives an alarm at the maximum setting point (5％ LEL or about 2.5 mg/l).

Other equivalent methods may be used to make the verification.

(5) Electrical fault simulation test

Each detector is to be provided with fault indicator indicating power failure of the detector, open circuit or short circuit of the circuit connecting the detector, and the short circuit of the circuit inside the detector, etc. Simulate the electrical fault, and verify whether the alarm indication exists.

(6) Alarm time delay verification test (where applicable)

Where the oil mist is pumped into the detector through pipelines, the longest and the shortest pipeline recommended by the manufacturer are to be used to verify whether the time delay from the moment the sample oil mist is pumped out from the crank case to the moment an alarm is given is within the range stated by the manufacturer.

(7) Lens contamination simulation test

Verify if the lens still can meet the functional requirements of the user provided that the lens is under the worst condition of contamination stated by the manufacturer.

(8) In addition to the above, after consultation between the Surveyor and the applicant, special and special-shaped products and other test items are to be tested as deemed necessary by CCS or required by plan/technical conditions.

8.4.3 Other electrical test items excluding functional tests are to comply with the requirements of *Guideline on Type Approval Test of Electric and Electronic Products* (2006). It is recommended that those test items be tested at the test organization recognized by CCS.

9 Unit/batch inspection

9.1 After the type approval is obtained from CCS, the oil mist detector produced by the plant in accordance with the acceptable conditions (including assembly, process, etc.) may be installed on board after passing the unit/batch inspection by CCS.

9.2 After type approval, the plant will be informed in written form of the detailed product inspection method when CCS issues type approval certificate.

9.3 Unit/batch inspection is to be performed according to the items described below.

9.3.1 Functional tests

(1) Multi-cylinder detection time interval test

(2) Basic functional test

(3) Alarm gain adjustment test

(4) Electrical fault simulation test

(5) Lens contamination simulation test

9.3.2 Electrical tests

(1) Power variation test

(2) Power failure test

(3) High voltage test

(4) Insulation resistance test

(5) In addition to the above, after consultation between the Surveyor and the applicant, special and special-shaped products and other test items are to be tested as deemed necessary by CCS or required by plan/technical conditions.

9.4 When applying for product inspection, the manufacture is to submit completed inspection reports or documents and product quality certificates. The certificate will be issued after the Surveyor finishes the inspection if CCS requires that the relevant tests be witnessed.