Guideline No.M-20 (201612)

M-20 Oil Mist Concentration Detection and Alarm Device

Issued date: 7 December,2016

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: M-20 (201612) Oct.20,2015

Main changes and effective date:

1.Modifying type test requirements according to UR-M67(2015)

2.Modifying general description according to complying and maintenance instructions of marine products guidelines.

3.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 2016; or

ii) installed in new ships for which the date of contract for construction is on or after

1 January 2016.

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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 drawing approval, t the following plans and documents should be submitted for examination as described below:

4.1.1 Main product performance specification table and system description;

4.1.2 General assembly plan;

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

4.1.4 Electrical schematic diagram;

4.1.5 Factory test program;

4.1.6 Operation manual including 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.

4.2 When applying for type approval, the following plans and documents should be submitted for examination:

4.2.1 Introduction of the manufacturer,including name、address、production history、production ability、technician and inspector、relationship of capital、mark of product etc.

4.2.2 Description of product

4.2.3 List of main production equipments

4.2.4 List of main test equipments t

4.2.5 Simple process of production

4.2.6 Quality management system certificate or documents

4.2.7 Document of enterprise registeration

4.2.8 Samples of nameplate and works quality certificate

4.2.9 Quality control program

4.2.10 List of qualified suppliers

4.2.11 Type test program

5 Technical requirements

5.1 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.

5.2 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.

5.3 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.

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

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

5.6 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.

5.7 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.

6 Materials and components

6.1 Materials and components should be controlled in accordance with the relevant requirements of the latest CCS rules.

7 Type test

7.1 General requirement

7.1.1The oil mist concentration detection and alarm device is generally to be selected in the presence of surveyor 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.7.1.2 Type tests should be carried out respectively for different type of oil mist detection and alarm equipment.However ,the same test items for the same parts need not to be performed repeatedly.

7.1.3 If the works has gained type approval certificate from any member of IACS,or entire or partial type test has been carried out by the recognized or authoritative test institution,entire or partial items of type test can be exempted under the consideration by CCS.

7.1.4 Test items not involved with modified parts could be exempted for the change of approval. Entire or partial items of type test can be exempted for the renewal approval under the consideration by CCS for product quality and production situation.

7.2 Test facilities

7.2.1 Environmental test for electrical parts should be generally carried out by recognized test house.

7.2.2 Functional tests could be carried out by the manufacturer or other test houses. A full range of facilities for carrying out the tests required by this procedure shall be available and be acceptable to CCS. 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.

7.2.3 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.

7.3 Test items

7.3.1 For the alarm/monitoring panel:

(a) Functional test

(b) Electrical power supply failure test.

(c)Energy fluctuation test ~~Power supply variation test.t~~

(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 included.

7.3.2 For the detector:

(a) Functional test

(b) Energy fluctuation test~~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.

7.4 Functional test

7.4.1 All tests to verify the functionality of crankcase oil mist detection and alarm equipment are to be carried out in accordance with 7.4.2 to 7.4.10 with an oil mist concentration in air, known in terms of mg/l to an accuracy of ±10%.

7.4.2 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.

7.4.3 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 7.4.4.

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

7.4.4 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.

7.4.5 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.

7.4.6 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.

7.4.7 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.

7.4.8 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.

7.4.9 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 7.3.2(e) and is concerned with the effects of condensation caused by the detection equipment being at a lower temperature than the crankcase atmosphere.

7.4.10 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.

7.5 Test methods and requirements are to include:

7.5.1 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.

7.5.2 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.

7.5.3 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.

7.5.4 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.

7.5.5 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.

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

7.5.7 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.

7.5.8 Where sensitivity levels can be adjusted, testing is to be carried out at the extreme and mid-point level settings.

7.5.9 Functional tests are to be witnessed by CCS surveyor.

7.6 Test record and report

7.6.1 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.

7.6.2 Test report is to include test introduction、information about test equipments with details and test results with 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;

8 Unit/batch inspection

8.1 After the type approval is obtained from CCS, the factory can apply for unit/batch inspection to CCS.Or else,the application would not be accepted unless CCS take special consideration to consent.Moreover,drawing approval and type test mentioned before must be completed in advance.

8.2 Unit/batch inspection may be requested only for those products which have been satisfactorily tested and well recorded.Spot inspection includes documents review and samples test stated in ~~9~~8.3.The percentage of samples is to be less than 2% in general.

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

8.3.1 Functional tests

(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) 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.

(3) 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.

(4) 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.

(5) 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.

8.3.2 Electrical tests

(1) Energy fluctuation test~~Power variation test~~;

(2) Power failure test;

(3) High voltage test;

(4) Insulation resistance test.