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# M-01 DIESEL ENGINES AND THEIR MAIN COMPONENTS AND PARTS

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Foreword:

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

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# DIESEL ENGINES AND THEIR MAIN COMPONENTS AND PARTS

## 1 Application

1.1 This Guideline applies to approval and inspection of main propulsion diesel engines, diesel engines for driving generators and other class-related marine diesel engines.
1.2 Test of nitrogen oxides emission from diesel engines is to refer to Guidelines for Testing and Survey of Emission of Nitrogen Oxides from Marine Diesel Engines.

## 2 Normative references

2.1 Currently effective CCS Rules for Classification of Sea-going Steel Ships.
2.2 Currently effective CCS Rules for Materials and Welding.

## 3 Definitions

3.1 The definitions in CCS Rules for Classification of Sea-going Steel Ships are applicable to this Chapter.
3.2 For the purpose of this Guideline:
(1) Low speed diesel engine is a diesel engine with a rated speed less than 300 r/min.
(2) Medium speed diesel engine is a diesel engine with a rated speed equal to or over 300 r/min, but less than 1400 r/min.
(3) High speed diesel engine is a diesel engine with a rated speed equal to or over 1400 r/min.
(4) Rated output is the maximum continuous output developed by diesel engines (i.e. the maximum shaft power for which the machinery is to be classed) based on the ambient conditions in unrestricted service. The rated speed is the speed corresponding to the rated output;
(5) Ambient conditions in unrestricted service:

| | |
|---|---|
| Total barometric pressure | 0.1MPa |
| Ambient temperature | 45℃ |
| Relative humidity | 60% |
| Seawater temperature (charge air coolant-inlet) | 32℃ |

## 4 Plans and documents

4.1 When requesting approval, the plans and documents specified in 9.1.10.1, Chapter 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships are to be submitted.
4.2 The following plans and technical information are to be submitted for information:
(1) Those specified in 9.1.10.2, Chapter 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships;
(2) Equivalent parameters of torsional vibration and longitudinal vibration and calculations used for bench check(if Applicable).

## 5 Materials and components

5.1 Materials and components are to comply with relevant requirements of CCS Rules.

5.2 A low speed diesel engine has such components and parts as bearing seat, bedplate, frame, cylinder block, crankshaft, cylinder cover, piston head, piston rod, crosshead, connecting rod, cylinder liner, tie rod, cylinder cover bolt, connecting rod bolt, main bearing bolt, transmission gearing, supercharger, air cooler, main starting valve, governing system, high-pressure fuel pipe and alarm, exhaust valve hydraulic pipe, fuel injection valve, fuel injection pump, cylinder cover safety valve, explosion-proof door, overspeed protective device, oil mist detector.

A medium or high speed diesel engine has such components and parts as engine body, crankshaft, connecting rod, piston, cylinder liner, heat exchanger, cylinder cover, high-pressure fuel pipe and alarm, connecting rod bolt, supercharger, fuel injection pump assembly.

Note: In addition to basic components and parts of diesel engines as mentioned above, attached systems or equipment of the engine are to be subject to CCS type approval or furnished with CCS product certificate or be subject to survey and test at manufacturer according to the requirements of applicable paragraphs of other Parts of CCS Rules. For example, Class I and II piping and fuel oil and lubricating oil piping (including pressure components such as engine-driven pumps), diesel engine safe and alarm system (including important sensor), electronic injection system and piping (including pump valves), mechanical joints and hoses, etc.

5.3 The main components and parts referred to in 5.2 are at least to comply with relevant requirements of CCS Rules. If the components and parts are produced by the diesel engine manufacturer itself, the Surveyor is to carry out related tests and inspections on site and sign the report, certificate of completion may not be issued necessarily. If the components and parts are purchased, the sub-contractor is to apply for inspection and certification by CCS; if any raw material is purchased from another manufacturer, the material manufacturer is to apply for inspection and certification by CCS. The attending Surveyor is to check the material certificate during inspection of completed components and parts.

## 6 Qualification of welding procedure

6.1 If any of the main components and parts referred to in 5.2 is welded, the welding procedure is to be evaluated and approved according to the relevant requirements of CCS Rules for Materials and Welding.

## 7 Design and technical requirements

7.1 Ambient conditions

Marine diesel engines are to operate normally with the ship having a 15°heel, or 22.5°roll, or 5° trim or 7.5°pitch. An emergency diesel engine is to operate normally and start up at 0℃ with both heel and roll being 22.5°or trim and pitch being 10°.

7.2 Check of strength and torsional vibration of crankshaft

7.2.1 Crankshaft strength check is to be carried out according to the requirements in Appendix 3, Chapter 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships.

7.2.2 Calculation for check of torsional vibration is to be based on the equivalent parameters of

torsional vibration submitted according to Chapter 12, PART THREE of CCS Rules for Classification of Sea-going Steel Ships.

7.3 NOx emission from diesel engines

The requirements for NOx emission from diesel engines are give in CCS Guidelines for Testing and Inspection of NOx Emission from Diesel Engines.

7.4 Materials

7.4.1 The requirements for testing materials of diesel engine components and parts are give in 9.2.2, Chapter 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships.

7.4.2 The requirements for non-destructive tests of diesel engine components and parts are given in 9.2.3, Chapter 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships.

7.5 Requirements for pressure tests of diesel engine components and parts

See 9.10.2, Chapter 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships.

7.6 Piping arrangement

7.6.1 See Section 4, Chapter 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships for details.

7.6.2 Diesel engines are to be fitted with high-pressure jacketed pipe assemblies and fuel leak alarms to comply with the requirements in Ch.II-2/Reg.4.2.2.5.2 and Reg.4.2.2.5.4 of 2000 Amendments to SOLAS, 1974.

7.7 Starting arrangements

See Section 5, Chapter 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships for details.

7.8 Scavenging and supercharging arrangements

See Section 6, Chapter 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships for details.

1.7.9 Fittings such as valves and governors

See Section 7, Chapter 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships for details.

## 8 Type test

8.1 Selection of typical samples

8.1.1 Low speed diesel engines for type test are to be selected according to the following principles:

(1) the type of the engines selected is to be representative;

(2) the engines selected have been manufactured in accordance with the plans and technical documents approved by CCS;

(3) internal tests have been carried out by the manufacturer to the engines for ensuring their reliable performance.

8.1.2 Medium and high speed diesel engines for type test are to be selected according to the following principles:

(1) the type of engines selected is to represent the normal production ability of the manufacturer;

(2) the engines selected are to comply with enhanced criteria.

8.2 Type test items

8.2.1 Type test for non-mass produced engines are to be carried out according to the requirements in Appendix 4, Chapter 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships.

8.2.2 Type test for mass produced engines are to be carried out according to the requirements in 1.2 of Appendix 6, Chapter 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships, and then according to the requirements in Appendix 5, Chapter 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships.

8.2.3 For new designs or major modifications to the diesel engine, the manufacturer shall measure the torsional vibration and longitudinal vibration(if required) comply with requirement of 12.1.3.1,Part Three of CCS Rules for Classification of Sea-going Steel Ships, and check the equivalent parameters.

8.3 Test conditions

8.3.1 If the test bench of the manufacturer is taken as approval test location, it is to be able to finish the test items specified in the test program. CCS will check the testing ability, testing means and testing personnel to confirm compliance with relevant requirements. Otherwise, the tests are to be carried out in places deemed appropriate by CCS.

8.3.2 The measuring instruments used in the tests are to have valid calibration certificates.

**9 Unit/batch inspection**

9.1 Low speed diesel engines

9.1.1 Large low speed marine diesel engines are to comply with the requirements in Appendix 1, Chapter 3, PART ONE of CCS Rules for Classification of Sea-going Steel Ships.

9.1.2 The inspections are to be carried out according to the approved inspection plan (related items in quality control plan). The material inspection, welding inspection, non-destructive test, processing inspection, assembly inspection of the parts referred to in 5.2 and bench test of complete engines are to be carried out with the attendance of the Surveyor.

9.2 Medium and high speed diesel engines

9.2.1 CCS unit/batch inspection may be requested only for those diesel engines which have been satisfactorily inspected/tested by the manufacturer and are ready for delivery.

9.2.2 Unit/batch inspection items for products of manufacturers approved by CCS:

(1) material inspection: according to the requirements of 7.4;

(2) non-destructive test: according to the requirements of 7.4; the testing personnel must have valid qualification certificates approved by CCS;

(3) the sampling ratio is to be specified in the inspection plan and specifically agreed by the manufacturer and the Surveyor. However, at least one engine is to be selected randomly from the batch and re-tested according to test items in Appendix 6, Chapter 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships or the test of which is to be witnessed at the manufacturer;

(4) raw material quality certificates and related inspection and test records for main parts are to be submitted to CCS Surveyor for review when applying for unit/batch inspection.

9.2.3 Inspection of products of manufacturers with CCS type approval A:

(1) the inspection is basically to review reports and all test items are to be completed by the manufacturer independently; inspection application is to be submitted before product

delivery, together with reports/records/documents covering all tests/inspections in 9.1, for review by CCS Surveyor;

(2) periodical audits are to be requested in time by manufacturers with CCS type approval A according to the requirements in Section 4, Chapter 3, PART ONE of CCS Rules for Classification of Sea-going Steel Ships.