

# M51 Programme for trials of i.c. engines to assess operational capability

(1987)  
(Rev.1  
1990)  
(Corr.  
1997)  
(Rev.2  
July  
2003)  
(Rev.3  
Jan  
2008)

## 1. Works trials (acceptance test)

The Programme for trials has been written on the assumption that a Classification Society may require that after the tests the fuel delivery system will be blocked so as to limit the engines to run at not more than 100% power.

Engines, which are to be subjected to trials on the test bed at the manufacturer's works and under the Society's supervision according to the Rules Classification Societies, are to be tested in accordance with the scope as specified below. Exceptions to this require the agreement of the Society.

### 1.1 Scope of works trials

For all stages, the engine is going to be tested, the pertaining operation values are to be measured and recorded by the engine manufacturer. All results are to be compiled in an acceptance protocol to be issued by the engine manufacturer.

In each case all measurements conducted at the various load points shall be carried out at steady operating conditions. The readings for 100% power (rated power at rated speed) are to be taken twice at an interval of at least 30 minutes.

#### 1.1.1 Main engines driving propellers

- a) 100% power (rated power) at rated engine speed  $n_o$ :  
at least 60 min – after having reached steady conditions.
- b) 110% power at engine speed  $n - 1,032 n_o$ :  
30-45 min – after having reached steady conditions.

#### NOTE:

After running on the test bed, the fuel delivery system of main engines is normally to be so adjusted that overload power cannot be given in service.

- c) 90% (or normal continuous cruise power), 75%, 50% and 25% power in accordance with the nominal propeller curve.
- d) Starting and reversing manoeuvres.
- e) Testing of governor and independent overspeed protective device.
- f) Shut down device.

#### Note:

1. The requirements in M51 Rev.3 are to be uniformly implemented by IACS Societies for engines; when an application for certification for an engine is dated on or after 1 January 2009.
2. The "date of application for certification of the engine" is the date of whatever document the Classification Society requires/accepts as an application or request for certification of an individual engine.

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## 1.1.2 Main engines driving generators for propulsion

The test is to be performed at rated speed with a constant governor setting under conditions of:

- a) 100% power (rated power) at rated engine speed:  
at least 50 min – after having reached steady conditions.
- b) 110% power:  
30 min – after having reached steady conditions.

## NOTE:

After running on the test bed, the fuel delivery system of diesel engines driving generators must be adjusted such that overload (110%) power can be given in service after installation on board, so that the governing characteristics including the activation of generator protective devices can be fulfilled at all times.

- c) 75%, 50% and 25% power and idle run.
- d) Start-up tests.
- e) Testing of governor and independent overspeed protective device.
- f) Shut-down device.

## 1.1.3 Engines driving auxiliaries

Test to be performed in accordance with 1.1.2.

## NOTE:

After running on the test bed, the fuel delivery system of diesel engines driving generators must be adjusted such that overload (110%) power can be given in service after installation on board, so that the governing characteristics including the activation of generator protective devices can be fulfilled at all times.

**1.2 Inspection of components**

Random checks of components to be presented for inspection after the works trials are left to the discretion of each Society.

**1.3 Parameters to be measured**

The data to be measured and recorded, when testing the engine at various load points are to include all necessary parameters for the engine operation. The crankshaft deflection is to be checked when this check is required by the manufacturer during the operating life of the engine.

1.4 In addition the scope of the trials may be expanded depending on the engine application.

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1.5 Integration tests: For electronically controlled diesel engines integration tests shall verify that the response of the complete mechanical, hydraulic and electronic system is as predicted for all intended operational modes. The scope of these tests shall be agreed with the Society for selected cases based on the FMEA required in UR M44.

## 2. Shipboard trials

After the conclusion of the running-in programme, prescribed by the engine manufacturer, engines are to undergo the trials as specified below:

### 2.1 Scope of trials

#### 2.1.1 Main propulsion engines driving fixed propellers

- |    |   |                  |
|----|---|------------------|
| a) | At rated engine speed $n_0$ :   | at least 4 hours |
|    | and   |                  |
|    | at engine speed corresponding to normal continuous cruise power:  | at least 2 hours |
| b) | At engine speed $n = 1,032 n_0$ :<br>(where the engine adjustment permits, see 1.1.1 b)                               | 30 minutes       |
| c) | At minimum on-load speed  |                  |
| d) | Starting and reversing manoeuvres   |                  |
| e) | In reverse direction of propeller rotation during the dock or sea trials at a minimum engine speed of $n = 0,7 n_0$ : | 10 minutes       |
| f) | Monitoring, alarm and safety systems.   |                  |

2.1.2 Main propulsion engines driving controllable pitch propellers or reversing gears 2.1.1 applies as appropriate.

Controllable pitch propellers are to be tested with various propeller pitches.

#### 2.1.3 Single Main engines driving generators for propulsion

The tests to be performed at rated speed with a constant governor setting under conditions of:

- |    |  |                  |
|----|--|------------------|
| a) | 100% power (rated <u>propulsion</u> power):  | at least 4 hours |
|    | and  |                  |
|    | at normal continuous cruise <u>propulsion</u> power:   | at least 2 hours |
| b) | 110% power ( <u>rated propulsion</u> power):   | 30 minutes       |
| c) | In reverse direction of propeller rotation at a minimum speed of 70% of the nominal propeller speed: | 10 minutes       |
| d) | Starting manoeuvres  |                  |
| e) | Monitoring, alarm and safety systems   |                  |

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## NOTE:

Tests are to be based on the rated electrical powers of the electric propulsion motors. ~~driven generators.~~

## 2.1.4 Engines driving auxiliaries

Engines driving generators or important auxiliaries are to be subjected to an operational test for at least 4 hours. During the test, the set concerned is required to operate at its rated power for an extended period.

It is to be demonstrated that the engine is capable of supplying 100% of its rated power, and in the case of shipboard generating sets account shall be taken of the times needed to actuate the generator's overload protection system.

2.1.5 The suitability of engine burn residual or other special fuels is to be demonstrated, if machinery installation is arranged to burn such fuels.

2.2 In addition the scope of the trials may be expanded in consideration of the special operating conditions, such as towing, trawling etc.

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