

TYPE APPROVAL CERTIFICATION SCHEME

MASS PRODUCED DIESEL ENGINES

1. Introduction

- 1.1 This scheme details the tests and inspection of diesel engines manufactured by mass production system for use in marine and offshore applications, and for which IRS Type Approval is requested for by the engine builder. The definition of mass production has been given in para 2.1.
- 1.2 Approval of plans of engine to IRS Rules (Part 4, Chapter 4, Section 4) is a pre-requisite for type approval of engines.
- 1.3 Engines submitted for approval for and found to be in compliance with IMO MARPOL 73/78, Annex VI requirements also, will be so indicated in the Type Approval Certificate.

2. Definition

- 2.1 Mass production may be defined, in relation to construction of marine engines for main and auxiliary purposes, as that machinery which is produced:
 - i) in quantity under strict quality control of material and parts according to a programme agreed by IRS;
 - ii) by the use of jigs and automatic machines designed to machine parts to close tolerances for interchangeability and which are to be verified on a regular inspection basis;
 - iii) by assembly with parts taken from stock and requiring little or no fitting of the parts and which is subject to:
 - iv) bench tests carried out on individual engines on a programme basis;
 - v) appraisal by final testing of engines selected at random after bench testing.
- 2.2 It should be noted that all castings, forgings and other parts for use in the foregoing machinery are also to be produced by similar methods with appropriate inspection.
- 2.3 The specification for machinery produced by the forging method must define the limits of manufacture of all component parts. The total production output is to be certified by the Manufacturer and verified as may be required, by IRS.

3. Scope

- 3.1 The scope of this test specification is limited to mass produced engines of the compression ignition type only having a bore not exceeding 300 mm.

4. Procedure for approval of mass production

- 4.1 Request for approval – documents to be submitted

4.1.1 Upon requesting approval for mass production of a type of internal combustion engine, the Manufacturer must submit all the necessary data concerning this type of engine:

- Drawings;
- technical specification of the main parts including tolerances;
- operation and maintenance manuals;
- list of subcontractors for the main parts.

4.2 Examination of the manufacturing processes and quality control procedures

4.2.1 The Manufacturer will supply full information regarding the manufacturing processes and quality control procedures applied in the workshops. These processes and procedures will be thoroughly examined on the spot by IRS. The examination will specially concern the following points:

- organization of quality control systems;
- recording of quality control operations;
- qualification and independence of personnel in charge of quality control.

4.3 Type test

4.3.1 A running test of at least 100 hours continuous duration will be carried out on an engine chosen in the production line. The programme of this test is examined specially for each case. At the end of the test, the main parts of the engine will be disassembled and examined. Request for waiver of some or all the test for engines of well-known type will be specially considered on case by case basis.

4.4 Validity of approval

4.4.1 IRS reserves the right to limit the duration of validity of the approval. IRS must be kept informed, without delay, of any change in the design of the engine, in the manufacturing or control processes or in the characteristics of the materials.

5. Continuous review of production

5.1 IRS Surveyors must have free access to the Workshops and to the Control Service premises and files.

5.2 Survey of production

- (a) Inspection and testing records are to be maintained to the satisfaction of the Surveyor;
- (b) The system for identification of parts is to be approved;
- (c) The Manufacturer must give full information about the quality control of the parts supplied by subcontractors, for which approval may be required;

5.2.1 IRS may apply direct and individual inspection procedures for parts supplied by subcontractors when deemed necessary.

5.3 Individual bench test

5.3.1 IRS may require that a bench test be made under its supervision.

6. Compliance and inspection certificate

6.1 For every engine liable to be installed on a ship classed by IRS, the Manufacturer is to supply a statement certifying that the engine is identical to the one which underwent the tests specified in 4.3 and give the inspection and test result. Each statement would bear a number, which is to appear on the engine. A copy of this statement is to be sent to IRS.

7. Type Test Conditions

7.1 The choice of the engine to be tested, from the production line, is to be agreed with IRS attending Surveyor.

7.1.1 The duration and programme of tests is in principle as follows:

- 80h at rated output;
- 8h at 110% overload;
- 10h at partial loads (1/4, 2/4, 3/4 and 9/10 of rated output);
- 2h at intermittent loads;
- Starting tests;
- Reverse running of direct reversing engines;
- Testing of Governor;
- Overspeed safety device;
- Lubricating oil system failure alarm and safety device (where fitted);
- Cooling water high temperature alarm (where fitted);
- Testing of the engine with turbocharger out of action when applicable;
- Testing of minimum speed for main propulsion engines and the idling speed for auxiliary engines;
- Functional test of the engine when inclined $\pm 22.5^\circ$ transversely and $\pm 10^\circ$ longitudinally. If the same can not be tested then compliance with this requirement is to be demonstrated to IRS Surveyor's satisfaction by simulation or alternative equivalent arrangement.

7.1.2 The tests at the above mentioned outputs are to be combined together in working cycles which are to be repeated subsequently with the whole duration within the limits indicated. The overload is to be alternately carried out with:

110% of rated output and 103% rpm

110% of rated output and 100% rpm.

7.1.3 For prototype engines, the duration and programme of tests are to be specially agreed with IRS.

7.1.4 For engines that are to be type approved for different purposes (multi-purpose engines) and that has different performances for each purpose, the programme and duration of test will be modified to cover the whole range of the engine performance taking into account the most severe values.

7.1.5 The rated output for which the engine is to be tested is the output corresponding to that declared by the manufacturer and agreed by IRS, i.e. actual maximum power which the engine, is capable of delivering continuously between the normal maintenance intervals stated by the manufacturer at speed and under the stated ambient conditions.

7.1.6 For engines which are designed to be started in low temperature, this is to be demonstrated during starting test or evidence of such capability is to be submitted

7.2 Condition of tests

7.2.1 The following particulars should be recorded:

- ambient air temperature;
- ambient air pressure;
- atmospheric humidity;
- external cooling water temperature;
- fuel and lubrication oil characteristics.

7.3 Measurements and recordings

7.3.1 In addition to those mentioned in 7.2.1, the following at least are to be measured or recorded:

- engine r.p.m.
- brake horsepower
- torque
- maximum combustion pressure
- indicated pressure diagrams where practicable
- exhaust smoke (with an approved smoke meter)
- lubricating oil pressure and temperature
- exhaust gas temperature in exhaust manifold and, where facilities are available, from each cylinder
- for supercharged engines
 - r.p.m. of turbocharger
 - air temperature and pressures before and after turboblower charge air cooler
 - exhaust gas temperature and pressures before and after turbocharger
 - charge air cooler cooling water inlet temperature.

7.4 After the type test, the main parts and especially those subject to wear, are to be disassembled and examined. Where a defect is identified, the manufacturer shall determine and specify satisfactory remedial measures. Retestes, where appropriate shall be agreed with IRS.

The End

TYPE APPROVAL CERTIFICATION SCHEME

MASS PRODUCED EXHAUST DRIVEN TURBOBLOWERS

1. Introduction

- 1.1 This scheme details the tests and inspection of exhaust gas driven turboblower manufactured by mass production system for use in marine and offshore applications, and for which IRS Type Approval is requested for by the turboblower manufacturer. The definition of mass production has been given in para 2.1.

2. Definition

- 2.1 Mass production may be defined, in relation to construction of exhaust driven turboblowers, as that machinery which is produced:
- i) in quantity under strict quality control of material and parts according to a programme agreed by IRS;
 - ii) by the use of jigs and automatic machines designed to machine parts to close tolerances for interchangeability and which are to be verified on a regular inspection basis;
 - iii) by assembly with parts taken from stock and requiring little or no fitting of the parts and which is subject to:
 - iv) bench tests carried out on individual turboblowers on a programme basis;
 - v) appraisal by final testing of turboblowers selected at random after bench testing.
- 2.2 It should be noted that all castings, forgings and other parts for use in the foregoing machinery are also to be produced by similar methods with appropriate inspection.
- 2.3 The specification for machinery produced by the foregoing method must define the limits of manufacture of all component parts. The total production output is to be certified by the Manufacturer and verified as may be required, by IRS.

3. Scope

- 3.1 The following procedure applies to the inspection of exhaust driven turboblowers which are manufactured on the basis of mass production methods and for which the maker has requested the approval.
- 3.2 Procedure of approval
- 3.2.1 Request for approval: when the manufacturer of turboblowers built on the basis of mass production methods applies for a simplified method of inspection, the following documentation must be submitted in triplicate:
- Cross-sectional drawings with main dimensions;
 - Drawings with necessary dimensions and material specifications as well as welding details of the rotating parts (shaft, wheels and blades);

- Technical specifications including maximum operating conditions (maximum permissible r.p.m. and maximum permissible temperature);
- List of main current suppliers and subcontractors for rotating parts;
- Operation and maintenance manuals.

3.2.2 The manufacturer will supply full information regarding the control organization as well as the inspection methods, the way of recording and proposed frequency and the method of material testing of important parts like rotor shaft, rotor disc, turbine wheel inducer, impeller, turbine blades and nozzle rings. These processes and procedure will be thoroughly examined on the spot by the Surveyor.

3.2.3 Details of calculations and tests to establish the service life of other stressed parts like bearings and seals are to be submitted.

3.3 Type test

3.3.1 The type test is to be carried out on a standard unit taken from the assembly line and is to be witnessed by the Surveyor. Normally the type test is to consist of a hot running test of one hour's duration at maximum permissible speed and maximum permissible temperature. Casing vibration during test is to be recorded. After the test the turboblower is to be opened up and examined.

3.3.2 For manufacturers who have facilities for testing the turboblower unit on an engine for which the turboblower is to be type approved, substitution of the hot running test by a test run of one hour's duration at overload (110% of the rated output) may be considered.

3.3.3 The performance data which may have to be verified are to be made available at the time of the type test.

3.4 Validity of Approval

3.4.1 IRS reserves the right to limit the duration of validity of approval, which is normally of 5 years duration. The approval will be invalid if there are any changes in the design, in the manufacturing or control processes or in the characteristics of the materials, which have not been approved in advance by IRS.

4. Continuous inspection of individual units

4.1 The Surveyors must have the right to inspect at random the quality control measures and to witness the under-mentioned tests as deemed necessary, as well as to have free access to all control records and subcontractors certificates.

4.2 Each individual unit is to be tested in accordance with 4.4 – 5 by the maker who is to issue a final certificate.

4.3 The major components of the turboblenders are to have identification marks so that they can easily be referred to the related certificates.

- 4.4 Material tests of the rotating parts are to be carried out by the maker or his subcontractor in accordance with IRS conditions for approval. The relevant certificate is to be produced and filed to the satisfaction of the Surveyor.
- 4.5 The cooling space of each gas inlet and outlet casings is to be hydraulically tested at pressure of either 0.4 N/mm² (4 bar) or 1.5 times the maximum working pressure, whichever is the greater. In general, the pressure tests are to be carried out as indicated. Special consideration will be given where design or testing features may require modification of the test requirements.
- 4.6 Each shaft and bladed wheel as well as the complete rotating assembly has to be individually dynamically balanced in accordance with the approved procedure for quality control.
- 4.7 All wheels (impellers and inducers) have to undergo an overspeed test for 3 minutes at 120% of the maximum speed at room temperature or 110% of the maximum speed at working temperature. If each forged wheel is individually controlled by an approved non-destructive examination method no overspeed test may be required except for wheels of type test unit.

4. Bench test

- 4.1 A mechanical running test of each unit for 20 minutes at maximum speed has to be carried out. However, the duration of the running test may be reduced to 10 minutes provided that the manufacturer is able to verify the distribution of defects established during the running tests on the basis of a sufficient number of tested turbo-chargers.
- 4.2 For manufacturers who have facilities in their works for testing the turboblowers on an engine for which the turboblowers are intended, the bench test may be replaced by a test run of 20 minutes at overload (110% of the rated output) on this engine.

5. Compliance and Certification

- 5.1 For every turboblower unit liable to be installed on an engine intended for a ship to be classed or classed with IRS, the Manufacturer is to supply a statement certifying that the turboblower is identical with one that underwent the tests specified in 3.3 and that prescribed tests were carried out. Results of these tests are to be also stated and copy is to be sent to IRS.

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