



Shipbuilding - Water-cooled four cycle diesel engines for propelling use

1. Scope This Japanese Industrial Standard specifies water-cooled four cycle diesel engines (hereinafter referred to as the "engines") used for propelling ships. This standard also applies to engines driving electric generators for electric propulsion systems.

2. Types The standards listed in Attached **Table 1** form part of the requirements of this standard by being quoted in this standard. The latest edition of these reference standards (including supplements) shall be used.

3. Performance The engine shall have the following performance. Performance shall be tested at shop, and basic load shall be continuous rated output ⁽¹⁾.

The output referred to in this standard shall be the output ⁽²⁾ measured by the hydraulic dynamometer at the aft end coupling of the crankshaft. When it is necessary to convert engine output data, etc., into data corrected for different atmospheric conditions, the requirements of **JIS B 8002-1** shall be complied with.

Note (1): The continuous rated output signifies the output at which the engine can be used continuously at the specified speed, and the specified atmospheric condition and the maintenance condition specified by the manufacturer of the engine for the period of normal maintenance intervals specified by the manufacturer of the engine.

Note (2): Shall conform to **JIS F 0401**.

a) Start up performance The start up performance shall be as follows:

- 1)** Engines of compressed air starting shall be capable of starting 12 times or more using the air reservoir to be equipped on the engine or the one having the same capacity or less. However, an engine that is capable of reversing the propeller without using compressed air for starting, or is equipped with a controllable pitch propeller shall be capable of starting 6 times or more.
- 2)** Engines of electric motor starting shall be capable of starting 6 times or more, using the batteries prepared for the engine or the one having the same capacity or less.
- 3)** Engines for manual starting shall be capable of being started easily by one man.

b) Running performance The engine shall be capable of continuous running smoothly without abnormal vibration and with a fair colour of exhaust gas, and there shall be no abnormal heat generation and noise without any engine adjustments in the range covering all load conditions. Also, the engine installed in a ship shall be capable of running continuously without causing engine abnormalities.

Remarks 1. The condition "installed in a ship" means a condition in which the ship heels up to 15 degrees, rolls up to 22.5 degrees, trims up to 5 degrees, and pitches up to 7.5 degrees including the case of their simultaneous occurrence.

Remark 2. If running conditions of the engine in a ship can be verified by drawings etc., verification of running performance may be dispensed with.

c) Performance of governor There shall be no harmful fluctuation of rotational speed during operation over an available speed range. The performance of governors for generator engines used in an electric propulsion system shall conform to **JIS F 4306-4, c)**.

d) Performance of minimum speed operation The engines shall, while operating under a load of 4.29% or less of the full load at a speed of 35% or less of the continuous rated speed, be able to operate smoothly and continuously without any adjustment during operation. This requirement shall not be applied to generator engines of an electric propulsion system.

e) Performance of reversing operation In the reversing operation test of 7.3.7, the engine shall be able to operate smoothly and continuously without any adjustment during operation. For a self-reversible engine, the time required for reversing operation from the ahead or astern condition, shall be within 10 seconds. This requirement shall not be applied for generator engines of an electric propulsion system.

f) Performance of turbocharger cut-off operation For an engine with turbochargers, removing the turbochargers or shutting off an arbitrary number of turbochargers, the engines shall operate smoothly and continuously without any adjustment during operation at an output with a mean effective pressure of 0.44 MPa or more.

4. Construction, shape and dimensions The construction, shape and dimensions of the engine shall be as follows. The principal dimensions are recommended to be in accordance with JIS Z 8601, and the permissible dimensional deviations for fits shall conform to JIS B 0401-1 ~ JIS B 0401-2, and the cylinder number shall conform to JIS B 8001.

- a) **Direction of rotation** The rotational direction of the crankshaft of the engine is recommended to be clockwise looking from the output end, but the engines with reduction gear may not conform to this specification.
- b) **Piston ring** It is recommended that piston rings conform to the requirements of JIS B 8032-1 ~ JIS B 8032-13 and JIS B 8037-1 ~ JIS B 8037-8.
- c) **Cylinder and cylinder liner** Cylinders and cylinder liners shall be corrosion-resistant, and the water jacket shall be so constructed as to be able to drain off water completely.
- d) **Cylinder head** The cylinder head shall be provided with a relief valve and an indicator cock. These fittings may, however, be dispensed with for engines having a cylinder bore of 230 mm or less.
- e) **Crankcase and oil sump** The crankcase and the oil sump shall be as follows:
 - 1) The crankcase is recommended to be provided with suitable holes for internal inspection and maintenance. It shall also be provided with relief valves to relieve excess pressure in the crankcase in the event of an internal explosion. The set pressure of the relief valve shall not exceed 20 kPa (gauge pressure), and the area and number of valves shall be appropriate for the size of the engine and the number of cylinders. However, for engines with a cylinder bore of 200 mm or less and a crankcase volume of 0.6 m³ or less, the provision of relief valves may be omitted.
 - 2) The oil sump of a wet sump type shall have such a capacity and a depth sufficient to prevent air being drawn through the suction pipe of a lubricating oil pump owing to the rolling of a ship. The oil sump shall have an oil gauge or other measuring device for the oil level.
- f) **Exhaust valve and valve seat** The exhaust valve and the valve seat shall be as follows:
 - 1) The beveled part of the exhaust valve shall be of such a rigid construction that distortion caused by the internal pressure of the cylinder can be minimized, and the valve seat shall have sufficient wear resistance.
 - 2) The valve seat shall be so constructed that heat transmission to the cylinder head is sufficient.
- g) **Fuel oil system** The fuel oil system shall be as follows:
 - 1) The fuel injection pump shall be arranged at a position that is convenient for inspection and maintenance, and so constructed either to minimize fuel oil leakage from the plunger and barrel assembly or to prevent the ingress of leaked oil from mixing with the lubricating oil in oil sump.
 - 2) The pressure gauge piping etc., of the fuel oil piping system shall be so constructed and supported that wear and damage to the piping due to vibration can be minimized.
 - 3) The fuel oil system in which the feeding rate of fuel oil is automatically regulated by adjusting the governor shall be so constructed as to be able to cut off the fuel oil independently.
- h) **Governor** The governor shall function safely and securely for governing purposes.
- i) **Reversing gear** The reduction gear shall be capable of being engaged or disengaged and making reversing operation without difficulties by one person.
- j) **Starting gear** The starting gear shall be as follows:
 - 1) For an engine of compressed air starting, the maximum working pressure of compressed air shall be 3.0 MPa or less. The starting air manifold of an engine with a cylinder bore of 300 mm or more shall be fitted with a rupture disc or a flame arrester at the starting air inlet.
 - 2) For an engine of electric motor starting, the voltage of the electric motor shall be either 12V or 24V.
- k) **Stopping gear** The stopping gear shall be as follows:
 - 1) The stopping gear shall be capable of shutting off the fuel oil supply to the engine and maintaining the stopping operation until the engine comes to a complete stop.
 - 2) When the engine is stopped by the activation of the safety system, the stopping gear shall be so constructed that it can be manually reset.
- l) **Fuel oil filter and lubricating oil filter** Fuel oil filters and lubricating oil filters shall have such a construction that they are readily cleaned or replaced.

m) **High-temperature spots** High-temperature spots such as the exhaust gas manifold shall be provided with a means to prevent the generation of fire, prevent the risk of personal injuries to operators and other suitable means.

- 1) When the surface temperature is likely to exceed 220°C, involving a risk of fire, oil-resistant thermal insulation shall be applied.
- 2) When the surface temperature exceeds 55°C, thermal insulation shall be applied or a warning sign calling attention to a possible hazard of burns.

n) **Air intake** The air intake of a turbocharger or the air intake of the suction air manifold shall have a construction to prevent the ingress of foreign matter.

o) **Turning gear** The turning gear, which is operated manually, shall be of a type that can be operated easily by one person.

p) **Lubricating oil priming pump** It is recommended that an engine with a cylinder bore exceeding 220 mm be equipped with a priming pump.

q) **Measuring instruments** It is recommended that the following measuring instruments be provided. However, engines with a cylinder bore of 150 mm or less shall, at least, be fitted with the measuring instruments asterisked, but engines with a cylinder bore of 100 mm or less may be fitted with a lubricating oil pressure gauge or a substitute for the pressure gauge only.

The installation procedure shall be based upon JIS F 7002, JIS F 7003 and JIS F 7004.

- ※ 1) Tachometer
- 2) Pressure gauge
 - 2.1) for cooling water
 - ※ 2.2) for lubricating oil
 - 2.3) for intake air (when equipped with turbochargers)
 - 2.4) for starting air (to be fitted to air reservoirs)
- 3) Thermometer
 - ※ 3.1) for cooling water (to be fitted to the outlet of the cooling water manifold of the engine)
 - 3.2) for lubricating oil (to be fitted to the oil outlet from the cooler or the inlet to the engine)
 - 3.3) for exhaust gas (to be fitted to the outlet from the exhaust gas manifold of the engine)

r) **Safety device** The safety device shall be as follows.

- 1) An engine with a continuous rated output exceeding 220 kW shall be provided with an overspeed governor that is capable of regulating speeds so as not to exceed 125% of the rated rotational speed. However, the generator engine for an electric propulsion system shall be provided with an overspeed governor that is capable of regulating speeds so as not to exceed 115% of the rated rotational speed.
- 2) An engine with a continuous rated output exceeding 37 kW shall be provided with an alarm system that is capable of activating when the lubricating oil pressure falls to such an extent that engine operation is adversely affected, and an engine with a continuous rated output exceeding 736 kW shall be provided with a safety system that issues an alarm and is capable of automatically stopping the engine upon detecting low lubricating oil pressures.

s) **Spring** The springs for the air intake valve, exhaust valve, fuel injection pump and the governor should preferably conform to JIS F 0503.

t) **Pipes, valves and others** Pipes, valves, cocks, bolts, nuts and washers should, as a rule, conform to the respective JIS.

5. **Appearance** The appearance of the engine shall be such that it is visually free from harmful defects, oil and water leakages, and is properly painted.

6. **Materials** The typical materials used for principal components of the engine are given in Reference Table 1.

Remark: This Table gives a general guidance and is not binding in nature.