



34.11.6 Governor Control

All engines are to be fitted with governors which will prevent the engines from exceeding the rated speed by more than 15%. In addition to the normal governor, each main engine having a maximum continuous output of 300 hp and over which can be declutched or which drives a controllable pitch propeller, is to be fitted with a separate overspeed device so adjusted that the speed cannot exceed the maximum rated speed by more than 20%. For generator sets see 35.21.

34.13 Bedplate

The bedplate or crankcase is to be of rigid construction, oiltight, and provided with a sufficient number of bolts to secure the same to the ship's structure. The structural arrangements for supporting and securing the main engines are to be submitted for approval. See Section 19 and for welded construction see also 30.13.3c and 30.35.10.

34.15 Cylinders and Covers, Liners, and Pistons

Parts such as cylinders, liners, cylinder covers, and pistons which are subject to high temperatures or pressures are to be made of material suitable for the stresses and temperature to which they are exposed. When the cylinder diameter is over 230 mm (9 in.), a relief valve, set to relieve at not more than 40% in excess of the maximum firing pressure is to be fitted on each cylinder of reversible engines and engines using air for starting. For auxiliary engines other effective means for determining the maximum cylinder pressure, such as a maximum-pressure indicator, will be specially considered.

34.17 Crankshafts

34.17.1 Diameter of Pins and Journals

The diameter of the crankshaft pins and journals, in mm or in., is not to be less than d as determined by the following equation.

$$d = c \sqrt{\frac{M + (M^2 + 4T^2)^{1/2}}{f}}$$

Metric Units

Inch/Pound Units

$$M = 1.86PD^2L$$

$$M = 0.131PD^2L$$

$$T = 1.02 \times 10^6 H/R$$

$$T = 63,000H/R$$

D = diameter of cylinder bore, in mm or in.

P = maximum firing pressure, in kg/cm² or psi

L = span between bearings, measured over the web, in mm or in.

H = hp at rated speed

- R = rpm at rated speed
 c = 1.16 for one-cylinder engines
 = 1.13 for two-cylinder engines
 = 1.10 for three-cylinder engines
 = 1.07 for four-cylinder engines
 = 1.04 for five-cylinder engines
 = 1.02 for six-cylinder engines
 = 1.00 for engines with more than six cylinders
 f = 1,900 for Grade 2 forgings
 = 2,140 for Grade 3 forgings
 = 2,310 for Grade 4 forgings

Values of f for other materials are subject to special consideration.

Note The above equation will usually apply to engines where a bearing adjoins each side of each crank and where single impulses occur at equal intervals. It may apply to other engines if M is modified to reflect the appropriate bending moments. Increased dimensions may be required where critical-speed arrangements or stress concentrations are not favorable. Where crankshaft dimensions are proposed which are less than those determined by the above equation, complete supporting data, including detailed stress analysis, are to be submitted for special consideration.

34.17.2 Maximum Firing Pressure and BHP

The Surveyor is to verify the maximum firing pressure P and brake horsepower during the full power trial of the engine. When the engine builder has demonstrated to the Surveyor by means of tests on a pilot engine that the design value of P is not exceeded within established limits of production tolerances and settings which would affect it, verification of P will not be required for an engine built on a production line, provided the engine delivers its rated power within the established limits.

34.17.3 Higher Ratings

Subsequent adjustments for the purpose of obtaining higher powers or higher maximum pressures will be subject to special consideration.

34.17.4 Solid Crankshaft Webs

The proportions of the crankshaft webs are to be such that the effective resisting moment of the web in bending is not less than 60% of the resisting moment of the minimum required diameter of pins and journals in bending; that is,

$$wt^2 \geq 0.35d^3$$

w = effective width of web in mm or in.

t = thickness of web in mm or in.

Where the proportions are such that pins and journals overlap, t may be taken to be the minimum diagonal distance through the web.

34.17.5 Built-up Crankshaft Webs

For built-up crankshafts t is not to be less than $0.55d$ and w not less than 1.8 diameters of the holes in the webs. These proportioned dimensions are based on the use of the same grade of material for both shaft and webs and may require modification in accordance with any difference in the grade of the materials. Proportions that differ from the above will be considered, provided they are equivalent in strength. The webs are to be shrunk or forced on the shaft and crank-pin and if doweled or keyed to the shaft, the shaft is to be increased in diameter in way of the web to compensate for the keyway.

34.18 Turbochargers and Superchargers

34.18.1 General

Turbochargers and superchargers intended for propulsion engines and for auxiliary engines of 135 horsepower (hp) and over are to be of an approved design.

34.18.2 Plans and Particulars to be Submitted

a For Engines of 300 mm (11.8 in.) Cylinder Bore and Less The particulars to be submitted are to include the following.

Sectional Assembly

Parts list

Material specifications

*Description and results of spin tests, burst tests, and containment tests

RPM and temperature limitations

Operating rpm and temperatures

*Stress calculations may be submitted in lieu of required spin tests, burst tests, and containment tests data.

b For Engines with Cylinder Bores Greater than 300 mm (11.8 in.) Plans and data as required for gas turbines per 33.17, as well as the following.

Description and results of spin tests, burst tests, containment tests, (as applicable)

RPM and temperature limitations

Operating rpm and temperature

34.18.3 Design Basis

a For Engines of 300 mm (11.8 in.) Cylinder Bore and Less Turbocharger and supercharger will be accepted on the basis of manufacturer's certification of spin or burst test results, and the engine manufacturer's guarantee that the limits of rpm and temperature will not be exceeded; as an alternative, detail design stress calculations may be submitted for review.

b For Engines with Cylinder Bores Greater than 300 mm (11.8 in.) Turbochargers are to meet the applicable requirements of Section 33 for gas turbines.