



# Standard Guide for Main Propulsion Medium Speed Marine Diesel Engines Covering Performance and Minimum Scope of Assembly<sup>1</sup>

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## 1. Scope

1.1 This guide covers performance and minimum scope of assembly of all medium speed marine diesel engines intended for main propulsion of single or multiple screw propelled marine vessels or for vessels using other than screw propeller-type main propulsion.

1.2 This guide is intended to supplement the regulations of legally constituted regulating authorities. In the event of any conflict, which may become apparent after publication of this guide, with such legally constituted regulations, the latter shall take precedence, as may be applicable within the jurisdiction of such authorities and specific to each case, unless such latter regulations are formally waived by proper cognizant authority.

1.3 This guide is not intended to relieve the purchaser of the obligation fully to advise the engine builder of all of the purchaser's unique operational considerations to allow those considerations to be satisfied.

## 2. Referenced Documents

### 2.1 *ABS Standard*:<sup>2</sup>

Rules for Building and Classing Steel Vessels

### 2.2 *IEEE Standard*:<sup>3</sup>

Standard No. 45, Recommended Practice for Electrical Installations on Shipboard

### 2.3 *ISO Standard*:<sup>4</sup>

ISO 3046/1 Reciprocating Internal Combustion Engines—Performance

### 2.4 *Code of Federal Regulations*:<sup>5</sup>

United States Coast Guard Regulations as Published in Code of Federal Regulations No. 46 (CFR 46)

## 3. Terminology

### 3.1 *Definitions of Terms Specific to This Standard*:

3.1.1 *diesel engine*—a reciprocating or rotary engine in

which ignition of the main fuel charge, as it is introduced to the combustion chamber, shall be by the heat of compression of the charge of combustion air, during regular operation of the engine from idle speeds up to full speed, regardless of whether miscellaneous methods to augment such heat of compression are used to facilitate starting of the engine under normal conditions or under low ambient temperature conditions or low intake air temperature conditions. Engines that are designed to operate with a continuously hot spot or bulb or other device to facilitate ignition or combustion, or both, of low cetane fuels, or any fuels slow to ignite or to burn, or both, shall be considered to be diesel engines for purposes of this guide.

3.1.2 *engine assembly*—contains, but is not necessarily limited to, that apparatus secured to or applied to a basic engine, which is needed to make the basic engine operable and capable of developing its rated power as indicated or to be indicated on the engine nameplate.

3.1.3 *fuel map*—a chart on which there is displayed a family of curves of various constant rates of specific fuel consumption, each curve of the family being plotted on a grid, the abscissa of which is engine r/min and the ordinate of which is brake horse power or brake mean effective pressure.

3.1.4 *medium speed diesel engine*—all diesel engines with crank-shaft rotative speeds encompassed by the maximum continuous speed bracket of 400 to 600 r/min (see Appendix X1).

## 4. Significance and Use

4.1 Comparison of brake horsepower developed and of specific fuel consumption rates from engine to engine may be made by use of data based upon a standard for composition of an engine assembly.

4.2 The purchaser of the engine assembly will be fully advised of the minimum scope of assembly which the purchaser may rightfully expect to be encompassed by a response to a request for quotation and to be delivered in response to a purchase order unless the engine builder in the proposal or in the offer to sell has clearly advised otherwise.

4.3 It will be made apparent to the purchaser that additional auxiliary and accessory equipment will be needed to supplement the defined engine assembly when full consideration is given to the application of the engine assembly as a prime mover in a specific vessel.

<sup>1</sup> This guide is under the jurisdiction of ASTM Committee F-25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.11 on Machinery.

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<sup>2</sup> Available from American Bureau of Shipping, 2 World Trade Center, 106th Floor, New York, NY 10048.

<sup>3</sup> Available from IEEE, 345 E. 47th St., New York, NY 10017.

<sup>4</sup> Available from ANSI, 11 W. 42nd St., 13th Floor, New York, NY 10036.

<sup>5</sup> Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

## 5. Regulations, Conventions, and Standards

5.1 *Specific*—The regulations, conventions, and standards to which a commercial marine vessel may be subject in regard to the main propulsion prime movers will vary depending upon the flag of registry of the vessel.

### 5.2 *General*:

5.2.1 There may be regulations, conventions, and standards and such applicable international treaties to which the country of registry may subscribe which shall be taken as forming a part of this guide to the extent specified herein and to the extent they shall be deemed applicable to the vessel by the country of registry.

5.2.2 Typical examples applicable to vessels of the United States of America registry are as follows: Institute of Electrical and Electronic Engineers Standard No. 45 (IEEE No. 45); Rules of the American Bureau of Shipping; Rules of the United States Coast Guard as printed in various Part Numbers of Title 46 CFR of the United States of America and formerly commonly known as CG-115 (Marine Engineering Regulations, also known as Sub-chapter F); and CG-259 (Electrical Engineering Regulations, also known as Sub-chapter J).

## 6. Ordering Information

6.1 Orders for machinery under this guide shall include the following:

- 6.1.1 ASTM designation, title, and date of this guide.
- 6.1.2 Quantity, and
- 6.1.3 Packaging or packing and preservation requirements, or both.

## 7. Minimum Scope of Assembly

7.1 Each engine assembly to meet this guide shall include the following:

7.1.1 The basic power producing unit or engine, be it that formed by an internal combustion reciprocating engine or by an internal combustion rotary engine.

7.1.2 An engine-mounted intake manifold or manifolds to conduct air for combustion to the basic engine, with such manifold properly secured to the basic engine and properly gasketed for the service intended, which is the efficient conduction of air to the basic engine when it is installed in a marine environment for main propulsion of a vessel.

7.1.3 An engine-mounted exhaust manifold properly insulated (including insulation by use of a water jacket application) as may be required by laws and regulations discussed in 2.2 herein [such as the requirements of USCG-115, paragraph 56.50-1 (k), Parts 50–60, Title 46 CFR].

7.1.4 One or more engine-driven and engine-mounted scavenging air blowers, if required by engine design concept, or one or more single shaft assemblies of an exhaust gas-driven turbine and combustion air blower, or both, if required by engine design concept, to provide a supply of air for scavenging or supercharging, or both, and for basic combustion of the fuel. The single-shaft exhaust gas-driven turbochargers may be engine mounted or separately mounted. The intended method of mounting of such turbochargers shall be clearly described to the prospective purchaser by the engine builder in any response to an inquiry so that the impact on installation cost and responsibility, if any, will be apparent. Turbocharger arrange-

ments, for water-washing or other routine maintenance procedures recommended by the engine builder, shall be provided.

7.1.5 An engineered arrangement of sufficient drilled and tapped holes, properly plugged during shipment, to allow measurement of combustion air and exhaust gas temperatures and pressures at appropriate points in the engine assembly.

7.1.6 One or more air cooler assemblies, if required by engine design concept and power rating, designed to accept all of the air for combustion and scavenging and to cool such air to appropriate temperatures as required by design of the basic engine and by the predicted range of brake horsepower output and concurrent specific fuel consumption rate range. Following the logic of 7.1.4, the air cooler assembly might be offered as a remotely mounted device along with its associated turbochargers. If so, as in the case of the turbocharger, the intended method of mounting shall be clearly described to the prospective purchaser by the engine builder so the impact on installation cost and responsibilities, if any, will be apparent.

7.1.6.1 Such cooler assemblies, commonly referred to as intercoolers or aftercoolers, shall be arranged, if required by overall engine design and application, to limit cooling or to add heat energy to the charge of air for combustion to allow operation of the engine at low continuous power ranges as indicated by the engine builder on a chart of the descriptive curves of performance of the engine (see 4.1 and 4.2).

7.1.7 A jacket water-circulating pump and any other closed circuit fresh water pumps required for operation of the engine. If this pump is not engine mounted and engine driven as parasitic load, the specific fuel rate for the engine on the factory test stand shall be corrected logically and accurately to increase appropriately the specific fuel rate demonstrated on the factory test stand and thereby to allow comparison to other engines (see Section 8).

7.1.8 One or more pressure pumps for main engine lubricating oil supply of each engine unit and, if required by design, for piston cooling service. If this pump(s) is not engine mounted and engine driven as parasitic load, the specific fuel rate for the engine on the factory test stand shall be corrected logically and accurately to increase appropriately the specific fuel rate demonstrated on the factory test stand and thereby to allow comparison to other engines (see Section 8).

7.1.9 A full flow lubricating oil duplex discharge strainer or filter for each engine unit to transmit all oil delivered to the engine by the main lubricating oil pressure pump; or, if required by engine design, lubricating oil supplied to the subordinate and discrete systems of the engine may be supplied via an additional separate duplex lubricating oil strainer. Such strainers need not necessarily be supplied as engine mounted.

7.1.10 An integral, lubricating oil sump, suitable for operation of that engine when installed in a horizontal position but of a limited capacity with respect to total oil charge. Such a sump may be provided with two or more openings which, if left open for connection to a drain, will allow use of a remote oil sump of larger capacity as suggested by the engine builder.

7.1.11 A duplex suction strainer of mesh as recommended by the engine builder to be located on the suction side of the main lubricating oil pressure pumps. Such a strainer need not necessarily be engine mounted.

7.1.12 A force feed cylinder or valve stem lubricator system, or both, if required by engine builder's design, or by the service intended, or both, or by main engine fuel intended, with both of the latter as stated by the purchaser.

7.1.13 Crankcase pressure relief valves or covers as recommended by the engine builder to meet standards of cognizant marine inspection and classification authority as identified by the purchaser.

7.1.14 An engine-barring device which shall be power driven unless clearly identified to the purchaser by the engine builder as required to be operated by manual effort only.

7.1.15 An engine-mounted flywheel secured to the drive end of the crankshaft complete and sufficient to carry timing marks. If required by drive system arrangement to the reduction gear (or to the propeller shafting if no reduction gear is to be used), the flywheel shall be complete and sufficient to accept mounting of the adjacent flange or coupling component. The machining of the flywheel to accept the adjacent flange or coupling component is part of an engine assembly. The associated set of bolts required shall not be part of an engine assembly.

7.1.16 *Propeller Thrust Bearing*—NO propeller thrust bearing shall be incorporated into the engine assembly for medium speed main propulsion marine diesel engines except as a result of a specific contractual requirement placed on the engine builder as a result of negotiation with the purchaser.

#### 7.1.17 *Governors:*

7.1.17.1 The engine builder shall provide the primary engine speed governor. The actuator portion of the governor with its power unit and the speed-sensing portion shall be engine mounted. Nothing in the specification is intended to prevent off-engine location of electro/electronic portions, if any, of the governor system. The required functions or other characteristics, or both, of the governor shall be specified to the engine builder by the purchaser.

7.1.17.2 The engine builder shall provide an overspeed automatic shutdown device or overspeed self-resetting device separate and distinct from the governor of 7.1.17.1 and it shall be engine mounted.

#### 7.1.18 *Start-Stop Controls:*

7.1.18.1 The engine builder shall provide an engine-mounted system either for complete local control only of the engine or adaptable for local control and remote control from the bridge or the engine room control console, or both. The scope of the remote control features required by the purchaser must be clearly presented to the engine builder in the purchase specification, and requirements of the therein identified cognizant regulatory bodies must be met by the engine builder.

7.1.18.2 If the main propulsion engine(s) are to be direct-reversible engines, the engine builder shall include the feature of reversibility and the engine mounted controls to accomplish stopping and prompt reversing adjustment and restarting of the engine in the opposite direction of rotation. Such controls may be either for complete local control only, of the engine, or adaptable for local control and remote control from the bridge or the engine room console, or both. The scope of the remote control features required in this case also must be clearly presented by the purchaser to the engine builder in the purchase

specification and requirements of the therein identified cognizant regulatory bodies must be met by the engine builder with respect to components supplied by the engine builder.

7.1.18.3 All required engine-mounted components and piping for compressed control air and starting air or hydraulic oil supplied shall be engine mounted by the engine builder including, but not necessarily limited to, a duplex filter with a line lubricator for air to the starting air distributor; pilot-operated main starting air valve; pilot air distribution lines; a starting air-reducing valve, if required; and starting air manifolds or headers. All such piping shall be terminated at flanges or other fitting in a workmanlike manner for connection to ship's lines by others.

#### 7.1.19 *Fuel Oil System:*

7.1.19.1 An engine-mounted, engine-driven, fuel oil booster pump (service pump) shall be provided, if required, by the engine builder's design; however, such a pump may be motor driven for this class of engine and not integral with the engine assembly as shipped. It is, however, to be an item furnished and to be treated as a parasitic load.

7.1.19.2 A duplex final fuel filter or strainer, as specified by the engine builder, shall be supplied by the engine builder. If engine mounted, it shall be properly protected for shipment so that the engine-mounted fuel distribution piping is maintained in a thoroughly clean condition during shipment and installation of the engine.

7.1.20 *Engine-Mounted Piping*—All required engine-mounted piping for jacket water, raw water, lubricating oil, fuel oil, starting air, control air or hydraulic oil, or a combination thereof, for controls shall be terminated in a workmanlike manner in a flange or other connection arrangement on the engine assembly, and all nonstandard companion flanges or other fittings shall be included by the engine builder.

7.1.21 All special tools not readily obtainable by an owner of a vessel but required for day-to-day maintenance efforts shall be included with the engine assembly as shipped. The engine builder shall provide a fully descriptive list of such special tools as part of a response to any request for a proposal for the machinery.

7.1.22 *Spare*s—No spares are required as part of an engine assembly. However, governmental agencies, the purchaser, the cognizant classification society, and the engine builder all have either authority or interest to see that an appropriate set of spares is provided on board the vessel before final approval to operate is given.

#### 7.1.23 *Instrumentation:*

7.1.23.1 Engine-mounted instrumentation for local observation. A set of engine-mounted instruments for local observation shall be provided to meet regulatory body requirements and the requirements of the purchaser. Also, a tachometer drive arrangement shall be provided as well as arrangements to allow measurement of cylinder pressures using a portable pressure measuring device, but not including such device.

7.1.23.2 Engine-mounted sensors for remote readout systems are not part of the engine assembly. However, a special set of instrument wells or drilled, tapped, and plugged openings may be required on the engine-mounted piping and components to accommodate remote reading instruments, and such