

# Documents for the Approval of Reciprocating Internal Combustion Engines

## Amended Rules and Guidance

Rules for the Survey and Construction of Steel Ships Parts B, and D  
Rules for High Speed Craft  
Rules for the Survey and Construction of Inland Waterway Ships  
Guidance for the Survey and Construction of Steel Ships Parts D, and GF  
Guidance for High Speed Craft  
Guidance for the Survey and Construction of Inland Waterway Ships  
Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use

## Reason for Amendment

IACS Unified Requirement (UR) M44 specifies requirements related to the documents for the approval of reciprocating internal combustion engines, and these requirements have already been incorporated into the NK Rules.

In February 2021, IACS adopted UR M44 (Rev.10) to clarify the year of publication to be used with respect to the industry standards referenced in the UR.

Accordingly, relevant requirements are amended based on IACS UR M44 (Rev.10). In addition, as a part of a comprehensive review of NK Rules, relevant provisions are amended to clarify the categorisations of some drawings and data on engines as to whether they are for approval purposes or for reference purposes.

## Outline of Amendment

The main contents of this amendment are as follows:

- (1) Aligns with IACS UR M44 (Rev.10) by specifying the year of publication in industry standards referred to in terminology related to the approval of reciprocating internal combustion engines.
- (2) Rearranges the drawings and data for reciprocating internal combustion engines specified in Chapter 2, Part D of the Rules for the Survey and Construction of Steel Ships, as tables and clarifies whether those for inspection and testing are for approval purposes or for reference purposes.

“Rules for the survey and construction of steel ships” has been partly amended as follows:

## **Part B CLASS SURVEYS**

### **Chapter 2 CLASSIFICATION SURVEYS**

#### **2.1 Classification Survey during Construction**

##### **2.1.3 Submission of Other Plans and Documents**

Sub-paragraph -1 has been amended as follows.

**1** When it is intended to build a ship to the classification with the Society, the following plans and documents are to be submitted, in addition to those required in **2.1.2**:

((1) to (6) are omitted.)

(7) The following plans and documents related to machinery:

(a) Main and auxiliary engines (including their attachments):

Plans and data specified in **2.1.3-1(2) and (3), 3.1.2(2) and 4.1.3(2), Part D**

((b) to (g) are omitted.)

((8) to (16) are omitted.)

## Part D MACHINERY INSTALLATIONS

### Chapter 2 RECIPROCATING INTERNAL COMBUSTION ENGINES

#### 2.1 General

##### 2.1.2 Terminology\*

Sub-paragraph -2 has been amended as follows.

2 The terminology used in the application of ~~1(3) and 2~~ of 2.1.3 ~~and as well as 2.1.4~~ is as specified in the following (1) to (36):

((1) to (25) are omitted.)

(26) “Quality assurance” means all the planned and systematic activities implemented within the quality system, and demonstrated as needed to provide adequate confidence that an entity will fulfil requirements for quality. Refer to *ISO 9000 series 9001:2015*.

((27) to (36) are omitted.)

Paragraph 2.1.3 has been amended as follows.

##### 2.1.3 Drawings and Data\*

1 Drawings and data to be submitted are generally as follows:

(1) Drawings and data for approval

Drawings and data specified in Table D2.1(a)

~~(a) Connecting rod bearings (including bolts details) of 4-stroke cycle engines~~

~~(b) High pressure oil pipes for driving exhaust valves with its shielding~~

~~(c) High pressure fuel oil pipes with its shielding and clamping~~

~~(d) Piping arrangements fitted to engines (including fuel oil, lubricating oil, cooling oil, cooling water, pneumatic and hydraulic systems, and information regarding the size, materials and working pressure of pipes)~~

~~(e) The drawings and data as specified in (3)(d) to (f)~~

~~(f) The drawings and data, etc. as required by the requirements of 2.1.4 (excluding those specified in 2.1.3-1(3))~~

~~(g) The following drawings and data for exhaust driven turbochargers:~~

~~i) Category A turbochargers (upon request)~~

~~1) Sectional assembly (including principal dimensions and names of components)~~

~~2) Containment test report~~

~~3) Test procedures~~

~~ii) Category B turbochargers~~

~~1) Sectional assembly (including principal dimensions and materials of housing components for containment evaluation)~~

~~2) Documentation of containment in the event of the disc fracture specified in 2.5.1-6-~~

~~3) Documentation of following operational data and limitations~~

~~• Maximum permissible operating speed (rpm)~~

~~• Maximum permissible exhaust gas temperature at the turbine inlet~~

- ~~• Minimum lubrication oil inlet pressure~~
  - ~~• Maximum lubrication oil outlet temperature~~
  - ~~• Maximum permissible vibration levels (self and externally generated vibrations)~~
  - ~~• Alarm level for overspeed (levels are also to be indicated on engine control system diagrams)~~
  - ~~• Alarm level for exhaust gas temperature at the turbine inlet (levels are also to be indicated on engine control system diagrams)~~
  - ~~• Lubrication oil inlet pressure low alarm set point (levels are also to be indicated on engine control system diagrams)~~
  - ~~• Lubrication oil outlet temperature high alarm set point (levels are also to be indicated on engine control system diagrams)~~
  - ~~4) Diagram of lubrication oil systems (diagrams included in piping arrangements fitted to engines may be accepted instead)~~
  - ~~5) Test report of type test (only for type tests)~~
  - ~~6) Test procedure (only for type tests)~~
  - ~~iii) Category C turbochargers~~
    - ~~1) Drawings listed in ii) above~~
    - ~~2) Drawings of the housing and rotating parts (including details of blade fixing)~~
    - ~~3) Material specifications (including mechanical properties and chemical composition) of the parts mentioned in 2) above~~
    - ~~4) Welding details and welding procedures for the parts mentioned in 2) above, if made of welded construction~~
- (2) Drawings and data for reference
- Drawings and data specified in Table D2.1(b)
- ~~(a) A list containing all drawings and data submitted (with relevant drawing numbers and revision status)~~
  - ~~(b) Gudgeon pins~~
  - ~~(c) Connecting rod bearings (including bolts details) of 2 stroke cycle engines~~
  - ~~(d) Rocker valve gears~~
  - ~~(e) Cylinder cover fixing bolts and valve box fixing bolts~~
  - ~~(f) Engine control system diagram (including the monitoring, safety and alarm systems)~~
  - ~~(g) Construction and arrangement of dampers, detuners, balancers or compensators, bracings as well as all calculation sheets related to engine balancing and engine vibration prevention~~
  - ~~(h) Location of measures preventing oil from spraying out from joints in flammable oil piping (if fitted)~~
  - ~~(i) The following drawings and data for exhaust driven turbochargers (only for category C turbochargers):~~
    - ~~i) Documentation of the safe torque transmission specified in 2.5.1-6 when the disc is connected to the shaft by an interference fit~~
    - ~~ii) Information on expected lifespan (Creep, low cycle fatigue and high cycle fatigue are to be considered.)~~
    - ~~iii) Operation and maintenance manuals~~
  - ~~(j) Other drawings and data deemed necessary by the Society~~
- (3) Drawings and data for the purpose of inspection and testing of reciprocating internal combustion engines
- ~~(a) A list containing all drawings and data submitted (including relevant drawing numbers~~

- and revision status)
- ~~(b) Engine particulars to be in the form designated by the Society~~
  - ~~(c) Material specifications of main parts with information on non-destructive testing and pressure testing as applicable to the material~~
  - ~~(d) Bedplate and crankcase of welded design, with welding details and welding instructions for approval of materials and weld procedure specifications. The weld procedure specification is to include details of pre and post weld heat treatment, weld consumables and fit-up conditions.~~
  - ~~(e) Thrust bearing bedplate of welded design, with welding details and welding instructions for approval of materials and weld procedure specifications. The weld procedure specification is to include details of pre and post weld heat treatment, weld consumables and fit-up conditions.~~
  - ~~(f) Frame/framebox/gearbox of welded design, with welding details and instructions for approval of materials and weld procedure specifications. The weld procedure specification is to include details of pre and post weld heat treatment, weld consumables and fit-up conditions.~~
  - ~~(g) Crankshaft, assembly and details~~
  - ~~(h) Thrust shaft or intermediate shaft (if integral with engine)~~
  - ~~(i) Shaft coupling bolts~~
  - ~~(j) Bolts and studs for main bearings~~
  - ~~(k) Bolts and studs for cylinder heads and exhaust valve (two-stroke design)~~
  - ~~(l) Bolts and studs for connecting rods~~
  - ~~(m) Tie rods~~
  - ~~(n) Schematic layout or other equivalent drawings and data on the reciprocating internal combustion engine of the following i) to vii) (Details of the system so far as supplied by the licensee such as: main dimensions, operating media and maximum working pressures):~~
    - ~~i) Starting air system~~
    - ~~ii) Fuel oil system~~
    - ~~iii) Lubricating oil system~~
    - ~~iv) Cooling water system~~
    - ~~v) Hydraulic system~~
    - ~~vi) Hydraulic system (for valve lift)~~
    - ~~vii) Engine control and safety system~~
  - ~~(o) Shielding of high pressure fuel pipes, assembly  
(All engines)~~
  - ~~(p) Construction of accumulators for hydraulic oil and fuel oil~~
  - ~~(q) High pressure parts for fuel oil injection system  
The documentation to contain specifications for pressures, pipe dimensions and materials.~~
  - ~~(r) Arrangement and details of the crankcase explosion relief valve (only for engines of a cylinder diameter of 200 mm or more or a crankcase volume of 0.6 m<sup>3</sup> or more)~~
  - ~~(s) Oil mist detection and/or alternative alarm arrangements~~
  - ~~(t) Cylinder head~~
  - ~~(u) Cylinder block, engine block~~
  - ~~(v) Cylinder liner~~
  - ~~(w) Counterweights (if not integral with crankshaft), including fastening~~
  - ~~(x) Connecting rod with cap~~
  - ~~(y) Crosshead~~

- ~~(z) Piston rod~~
- ~~(aa) Piston, assembly, including identification (e.g. drawing number) of components~~
- ~~(ab) Piston head~~
- ~~(ac) Camshaft drive, assembly, including identification (e.g. drawing number) of components~~
- ~~(ad) Flywheel~~
- ~~(ae) Arrangement of foundation (for main engines only)~~
- ~~(af) Fuel oil injection pump~~
- ~~(ag) Shielding and insulation of exhaust pipes and other parts of high temperature which may be impinged as a result of a fuel system failure, assembly~~
- ~~(ah) Construction and arrangement of dampers~~
- ~~(ai) For electronically controlled engines, assembly drawings or arrangements of the following i) to iv):~~
  - ~~i) Control valves~~
  - ~~ii) High pressure pumps~~
  - ~~iii) Drive for high pressure pumps~~
  - ~~iv) Valve bodies, if applicable~~
- ~~(aj) Operation and service manuals~~  
~~Operation and service manuals are to contain maintenance requirements (servicing and repair) including details of any special tools and gauges that are to be used with their fitting/settings together with any test requirements on completion of maintenance.~~
- ~~(ak) Test program resulting from FMEA (for engine control system) in cases of engines that rely on hydraulic, pneumatic or electronic control of fuel injection and/or valves~~
- ~~(al) Production specifications for castings and welding (sequence)~~
- ~~(am) Certification of an approval of use for environmental tests, control components~~  
~~Drawings and data modified for a specific application are to be submitted to the Society for information or approval, as applicable.~~
- ~~(an) Quality requirements for engine production~~
- ~~(ao) Other drawings and data deemed necessary by the Society~~

2 The drawings and data for the inspection and testing specified in ~~-1(3)~~ above (the items represented by the mark  $\bigcirc$  in **Table D2.1(a)** and **Table D2.1(b)**, hereinafter indicated the same way throughout this Chapter) are to be submitted in accordance with **2.1.4-1** by the engine manufacturer producing engines with the drawings and data whose approval of use has been obtained in accordance with **2.1.1-3** (hereinafter referred to as “licensee” in this Chapter). ~~but~~ Such drawings and data, however, may be submitted by the licensor in accordance with **2.1.4-2**.

Table D2.1(a) has been added as follows.

**Table D2.1(a) Drawings and Data for Approval**

	<u>Items</u>	<u>For inspection and testing</u>
(1)	<u>Engine particulars (in the format designated by the Society)</u>	<u>○</u>
(2)	<u>Material specifications of main parts with information on non-destructive testing and pressure testing as applicable to the material</u>	<u>○</u>
(3)	<u>Bedplate and crankcase of welded design, with welding details and welding instructions<sup>(1)</sup></u>	<u>○</u>
(4)	<u>Thrust bearing bedplate of welded design, with welding details and welding instructions<sup>(1)</sup></u>	<u>○</u>
(5)	<u>Frame/framebox/gearbox of welded design, with welding details and instructions<sup>(1)</sup></u>	<u>○</u>
(6)	<u>Crankshaft, assembly and details</u>	<u>○</u>
(7)	<u>Thrust shaft or intermediate shaft (if integral with engine)</u>	<u>○</u>
(8)	<u>Shaft coupling bolts</u>	<u>○</u>
(9)	<u>Connecting rod bearings (four-stroke design)</u>	<u>—</u>
(10)	<u>Bolts and studs for connecting rods (four-stroke design)</u>	<u>○</u>
(11)	<u>Schematic layout or other equivalent drawings and data on the reciprocating internal combustion engine of the following (a) to (g) (details of the system so far as supplied by the licensee such as: main dimensions, operating media and maximum working pressures).</u> <u>(a) Starting air system</u> <u>(b) Fuel oil system</u> <u>(c) Lubricating oil system</u> <u>(d) Cooling water system</u> <u>(e) Hydraulic system</u> <u>(f) Hydraulic system (for valve lift)</u> <u>(g) Engine control and safety system</u>	<u>○</u>
(12)	<u>High pressure oil pipes for driving exhaust valves with its shielding</u>	<u>—</u>
(13)	<u>Shielding of high pressure fuel pipes, assembly (all engines)</u>	<u>○</u>
(14)	<u>High pressure parts for fuel oil injection system</u> <u>The documentation to contain specifications for pressures, pipe dimensions and materials.</u>	<u>○</u>
(15)	<u>Arrangement and details of the crankcase explosion relief valve (only for engines of a cylinder diameter of 200 mm or more or a crankcase volume of 0.6 m<sup>3</sup> or more)</u>	<u>○</u>
(16)	<u>Oil mist detection and/or alternative alarm arrangements</u>	<u>○</u>
(17)	<u>Connecting rod with cap (four-stroke design)</u>	<u>○</u>
(18)	<u>Arrangement of foundation (for main engines only)</u>	<u>○</u>
(19)	<u>The drawings, data, etc. required by 2.1.4.</u>	<u>○</u>

Table D2.1(a) Drawings and Data for Approval (continued)

	<u>Items</u>	<u>For inspection and testing</u>
(20)	<p><u>The following drawings and data for exhaust driven turbochargers:</u></p> <p><u>(a) Category A turbochargers (upon request)</u></p> <p><u>i) Sectional assembly (including principal dimensions and names of components)</u></p> <p><u>ii) Containment test report</u></p> <p><u>iii) Test procedures</u></p> <p><u>(b) Category B turbochargers</u></p> <p><u>i) Sectional assembly (including principal dimensions and materials of housing components for containment evaluation.)</u></p> <p><u>ii) Documentation of containment in the event of the disc fracture specified in 2.5.1-6</u></p> <p><u>iii) Documentation of following operational data and limitations</u></p> <ul style="list-style-type: none"> <li><u>• Maximum permissible operating speed (rpm)</u></li> <li><u>• Maximum permissible exhaust gas temperature at the turbine inlet</u></li> <li><u>• Minimum lubrication oil inlet pressure</u></li> <li><u>• Maximum permissible vibration levels (self- and externally generated vibrations)</u></li> <li><u>• Alarm level for exhaust gas temperature at the turbine inlet (levels are also to be indicated on engine control system diagrams)</u></li> <li><u>• Lubrication oil inlet pressure low alarm set point (levels are also to be indicated on engine control system diagrams)</u></li> <li><u>• Lubrication oil outlet temperature high alarm set point (levels are also to be indicated on engine control system diagrams)</u></li> </ul> <p><u>iv) Diagram of lubrication oil systems (diagrams included in piping arrangements fitted to engines may be accepted instead)</u></p> <p><u>v) Test report of type test (only for type tests)</u></p> <p><u>vi) Test procedure (only for type tests)</u></p> <p><u>(c) Category C turbochargers</u></p> <p><u>i) Drawings listed in (b) above</u></p> <p><u>ii) Drawings of the housing and rotating parts (including details of blade fixing)</u></p> <p><u>iii) Material specifications (including mechanical properties and chemical composition) of the parts mentioned in ii) above</u></p> <p><u>iv) Welding details and welding procedures for the parts mentioned in ii) above, if made of welded construction</u></p>	<p align="center">—</p>
(21)	<p><u>Other drawings and data deemed necessary by the Society</u></p>	<p align="center">○</p>

Note:

- (1) For approval of materials and weld procedure specifications, the weld procedure specification is to include details of pre- and post-weld heat treatments, weld consumables and fit-up conditions.

Table D2.1(b) has been added as follows.

Table D2.1(b) Drawings and Data for Reference

	Items	For inspection and testing
(1)	<u>A list containing all drawings and data submitted (including relevant drawing numbers and revision status)</u>	<u>○</u>
(2)	<u>Bolts and studs for main bearings</u>	<u>○</u>
(3)	<u>Connecting rod bearings (two-stroke design)</u>	<u>—</u>
(4)	<u>Bolts and studs for cylinder heads and exhaust valve (two-stroke design)</u>	<u>○</u>
(5)	<u>Bolts and studs for connecting rods (two-stroke design)</u>	<u>○</u>
(6)	<u>Tie rods</u>	<u>○</u>
(7)	<u>Piston pins</u>	<u>—</u>
(8)	<u>Construction of accumulators for hydraulic oil and fuel oil</u>	<u>○</u>
(9)	<u>Cylinder head fixing bolts and valve box fixing bolts</u>	<u>—</u>
(10)	<u>Rocker valve gears</u>	<u>—</u>
(11)	<u>Cylinder head</u>	<u>○</u>
(12)	<u>Cylinder block, engine block</u>	<u>○</u>
(13)	<u>Cylinder liner</u>	<u>○</u>
(14)	<u>Counterweights (if not integral with crankshaft), including fastening</u>	<u>○</u>
(15)	<u>Connecting rod with cap (two-stroke design)</u>	<u>○</u>
(16)	<u>Crosshead</u>	<u>○</u>
(17)	<u>Piston rod</u>	<u>○</u>
(18)	<u>Piston, assembly, including identification (e.g. drawing number) of components</u>	<u>○</u>
(19)	<u>Piston head</u>	<u>○</u>
(20)	<u>Camshaft drive, assembly, including identification (e.g. drawing number) of components</u>	<u>○</u>
(21)	<u>Flywheel</u>	<u>○</u>
(22)	<u>Fuel oil injection pump</u>	<u>○</u>
(23)	<u>Shielding and insulation of exhaust pipes and other parts of high temperature which may be impinged as a result of a fuel system failure, assembly</u>	<u>○</u>
(24)	<u>Construction and arrangement of dampers</u>	<u>○</u>
(25)	<u>Construction and arrangement of detuners, balancers or compensators, bracings as well as all calculation sheets related to engine balancing and engine vibration prevention</u>	<u>—</u>
(26)	<u>For electronically controlled engines, assembly drawings or arrangements of the following (a) to (d):</u> <u>(a) Control valves</u> <u>(b) High-pressure pumps</u> <u>(c) Drive for high pressure pumps</u> <u>(d) Valve bodies, if applicable</u>	<u>○</u>
(27)	<u>Operation and service manuals<sup>(1)</sup></u>	<u>○</u>
(28)	<u>Engine control system diagram (including the monitoring, safety and alarm systems)</u>	<u>—</u>
(29)	<u>Test program resulting from FMEA (for engine control system) in cases of engines that rely on hydraulic, pneumatic or electronic control of fuel injection and/or valves</u>	<u>○</u>
(30)	<u>Production specifications for castings and welding (sequence)</u>	<u>○</u>
(31)	<u>Certification of an approval of use for environmental tests, control components<sup>(2)</sup></u>	<u>○</u>
(32)	<u>Quality requirements for engine production</u>	<u>○</u>
(33)	<u>Location of measures preventing oil from spraying out from joints in flammable oil piping (if fitted)</u>	<u>—</u>

Table D2.1(b) Drawings and Data for Reference (continued)

	Items	For inspection and testing
(34)	<p>The following drawings and data for exhaust driven turbochargers (only for category C turbochargers):</p> <p>(a) Documentation of the safe torque transmission specified in 2.5.1-6 when the disc is connected to the shaft by an interference fit</p> <p>(b) Information on expected lifespan (creep, low cycle fatigue and high cycle fatigue are to be considered)</p> <p>(c) Operation and maintenance manuals</p>	—
(35)	Other drawings and data deemed necessary by the Society	○

Notes:

- (1) Operation and service manuals are to contain maintenance requirements (servicing and repair) including details of any special tools and gauges that are to be used with their fitting/settings together with any test requirements on completion of maintenance.
- (2) Drawings and data modified for a specific application are to be submitted to the Society for reference or approval, as applicable.

## 2.1.4 Approval of Reciprocating Internal Combustion Engines

Sub-paragraph -1 has been amended as follows.

**1** Reciprocating internal combustion engines are to be approved in accordance with the following **(1)** to **(6)**:

- (1) Development of documents and data for engine production
  - (a) Prior to the start of the reciprocating internal combustion engine approval process in accordance with the following ~~(3c)~~ and subsequent sub-paragraphs of this paragraph, a design approval is to be obtained as specified separately by the Society.
  - (b) Each type of reciprocating internal combustion engine is to be provided with a certificate of approval of use obtained by the licensor in accordance with 2.1.1-3. For the first engine of a type or for those with no service records, the process of an approval of use and the approval process for production by the licensee may be performed simultaneously.
  - (c) The licensor is to review the drawings and data of the reciprocating internal combustion engine whose approval of use has been obtained for the application and develop, if necessary, application specific drawings and data for production of reciprocating internal combustion engines for the use of the licensee in developing the reciprocating internal combustion engine specific production drawings and data for the inspection and testing specified listed in 2.1.3-1(3).
  - (d) If substantive modifications to the drawings and data of the reciprocating internal combustion engine whose approval of use has been obtained have been made in the drawings and data of reciprocating internal combustion engines to be produced, the affected drawings and data are to be resubmitted to the Society as specified separately by the Society.
- (2) Drawings and data for the ~~purpose of~~ inspection and testing of reciprocating internal combustion engines
  - (a) The licensee is to develop the drawings and data for the inspection and testing specified listed in 2.1.3-1(3) and a comparison list of these drawings and data to the drawings and data of the reciprocating internal combustion engine whose approval of use has been obtained by the licensor and submit these drawings and the comparison list to the Society.
  - (b) ~~In applying~~ As for the drawings and data for the inspection and testing specified in

~~2.1.3-1(3)~~, if there are differences in the technical content on the licensee's production drawings and data of the reciprocating internal combustion engine compared to the drawings and data of the reciprocating internal combustion engine whose approval of use has been obtained by the licensor, the licensee is to submit "Confirmation of the licensor's acceptance of licensee's modifications" approved by the licensor and signed by the licensee and licensor. If the licensor acceptance is not confirmed, the reciprocating internal combustion engine manufactured by the licensee is to be regarded as a different engine type and is **2.1.1-3** is to apply to the reciprocating internal combustion engine.

- (c) In applying (b) above, modifications applied by the licensee are to be provided with appropriate quality requirements.
- (d) The Society returns the drawings and data specified in (a) and (b) above to the licensee with confirmation that the design has been approved.
- (e) The licensee or its subcontractors are to prepare to be able to provide the drawings and data specified in (a) and (b) above so that the Surveyor can use the information for inspection purposes during manufacture and testing of the reciprocating internal combustion engine and its components.

(3) Additional drawings and data

In addition to the drawings and data for the inspection and testing specified listed in ~~2.1.3-1(3)~~, the licensee is to be able to provide to the Surveyor performing the test specified in **2.6.1** upon request the relevant detail drawings, production quality control specifications and acceptance criteria. These drawings and data are for supplemental purposes to the survey only.

((4) to (6) are omitted.)

## 2.2 Materials, Construction and Strength

### 2.2.1 Materials

Sub-paragraph -1 has been amended as follows.

**1** Materials intended for the principal components of reciprocating internal combustion engines and their non-destructive tests as well as surface inspections and dimension inspections are to conform to the requirements given in **Table D2.12**. However, with respect to ultrasonic testing as well as surface inspections and dimension inspections, submission or presentation of test results to the Surveyor may be considered sufficient. In cases where deemed necessary by the Society, tests or inspections may also be required for any parts not specified in **Table D2.12**.

Table D2.1 has been renumbered to Table D2.2.

Table D2.12 Application of Materials and Non-destructive Tests as well as Surface Inspections and Dimension Inspections to Principal Components of Reciprocating Internal Combustion Engines  
(Omitted)

## 2.3 Crankshafts

### 2.3.1 Solid Crankshafts\*

Sub-paragraph -1 has been amended as follows.

1 The diameters of crankpins and journals are to be not less than the value given by the following formula:

$$d_c = \left\{ \left( M + \sqrt{M^2 + T^2} \right) D^2 \right\}^{\frac{1}{3}} K_m K_s K_r$$

where

$d_c$  : Required diameter of crankshaft (*mm*)

$M$  :  $10^{-2} A L P_{max}$

$T$  :  $10^{-2} B S P_{mt}$

$S$  : Length of stroke (*mm*)

$L$  : Span of bearings adjacent to crank measured from centre to centre (*mm*)

$P_{max}$  : Maximum combustion pressure in cylinder (*MPa*)

$P_{mt}$  : Indicated mean effective pressure (*MPa*)

$A$  and  $B$  : Coefficients given in **Table D2.32** and **Table D2.43** for engines having equal firing intervals (in the case of Vee engines, those with equal firing intervals on each bank.). Special consideration will be given to values  $A$  and  $B$  for reciprocating internal combustion engines having unequal firing intervals or for those not covered by the Tables.

$D$  : (Omitted)

$K_m$  : (Omitted)

$K_s$  : (Omitted)

$K_r$  : (Omitted)

Table D2.2 and Table D2.3 have been renumbered to Table D2.3 and Table D2.4.

Table D2.23 Value of Coefficients  $A$  and  $B$  for Single Acting In-line Engines  
(Omitted)

Table D2.34(a) Value of Coefficients  $A$  and  $B$  for Single Acting 2-stroke cycle Vee Engines with Parallel Connecting Rods  
(Omitted)

Table D2.34(b) Value of Coefficients  $A$  and  $B$  for Single Acting 4-stroke cycle Vee Engines with Parallel Connecting Rods  
(Omitted)

### 2.4.3 Protection against Crankcase Explosion\*

Sub-paragraph -2 has been amended as follows.

2 The number and locations of the explosion relief valves specified in -1 are to be in accordance with **Table D2.45**.

Table D2.4 has been renumbered to Table D2.5.

Table D2.~~4~~5 Number and Location of Explosion Relief Valves  
(Omitted)

## **2.5 Associated Installations**

### **2.5.1 Exhaust Driven Turbochargers\***

Sub-paragraph -8 has been amended as follows.

**8** For categories *B* and *C* turbochargers, the indications and alarms listed in the **Table D2.~~6~~5** are to be provided. Indications may be provided at local locations, monitoring stations or control stations. Alarm levels may be equal to permissible limits, but are not to be reached when operating the engine at 110 % power, or at any approved intermittent overload beyond 110 % in cases where the turbochargers are fitted to engines for which intermittent overload power is approved.

Table D2.5 has been renumbered to Table D2.6.

Table D2.~~5~~6 Alarms and Indications of Turbochargers  
(Omitted)

### **2.5.8 Accumulators and Common Accumulators for Electronically-controlled Engines which are used as the Main Propulsion Machinery**

Sub-paragraph -1 has been amended as follows.

**1** Accumulators and common accumulators are to comply with the requirements in **Chapter 10**. However, notwithstanding this requirement, materials and non-destructive tests as well as surface inspections and dimension inspections are to be in accordance with **Table D2.~~4~~2** and hydrostatic tests are to be in accordance with **Table D2.~~7~~6**.

## **2.6 Tests**

### **2.6.1 Shop Tests\***

Sub-paragraph -1 has been amended as follows.

**1** For components or accessories specified in **Table D2.~~6~~7**, hydrostatic tests are to be carried out on the water or oil side of the component at the pressures shown in the Table. In cases deemed necessary by the Society, tests may also be required for any components not specified in **Table D2.~~6~~7**.

Table D2.6 has been renumbered to Table D2.7.

Table D2.~~6~~7 Hydrostatic Test Pressure  
(Omitted)

## Chapter 11 WELDING FOR MACHINERY INSTALLATIONS

### 11.2 Welding Procedure and Related Specifications

#### 11.2.1 Approval of Welding Procedure and Related Specifications\*

Sub-paragraph -1(1) has been amended as follows.

- 1** The manufacturer is to obtain the approval of the welding procedures in the following cases:
- (1) Where the welding procedures are first adopted for the welding work specified below.
    - (a) (Omitted)
    - (b) (Omitted)
    - (c) Welding work for the principal components of prime movers, etc. (these principal components are specified in **Table D2.12**, **3.2.1-1**, **4.1.2(5)** and **5.2.1-1**; hereinafter, this definition applies throughout this Chapter)
    - (d) (Omitted)
    - (e) (Omitted)
    - (f) (Omitted)
- ((2) and (3) are omitted.)

“Rules for high speed craft” has been partly amended as follows:

## **Part 2 CLASS SURVEYS**

### **Chapter 2 CLASSIFICATION SURVEYS**

#### **2.1 Classification Survey during Construction**

##### **2.1.3 Submission of Other Plans and Documents**

Sub-paragraph -1(7) has been amended as follows.

**1** When it is intended to build a craft to the classification with the Society, the following plans and documents are to be submitted in addition to those required in **2.1.2**:

((1) to (6) are omitted.)

(7) The following plans and documents related to machinery:

(a) Main and auxiliary engines (including their accessories):

i) Reciprocating internal combustion engines

Plans and data specified in **2.1.3-1(2) and (3), Part 9** of the Rules

ii) Gas turbines

Plans and data specified in **3.1.3(2), Part 9** of the Rules

((b) to (i) are omitted.)

((8) and (9) are omitted.)

# Part 9 MACHINERY INSTALLATIONS

## Chapter 2 RECIPROCATING INTERNAL COMBUSTION ENGINES

### 2.1 General

#### 2.1.2 Terminology

Sub-paragraph -2 has been amended as follows.

2 The terminology used in the application of ~~1(3) and 2 of 2.1.3 as well as~~ and 2.1.4 is as specified in the following (1) to (36):

((1) to (25) are omitted.)

(26) “Quality assurance” means all the planned and systematic activities implemented within the quality system, and demonstrated as needed to provide adequate confidence that an entity will fulfil requirements for quality. Refer to *ISO 9000 series 9001:2015*.

((27) to (36) are omitted.)

Paragraph 2.1.3 has been amended as follows.

#### 2.1.3 Drawings and Data\*

1 Drawings and data to be submitted are generally as follows:

(1) Drawings and data for approval

Drawings and data specified in **Table 9.2.1(a)**

~~(a) Connecting rod bearings (including bolts details) of 4-stroke cycle engines~~

~~(b) High pressure oil pipes for driving exhaust valves with its shielding~~

~~(c) High pressure fuel oil pipes with its shielding and clamping~~

~~(d) Piping arrangements fitted to engine (including fuel oil, lubricating oil, cooling oil, cooling water, pneumatic and hydraulic systems, and information regarding the size, materials and working pressure of pipes)~~

~~(e) The drawings and data as specified in **(3)(d) to (f)**~~

~~(f) The drawings and data, etc. as required by the requirements of **2.1.4** (excluding those specified in **2.1.3-1(3)**)~~

~~(g) The following drawings and data for exhaust driven turbochargers:~~

~~i) Category A turbochargers (upon request)~~

~~1) Sectional assembly (including principal dimensions and names of components)~~

~~2) Containment test report~~

~~3) Test procedures~~

~~ii) Category B turbochargers~~

~~1) Sectional assembly (including principal dimensions and materials of housing components for containment evaluation)~~

~~2) Documentation of containment in the event of the disc fracture~~

~~3) Documentation for the following operational data and limitations~~

~~• Maximum permissible operating speed (*rpm*)~~

~~• Maximum permissible exhaust gas temperature at the turbine inlet~~

~~• Minimum lubrication oil inlet pressure~~

- ~~• Maximum lubrication oil outlet temperature~~
- ~~• Maximum permissible vibration levels (self and externally generated vibration)~~
- ~~• Alarm level for overspeed (levels are also to be indicated on engine control system diagrams)~~
- ~~• Alarm level for exhaust gas temperature at the turbine inlet (levels are also to be indicated on engine control system diagrams)~~
- ~~• Lubrication oil inlet pressure low alarm set point (levels are also to be indicated on engine control system diagrams)~~
- ~~• Lubrication oil outlet temperature high alarm set point (levels are also to be indicated on engine control system diagrams)~~
- ~~4) Diagram of lubrication oil systems (diagrams included in piping arrangements fitted to engines may be accepted instead)~~
- ~~5) Test report of type test (only for type tests)~~
- ~~6) Test procedure (only for type tests)~~
- ~~iii) Category C turbochargers=~~
  - ~~1) Drawings listed in ii) above~~
  - ~~2) Drawings of the housing and rotating parts (including details of blade fixing)~~
  - ~~3) Material specifications (including mechanical property and chemical composition) of the parts mentioned in 2) above~~
  - ~~4) Welding details and welding procedures for the parts mentioned in 2) above, if made of welded construction~~

(2) Drawings and data for reference

Drawings and data specified in Table 9.2.1(b)

- ~~(a) A list containing all drawings and data submitted (with relevant drawing numbers and revision status)=~~
- ~~(b) Gudgeon pins~~
- ~~(c) Connecting rod bearings (including bolts details) of 2 stroke cycle engines~~
- ~~(d) Rocker valve gears~~
- ~~(e) Cylinder cover fixing bolts and valve box fixing bolts~~
- ~~(f) Engine control system diagram (including the monitoring, safety and alarm systems)~~
- ~~(g) Construction and arrangement of dampers, detuners, balancers or compensators, bracing as well as calculation sheets related to engine balancing and engine vibration prevention~~
- ~~(h) Location of measures preventing oil from spraying out from joints in flammable oil piping (if fitted)~~
- ~~(i) The following drawings and data for exhaust driven turbochargers (only for category C turbochargers):~~
  - ~~i) Documentation of safe torque transmission when the disc is connected to the shaft by an interference fit~~
  - ~~ii) Information on expected lifespan (Creep, low cycle fatigue and high cycle fatigue are to be considered.)~~
  - ~~iii) Operation and maintenance manuals~~
- ~~(j) Other drawings and data deemed necessary by the Society~~
- ~~(3) Drawings and data for the purpose of inspection and testing of reciprocating internal combustion engines~~
  - ~~(a) A list containing all drawings and data submitted (including relevant drawing numbers and revision status)~~
  - ~~(b) Engine particulars to be in the form designated by the Society~~

- ~~(c) Material specifications of main parts with information on non-destructive testing and pressure testing as applicable to the material~~
- ~~(d) Bedplate and crankcase of welded design, with welding details and welding instructions for approval of materials and weld procedure specifications. The weld procedure specification is to include details of pre and post weld heat treatment, weld consumables and fit-up conditions.~~
- ~~(e) Thrust bearing bedplate of welded design, with welding details and welding instructions for approval of materials and weld procedure specifications. The weld procedure specification is to include details of pre and post weld heat treatment, weld consumables and fit-up conditions.~~
- ~~(f) Frame/framebox/gearbox of welded design, with welding details and instructions for approval of materials and weld procedure specifications. The weld procedure specification is to include details of pre and post weld heat treatment, weld consumables and fit-up conditions.~~
- ~~(g) Crankshaft, assembly and details~~
- ~~(h) Thrust shaft or intermediate shaft (if integral with engine)~~
- ~~(i) Shaft coupling bolts~~
- ~~(j) Bolts and studs for main bearings~~
- ~~(k) Bolts and studs for cylinder heads and exhaust valve (two stroke design)~~
- ~~(l) Bolts and studs for connecting rods~~
- ~~(m) Tie rods~~
- ~~(n) Schematic layout or other equivalent drawings and data on the reciprocating internal combustion engine of the following i) to vii) (Details of the system so far as supplied by the licensee such as main dimensions, operating media and maximum working pressures):~~
  - ~~i) Starting air system~~
  - ~~ii) Fuel oil system~~
  - ~~iii) Lubricating oil system~~
  - ~~iv) Cooling water system~~
  - ~~v) Hydraulic system~~
  - ~~vi) Hydraulic system (for valve lift)~~
  - ~~vii) Engine control and safety system~~
- ~~(o) Shielding of high pressure fuel pipes, assembly  
(All engines)~~
- ~~(p) Construction of accumulators for hydraulic oil and fuel oil~~
- ~~(q) High pressure parts for fuel oil injection system  
The documentation to contain specifications for pressures, pipe dimensions and materials.~~
- ~~(r) Arrangement and details of the crankcase explosion relief valve (only for engines of a cylinder diameter of 200 mm or more or a crankcase volume of 0.6 m<sup>3</sup> or more)~~
- ~~(s) Oil mist detection and/or alternative alarm arrangements~~
- ~~(t) Cylinder head~~
- ~~(u) Cylinder block, engine block~~
- ~~(v) Cylinder liner~~
- ~~(w) Counterweights (if not integral with crankshaft), including fastening~~
- ~~(x) Connecting rod with cap~~
- ~~(y) Crosshead~~
- ~~(z) Piston rod~~
- ~~(aa) Piston, assembly, including identification (e.g. drawing number) of components~~

- ~~(ab) Piston head~~
- ~~(ac) Camshaft drive, assembly, including identification (e.g. drawing number) of components~~
- ~~(ad) Flywheel~~
- ~~(ae) Arrangement of foundation (for main engines only)~~
- ~~(af) Fuel oil injection pump~~
- ~~(ag) Shielding and insulation of exhaust pipes and other parts of high temperature which may be impinged as a result of a fuel system failure, assembly~~
- ~~(ah) Construction and arrangement of dampers~~
- ~~(ai) For electronically controlled engines, assembly drawings or arrangements of the following i) to iv):~~
  - ~~i) Control valves~~
  - ~~ii) High pressure pumps~~
  - ~~iii) Drive for high pressure pumps~~
  - ~~iv) Valve bodies, if applicable~~
- ~~(aj) Operation and service manuals~~  
~~Operation and service manuals are to contain maintenance requirements (servicing and repair) including details of any special tools and gauges that are to be used with their fitting/settings together with any test requirements on completion of maintenance.~~
- ~~(ak) Test program resulting from FMEA (for engine control system) in cases of engines that rely on hydraulic, pneumatic or electronic control of fuel injection and/or valves~~
- ~~(al) Production specifications for castings and welding (sequence)~~
- ~~(am) Certification of an approval of use for environmental tests, control components. Documents modified for a specific application are to be submitted to the Society for information or approval, as applicable.~~
- ~~(an) Quality requirements for engine production~~
- ~~(ao) Other drawings and data deemed necessary by the Society~~

2 The drawings and data for the purpose of inspection and testing specified in ~~-1(3) above~~ (the items represented by the mark ○ in Table 9.2.1(a) and Table 9.2.1(b), hereinafter indicated in the same way throughout this Chapter) are to be submitted in accordance with 2.1.4-1 by the engine manufacturer producing engines with the drawings and data whose approval of use has been obtained in accordance with 2.1.1-2 (hereinafter referred to as “license” in this Chapter) ~~but~~. Such drawings and data, however, may be submitted by the licensor in accordance with 2.1.4-2.

Table 9.2.1(a) has been added as follows.

**Table 9.2.1(a) Drawings and Data for Approval**

	<u>Items</u>	<u>For inspection and testing</u>
(1)	<u>Engine particulars (in the format designated by the Society)</u>	<u>○</u>
(2)	<u>Material specifications of main parts with information on non-destructive testing and pressure testing as applicable to the material</u>	<u>○</u>
(3)	<u>Bedplate and crankcase of welded design, with welding details and welding instructions<sup>(1)</sup></u>	<u>○</u>
(4)	<u>Thrust bearing bedplate of welded design, with welding details and welding instructions<sup>(1)</sup></u>	<u>○</u>
(5)	<u>Frame/framebox/gearbox of welded design, with welding details and instructions<sup>(1)</sup></u>	<u>○</u>
(6)	<u>Crankshaft, assembly and details</u>	<u>○</u>
(7)	<u>Thrust shaft or intermediate shaft (if integral with engine)</u>	<u>○</u>
(8)	<u>Shaft coupling bolts</u>	<u>○</u>
(9)	<u>Connecting rod bearings (four-stroke design)</u>	<u>—</u>
(10)	<u>Bolts and studs for connecting rods (four-stroke design)</u>	<u>○</u>
(11)	<u>Schematic layout or other equivalent drawings and data on the reciprocating internal combustion engine of the following (a) to (g) (details of the system so far as supplied by the licensee such as: main dimensions, operating media and maximum working pressures).</u> <u>(a) Starting air system</u> <u>(b) Fuel oil system</u> <u>(c) Lubricating oil system</u> <u>(d) Cooling water system</u> <u>(e) Hydraulic system</u> <u>(f) Hydraulic system (for valve lift)</u> <u>(g) Engine control and safety system</u>	<u>○</u>
(12)	<u>High pressure oil pipes for driving exhaust valves with its shielding</u>	<u>—</u>
(13)	<u>Shielding of high pressure fuel pipes, assembly (all engines)</u>	<u>○</u>
(14)	<u>High pressure parts for fuel oil injection system</u> <u>The documentation to contain specifications for pressures, pipe dimensions and materials.</u>	<u>○</u>
(15)	<u>Arrangement and details of the crankcase explosion relief valve (only for engines of a cylinder diameter of 200 mm or more or a crankcase volume of 0.6 m<sup>3</sup> or more)</u>	<u>○</u>
(16)	<u>Oil mist detection and/or alternative alarm arrangements</u>	<u>○</u>
(17)	<u>Connecting rod with cap (four-stroke design)</u>	<u>○</u>
(18)	<u>Arrangement of foundation (for main engines only)</u>	<u>○</u>
(19)	<u>The drawings, data, etc. required by 2.1.4.</u>	<u>○</u>

Table 9.2.1(a) Drawings and Data for Approval (continued)

	<u>Items</u>	<u>For inspection and testing</u>
(20)	<p><u>The following drawings and data for exhaust driven turbochargers:</u></p> <p><u>(a) Category A turbochargers (upon request)</u></p> <p><u>i) Sectional assembly (including principal dimensions and names of components)</u></p> <p><u>ii) Containment test report</u></p> <p><u>iii) Test procedures</u></p> <p><u>(b) Category B turbochargers</u></p> <p><u>i) Sectional assembly (including principal dimensions and materials of housing components for containment evaluation.)</u></p> <p><u>ii) Documentation of containment in the event of the disc fracture</u></p> <p><u>iii) Documentation of following operational data and limitations</u></p> <ul style="list-style-type: none"> <li><u>• Maximum permissible operating speed (rpm)</u></li> <li><u>• Maximum permissible exhaust gas temperature at the turbine inlet</u></li> <li><u>• Minimum lubrication oil inlet pressure</u></li> <li><u>• Maximum permissible vibration levels (self- and externally generated vibrations)</u></li> <li><u>• Alarm level for exhaust gas temperature at the turbine inlet (levels are also to be indicated on engine control system diagrams)</u></li> <li><u>• Lubrication oil inlet pressure low alarm set point (levels are also to be indicated on engine control system diagrams)</u></li> <li><u>• Lubrication oil outlet temperature high alarm set point (levels are also to be indicated on engine control system diagrams)</u></li> </ul> <p><u>iv) Diagram of lubrication oil systems (diagrams included in piping arrangements fitted to engines may be accepted instead)</u></p> <p><u>v) Test report of type test (only for type tests)</u></p> <p><u>vi) Test procedure (only for type tests)</u></p> <p><u>(c) Category C turbochargers</u></p> <p><u>i) Drawings listed in (b) above</u></p> <p><u>ii) Drawings of the housing and rotating parts (including details of blade fixing)</u></p> <p><u>iii) Material specifications (including mechanical properties and chemical composition) of the parts mentioned in ii) above</u></p> <p><u>iv) Welding details and welding procedures for the parts mentioned in ii) above, if made of welded construction</u></p>	—
(21)	<u>Other drawings and data deemed necessary by the Society</u>	○

Notes:

- (1) For approval of materials and weld procedure specification, the weld procedure specification is to include details of pre- and post-weld heat treatments, weld consumables and fit-up conditions.

Table 9.2.1(b) has been added as follows.

**Table 9.2.1(b) Drawings and Data for Reference**

	<u>Items</u>	<u>For inspection and testing</u>
(1)	<u>A list containing all drawings and data submitted (including relevant drawing numbers and revision status)</u>	<u>○</u>
(2)	<u>Bolts and studs for main bearings</u>	<u>○</u>
(3)	<u>Connecting rod bearings (two-stroke design)</u>	<u>—</u>
(4)	<u>Bolts and studs for cylinder heads and exhaust valve (two-stroke design)</u>	<u>○</u>
(5)	<u>Bolts and studs for connecting rods (two-stroke design)</u>	<u>○</u>
(6)	<u>Tie rods</u>	<u>○</u>
(7)	<u>Piston pins</u>	<u>—</u>
(8)	<u>Construction of accumulators for hydraulic oil and fuel oil</u>	<u>○</u>
(9)	<u>Cylinder head fixing bolts and valve box fixing bolts</u>	<u>—</u>
(10)	<u>Rocker valve gears</u>	<u>—</u>
(11)	<u>Cylinder head</u>	<u>○</u>
(12)	<u>Cylinder block, engine block</u>	<u>○</u>
(13)	<u>Cylinder liner</u>	<u>○</u>
(14)	<u>Counterweights (if not integral with crankshaft), including fastening</u>	<u>○</u>
(15)	<u>Connecting rod with cap (two-stroke design)</u>	<u>○</u>
(16)	<u>Crosshead</u>	<u>○</u>
(17)	<u>Piston rod</u>	<u>○</u>
(18)	<u>Piston, assembly, including identification (e.g. drawing number) of components</u>	<u>○</u>
(19)	<u>Piston head</u>	<u>○</u>
(20)	<u>Camshaft drive, assembly, including identification (e.g. drawing number) of components</u>	<u>○</u>
(21)	<u>Flywheel</u>	<u>○</u>
(22)	<u>Fuel oil injection pump</u>	<u>○</u>
(23)	<u>Shielding and insulation of exhaust pipes and other parts of high temperature which may be impinged as a result of a fuel system failure, assembly</u>	<u>○</u>
(24)	<u>Construction and arrangement of dampers</u>	<u>○</u>
(25)	<u>Construction and arrangement of detuners, balancers or compensators, bracings as well as all calculation sheets related to engine balancing and engine vibration prevention</u>	<u>—</u>
(26)	<u>For electronically controlled engines, assembly drawings or arrangements of the following (a) to (d):</u> <u>(a) Control valves</u> <u>(b) High-pressure pumps</u> <u>(c) Drive for high pressure pumps</u> <u>(d) Valve bodies, if applicable</u>	<u>○</u>
(27)	<u>Operation and service manuals<sup>(1)</sup></u>	<u>○</u>
(28)	<u>Engine control system diagram (including the monitoring, safety and alarm systems)</u>	<u>—</u>
(29)	<u>Test program resulting from FMEA (for engine control system) in cases of engines that rely on hydraulic, pneumatic or electronic control of fuel injection and/or valves</u>	<u>○</u>
(30)	<u>Production specifications for castings and welding (sequence)</u>	<u>○</u>
(31)	<u>Certification of an approval of use for environmental tests, control components<sup>(2)</sup></u>	<u>○</u>
(32)	<u>Quality requirements for engine production</u>	<u>○</u>
(33)	<u>Location of measures preventing oil from spraying out from joints in flammable oil piping (if fitted)</u>	<u>—</u>

Table 9.2.1(b) Drawings and Data for Reference (continued)

	Items	For inspection and testing
(34)	The following drawings and data for exhaust driven turbochargers (only for category C turbochargers): (a) Documentation of the safe torque transmission when the disc is connected to the shaft by an interference fit (b) Information on expected lifespan (creep, low cycle fatigue and high cycle fatigue are to be considered) (c) Operation and maintenance manuals	—
(35)	Other drawings and data deemed necessary by the Society	○

Notes:

- (1) Operation and service manuals are to contain maintenance requirements (servicing and repair) including details of any special tools and gauges that are to be used with their fitting/settings together with any test requirements on completion of maintenance.
- (2) Drawings and data modified for a specific application are to be submitted to the Society for information or approval, as applicable.

## 2.1.4 Approval of Reciprocating Internal Combustion Engines\*

Sub-paragraph -1 has been amended as follows.

**1** Reciprocating internal combustion engines are to be approved in accordance with the following **(1)** to **(6)**:

- (1) Development of documents and data for engine production
  - (a) Prior to the start of the reciprocating internal combustion engine approval process in accordance with the following ~~(3c)~~ and subsequent sub-paragraphs of this paragraph, a design approval is to be obtained as specified separately by the Society.
  - (b) Each type of reciprocating internal combustion engine is to be provided with a certificate of approval of use obtained by the licensor in accordance with **2.1.1-2**. For the first engine of a type or for those with no service records, the process of an approval of use and the approval process for production by the licensee may be performed simultaneously.
  - (c) The licensor is to review the drawings and data of the reciprocating internal combustion engine whose approval of use has been obtained for the application and develop, if necessary, application specific drawings and data for production of reciprocating internal combustion engines for the use of the licensee in developing the reciprocating internal combustion engine specific production drawings and data ~~listed~~ for the purpose of inspection and testing specified in 2.1.3-1(3).
  - (d) If substantive modifications to the ~~the~~ drawings and data of the reciprocating internal combustion engine whose approval of use has been obtained have been made in the drawings and data of reciprocating internal combustion engines to be produced, the affected drawings and data are to be resubmitted to the Society as specified separately by the Society.
- (2) Drawings and data for the ~~purpose of~~ inspection and testing of reciprocating internal combustion engines
  - (a) The licensee is to develop the drawings and data ~~listed~~ for the inspection and testing specified in 2.1.3-1(3) and a comparison list of these drawings and data to the drawings and data of the reciprocating internal combustion engine whose approval of use has been obtained by the licensor and submit these drawings and the comparison list to the Society.
  - (b) ~~In applying~~ As for the drawings and data for the inspection and testing specified in

**2.1.3-1(3)**, if there are differences in the technical content on the licensee's production drawings and data of the reciprocating internal combustion engine compared to the drawings and data of the reciprocating internal combustion engine whose approval of use has been obtained by the licensor, the licensee is to submit "Confirmation of the licensor's acceptance of licensee's modifications" approved by the licensor and signed by the licensee and licensor. If the licensor acceptance is not confirmed, the reciprocating internal combustion engine manufactured by the licensee is to be regarded as a different engine type and is **2.1.1-2** is to apply to the reciprocating internal combustion engine.

- (c) In applying (b) above, modifications applied by the licensee are to be provided with appropriate quality requirements.
- (d) The Society returns the drawings and data specified in (a) and (b) above to the licensee with confirmation that the design has been approved.
- (e) The licensee or its subcontractors are to prepare to be able to provide the drawings and data specified in (a) and (b) above so that the Surveyor can use the information for inspection purposes during manufacture and testing of the reciprocating internal combustion engine and its components.

(3) Additional drawings and data

In addition to the drawings and data ~~listed~~ listed for inspection and testing specified in 2.1.3-1(3), the licensee is to be able to provide to the Surveyor performing the test specified in **2.6.1, Part D of the Rules for the Survey and Construction of Steel Ships** upon request the relevant detail drawings, production quality control specifications and acceptance criteria. These drawings and data are for supplemental purposes to the survey only.

((4) to (6) are omitted.)

## 2.3 Associated Installations

### 2.3.7 Accumulators and Common Accumulators for Electronically-controlled Engines which are used as the Main Propulsion Machinery

Sub-paragraph -1 has been amended as follows.

**1** Accumulators and common accumulators are to comply with the requirements in **Chapter 10, Part D of the Rules for the Survey and Construction of Steel Ships**. However, notwithstanding this requirement, materials and non-destructive tests as well as surface inspections and dimension inspections are to be in accordance with **Table D2.12, Part D of the Rules for the Survey and Construction of Steel Ships** and hydrostatic tests are to be in accordance with **Table D2.67, Part D of the Rules for the Survey and Construction of Steel Ships**.

“Rules for the survey and construction of inland waterway ships” has been partly amended as follows:

## **Part 2 CLASS SURVEYS**

### **Chapter 2 CLASSIFICATION SURVEYS**

#### **2.1 Classification Survey during Construction**

##### **2.1.3 Submission of Other Plans and Documents**

Sub-paragraph -1 has been amended as follows.

**1** When it is intended to build a ship to the classification with the Society, the following plans and documents are to be submitted, in addition to those required in **2.1.2**:

((1) to (6) are omitted.)

(7) The following plans and documents related to machinery:

(a) Main and auxiliary engines (including their attachments):

Plans and data specified in **2.1.3-1(2) and (3), Part 7**

((b) to (f) are omitted.)

((8) and (9) are omitted.)

# Part 7 MACHINERY INSTALLATIONS

## Chapter 2 RECIPROCATING INTERNAL COMBUSTION ENGINES

### 2.1 General

#### 2.1.2 Terminology

Sub-paragraph -2 has been amended as follows.

2 The terminology used in the application of ~~1(3) and 2~~ of 2.1.3 as well as and 2.1.4 is as specified in the following (1) to (36):

((1) to (25) are omitted.)

(26) “Quality assurance” means all the planned and systematic activities implemented within the quality system, and demonstrated as needed to provide adequate confidence that an entity will fulfil requirements for quality. Refer to *ISO 9000 series 9001:2015*.

((27) to (36) are omitted.)

Paragraph 2.1.3 has been amended as follows.

#### 2.1.3 Drawings and Data\*

1 Drawings and data to be submitted are generally as follows:

(1) Drawings and data for approval

Drawings and data specified in Table 7.2.1(a)

~~(a) Connecting rod bearings (including bolts details) of 4-stroke cycle engines~~

~~(b) High pressure oil pipes for driving exhaust valves with its shielding~~

~~(c) High pressure fuel oil pipes with its shielding and clamping~~

~~(d) Piping arrangements fitted to engines (including fuel oil, lubricating oil, cooling oil, cooling water, pneumatic and hydraulic systems, and information regarding the size, materials and working pressure of pipes)~~

~~(e) The drawings and data as specified in (3)(d) to (f)~~

~~(f) The drawings and data, etc. as required by the requirements of 2.1.4 (excluding those specified in 2.1.3-1(3))~~

~~(g) The following drawings and data for exhaust driven turbochargers:~~

~~i) Category A turbochargers (upon request)~~

~~1) Sectional assembly (including principal dimensions and names of components)~~

~~2) Containment test report~~

~~3) Test procedures~~

~~ii) Category B turbochargers~~

~~1) Sectional assembly (including principal dimensions and materials of housing components for containment evaluation)~~

~~2) Documentation of containment in the event of the disc fracture specified in 2.5.1-6-~~

~~3) Documentation of the following operational data and limitations-~~

~~• Maximum permissible operating speed (rpm)~~

~~• Maximum permissible exhaust gas temperature at the turbine inlet~~

~~• Minimum lubrication oil inlet pressure~~

~~• Maximum lubrication oil outlet temperature~~

- ~~• Maximum permissible vibration levels (self- and externally-generated vibration)~~
- ~~• Alarm level for overspeed (levels are also to be indicated on engine control system diagrams)~~
- ~~• Alarm level for exhaust gas temperature at the turbine inlet (levels are also to be indicated on engine control system diagrams)~~
- ~~• Lubrication oil inlet pressure low alarm set point (levels are to also be indicated on engine control system diagrams)~~
- ~~• Lubrication oil outlet temperature high alarm set point (levels are to also be indicated on engine control system diagrams)~~
- ~~4) Diagram of lubrication oil systems (diagrams included in piping arrangements fitted to engines may be accepted instead)~~
- ~~5) Test report of type test (only for type tests)~~
- ~~6) Test procedure (only for type tests)~~

~~iii) Category C turbochargers~~

- ~~1) Drawings listed in ii) above~~
- ~~2) Drawings of the housing and rotating parts (including details of blade fixing)~~
- ~~3) Material specifications of the parts mentioned in 2) above (Mechanical property and chemical composition are to be provided.)~~
- ~~4) Welding details and welding procedures for the parts mentioned in 2) above, if made of welded construction~~

(2) Drawings and data for reference

Drawings and data specified in Table 7.2.1(b)

- ~~(a) A list containing all drawings and data submitted (with relevant drawing numbers and revision status)~~
- ~~(b) Gudgeon pins~~
- ~~(c) Connecting rod bearings (including bolts details) of 2-stroke cycle engines~~
- ~~(d) Rocker valve gears~~
- ~~(e) Cylinder cover fixing bolts and valve box fixing bolts~~
- ~~(f) Engine control system diagram (including the monitoring, safety and alarm systems)~~
- ~~(g) Construction and arrangement of dampers, detuners, balancers or compensators, bracings as well as all calculation sheets related to engine balancing and engine vibration prevention~~
- ~~(h) Location of measures preventing oil from spraying out from joints in flammable oil piping (if fitted)~~
- ~~(i) The following drawings and data for exhaust driven turbochargers (only for category C turbochargers):~~
  - ~~i) Documentation of the safe torque transmission specified in 2.5.1.6 when the disc is connected to the shaft by an interference fit~~
  - ~~ii) Information on expected lifespan (Creep, low cycle fatigue and high cycle fatigue are to be considered.)~~
  - ~~iii) Operation and maintenance manuals~~
- ~~(j) Other drawings and data deemed necessary by the Society~~

~~(3) Drawings and data for the purpose of inspection and testing of reciprocating internal combustion engines~~

- ~~(a) A list containing all drawings and data submitted (including relevant drawing numbers and revision status)~~
- ~~(b) Engine particulars to be in the form designated by the Society~~
- ~~(c) Material specifications of main parts with information on non-destructive testing and pressure testing as applicable to the material~~
- ~~(d) Bedplate and crankcase of welded design, with welding details and welding instructions for approval of materials and weld procedure specifications. The weld procedure specification is to include details of pre and post weld heat treatment, weld consumables~~

- and fit-up conditions:
- ~~(e) Thrust bearing bedplate of welded design, with welding details and welding instructions for approval of materials and weld procedure specifications. The weld procedure specification is to include details of pre and post weld heat treatment, weld consumables and fit-up conditions:~~
  - ~~(f) Frame/framebox/gearbox of welded design, with welding details and instructions for approval of materials and weld procedure specifications. The weld procedure specification is to include details of pre and post weld heat treatment, weld consumables and fit-up conditions:~~
  - ~~(g) Crankshaft, assembly and details~~
  - ~~(h) Thrust shaft or intermediate shaft (if integral with engine)~~
  - ~~(i) Shaft coupling bolts~~
  - ~~(j) Bolts and studs for main bearings~~
  - ~~(k) Bolts and studs for cylinder heads and exhaust valve (two stroke design)~~
  - ~~(l) Bolts and studs for connecting rods~~
  - ~~(m) Tie rods~~
  - ~~(n) Schematic layout or other equivalent drawings and data on the reciprocating internal combustion engine of the following i) to vii) (Details of the system so far as supplied by the licensee such as: main dimensions, operating media and maximum working pressures):~~
    - ~~i) starting air system~~
    - ~~ii) Fuel oil system~~
    - ~~iii) Lubricating oil system~~
    - ~~iv) Cooling water system~~
    - ~~v) Hydraulic system~~
    - ~~vi) Hydraulic system (for valve lift)~~
    - ~~vii) Engine control and safety system~~
  - ~~(o) Shielding of high pressure fuel pipes, assembly  
(All engines)~~
  - ~~(p) Construction of accumulators for hydraulic oil and fuel oil~~
  - ~~(q) High pressure parts for fuel oil injection system  
The documentation to contain specifications for pressures, pipe dimensions and materials.~~
  - ~~(r) Arrangement and details of the crankcase explosion relief valve (only for engines of a cylinder diameter of 200 mm or more or a crankcase volume of 0.6 m<sup>3</sup> or more)~~
  - ~~(s) Oil mist detection and/or alternative alarm arrangements~~
  - ~~(t) Cylinder head~~
  - ~~(u) Cylinder block, engine block~~
  - ~~(v) Cylinder liner~~
  - ~~(w) Counterweights (if not integral with crankshaft), including fastening~~
  - ~~(x) Connecting rod with cap~~
  - ~~(y) Crosshead~~
  - ~~(z) Piston rod~~
  - ~~(aa) Piston, assembly, including identification (e.g. drawing number) of components~~
  - ~~(ab) Piston head~~
  - ~~(ac) Camshaft drive, assembly, including identification (e.g. drawing number) of components~~
  - ~~(ad) Flywheel~~
  - ~~(ae) Arrangement of foundation (for main engines only)~~
  - ~~(af) Fuel oil injection pump~~

- ~~(ag) Shielding and insulation of exhaust pipes and other parts of high temperature which may be impinged as a result of a fuel system failure, assembly~~
- ~~(ah) Construction and arrangement of dampers~~
- ~~(ai) For electronically controlled engines, assembly drawings or arrangements of the following i) to iv):~~
  - ~~i) Control valves~~
  - ~~ii) High pressure pumps~~
  - ~~iii) Drive for high pressure pumps~~
  - ~~iv) Valve bodies, if applicable~~
- ~~(aj) Operation and service manuals~~  
~~Operation and service manuals are to contain maintenance requirements (servicing and repair) including details of any special tools and gauges that are to be used with their fitting/settings together with any test requirements on completion of maintenance.~~
- ~~(ak) Test program resulting from FMEA (for engine control system) in cases of engines that rely on hydraulic, pneumatic or electronic control of fuel injection and/or valves~~
- ~~(al) Production specifications for castings and welding (sequence)~~
- ~~(am) Certification of an approval of use for environmental tests, control components. Documents modified for a specific application are to be submitted to the Society for information or approval, as applicable.~~
- ~~(an) Quality requirements for engine production~~
- ~~(ao) Other drawings and data deemed necessary by the Society~~

2 The drawings and data for the inspection and testing specified in ~~-1(3) above~~ (the items represented by the mark ○ in **Table 7.2.1(a)** and **Table 7.2.1(b)**, hereinafter indicated in the same way throughout this Chapter) are to be submitted in accordance with **2.1.4-1** by the engine manufacturer producing engines with the drawings and data whose approval of use has been obtained in accordance with **2.1.1-2** (hereinafter referred to as “licensee” in this Chapter) ~~but~~. Such drawings and data, however, may be submitted by the licensor in accordance with **2.1.4-2**.

Table 7.2.1(a) has been added as follows.

**Table 7.2.1(a) Drawings and Data for Approval**

	<u>Items</u>	<u>For inspection and testing</u>
(1)	<u>Engine particulars (in the format designated by the Society)</u>	<u>○</u>
(2)	<u>Material specifications of main parts with information on non-destructive testing and pressure testing as applicable to the material</u>	<u>○</u>
(3)	<u>Bedplate and crankcase of welded design, with welding details and welding instructions<sup>(1)</sup></u>	<u>○</u>
(4)	<u>Thrust bearing bedplate of welded design, with welding details and welding instructions<sup>(1)</sup></u>	<u>○</u>
(5)	<u>Frame/framebox/gearbox of welded design, with welding details and instructions<sup>(1)</sup></u>	<u>○</u>
(6)	<u>Crankshaft, assembly and details</u>	<u>○</u>
(7)	<u>Thrust shaft or intermediate shaft (if integral with engine)</u>	<u>○</u>
(8)	<u>Shaft coupling bolts</u>	<u>○</u>
(9)	<u>Connecting rod bearings (four-stroke design)</u>	<u>—</u>
(10)	<u>Bolts and studs for connecting rods (four-stroke design)</u>	<u>○</u>
(11)	<u>Schematic layout or other equivalent drawings and data on the reciprocating internal combustion engine of the following (a) to (g) (details of the system so far as supplied by the licensee such as: main dimensions, operating media and maximum working pressures).</u> <u>(a) Starting air system</u> <u>(b) Fuel oil system</u> <u>(c) Lubricating oil system</u> <u>(d) Cooling water system</u> <u>(e) Hydraulic system</u> <u>(f) Hydraulic system (for valve lift)</u> <u>(g) Engine control and safety system</u>	<u>○</u>
(12)	<u>High pressure oil pipes for driving exhaust valves with its shielding</u>	<u>—</u>
(13)	<u>Shielding of high pressure fuel pipes, assembly (all engines)</u>	<u>○</u>
(14)	<u>High pressure parts for fuel oil injection system</u> <u>The documentation to contain specifications for pressures, pipe dimensions and materials.</u>	<u>○</u>
(15)	<u>Arrangement and details of the crankcase explosion relief valve (only for engines of a cylinder diameter of 200 mm or more or a crankcase volume of 0.6 m<sup>3</sup> or more)</u>	<u>○</u>
(16)	<u>Oil mist detection and/or alternative alarm arrangements</u>	<u>○</u>
(17)	<u>Connecting rod with cap (four-stroke design)</u>	<u>○</u>
(18)	<u>Arrangement of foundation (for main engines only)</u>	<u>○</u>
(19)	<u>The drawings, data, etc. required by 2.1.4.</u>	<u>○</u>

Table 7.2.1(a) Drawings and Data for Approval (continued)

	<u>Items</u>	<u>For inspection and testing</u>
(20)	<p><u>The following drawings and data for exhaust driven turbochargers:</u></p> <p><u>(a) Category A turbochargers (upon request)</u></p> <p><u>i) Sectional assembly (including principal dimensions and names of components)</u></p> <p><u>ii) Containment test report</u></p> <p><u>iii) Test procedures</u></p> <p><u>(b) Category B turbochargers</u></p> <p><u>i) Sectional assembly (including principal dimensions and materials of housing components for containment evaluation.)</u></p> <p><u>ii) Documentation of containment in the event of the disc fracture specified in 2.5.1-6</u></p> <p><u>iii) Documentation of following operational data and limitations</u></p> <ul style="list-style-type: none"> <li><u>• Maximum permissible operating speed (rpm)</u></li> <li><u>• Maximum permissible exhaust gas temperature at the turbine inlet</u></li> <li><u>• Minimum lubrication oil inlet pressure</u></li> <li><u>• Maximum permissible vibration levels (self- and externally generated vibrations)</u></li> <li><u>• Alarm level for exhaust gas temperature at the turbine inlet (levels are also to be indicated on engine control system diagrams)</u></li> <li><u>• Lubrication oil inlet pressure low alarm set point (levels are also to be indicated on engine control system diagrams)</u></li> <li><u>• Lubrication oil outlet temperature high alarm set point (levels are also to be indicated on engine control system diagrams)</u></li> </ul> <p><u>iv) Diagram of lubrication oil systems (diagrams included in piping arrangements fitted to engines may be accepted instead)</u></p> <p><u>v) Test report of type test (only for type tests)</u></p> <p><u>vi) Test procedure (only for type tests)</u></p> <p><u>(c) Category C turbochargers</u></p> <p><u>i) Drawings listed in (b) above</u></p> <p><u>ii) Drawings of the housing and rotating parts (including details of blade fixing)</u></p> <p><u>iii) Material specifications (including mechanical properties and chemical composition) of the parts mentioned in ii) above</u></p> <p><u>iv) Welding details and welding procedures for the parts mentioned in ii) above, if made of welded construction</u></p>	—
(21)	<u>Other drawings and data deemed necessary by the Society</u>	○

Note:

- (1) For approval of materials and weld procedure specifications, the weld procedure specification is to include details of pre -and post-weld heat treatment, weld consumables and fit-up conditions.

Table 7.2.1(b) has been added as follows.

**Table 7.2.1(b) Drawings and Data for Reference**

	<u>Items</u>	<u>For inspection and testing</u>
(1)	<u>A list containing all drawings and data submitted (including relevant drawing numbers and revision status)</u>	<u>○</u>
(2)	<u>Bolts and studs for main bearings</u>	<u>○</u>
(3)	<u>Connecting rod bearings (two-stroke design)</u>	<u>—</u>
(4)	<u>Bolts and studs for cylinder heads and exhaust valve (two-stroke design)</u>	<u>○</u>
(5)	<u>Bolts and studs for connecting rods (two-stroke design)</u>	<u>○</u>
(6)	<u>Tie rods</u>	<u>○</u>
(7)	<u>Piston pins</u>	<u>—</u>
(8)	<u>Construction of accumulators for hydraulic oil and fuel oil</u>	<u>○</u>
(9)	<u>Cylinder head fixing bolts and valve box fixing bolts</u>	<u>—</u>
(10)	<u>Rocker valve gears</u>	<u>—</u>
(11)	<u>Cylinder head</u>	<u>○</u>
(12)	<u>Cylinder block, engine block</u>	<u>○</u>
(13)	<u>Cylinder liner</u>	<u>○</u>
(14)	<u>Counterweights (if not integral with crankshaft), including fastening</u>	<u>○</u>
(15)	<u>Connecting rod with cap (two-stroke design)</u>	<u>○</u>
(16)	<u>Crosshead</u>	<u>○</u>
(17)	<u>Piston rod</u>	<u>○</u>
(18)	<u>Piston, assembly, including identification (e.g. drawing number) of components</u>	<u>○</u>
(19)	<u>Piston head</u>	<u>○</u>
(20)	<u>Camshaft drive, assembly, including identification (e.g. drawing number) of components</u>	<u>○</u>
(21)	<u>Flywheel</u>	<u>○</u>
(22)	<u>Fuel oil injection pump</u>	<u>○</u>
(23)	<u>Shielding and insulation of exhaust pipes and other parts of high temperature which may be impinged as a result of a fuel system failure, assembly</u>	<u>○</u>
(24)	<u>Construction and arrangement of dampers</u>	<u>○</u>
(25)	<u>Construction and arrangement of detuners, balancers or compensators, bracings as well as all calculation sheets related to engine balancing and engine vibration prevention</u>	<u>—</u>
(26)	<u>For electronically controlled engines, assembly drawings or arrangements of the following (a) to (d):</u> <u>(a) Control valves</u> <u>(b) High-pressure pumps</u> <u>(c) Drive for high pressure pumps</u> <u>(d) Valve bodies, if applicable</u>	<u>○</u>
(27)	<u>Operation and service manuals<sup>(1)</sup></u>	<u>○</u>
(28)	<u>Engine control system diagram (including the monitoring, safety and alarm systems)</u>	<u>—</u>
(29)	<u>Test program resulting from FMEA (for engine control system) in cases of engines that rely on hydraulic, pneumatic or electronic control of fuel injection and/or valves</u>	<u>○</u>
(30)	<u>Production specifications for castings and welding (sequence)</u>	<u>○</u>
(31)	<u>Certification of an approval of use for environmental tests, control components<sup>(2)</sup></u>	<u>○</u>
(32)	<u>Quality requirements for engine production</u>	<u>○</u>
(33)	<u>Location of measures preventing oil from spraying out from joints in flammable oil piping (if fitted)</u>	<u>—</u>

Table 7.2.1(b) Drawings and Data for Reference (continued)

	Items	For inspection and testing
(34)	<p>The following drawings and data for exhaust driven turbochargers (only for category C turbochargers):</p> <p>(a) Documentation of the safe torque transmission specified in 2.5.1-6 when the disc is connected to the shaft by an interference fit</p> <p>(b) Information on expected lifespan (creep, low cycle fatigue and high cycle fatigue are to be considered)</p> <p>(c) Operation and maintenance manuals</p>	—
(35)	Other drawings and data deemed necessary by the Society	○

Notes:

- (1) Operation and service manuals are to contain maintenance requirements (servicing and repair) including details of any special tools and gauges that are to be used with their fitting/settings together with any test requirements on completion of maintenance.
- (2) Drawings and data modified for a specific application are to be submitted to the Society for reference or approval, as applicable.

## 2.1.4 Approval of Reciprocating Internal Combustion Engines\*

Sub-paragraph -1 has been amended as follows.

**1** Reciprocating internal combustion engines are to be approved in accordance with the following **(1)** to **(6)**:

- (1) Development of documents and data for engine production
  - (a) Prior to the start of the reciprocating internal combustion engine approval process in accordance with the following ~~(3c)~~ and subsequent sub-paragraphs of this paragraph, a design approval is to be obtained as specified separately by the Society.
  - (b) Each type of reciprocating internal combustion engine is to be provided with a certificate of approval of use obtained by the licensor in accordance with 2.1.1-2. For the first engine of a type or for those with no service records, the process of an approval of use and the approval process for production by the licensee may be performed simultaneously.
  - (c) The licensor is to review the drawings and data of the reciprocating internal combustion engine whose approval of use has been obtained for the application and develop, if necessary, application specific drawings and data for production of reciprocating internal combustion engines for the use of the licensee in developing the reciprocating internal combustion engine specific production drawings and data ~~listed~~ listed for the inspection and testing specified in 2.1.3-1(3).
  - (d) If substantive modifications to the ~~the~~ drawings and data of the reciprocating internal combustion engine whose approval of use has been obtained have been made in the drawings and data of reciprocating internal combustion engines to be produced, the affected drawings and data are to be resubmitted to the Society as specified separately by the Society.
- (2) Drawings and data for the ~~purpose of~~ inspection and testing of reciprocating internal combustion engines
  - (a) The licensee is to develop the drawings and data ~~listed~~ listed for the inspection and testing specified in 2.1.3-1(3) and a comparison list of these drawings and data to the drawings and data of the reciprocating internal combustion engine whose approval of use has been obtained by the licensor and submit these drawings and the comparison list to the Society.
  - (b) ~~In applying~~ As for the drawings and data for the inspection and testing specified in

~~2.1.3-1(3)~~, if there are differences in the technical content on the licensee's production drawings and data of the reciprocating internal combustion engine compared to the drawings and data of the reciprocating internal combustion engine whose approval of use has been obtained by the licensor, the licensee is to submit "Confirmation of the licensor's acceptance of licensee's modifications" approved by the licensor and signed by the licensee and licensor. If the licensor acceptance is not confirmed, the reciprocating internal combustion engine manufactured by the licensee is to be regarded as a different engine type and is **2.1.1-2** is to apply to the reciprocating internal combustion engine.

- (c) In applying (b) above, modifications applied by the licensee are to be provided with appropriate quality requirements.
- (d) The Society returns the drawings and data specified in (a) and (b) above to the licensee with confirmation that the design has been approved.
- (e) The licensee or its subcontractors are to prepare to be able to provide the drawings and data specified in (a) and (b) above so that the Surveyor can use the information for inspection purposes during manufacture and testing of the reciprocating internal combustion engine and its components.

(3) Additional drawings and data

In addition to the drawings and data ~~listed~~ for the inspection and testing specified in 2.1.3-1(3), the licensee is to be able to provide to the Surveyor performing the test specified in **2.6.1** upon request the relevant detail drawings, production quality control specifications and acceptance criteria. These drawings and data are for supplemental purposes to the survey only.

((4) to (6) are omitted.)

## 2.2 Materials, Construction and Strength

### 2.2.1 Materials

Sub-paragraph -1 has been amended as follows.

**1** Materials intended for the principal components of reciprocating internal combustion engines and their non-destructive tests as well as surface inspections and dimension inspections are to conform to the requirements given in **Table 7.2.1~~2~~**. However, with respect to ultrasonic testing as well as surface inspections and dimension inspections, submission or presentation of test results to the Surveyor may be considered sufficient. In cases where deemed necessary by the Society, tests or inspections may also be required for any parts not specified in **Table 7.2.1~~2~~**.

Table 7.2.1 has been renumbered to Table 7.2.2.

Table 7.2.1~~2~~ Application of Materials and Non-destructive Tests as well as Surface Inspections and Dimension Inspections to Principal Components of Reciprocating Internal Combustion Engines  
(Omitted)

## 2.3 Crankshafts

### 2.3.1 Solid Crankshafts

Sub-paragraph -1 has been amended as follows.

1 The diameters of crankpins and journals are to be not less than the value given by the following formula:

$$d_c = \left\{ \left( M + \sqrt{M^2 + T^2} \right) D^2 \right\}^{\frac{1}{3}} K_m K_s K_h$$

Where:

$d_c$ : Required diameter of crankshaft ( $mm$ )

$M$ :  $10^{-2} A L P_{max}$

$T$ :  $10^{-2} B S P_{mf}$

$S$ : Length of stroke ( $mm$ )

$L$ : Span of bearings adjacent to crank measured from centre to centre ( $mm$ )

$P_{max}$ : Maximum combustion pressure in cylinder ( $MPa$ )

$P_{mf}$ : Indicated mean effective pressure ( $MPa$ )

$A$  and  $B$ : Coefficients given in **Table 7.2.32** and **Table 7.2.43** for engines having equal firing intervals (in the case of Vee engines, those with equal firing intervals on each bank.). Special consideration will be given to values  $A$  and  $B$  for reciprocating internal combustion engines having unequal firing intervals or for those not covered by the Tables.

$D$ : (Omitted)

$K_m$ : (Omitted)

$K_s$ : (Omitted)

$K_h$ : (Omitted)

Table 7.2.2 has been renumbered to Table 7.2.3.

Table 7.2.23 Value of Coefficients  $A$  and  $B$  for Single Acting In-line Engines  
(Omitted)

Table 7.2.3 has been renumbered to Table 7.2.4.

Table 7.2.34(1) Value of Coefficients  $A$  and  $B$  for Single Acting 2-stroke cycle Vee Engines with Parallel Connecting Rods  
(Omitted)

Table 7.2.34(2) Value of Coefficients  $A$  and  $B$  for Single Acting 4-stroke cycle Vee Engines with Parallel Connecting Rods  
(Omitted)

## 2.4 Safety Devices

### 2.4.3 Protection against Crankcase Explosion\*

Sub-paragraph -2 has been amended as follows.

**2** The number and locations of the explosion relief valves specified in **-1** are to be in accordance with **Table 7.2.45**.

Table 7.2.4 has been renumbered to Table 7.2.5.

Table 7.2.45 Number and Location of Explosion Relief Valves  
(Omitted)

## 2.5 Associated Installations

### 2.5.1 Exhaust Driven Turbochargers\*

Sub-paragraph -8 has been amended as follows.

**8** For categories *B* and *C* turbochargers, the indications and alarms listed in **Table 7.2.56** are to be provided. Indications may be provided at local locations, monitoring stations or control stations. Alarm levels may be equal to permissible limits, but are not to be reached when operating the engine at 110% power, or at any approved intermittent overload beyond 110% in cases where the turbochargers are fitted to engines for which intermittent overload power is approved.

### 2.5.8 Accumulators and Common Accumulators for Electronically-controlled Engines which are used as the Main Propulsion Machinery

Sub-paragraph -1 has been amended as follows.

**1** Accumulators and common accumulators are to comply with the requirements in **Chapter 10, Part D of the Rules for the Survey and Construction of Steel Ships**. However, notwithstanding this requirement, materials and non-destructive tests as well as surface inspections and dimension inspections are to be in accordance with **Table D2.42, Part D of the Rules for the Survey and Construction of Steel Ships** and hydrostatic tests are to be in accordance with **Table D2.67, Part D of the Rules for the Survey and Construction of Steel Ships**.

Table 7.2.5 has been renumbered to Table 7.2.6.

Table 7.2.56 Alarms and Indications of Turbochargers  
(Omitted)

## 2.6 Tests

### 2.6.1 Shop Tests\*

Sub-paragraph -1 has been amended as follows.

**1** For components or accessories specified in **Table 7.2.67**, hydrostatic tests are to be carried out on the water or oil side of the component at the pressures shown in the Table. In cases deemed necessary by the Society, tests may also be required for any components not specified in **Table 7.2.67**.

Table 7.2.6 has been renumbered to Table 7.2.7.

Table 7.2.67 Hydrostatic Test Pressure  
(Omitted)

“Guidance for the survey and construction of steel ships” has been partly amended as follows:

## **Part D MACHINERY INSTALLATIONS**

### **D2 RECIPROCATING INTERNAL COMBUSTION ENGINES**

#### **D2.1 General**

Paragraph D2.1.3 has been amended as follows.

##### **D2.1.3 Drawings and Data**

For the following data, those represented by two sizes in generic range of turbochargers (i.e. the same components, materials, etc., with the only difference being the size) are acceptable.

- (1) The documentation for safe torque transmission specified in ~~2.1.3-1(2)(i)~~ **(34)(a), Table D2.1(b), Part D of the Rules.**
- (2) The operation and maintenance manuals listed in ~~2.1.3-1(2)(i)iii~~ **(34)(c), Table D2.1(b), Part D of the Rules.**

## **D10 PRESSURE VESSELS**

### **D10.9 Tests**

#### **D10.9.1 Shop Tests**

Sub-paragraph -2 has been amended as follows.

**2** Notwithstanding the requirements in **10.9.1, Part D of the Rules**, hydrostatic tests of heat exchangers fitted to engines having cylinder bores of 300 *mm* or less may be omitted~~r~~ (see **Table D2.67 of the Rules**).

## **Part GF SHIPS USING LOW-FLASHPOINT FUELS**

### **Annex 3 GUIDANCE FOR HIGH PRESSURE GAS-FUELLED ENGINES**

#### **Chapter 2 CONSTRUCTION AND EQUIPMENT OF HIGH PRESSURE GAS-FUELLED ENGINES**

##### **2.3 Safety Systems**

##### **2.3.2 Protection Against Explosions**

Sub-paragraph -1 has been amended as follows.

**1** Relief valves approved in accordance with **Table D2.45, Part D of the Rules** are to be provided for crankcases.

“Guidance for high speed craft” has been partly amended as follows:

## **Part 9 MACHINERY INSTALLATIONS**

### **Chapter 2 RECIPROCATING INTERNAL COMBUSTION ENGINES**

#### **2.1 General**

Paragraph 2.1.3 has been amended as follows.

##### **2.1.3 Drawings and Data**

For the following data, those represented by two sizes in a generic range of turbochargers (i.e. the same components, materials, etc., with the only difference being the size) are acceptable.

- (1) The documentation of safe torque transmission specified in ~~2.1.3-1(2)(i)~~ **(34)(a), Table 9.2.1(b), Part 9 of the Rules.**
- (2) The operation and maintenance manuals listed in ~~2.1.3-1(2)(iii)~~ **(34)(c), Table 9.2.1(b), Part 9 of the Rules.**

“Guidance for the survey and construction of inland waterway ships” has been partly amended as follows:

## **Part 7 MACHINERY INSTALLATIONS**

### **Chapter 2 RECIPROCATING INTERNAL COMBUSTION ENGINES**

#### **2.1 General**

Paragraph 2.1.3 has been amended as follows.

##### **2.1.3 Drawings and Data**

For the following data, those represented by two sizes in a generic range of turbochargers (i.e. the same components, materials, etc., with the only difference being the size) are acceptable.

- (1) The documentation for safe torque transmission specified in ~~2.1.3-1(2)(i)~~ **(34)(a), Table 7.2.1(b), Part 7 of the Rules.**
- (2) The operation and maintenance manuals listed in ~~2.1.3-1(2)(i)iii~~ **(34)(c), Table 7.2.1(b), Part 7 of the Rules.**

## Chapter 8 PRESSURE VESSELS

### 8.9 Tests

#### 8.9.1 Shop Tests

Sub-paragraph -2 has been amended as follows.

**2** Notwithstanding the requirements in **8.9.1-2, Part 7 of the Rules**, hydrostatic tests of heat exchangers fitted to engines having cylinder bores of 300 *mm* or less may be omitted~~r~~ (see **Table 7.2.67, Part 7 of the Rules**).

“Guidance for the approval and type approval of materials and equipment for marine use” has been partly amended as follows:

## **Part 6 MACHINERY**

### **Chapter 8 APPROVAL OF USE OF RECIPROCATING INTERNAL COMBUSTION ENGINES**

#### **8.2 Application and Approval of Submitted Documents**

##### **8.2.2 Drawings and Data**

Sub-paragraph -1(2) has been amended as follows.

**1** Drawings and data to be submitted are as specified in the following **(1)** and **(2)**, as appropriate for the type of the reciprocating internal combustion engine. Upon review and approval of the submitted drawings and data, they are returned to the licensor.

- (1) (Omitted)
- (2) Drawings and data to be submitted for information on an overview of the engine’s design, engine characteristics and performance
  - (a) (Omitted)
  - (b) Engine particulars ~~to be in the form designated by the Society~~ (e.g. Data sheet with general engine information, Project Guide, Marine Installation Manual in the format designated by the Society)
  - ((c) to (ae) are omitted.)