

GUIDANCE RELATING TO THE RULES FOR THE CLASSIFICATION OF STEEL SHIPS

(Guidance for Approval of Manufacturing Process and Type Approval, Etc.)

-External Opinion Inquiry-

2019. 10.



Hull Rule Development Team

- Main Amendments -

(1) Enter into force on 1 January 2020 (the date of application for certification of material & welding or the contract date for ship construction)

● To reflect Request for Establishment/Revision of Classification Technical Rules

| Present | Amendment | reason |
|---|---|---|
| <p style="text-align: center;">CHAPTER 2 APPROVAL OF MANUFACTURING PROCESS</p> <p style="text-align: center;">Section 1 General<Omitted></p> <p style="text-align: center;">Section 2-1 Rolled Steels</p> <p>201. ~ 202. <Omitted></p> <p>203. Approval tests</p> <p style="padding-left: 20px;">1. ~ 5. <Omitted></p> <p>Table 2.2.1 Approval Test Items for Rolled Steels <Omitted></p> <p>Table 2.2.2 Test Items and Selection of Test Specimens <Omitted></p> <p>204. ~ 205. <Omitted></p> | <p style="text-align: center;">CHAPTER 2 APPROVAL OF MANUFACTURING PROCESS</p> <p style="text-align: center;">Section 1 General<Sames as the present guidance></p> <p style="text-align: center;">Section 2-1 Rolled Steels</p> <p>201. ~ 202. <Sames as the present guidance></p> <p>203. Approval tests</p> <p style="padding-left: 20px;">1. ~ 5. <Sames as the present guidance></p> <p>Table 2.2.1 Approval Test Items for Rolled Steels</p> <p>Table 2.2.2 Test Items and Selection of Test Specimens</p> <p>204. ~ 205. <Sames as the present guidance></p> | <p>* It is reflected Request for IMO MSC. 1/Circ.1599 Annex, Interim guidelines</p> |

Table 2.2.1 Approval Test Items for Rolled Steels (2017) (2018)

| Kinds | grade | Base metal test | | | | | | | | | | | | | | Brittle fracture test | Weldability test | | | | | | | Other test | | | |
|--|--|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------------------|-----------------------|------------------|-----|-----|-----|-----|-----|-----|------------|-----|-----|-----|
| | | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) | (l) | (m) | (n) | (o) | (p) | (q) | (r) | (s) | (t) | (u) | (v) | (w) | (x) | (y) | (z) |
| Rolled steel for hull | <i>A, B</i> | ○ | ○ | ○ | | ○ | | ○ | | | ○ | | | | | | | | | | | | | | | | |
| | <i>D</i> | ○ | ○ | ○ | | ○ | | ○ | | | ○ | ○ | | | | | | | | | | | | | | | |
| | <i>E</i> | ○ | ○ | ○ | | ○ | | ○ | | | ○ | ○ | | | | ○ | | ○ | ○ | ○ | ○ | | | | | | |
| | <i>AH32, AH36, AH40, DH32, DH36, DH40</i> | ○ | ○ | ○ | | ○ | | ○ | | | ○ | ○ | | | | | | ○ | ○ | ○ | ○ | | | | | | |
| | <i>EH32, EH36, EH40, FH32, FH36, FH40</i> | ○ | ○ | ○ | | ○ | | ○ | | | ○ | ○ | | | | ○ | ○ ₍₇₎ | ○ | ○ | ○ | ○ | | | | | | |
| YP47 steel plates (Sec. 2-4) | <i>EH47-H</i> | ○ | ○ | ○ | | ○ | | ○ | | | ○ | ○ | | | ○ ₍₈₎ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | | |
| High strength steels for welded structures (Sec. 2-6) | <i>AH43~FH97, FH43~FH70</i> | ○ | ○ | ○ | | ○ | | ○ | ○ | | ○ | ○ | | | ○ | ○ | | ○ | ○ | ○ | ○ | ○ | | | | | |
| Rolled steels for low temp. service | <i>RL235A~RL9N490</i> | ○ | ○ | ○ | | ○ | | ○ | ○ | | ○ | ○ | | | ○ | ○ | | ○ | ○ | ○ | ○ | | | | | | |
| Rolled steel for boilers | <i>RSP42~RSP49A</i> | ○ | ○ | ○ | | ○ | | ○ | ○ | | ○ | | | | | | | | ○ | | | | | ○ | ○ | | |
| Rolled steels for pressure vessels | <i>RPV24~RPV50</i> | ○ | ○ | ○ | | ○ | | ○ | ○ | | ○ | ○ | | | ○ | | | | ○ | | | | | | | | |
| Round bars for chain | <i>RSBC31~RSBC70</i> | ○ | ○ | ○ | | ○ | | ○ | ○ | | ○ | | | | | | | | ○ | | | | | | | | |
| Round bars for offshore chains and accessories(6) | <i>RSBCR3, RSBCR3S, RSBCR4, RSBCR4S RSBCR5</i> | - | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rolled steels bar for boilers | <i>RSB42~RSB46</i> | ○ | ○ | ○ | | ○ | | ○ | ○ | | ○ | | | | | | | | | | | | | | | | |
| Rolled and forged steel carbon bars | <i>RSFB400 ~RSFB760</i> | ○ | ○ | ○ | | ○ | | ○ | ○ | | ○ | | | | | | | | | | | | | | | | |
| Rolled and forged steel low alloy steel bars | <i>RSFB600A ~RSFB1100A</i> | ○ | ○ | ○ | | ○ | | ○ | ○ | | ○ | | | | | | | | | | | | | | | | |
| Rolled stainless steels | <i>RSTS304~RSTS347 RSTS31803, RSTS32750</i> | ○ | ○ | ○ | | ○ | ○ | ○ | ○ | | ○ | | | | | | | | | | | | | | | ○ | |
| Stainless clad steel plates | Base metal | <i>A~E</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Clad metal | <i>RSTS304~RSTS347</i> | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | | | | | | | | | ○ | ○ |
| High manganese austenitic steel plates ⁽¹⁰⁾ | <i>HMN40</i> | ○ | ○ | ○ | | ○ | | ○ | | | ○ | ○ | | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | | | ○ | |

Notes

- (1) Where thermo-mechanical controlled processing(TMCP) is performed, tensile test after stress relieving is required in addition to those tests given in table.
- (2) For steel materials with consideration against through thickness properties as specified in **Pt 2, Ch 1.** of the Rules, the tensile test of through thickness direction, microscopic examination for non-metallic inclusions, ultrasonic test are required in addition to those tests given in table.
- (3) For steels other than steel plates, the strain ageing Charpy impact test, NRL drop weight test and CTOD test are not required, unless otherwise specified. However, where cast piece from the continuous casting method is used, the macro-structure of the cast piece and sulphur print test may be required.
- (4) The CTOD test, high temperature tension test and creep test as specified in the Table are performed for the purpose of evaluating low temperature toughness and high temperature characteristics, and these tests may be omitted in case appropriate records prepared by the manufacturer are available or in case the Society deems the test unnecessary.

Table 2.2.1 Approval Test Items for Rolled Steels (continued)

| | |
|-------|--|
| Notes | |
| (5) | Additional tests such as large scale brittle fracture tests (Double Tension test, ESSO test, Deep Notch test, etc.) or other tests may be required when deemed necessary by the Society. |
| (6) | The approval test items of round bar for offshore chains and accessories are to be in accordance with Sec. 10-3 . |
| (7) | Brittle crack arrest steel is to be carried out standard ESSO test in accordance with Pt 2, Ch 1, Sec. 2 of the Guidance. |
| (8) | Instead of CTOD test, deep notch test may be carried out. |
| (9) | Kind of test |
| | (a) Chemical analysis (b) Sulphur print (c) Micro structure (d) Macro structure (e) Ferrite grain size |
| | (f) Hardness test (g) Tensile test (h) Bend test (i) Shearing strength test (j) Charpy impact test |
| | (k) Strain charpy impact test (l) Hydrogen embrittlement test (m) <u>Fatigue test</u> |
| | (n) CTOD test (o) NRL drop weight test (p) Esso test (q) Weldment tensile test |
| | (r) Weldment impact test (s) Max. hardness test (t) Macro structure (u) Hydrogen crack test |
| | (v) <u>Fatigue test</u> (w) High temp. tensile test (x) Creep test (y) Corrosion test (z) Ultrasonic test |
| (10) | <u>Base metal test is to include corrosion test(general corrosion test, intergranular corrosion test and stress corrosion cracking test). Weldability test is to include micro structure, bend test and corrosion test(general corrosion test, intergranular corrosion test and stress corrosion cracking test).</u> |

Table 2.2.2 Test Items and Selection of Test Specimens (2018) (2019)

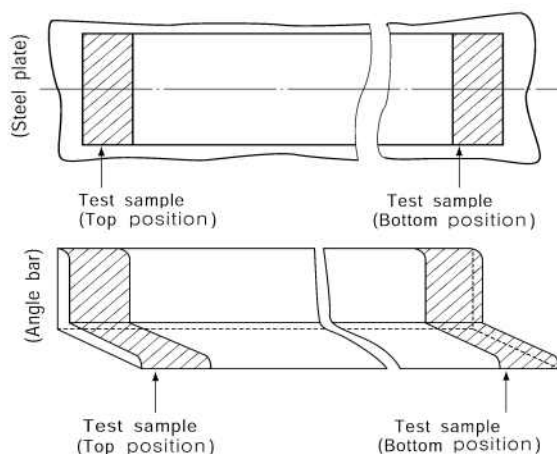
| Approval test items | | Position of the Sample ⁽⁰⁾ | Direction of the test specimens | Approval Testing method | acceptance criteria |
|---------------------|---|---------------------------------------|---------------------------------|---|---|
| Base metal test | Chemical analysis | T(Top) | - | KS D 0228 or equivalent method. Ladle analysis and production analysis(from the tensile test specimens) are to be performed for C, Si, Mn, P, S and other elements as deemed necessary. | The chemical composition by ladle analysis is to comply with the requirements in Pt2, Ch1, Sec3 of the Rules. Excess difference in the chemical compositions between melt analysis and product analysis is not to be accepted. |
| | Sulphur print | T | T (Transverse) | KS D 0226 or equivalent method. Length is to be greater than 600 mm (cross section in the case of cast piece) | Segregation, etc, deemed to have negative effect are not to be present |
| | Microscopic exam. for non-metallic inclusion | T | T | ISO 4969 or equivalent method. | Acceptance criteria is the reference. |
| | Macro structure | T | T | KS D 0204 or equivalent method. | |
| | Micro structure | T | - | Microscopic photographs (approx. 100x) of base metal, joining part and cladding metal are to be taken | |
| | Ferrite grain size | T | | KS D 0205 or equivalent method. Magnification of microscopic photographs are to be as a rule 100x. ⁽²⁾ | |
| | Hardness test | T | - | In accordance with Pt 2 of the Rules. Hardness distribution in the thickness direction is to be measured in the case of stainless clad steel. | To meet the requirements in Pt 2, Ch 1, Sec 3 of the Rules, to be as appropriate by the Society. |
| | Tensile test | T | T ⁽³⁾ | In accordance with Pt 2 of the Rules. ⁽⁴⁾⁽⁵⁾ | To meet the requirements in Pt 2, Ch 1, Sec 3 of the Rules. |
| | | B (Bottom) | T ⁽³⁾ | | |
| | Tensile test of through thickness direction | T | thickness direction | In accordance with Pt 2 of the Rules | To meet the requirements in Pt 2, Ch 1, Sec 3 of the Rules |
| | | B | | | |
| | Tensile test (stress relieved) ⁽⁶⁾ | T | T ⁽³⁾ | Tensile test after stress relieving at 600°C (2 min/mm with minimum 1 hour holding) | Acceptance criteria is the reference. |
| | | B | T ⁽³⁾ | | |
| | Bend test | B | T | In accordance with Pt 2 of the Rules. However, in case of not being prescribed in the Pt 2 , bend test is to be in accordance with recognized national or international standard which the Society considers appropriate. | Defects etc, deemed to have negative effect are not to be present |
| | Shearing strength test | T | - | In accordance with Pt 2 of the Rules | To meet the requirements in Pt 2, Ch 1, Sec 3 of the Rules |
| | | B | | | |
| | V-notch Charpy impact test | T | P (Parallel) | Using R4 test specimen, the transition temperature curve of the absorbed energy and fracture surface ratio is to be determined by testing three pieces at each temperature. ⁽⁸⁾⁽⁹⁾ (also the lateral expansion to be reported.) Furthermore, the test temperature is to include the temperature as specified in Pt 2 of the Rules, and its interval is to be 10~20°C ⁽¹⁰⁾ V-notch Charpy impact test specimens for stainless clad steels are to be taken from the base material. | To meet the requirements in Pt 2 of the Rules. Others are the reference. |
| | | | T ⁽⁷⁾ | | |
| | Strain ageing V-notch charpy impact test | T | P | Same as V-notch Charpy impact test. However The test specimens which have been maintained for one hour at 250°C after strain of 5 % have been applied is, as a rule, to be used. ⁽⁸⁾⁽⁹⁾⁽¹¹⁾ | Acceptance criteria is the reference. |
| | | | | | |
| | Hydrogen embrittlement test | T | P | In accordance with Pt 2, Ch 1, Sec 3 of the Rules | To meet the requirements in Pt 2, Ch 1, Sec 3 of the Rules |
| | | B | P | | |
| | <u>Fatigue test</u> | <u>T</u> | - | <u>Fatigue tests is to be carried out for butt welded joints and is in accordance with Pt7, Chapter 5, 418.2.(4).(B).</u> | <u>S-N curve should be equal to or above D curve in IIW.</u> |

Table 2.2.2 Test Items and Selection of Test Specimens (continued) (2018) (2019)

| Approval test items | | Position of the Sample | Direction of the test specimens | Approval Testing method | acceptance criteria |
|----------------------------------|-------------------------|------------------------|------------------------------------|--|---|
| Brittle fracture test | CTOD test | T | P | BS 7448 or equivalent. To be consulted with the Society the dimension of test specimen, test condition, etc, when newly performing tests at the time of approval. | Acceptance criteria is the reference. |
| | NRL drop weight test | T | P ⁽⁷⁾ | ASTM E 208 or equivalent method. The NDTT(Non- Ductility transition temperature) is to be determined and photographs of the tested specimens are to be taken and enclosed with the test report. | Acceptance criteria is the reference. However, in case of rolled steels for hull structural, no fracture to be occurred at the impact test temperature specified in Pt 2, Ch 1, 301. of the Rules. |
| Weldability test | Weldment tensile test | T | T(to the welding direction) | in accordance with the test method described in below 203. 3 | in accordance with the test method described in below 203. 3 |
| | Weldment impact test | T | | | |
| | Maximum hardness test | T | - | | |
| | Macro structure | T | - | | |
| | <u>Fatigue test</u> | <u>T</u> | <u>T(to the welding direction)</u> | <u>Fatigue tests is to be carried out for butt welded joints and is in accordance with Pt7, Chapter 5, 418.2.(4).(B).</u> | <u>S-N curve should be equal to or above D curve in IIW.</u> |
| High temp. characteristics tests | High temp. tensile test | T | P | KS D0026 (High temp. tensile test), KS B 0814 (Creep test) or equivalent.. To be consulted with the Society on the dimension of test specimen, test condition etc, when newly performing tests at the time of Approval. | Acceptance criteria is the reference. |
| | Creep test | T | P | | |
| Corrosion resistance test | Corrosion test | T | - | ISO 3651-2, ISO 3651-1, KS D 0222 or equivalent method. For duplex stainless steel(<i>RSTS31803, RSTS32750</i>), corrosion test shall be carry out in accordance with ASTM G48 Method A or equivalent method. The test temperature shall be 20°C (±2) for <i>RSTS31803</i> , 50°C(±2) for <i>RSTS32750</i> and the exposure time shall be minimum 24h. | Acceptance criteria is the reference. For duplex stainless steel (<i>RSTS31803, RSTS32750</i>), no pitting is required at 20 X magnification. The weight loss is to be less than 4.0 g/m ² . |
| | | | | <u>For high manganese austenitic steel, general corrosion test shall be carried out in accordance with ASTM NACE/ASTM G31-12a or equivalent method. Intergranular corrosion test shall follow ASTM A262 or equivalent method and stress corrosion cracking test shall be lined with ASTM G36 and ASTM G123 or equivalent method.</u> | <u>Acceptance criteria is the reference.</u> |
| Non-destructive test | Ultrasonic test | All surface | - | KS D 0234 (Clad Steels), KS D 0233 (Steels with through thickness property), KS D 0248 (Bars for chains) or equivalent method. | Clad Steels to be met the requirements of class 1 of KS D 0234 . Others to be free from any defects deemed to have negative effect. |

Notes

(0) The followings can be shown the example of the position (Top and Bottom) where the test samples are detached



(1) For rolled steels for hull, the content of the following elements is to be checked: C, Mn, Si, P, S, Ni, Cr, Mo, Al, N, Nb, V, Cu, As, Sn, Ti and, for steel manufactured from electric or open-hearth furnace, Sb and B.

(2) For thick products in general at least three examinations are to be made at surface, one quarter and mid-thickness of the