

Present	Amendment
<p style="text-align: center;"><b>CHAPTER 1 MATERIALS</b></p> <p style="text-align: center;"><b>Section 1 General</b></p> <p><b>101. Application</b></p> <p>1. &lt;Omitted&gt;</p> <p>2. The materials other than those prescribed in this Chapter may be used where specially approved in connection with the design. In such cases, the detailed data relating to the chemical compositions and mechanical properties, etc. of the materials are to be submitted for approval.</p> <p>3. &lt;New&gt;</p> <p>3. &lt;Omitted&gt;</p> <p><b>102. ~ 106. &lt;Omitted&gt;</b></p> <p><b>107. Test certificates (2017)</b></p> <p>1. ~ 3. &lt;Omitted&gt;</p> <p>4. &lt;New&gt;</p> <p><b>108. &lt;Omitted&gt;</b></p> <p><b>109. Retest procedures</b></p> <p>1. ~ 2. &lt;Omitted&gt;</p> <p>3. If a heat treated material fails to meet the requirements in any test, retest and heat treatment may be allowed two times(three times including the first test) with the same number of specimens as the initial test. In this case, however, the material is not to be considered as having complied with the requirements, unless all tests fully comply with the test requirements. (2018)</p> <p>4. &lt;Omitted&gt;</p> <p><b>110. &lt;Omitted&gt;</b></p>	<p style="text-align: center;"><b>CHAPTER 1 MATERIALS</b></p> <p style="text-align: center;"><b>Section 1 General</b></p> <p><b>101. Application</b></p> <p>1. &lt;Same as the present Rules&gt;</p> <p>2. The materials other than those prescribed in this Chapter may be used where specially approved in connection with the design. In such cases, the detailed data relating to the chemical compositions and mechanical properties, etc. of the materials are to be submitted for approval.</p> <p>3. <u>The material equivalent to this Chapter may be used without approval of 2. In such cases, except as otherwise specified, chemical composition and mechanical properties are to be in accordance with the relevant standards, and the requirements of each Chapter are to be applied for approval of manufacturing process, testing and inspection. (2019)</u></p> <p>4. &lt;Same as the present Rules&gt;</p> <p><b>102. ~ 106. &lt;Same as the present Rules&gt;</b></p> <p><b>107. Test certificates (2017)</b></p> <p>1. ~ 3. &lt;Same as the present Rules&gt;</p> <p>4. <u>The manufacturer is to keep the test certificates more than 10 years from the supply date of products for identification and handling. (2019)</u></p> <p><b>108. &lt;Same as the present Rules&gt;</b></p> <p><b>109. Retest procedures</b></p> <p>1. ~ 2. &lt;Same as the present Rules&gt;</p> <p>3. If a heat treated material fails to meet the requirements in any test, retest and heat treatment may be allowed two times(three times including the first test) with the same number of specimens as the initial test. In this case, however, the material is not to be considered as having complied with the requirements, unless all tests fully comply with the test requirements. (2018)</p> <p>4. &lt;Same as the present Rules&gt;</p> <p><b>110. &lt;Same as the present Rules&gt;</b></p>

Present	Amendment
<p style="text-align: center;"><b>Section 4 Steel Tubes and Pipes</b></p> <p><b>401. ~ 402. &lt;Omitted&gt;</b></p> <p><b>403. Stainless steel pipes</b></p> <p>1. ~ 4. &lt;Omitted&gt;</p> <p><b>5. Mechanical properties</b></p> <p>(1) The mechanical properties of stainless steel pipes are to comply with the following requirements.</p> <p>(a) <i>Tensile test</i> The tensile test of stainless steel pipes is to comply with the requirements given in <b>Table 2.1.61</b>.</p> <p>(b) <i>Flattening test</i> Flattening tests are to be carried out in accordance with the requirements in <b>402. 5 (2)</b>. However, where the requirements are applied, the value of e is to be taken as 0.09.</p> <p>(c) &lt;New&gt;</p> <p>(2) &lt;Omitted&gt;</p> <p>6. ~ 11. &lt;Omitted&gt;</p> <p><b>404. ~ 405. &lt;Omitted&gt;</b></p>	<p style="text-align: center;"><b>Section 4 Steel Tubes and Pipes</b></p> <p><b>401. ~ 402. &lt;Same as the present Rules&gt;</b></p> <p><b>403. Stainless steel pipes</b></p> <p>1. ~ 4. &lt;Same as the present Rules&gt;</p> <p><b>5. Mechanical properties</b></p> <p>(1) The mechanical properties of stainless steel pipes are to comply with the following requirements.</p> <p>(a) <i>Tensile test</i> The tensile test of stainless steel pipes is to comply with the requirements given in <b>Table 2.1.61</b>.</p> <p>(b) <i>Flattening test</i> Flattening tests are to be carried out in accordance with the requirements in <b>402. 5 (2)</b>. However, where the requirements are applied, the value of e is to be taken as 0.09.</p> <p>(c) <i>Guided Bend test</i> <u>For welded steel pipes of 200A and over, the flattening test may be substituted for that for guided bend test.</u> <i>(2019)</i></p> <p>(2) &lt;Same as the present Rules&gt;</p> <p>6. ~ 11. &lt;Same as the present Rules&gt;</p> <p><b>404. ~ 405. &lt;Same as the present Rules&gt;</b></p>

Present	Amendment
<p align="center"><b>Section 4 Welding Procedure Qualification Tests</b> [See Guidance]</p> <p><b>401. General</b></p> <p><b>1. Application</b></p> <p>(1) <u>The welding procedures to be applied to hull construction specified in this Chapter as well as cargo tank, secondary barriers and piping arrangements in ships carrying liquefied gases in bulk, are to be those satisfactorily complying with the welding procedure qualification tests specified in this Section.</u></p> <p>(2) <u>The welding procedures qualification test for areas other than those specified in (1) is to be in accordance with the Guidance in relating to Rules. [See Guidance]</u></p> <p>2. &lt;Omitted&gt;</p> <p><b>3. General requirements of WPQT</b></p> <p>(1) The manufacturers are to obtain the approval of the welding procedure qualifications before the welding works in the following case specified in (a) through (b)</p> <p>(a) Where the welding procedure is first adopted for welding works specified in 1.</p> <p>(i) &lt;New&gt;</p> <p>(ii) &lt;New&gt;</p> <p>(iii) &lt;New&gt;</p> <p>(iv) &lt;New&gt;</p> <p>(b) &lt;Omitted&gt;</p> <p>(2) &lt;Omitted&gt;</p>	<p align="center"><b>Section 4 Welding Procedure Qualification Tests</b> [See Guidance]</p> <p><b>401. General</b></p> <p><b>1. Application</b></p> <p>(1) <u>The welding procedures to be applied to hull construction, machinery and piping specified in this Chapter are to be those satisfactorily complying with the welding procedure qualification tests specified in this Section. (2019)</u></p> <p>(2) <u>The welding procedures qualification test for cargo tank, secondary barriers and piping arrangements in ships carrying liquefied gases in bulk, and for the low-flashpoint fuels tank are to be in accordance with Pt 7, Ch 5, Sec 6 of Rules and Rules/Guidances for the Classification of Ships Using Low-flashpoint Fuels. (2019)</u></p> <p>2. &lt;Same as the present Rules&gt;</p> <p><b>3. General requirements of WPQT</b></p> <p>(1) The manufacturers are to obtain the approval of the welding procedure qualifications before the welding works in the following case specified in (a) through (b)</p> <p>(a) Where the welding procedure is first adopted for welding works specified in 1. and as follows. (2019)</p> <p>(i) <u>Welding work for boiler, Class 1 and Class 2 pressure vessels</u></p> <p>(ii) <u>Welding work for principal components of machinery (the principal components specified in Table 5.2.4 of Pt 5, Ch 2 and Ch 3 of the Rules) and piping system</u></p> <p>(iii) <u>Welding work using special materials</u></p> <p>(iv) <u>Welding work using special welding process</u></p> <p>(b) &lt;Same as the present Rules&gt;</p> <p>(2) &lt;Same as the present Rules&gt;</p>

Present	Amendment
<p><b>402. Welding procedure specification</b></p> <p>1. &lt;Omitted&gt;</p> <p>2. The pWPS can be modified and amended during procedure tests as deemed necessary however it is to define, at least, the following welding variables.</p> <ul style="list-style-type: none"> <li>(1) Kind of base metal</li> <li>(2) Nominal thickness or diameter range(dimensions)</li> <li>(3) Welding process</li> <li>(4) Joint or groove designs with tolerances</li> <li>(5) Welding position(s) and direction of progression</li> <li>(6) Welding consumables(grade, shielded gas, backing, flux, etc.)</li> <li>(7) Electrical characteristics(amperage, voltage and pole nature etc.)</li> <li>(8) Travel speed and heat input ranges</li> <li>(9) Preheat and maximum interpass temperature</li> <li>(10) Post weld heat temperature (if any)</li> <li>(11) &lt;New&gt;</li> </ul> <p>(11) Other conditions necessary for the welding procedure (ex. : welding speed, heat input etc.)</p> <p>3. ~ 6. &lt;Omitted&gt;</p>	<p><b>402. Welding procedure specification</b></p> <p>1. &lt;Same as the present Rules&gt;</p> <p>2. The pWPS can be modified and amended during procedure tests as deemed necessary however it is to define, at least, the following welding variables.</p> <ul style="list-style-type: none"> <li>(1) Kind of base metal</li> <li>(2) Nominal thickness or diameter range(dimensions)</li> <li>(3) Welding process</li> <li>(4) Joint or groove designs with tolerances</li> <li>(5) Welding position(s) and direction of progression</li> <li>(6) Welding consumables(grade, shielded gas, backing, flux, etc.)</li> <li>(7) Electrical characteristics(amperage, voltage and pole nature etc.)</li> <li>(8) Travel speed and heat input ranges</li> <li>(9) Preheat and maximum interpass temperature</li> <li>(10) Post weld heat temperature (if any)</li> <li>(11) <del>Wire/strip feed speed range(for fully mechanized or automatic) (2019)</del></li> </ul> <p>(11) Other conditions necessary for the welding procedure (ex. : welding speed, heat input etc.)</p> <p>3. ~ 6. &lt;Same as the present Rules&gt;</p>
<p><b>403. Welding procedure qualification tests(WPQT)</b></p> <p>1. ~ 2. &lt;Omitted&gt;</p> <p>3. &lt;New&gt;</p> <p>3. ~ 6. &lt;Omitted&gt;</p>	<p><b>403. Welding procedure qualification tests(WPQT)</b></p> <p>1. ~ 2. &lt;Same as the present Rules&gt;</p> <p>3. <u>The laboratory or testing establishment used to perform the tests is to have the necessary equipment, maintained in good order and suitably calibrated. And Pt 2, Ch 1, 201. of Rules is applied on those. (2019)</u></p> <p>4. ~ 7. &lt;Same as the present Rules&gt;</p>

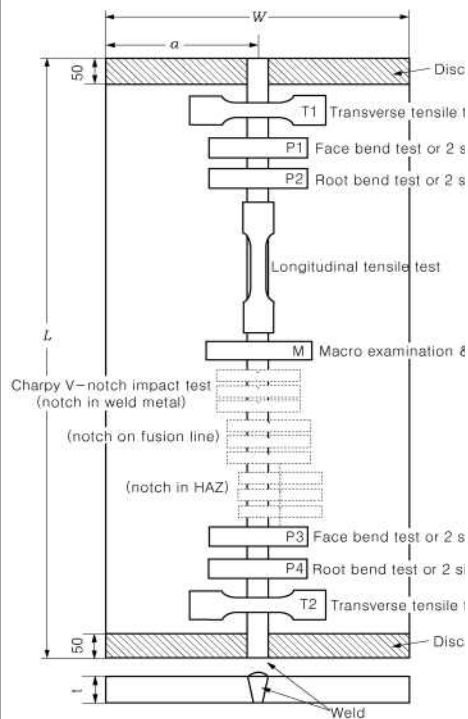
## Present

### 404. Tests for butt welded joints

1. ~ 2. <Omitted>

#### 3. Test assemblies

- (1) Test assemblies are to be prepared with the same or equivalent material used in the actual work.
- (2) The dimensions and types of test assembly are to be as indicated in **Fig 2.2.6**.



(Note)

The test assembly is to be of a size with the minimum dimensions:

- (1) manual or semi-automatic welding:

Width(W) : min. 300mm  
Length(L) : min. 350mm

- (2) automatic welding

Width(W) : min. 400mm  
Length(L) : min. 1,000mm

(A) Test assembly for Hull Structural Steels, High Strength Quenching and Tempered Steels, Stainless Steels or Aluminium Alloys

**Fig 2.2.6 Welding procedure test assembly** (Unit : mm) (cont'd)

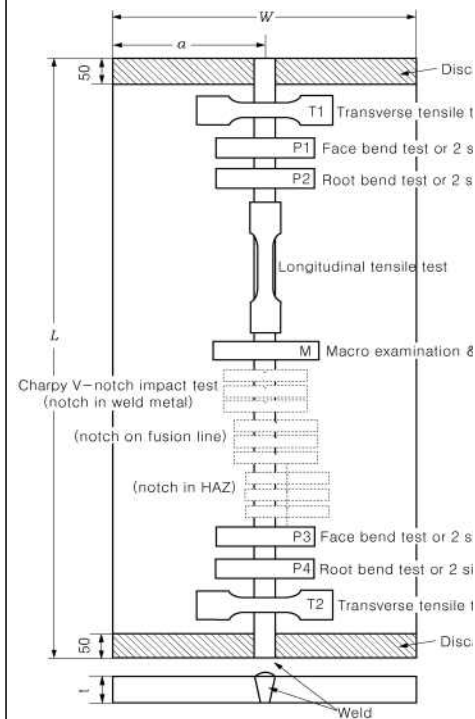
## Amendment

### 404. Tests for butt welded joints

1. ~ 2. <Omitted>

#### 3. Test assemblies

- (1) Test assemblies are to be prepared with the same or equivalent material used in the actual work.
- (2) The dimensions and types of test assembly are to be as indicated in **Fig 2.2.6**.



(Note)

The test assembly is to be of a size with the minimum dimensions:

- (1) manual or semi-automatic welding:

Width(W) : min. 300mm  
Length(L) : min. 350mm

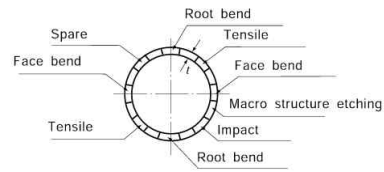
- (2) automatic welding

Width(W) : min. 400mm  
Length(L) : min. 1,000mm

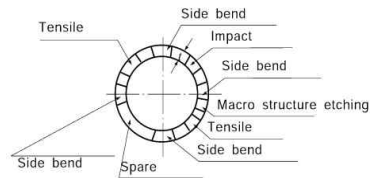
(A) Test assembly for Hull Structural Steels, High Strength Quenching and Tempered Steels, Stainless Steels, Rolled steels for boiler/pressure vessel/low temp' service or Aluminium Alloys (2019)

**Fig 2.2.6 Welding procedure test assembly** (Unit : mm) (cont'd)

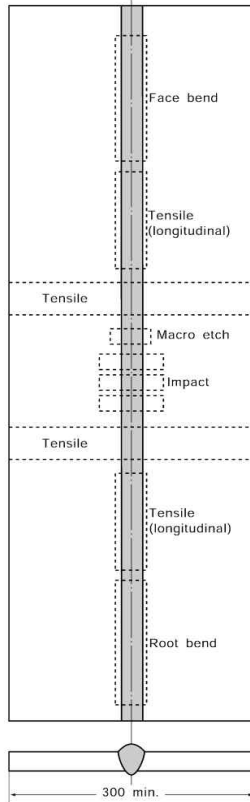
**Present**



(B) Test assembly for pipes up to 20mm in thickness



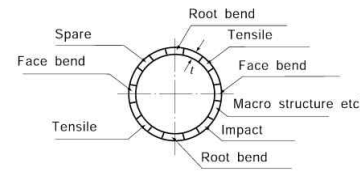
(C) Test assembly for pipes over 20mm in thickness



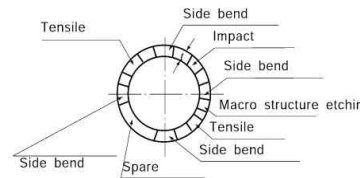
(D) Test assembly for *RL9N490*

**Fig 2.2.6 Welding procedure test assembly (Unit : mm)**

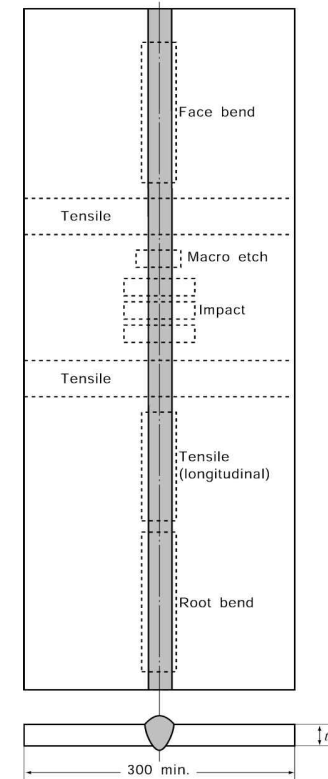
**Amendment**



(B) Test assembly for pipes less than 19mm in thickness



(C) Test assembly for pipes 19mm and over in thickness



(Note)

If base material and weld metal have not markedly different strength levels, two transverse bend specimens may alternatively be tested for two longitudinal bend specimens. (2019)

(D) Test assembly for *RL9N490*

**Fig 2.2.6 Welding procedure test assembly (Unit : mm)**

Present	Amendment
<p>(3) &lt;Omitted&gt;</p> <p>(4) <u>Test assemblies for the pipes over 500 mm in outer diameter at the actual work may be those for the plates.</u></p> <p>(5) &lt;Omitted&gt;</p> <p><b>4. Visual inspection</b></p> <p><del>— Welding surface is to be regular and uniform surface and is to be free from injurious defects, such as cracks, undercuts, overlaps, etc.</del></p> <p><b>5. Tensile tests</b></p> <p>(1) The number of tensile test specimens taken from each test assembly is to be as shown in <b>Table 2.2.4</b>.</p>	<p>(3) &lt;Same as the present Rules&gt;</p> <p>(4) <u>When the test for plate is approved, the welding for the pipes over 500 mm in outer diameter is permitted. And when the test for pipes over 25 mm is approved, the welding for the plates is permitted. (2019)</u></p> <p>(5) &lt;Same as the present Rules&gt;</p> <p><b>4. &lt;Deleted&gt;</b></p> <p><b>4. Tensile tests</b></p> <p>(1) The number of tensile test specimens taken from each test assembly is to be as shown in <b>Table 2.2.4</b> and <b>Table 2.2.5. (2019)</b></p>

<Present>

**Table 2.2.4 Kinds of Test for Butt Welded Joints (2017)**

Grades and material symbols of test specimens			Kinds and number of specimens for test <sup>(1)</sup>					Non-destructive insp. <sup>(4)</sup>
			Visual insp.	Tensile test	Bend test	Impact test	Macro-structure insp.	
Rolled steels for hull structural	Normal strength steel	<i>A, B, D, E</i>	2	4 <sup>(2)</sup>			-	
	Higher strength steel	<i>AH 32, DH 32, EH 32, FH 32, AH 36, DH 36, EH 36, FH 36, AH 40, DH 40, EH 40, FH 40</i>					1 <sup>(11)</sup>	
Rolled steels for low temperature service		<i>RL235A, RL235B, RL325A, RL325B, RL360, RL 1N355, RL 2N255, RL 3N355, RL 5N390</i> <i>RL 9N490</i>	4 <sup>(5)</sup>	2	(3)	1	-	
Steel pipes for low temperature service		<i>RLPA, RLPB, RLPC, RLP 2, RLP 3, RLP 9</i>						
Weldable high strength steel		<i>AH 43, DH 43, EH 43, FH 43, AH 47, DH 47, EH 47, FH 47, AH 51, DH 51, EH 51, FH 51, AH 56, DH 56, EH 56, FH 56, AH 63, DH 63, EH 63, FH 63, AH 70, DH 70, EH 70, FH 70</i>	2	4 <sup>(2)</sup>	(3)(10)	1	1 <sup>(++)</sup>	Welding positions of whole length
Casting for welded construction and Hull steel forging		<i>RSC 410, RSC 450, RSC 480, RSC 520, RSC 560, RSC 600, RSC 440A, RSC 480A, RSC 550A, RSF 410H, RSF 450H, RSF 480H, RSF 520H, RSF 560H, RSF 600H, RSF 550AH, RSF 600AH, RSF 650AH</i>						
Rolled stainless steels		<i>RSTS 304, RSTS 304L, RSTS 304N1, RSTS 304N2, RSTS 304LN, RSTS 309S, RSTS 310S, RSTS 316, RSTS 316L, RSTS 316N, RSTS 316LN, RSTS 317, RSTS 317L, RSTS 317LN, RSTS 321, RSTS 347</i>	4	2	(6)	1	-	
Stainless steel pipes		<del><i>RSTS 304TP, RSTS 304LTP, RSTS 309STP, RSTS 310STP, RSTS 316TP, RSTS 316LTP, RSTS 317TP, RSTS 317LTP, RSTS 321TP, RSTS 347TP</i></del>						
Aluminium alloys <sup>(7)</sup>	5000 series	<i>5083P, 5383P, 5059P, 5086P, 5754P, 5083S, 5383S, 5059S, 5086S<sup>(8)</sup></i>	4 <sup>(2)</sup>				-	
	6000 series	<i>60054S, 6061S, 6082S<sup>(9)</sup></i>						



NOTES:

- (1) Where found necessary by the Society, microscopic test, hardness test and tests other than these may be required. **[See Guidance]**
- (2) Two root and two face bend specimens are to be tested. For thickness 12 mm and over, four side bend specimens may alternatively be tested.
- (3) No. of test sets and position of notch are as shown in **Fig 2.2.7**.
- (4) Internal inspections by radiographic examination or ultrasonic examination and surface inspections by magnetic particle examination or liquid penetrant examination are to be carried out.
- (5) Two specimens are to be taken longitudinally and transversely respectively (See. Fig 2.2.6)
- ~~(6) Where found necessary by the Society, impact tests up to steels specially used for may be required. **[See Guidance]**~~
- (7) Material symbols of aluminium alloys include the symbols of which is the temper condition.
- (8) Rolled products which have the same grade and temp condition may be used.
- (9) Other rolled aluminium alloys of 6000 series with minimum tensile strength  $260 \text{ N/mm}^2$  may be used.
- (10) Where impact test is required.
- (11) Hardness test ( $H_v10$ ) is required for weldable high strength steel and hull structural steel with specified minimum yield strength of  $R_{eH} \geq 355 \text{ N/mm}^2$

<Amendment>

Table 2.2.4 Kinds of Test for Plates with Butt Welded Joints (2017) (2019)

Grades and material symbols of test specimens			Kinds and number of specimens for test <sup>(1)</sup>											
			Visual insp.	Tensile test	Bend test	Impact test	Macro-structure insp.	Hard. test	Non-destructive insp. <sup>(4)</sup>	Brittle fracture initiation test				
Rolled steels for hull structural	Normal strength steel	<i>A, B, D, E</i>	2	4 <sup>(2)</sup>	(3)	1	-	-	-					
	Higher strength steel	<i>AH 32, DH 32, EH 32, FH 32, AH 36, DH 36, EH 36, FH 36, AH 40, DH 40, EH 40, FH 40</i>					1 <sup>(10)</sup>							
		<i>EH 47-H</i>					1 <sup>(13)</sup>							
Rolled steels for low temperature service	<i>RL235A, RL235B, RL325A, RL325B, RL360, RL 1N355, RL 2N255, RL 3N355, RL 5N390</i>		3 <sup>(5)</sup>	2	(3)	1	1	-	-					
	<i>RL 9N490</i>													
Weldable high strength steel		<i>AH 43, DH 43, EH 43, FH 43, AH 47, DH 47, EH 47, FH 47, AH 51, DH 51, EH 51, FH 51, AH 56, DH 56, EH 56, FH 56, AH 63, DH 63, EH 63, FH 63, AH 70, DH 70, EH 70, FH 70, AH 90, DH 90, EH 90, AH 97, DH 97, EH 97</i>	2	4 <sup>(2)</sup>	(3) <sup>(9)</sup>	1	1	-	-					
Casting for welded construction and Hull steel forging		<i>RSC 410, RSC 450, RSC 480, RSC 520, RSC 560, RSC 600, RSC 440A, RSC 480A, RSC 550A, RSF 410H, RSF 450H, RSF 480H, RSF 520H, RSF 560H, RSF 600H, RSF 550AH, RSF 600AH, RSF 650AH</i>					-			-	-	-	-	-
Rolled stainless steels		<i>RSTS 304, RSTS 304L, RSTS 304N1, RSTS 304N2, RSTS 304LN, RSTS 309S, RSTS 310S, RSTS 316, RSTS 316L, RSTS 316N, RSTS 316LN, RSTS 317, RSTS 317L, RSTS 317LN, RSTS 321, RSTS 347</i>												
Aluminium alloys <sup>(6)</sup>	5000 series	<i>5083P, 5383P, 5059P, 5086P, 5754P, 5083S, 5383S, 5059S, 5086S<sup>(7)</sup></i>	-	-	-	-	-	-	-					
	6000 series	<i>6005AS, 6061S, 6082S<sup>(8)</sup></i>												
Rolled steel plates for boiler & pressure vessel	Boiler and class 1 pressure vessel <sup>(11)</sup>	<i>RSP 24, RSP 30, RSP 32, RSP 30A, RSP 32A,</i>	4 <sup>(2)</sup>	3 set <sup>(12)</sup>	-	1	1	-	-					
	Class 2 pressure vessel <sup>(11)</sup>	<i>RPV 24, RPV 32, RPV 36, RPV 42, RPV 46, RPV 50, etc.</i>												
	Class 3 pressure vessel <sup>(11)</sup>													
The tests may be omitted according to the discretion of the Society														

NOTES:

- (1) Where found necessary by the Society, microscopic test, hardness test and tests other than these may be required. **[See Guidance]**
- (2) Two root and two face bend specimens are to be tested. For thickness 12 mm and over, four side bend specimens may alternatively be tested. Where rolled steel plates for boiler & pressure vessel were tested, four side bend specimens may alternatively be tested for two root and two face bend specimens.
- (3) No. of test sets and position of notch are as shown in **Fig 2.2.7**.
- (4) Internal inspections by radiographic examination or ultrasonic examination and surface inspections by magnetic particle examination or liquid penetrant examination are to be carried out. Where rolled steel plates for boiler & pressure vessel were tested, radiographic examination is to be carried out for internal inspections.
- (5) Two specimens are to be taken transversely and one specimen is to be taken longitudinally (See Fig 2.2.6)
- (6) Material symbols of aluminium alloys include the symbols of which is the temper condition.
- (7) Rolled products which have the same grade and temp condition may be used.
- (8) Other rolled aluminium alloys of 6000 series with minimum tensile strength  $260 \text{ N/mm}^2$  may be used.
- (9) Where impact test is required.
- (10) Hardness test ( $H_v10$ ) is required for hull structural steel with specified minimum yield strength of  $R_{eH} \geq 355 \text{ N/mm}^2$
- (11) The classification for pressure vessel is in accordance with Pt 5, Ch 5.
- (12) The positions of notches are a,b,c in Fig 2.2.7.
- (13) Deep notch test or CTOD test may be required. However brittle fracture test may be waived for the welding procedure of heat input less than 200 kJ/cm.

<New>

**Table 2.2.5 Kinds of Test for Pipes with Butt Welded Joints (2019)**

Grades and material symbols of test specimens		Kinds and number of specimens for test <sup>(1)(2)(3)</sup>					
		Visual insp.	Tensile test	Bend test <sup>(5)</sup>	Impact test <sup>(6)</sup>	Macro-structure insp.	Hard. test
The pipes for ordinary piping	<i>RSTH 35, RSTH 42, RSTH 52, RSTH 12, RSTH 22, RSTH 23, RSTH 24,</i>	Welding positions of whole length	2	4	-	1	Welding positions of whole length <sup>(9)</sup>
The pipes used for high temperature and high pressure <sup>(4)</sup>	<i>RST 138, RST 142, RST 238, RST 242, RST 249, RST 338, RST 342, RST 349, RST 412, RST 422, RST 423, RST 424, RBH 1, RBH 2, RBH 3, RBH 4, RBH 5, RBH 6, etc.</i>				(7)		
Steel pipes for low temperature service	<i>RLPA, RLPB, RLPC, RLP 2, RLP 3, RLP 9</i>				(8)		
Stainless steel pipes	<i>RSTS 304TP, RSTS 304LTP, RSTS 309STP, RSTS 310STP, RSTS 316TP, RSTS 316LTP, RSTS 317TP, RSTS 317LTP, RSTS 321TP, RSTS 347TP</i>				-		

Notes :

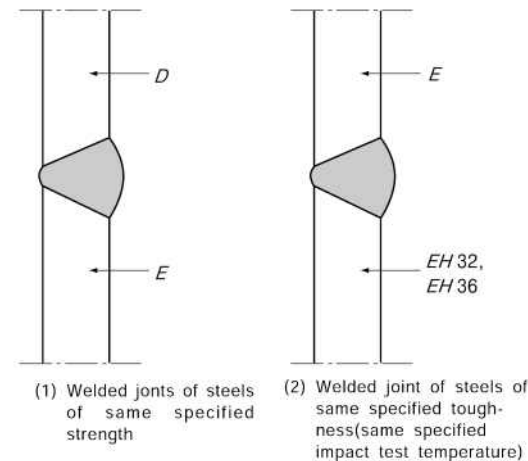
- (1) Where found necessary by the Society, microscopic test, hardness test and tests other than these may be required. **[See Guidance]**
- (2) Regardless of the above, as for those of less than 50 mm in outer diameter, test assemblies are to be prepared by two sets, one for tensile test, the other for macro, micro structure and hardness distribution examinations to be carried out respectively.
- (3) For the welding procedure qualification tests on materials used at high temperature, the Society may require a creep test or high temperature tensile test.
- (4) For steam pipes and flanges to be used in the place where the design pressure is not less than 30 kgf/cm<sup>2</sup> and the design temperature exceeds 400°C.
- (5) Where preparation of the above test specimens is not possible depending on pipe's diameter, test specimens for face bend test and root bend test may be reduced to one set each for those of 19 mm thickness or less, and for side bend test may be reduced to one set for those of over 19 mm.
- (6) In a case where preparation of impact test specimens is not possible depending on pipe's dimensions or in case where welding is made with a base metal having no impact value required, impact test may be omitted subject to the approval of the Society.
- (7) The position of notch is "a" in **Fig 2.2.7**.
- (8) Position of notch is as shown in **Fig 2.2.7**.
- (9) For those with an outer diameter of 130 mm or above, and with a design working pressure 30 kgf/cm<sup>2</sup> or above, and further with maximum design temperature over 400°C. However, even for the pipes having an outer diameter of less than 130 mm, radiographic examination depending on material and working condition may be required.
- (10) Internal inspections by radiographic examination or ultrasonic examination and surface inspections by magnetic particle examination or liquid penetrant examination are to be carried out.

### Present

(2) Tensile tests are to be carried out with the test specimen shown in **Table 2.2.1**. The tensile strength is not to be less than the minimum tensile strength specified for the base metal except for those specified in **Table 2.2.5**. When butt welds are made between plates of different grades, the tensile strength to be obtained on the welded assembly is to be in accordance with the requirements relating to the steel grade having lower strength. —{See Guidance}—

### Amendment

(2) Tensile tests are to be carried out with the test specimen shown in **Table 2.2.1**. The tensile strength is not to be less than the minimum tensile strength specified for the base metal except for those specified in **Table 2.2.6**. When butt welds are made between plates of different grades, the tensile strength to be obtained on the welded assembly is to be in accordance with the requirements relating to the steel grade having lower strength. In this case, "lower strength grade of steel" means grade E of Fig 2.2.7, (2). (2019)



**Fig 2.2.7 Butt Welds between Different Steel Grades (2019)**

Present	Amendment
<p>(3) In those cases where the consumables are not unavoidably approved by the Society, it is to be required additionally to prepare a R 14A deposited metal tensile test specimen as shown in <b>Table 2.2.1</b> in entirely weld metal and the tensile properties recorded for each specimen are not to be less than the minimum required for the approval of the appropriate grade of consumable. Where more than one welding process or type of consumable has been used to make the test weld, test specimens are to be taken from the area of the weld where each was used with the exception of those processes or consumables used to make the first weld run or root deposit. <del>[See Guidance]</del></p> <p><b>6. Bend tests</b></p> <p>(1) &lt;Omitted&gt;</p> <p>(2) The shape and dimension of face bend specimen, root bend specimen or side bend specimen are to be as indicated in <i>RB1</i>, <i>RB2</i> or <i>RB3</i> of <b>Table 2.2.2</b>. Bend test procedure and inside bend diameter are to be as indicated in <b>Table 2.2.6</b>. There is to be no crack nor any other defect greater than 3 mm in length in any direction on the surface of bend specimen. (2018)</p> <p>(3) For butt joints in heterogeneous <u>steel plates</u>, face and root longitudinal bend test specimens may be used instead of the transverse bend test specimens.</p> <p><b>7. Impact tests</b></p> <p>(1) <i>Normal and higher strength hull structural steels</i></p> <p>(a) ~ (c) &lt;Omitted&gt;</p> <p>(d) Test temperature and absorbed energy are to be in accordance with <b>Table 2.2.7</b>.</p>	<p>(3) <u>In following cases</u> where the consumables are not unavoidably approved by the Society, it is to be required additionally to prepare a R 14A deposited metal tensile test specimen as shown in <b>Table 2.2.1</b> in entirely weld metal and the tensile properties recorded for each specimen are not to be less than the minimum required for the approval of the appropriate grade of consumable.</p> <p>(a) <u>For the urgency of the corresponding work schedule</u></p> <p>(b) <u>For a small quantity of welding consumables with the rare frequency of the survey in future</u></p> <p><u>Unless the welding consumables are approved by the Society, the Welding Procedure Specification is to be deemed valid only for same Lot with welding consumables used. And the Lot no. is to be stated in the Welding Procedure Specification. (2019)</u></p> <p>(4) Where more than one welding process or type of consumable has been used to make the test weld, test specimens are to be taken from the area of the weld where each was used with the exception of those processes or consumables used to make the first weld run or root deposit.</p> <p><b>5. Bend tests</b></p> <p>(1) &lt;Same as the present Rules&gt;</p> <p>(2) The shape and dimension of face bend specimen, root bend specimen or side bend specimen are to be as indicated in <i>RB1</i>, <i>RB2</i> or <i>RB3</i> of <b>Table 2.2.2</b>. Bend test procedure and inside bend diameter are to be as indicated in <b>Table 2.2.7</b>. There is to be no crack nor any other defect greater than 3 mm in length in any direction on the surface of bend specimen. (2018)</p> <p>(3) For butt joints in heterogeneous <u>base metals</u>, face and root longitudinal bend test specimens may be used instead of the transverse bend test specimens. (2019)</p> <p><b>6. Impact tests</b></p> <p>(1) <i>Normal and higher strength hull structural steels</i></p> <p>(a) ~ (c) &lt;Same as the present Rules&gt;</p> <p>(d) Test temperature and absorbed energy are to be in accordance with <b>Table 2.2.8</b>.</p>

## Present

**Table 2.2.7 Impact test requirements for butt joints** ( $t \leq 50$  mm)<sup>(1),(2)</sup>

Grade of steel	Test temp. (°C)	Value of minimum average absorbed energy (J) <sup>(4)</sup>		
		For manually or semi-automatically welded joints		For automatically welded joints
		Downhand, Horizontal, Overhead	Vertical upward, Vertical downward	
<i>A</i> <sup>(3)</sup>	20	47 min.	34 min.	34 min.
<i>B</i> <sup>(3)</sup> , <i>D</i>	0			
<i>E</i>	-20			
<i>AH 32</i> , <i>AH 36</i>	20			
<i>DH 32</i> , <i>DH36</i>	0			
<i>EH 32</i> , <i>EH 36</i>	-20			
<i>FH 32</i> , <i>FH 36</i>	-40			
<i>AH 40</i>	20	39 min.	39 min.	39 min.
<i>DH 40</i>	0			
<i>EH 40</i>	-20			
<i>FH 40</i>	-40			

Note:

- (1) For thickness above 50 mm, impact test requirements are to be agreed by the Society. **[See Guidance]**
- (2) These requirements are to apply to test piece of which butt weld is perpendicular to the rolling direction of the plates.
- (3) For Grade A and B steels average absorbed energy on fusion line and in heat affected zone is to be minimum 27 J.
- (4) When the absorbed energy of two or more test specimens among a set of test specimens is less in value than the specified average absorbed energy or when the absorbed energy of a single test specimen is less in value than 70 % of the specified average absorbed energy, the test is considered to have failed.

## Amendment

**Table 2.2.7 Impact test requirements for butt joints** ( $t \leq 50$  mm)<sup>(1),(2)</sup> **(2019)**

Grade of steel	Test temp. (°C)	Value of minimum average absorbed energy (J) <sup>(4)</sup>		
		For manually or semi-automatically welded joints		For automatically welded joints
		Downhand, Horizontal, Overhead	Vertical upward, Vertical downward	
<i>A</i> <sup>(3)</sup>	20	47 min.	34 min.	34 min.
<i>B</i> <sup>(3)</sup> , <i>D</i>	0			
<i>E</i>	-20			
<i>AH 32</i> , <i>AH 36</i>	20			
<i>DH 32</i> , <i>DH36</i>	0			
<i>EH 32</i> , <i>EH 36</i>	-20			
<i>FH 32</i> , <i>FH 36</i>	-40			
<i>AH 40</i>	20	39 min.	39 min.	39 min.
<i>DH 40</i>	0			
<i>EH 40</i>	-20			
<i>FH 40</i>	-40			
<i>EH 47-H</i> ( $t > 50$ mm)	-20	64 min.		

Note:

- (1) For thickness above 50 mm other than *EH47-H*, impact test requirements are to be agreed by the Society. **[See Guidance]**
- (2) These requirements are to apply to test piece of which butt weld is perpendicular to the rolling direction of the plates.
- (3) For Grade A and B steels average absorbed energy on fusion line and in heat affected zone is to be minimum 27 J.
- (4) When the absorbed energy of two or more test specimens among a set of test specimens is less in value than the specified average absorbed energy or when the absorbed energy of a single test specimen is less in value than 70 % of the specified average absorbed energy, the test is considered to have failed.

Present	Amendment
<p>(e) When butt welds are made between different steel grades/types, the test specimens are to be taken from the side of the joint with lower toughness of steel. Temperature and absorbed energy results are to be in accordance with the requirements for the lower toughness steel. <b>[See Guidance]</b></p> <p>(f) ~ (g) &lt;Omitted&gt;</p> <p>(2) ~ (3) &lt;Omitted&gt;</p> <p>(4) <u>Steels for low temperature Service</u></p> <p>(a) The test specimen is to be charpy V-notch impact test specimen as shown in <b>Table 2.1.3</b> and to be taken from the position in <b>Fig 2.2.6</b>.</p> <p>(b) The number of test specimens taken from test assemblies, the position of notch for the test specimen, test temperature and absorbed energy are as specified in <b>Table 2.2.8</b>.</p> <p><del>(5) <u>Rolled stainless steels and stainless steel pipes</u></del></p> <p><del>(a) Where deemed necessary by the Society, impact test may be required.</del></p> <p><del>(b) Test temperature and absorbed energy are to be in accordance with the requirements of base metal</del></p> <p><u>(5) &lt;New&gt;</u></p> <p><u>(6) &lt;New&gt;</u></p>	<p>(e) When butt welds are made between different steel grades/types, the test specimens are to be taken from the side of the joint with lower toughness of steel. Temperature and absorbed energy results are to be in accordance with the requirements for the lower toughness steel. <u>In this case, "lower toughness grade of steel" means grade D of <b>Fig 2.2.7</b>, (1). (2019)</u></p> <p>(f) ~ (g) &lt;Same as the present Rules&gt;</p> <p>(2) ~ (3) &lt;Same as the present Rules&gt;</p> <p>(4) <u>Steels &amp; Pipes for low temperature Service (2019)</u></p> <p>(a) The test specimen is to be charpy V-notch impact test specimen as shown in <b>Table 2.1.3</b> and to be taken from the position in <b>Fig 2.2.6</b>.</p> <p>(b) The number of test specimens taken from test assemblies, the position of notch for the test specimen, test temperature and absorbed energy are as specified in <b>Table 2.2.8</b>.</p> <p><u>(5) &lt;Deleted&gt;</u></p> <p><u>(5) <u>Rolled steel plates for boiler and class 1 pressure vessel (2019)</u></u></p> <p><u>(a) Impact test is to be performed as described in the above (1). The locations of notches are "a,b,c" of <b>Fig 2.2.8</b>.</u></p> <p><u>(b) Test temperature and absorbed energy are to be in accordance with the requirements of base metal.</u></p> <p><u>(6) <u>Pipes for high temperature and high pressure (2019)</u></u></p> <p><u>(a) Impact test is to be performed as described in the above (1). The location of notch is "a" of <b>Fig 2.2.8</b>.</u></p> <p><u>(b) Test temperature and absorbed energy are to be in accordance with the requirements of base metal.</u></p>



## Present

**Table 2.2.8 Impact Test Requirements for Butt Welded Joint** (Steels for low temperature Service)

Grade of steel	Test temp. (°C) <sup>(4)</sup>	A <sup>(1)</sup>			
		Value of average absorbed energy(J) <sup>(3)</sup>	B, C, D, E <sup>(1)</sup>		
			Value of average absorbed energy(J) <sup>(3)</sup>		
		L <sup>(2)</sup>	T <sup>(2)</sup>		
<i>RL 235A</i>	- 40	27 min.	41 min.	27 min.	
<i>RL 235B</i>	- 50				
<i>RL 325A</i>	- 50				
<i>RL 325B</i>	- 60				
<i>RL 360</i>	- 60				
<i>RL 1N355</i>	- 80				
<i>RL 2N255</i>	- 70				
<i>RL 3N355</i>	- 100				
<i>RL 5N390</i>	- 120				
<i>RL 9N490</i>	- 196				
<i>RLPA</i>	- 40		27 min.		
<i>RLPB</i>	- 50				
<i>RLPC</i>	- 60				
<i>RLP 2</i>	- 70				
<i>RLP 3</i>	- 95				
<i>RLP 9</i>	- 196	41 min.			

**NOTES:**

- (1) Position of notch as shown in Fig 2.2.7.
- (2) L(or T) indicates that the direction of welding is transverse (or parallel) to the rolling direction of test materials.
- (3) When the absorbed energy of two or more test specimens among a set of test specimens is less in value than the specified average absorbed energy or when the absorbed energy of a single test specimen is less in value than 70% of the specified average absorbed energy, the test is considered to have failed.
- (4) ~~Where requirements in Pt 7, Ch 5 apply, the impact test temperature is to be as given as follows:~~
  - (a) ~~Impact test temperature for RL 24A through RL 5N43 is to be the lower of the temperatures given in Table 2.1.18 specified in Pt 2, Ch 1.~~
  - (b) ~~Impact test temperature for RLPA through RLPC is to be either 5°C below the design temperature or -20°C whichever is the lower.~~

## Amendment

**Table 2.2.9 Impact Test Requirements for Butt Welded Joint** (Steels for low temperature Service) (2019)

Grade of steel	Test temp. (°C) <sup>(4)</sup>	A <sup>(1)</sup>			
		Value of average absorbed energy(J) <sup>(3)</sup>	B, C, D, E <sup>(1)</sup>		
			Value of average absorbed energy(J) <sup>(3)</sup>		
		L <sup>(2)</sup>	T <sup>(2)</sup>		
<i>RL 235A</i>	- 40	27 min.	41 min.	27 min.	
<i>RL 235B</i>	- 50				
<i>RL 325A</i>	- 50				
<i>RL 325B</i>	- 60				
<i>RL 360</i>	- 60				
<i>RL 1N355</i>	- 80				
<i>RL 2N255</i>	- 70				
<i>RL 3N355</i>	- 100				
<i>RL 5N390</i>	- 120				
<i>RL 9N490</i>	- 196				
<i>RLPA</i>	- 40		27 min.		
<i>RLPB</i>	- 50				
<i>RLPC</i>	- 60				
<i>RLP 2</i>	- 70				
<i>RLP 3</i>	- 95				
<i>RLP 9</i>	- 196	41 min.			

**NOTES:**

- (1) Position of notch as shown in Fig 2.2.7.
- (2) L(or T) indicates that the direction of welding is transverse (or parallel) to the rolling direction of test materials.
- (3) When the absorbed energy of two or more test specimens among a set of test specimens is less in value than the specified average absorbed energy or when the absorbed energy of a single test specimen is less in value than 70% of the specified average absorbed energy, the test is considered to have failed.
- (4) <Deleted>

Present	Amendment
<p><b>8. Macro-structure inspection</b></p> <p>(1) ~ (2) &lt;Omitted&gt;</p> <p><b>9. Non-destructive inspection</b> <del>–{See Guidance}–</del></p> <p>(1) Test assemblies are to be examined for the whole length(excepting discard area of test assembly of <b>Fig 2.2.6</b>) by visual and by non-destructive testing prior to the cutting of test specimen. Non destructive examinations should be carried out after any required post weld heat treatment, natural or artificial ageing, and prior to the cutting of the test specimens.</p> <p>(2) For weldable high strength steels with specified minimum yield strength of 420 N/mm<sup>2</sup> and above the non-destructive testing is to be delayed for a minimum of 48 hrs, unless heat treatment has been carried out.</p> <p>(3) NDT procedures are to be agreed with the Society. The results of non-destructive testing are to show that there are no cracks or other injurious defects, and acceptance criteria is to be in accordance with the relevant requirements of the relevant Rules.</p> <p>(4) &lt;New&gt;</p>	<p><b>7. Macro-structure inspection</b></p> <p>(1) ~ (2) &lt;Same as the present Rules&gt;</p> <p><b>8. Visual &amp; Non-destructive inspection</b></p> <p>(1) Test assemblies are to be examined for the whole length(excepting discard area of test assembly of <b>Fig 2.2.6</b>) by visual and by non-destructive testing prior to the cutting of test specimen. <u>Visual and non-destructive</u> examinations should be carried out after any required post weld heat treatment, natural or artificial ageing, and prior to the cutting of the test specimens. <i>(2019)</i></p> <p>(2) For weldable high strength steels with specified minimum yield strength of 420 N/mm<sup>2</sup> and above the <u>visual and non-destructive testing are</u> to be delayed for a minimum of 48 hrs, unless heat treatment has been carried out. <i>(2019)</i></p> <p>(3) NDT procedures are to be agreed with the Society. The results of non-destructive testing are to show that there are no cracks or other injurious defects.</p> <p>(4) <u>Acceptance criteria is to be in accordance with the relevant requirements of the relevant Rules as follows. However, if agreed by the Society, imperfections detected by visual or non-destructive testing may be assessed in accordance with ISO 5817, class B, except for imperfection type such as excess weld metal and excess penetration for which level C applies</u> <i>(2019)</i></p> <p>(a) <u>Rolled steels for hull - <b>Annex 2-7</b></u></p> <p>(b) <u>High strength steels for welded structures - <b>Annex 2-7</b> or <b>Pt 7, Ch 5</b> of the Rules</u></p> <p>(c) <u>Rolled steels for low temperature service - <b>Pt 7, Ch 5</b> of the Rules</u></p> <p>(d) <u>Materials for machinery installation(boilers, pressure vessel and piping system) - <b>Pt 5, Ch 5</b> or <b>Ch 6</b> of the Rules</u></p>

## Present

### 10. Hardness test --[See Guidance]--

(1) For weldable high strength steel and hull structural rolled steels with specified minimum yield strength of  $ReH \geq 355 \text{ N/mm}^2$ , hardness test (the vickers method Hv10) is to be carried out in accordance with the Guidance relating to the Rules specified by the Society.

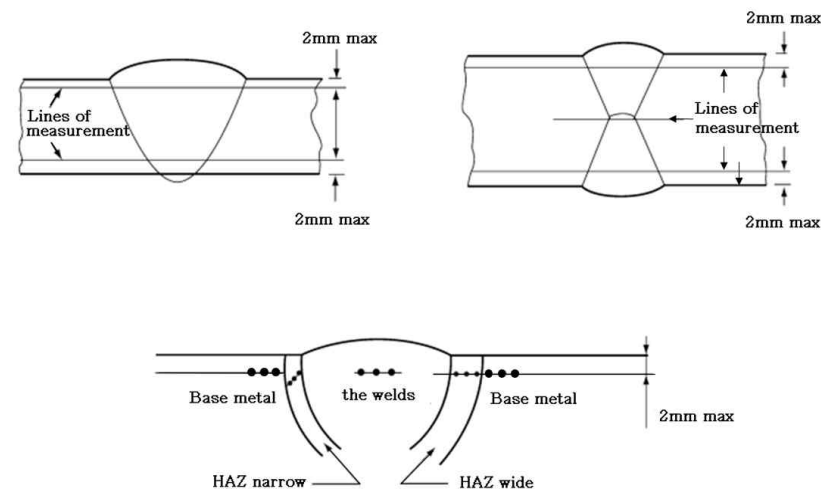
(2) The results from the hardness test are not to exceed the following:

- Steel with a specified minimum yield strength  $ReH \leq 420 \text{ N/mm}^2$  : 350 Hv10
- Steel with a specified minimum yield strength  $420 \text{ N/mm}^2 < ReH \leq 690 \text{ N/mm}^2$  : 420 Hv10

## Amendment

### 9. Hardness test (2019)

(1) Hardness distribution at positions shown in **Fig 2.2.9** is to be measured.



#### Note

1. Measuring load is to be 10 kg vickers and measuring intervals are to be 1 mm.
2. For *EH47-H*, measurement points are to include mid-thickness position in addition.

**Fig 2.2.6 Hardness Test for butt welded joint (Units : mm)**

**Present**

**Amendment**

(2) The results from the hardness test are to be in accordance with **Table 2.2.10. (2019)**

**Table 2.2.10 Hardness Test Requirements for Butt Welded Joint (2019)**

<u>Grades and material symbols of test specimens</u>		<u>Hardness (Hv10)</u>
<u>Rolled steels for hull structural</u>	<u>AH 36, DH 36, EH 36, FH 36, AH 40, DH 40, EH 40, FH 40</u>	<u>350 max.</u>
	<u>EH47-H</u>	<u>380 max.</u>
<u>Weldable high strength steel</u>		<u>420 max.</u>
<u>Rolled steels &amp; Steel pipes for low temperature service</u>	<u>RL 235A, RL 235B, RL 325A, RL 325B, RLPA, RLPB, RLPC</u>	<u>320 max.</u>
	<u>RL 360</u>	<u>380 max.</u>
	<u>RL 1N355, RL 2N255, RLP 2</u>	<u>300 max.</u>
	<u>RL 3N355, RL 5N390, RLP 3</u> <u>RL 9N490, RLP 9</u>	<u>350 max.</u>
<u>Rolled steel plates for boiler &amp; pressure vessel</u> <u>The pipes for ordinary piping</u> <u>The pipes used for high temperature and high pressure</u>		<u>320 max.<sup>(1)</sup></u>
<u>Note :</u> <u>(1) For non-heat treated, hardness may be accepted by 380 max.</u>		

Present	Amendment
<p data-bbox="331 188 474 220"><u>10. &lt;New&gt;</u></p>	<p data-bbox="1171 193 1682 225"><b>10. Brittle fracture initiation test (2019)</b></p> <ul style="list-style-type: none"><li data-bbox="1205 236 1977 328">(1) <u>Test assemblies are to be welded for highest heat input and lowest heat input position and all applicable tests are to be made on those assemblies.</u></li><li data-bbox="1205 331 1977 363">(2) <u>Test method and acceptance criteria</u><ul style="list-style-type: none"><li data-bbox="1238 367 1977 459">(a) <u>Deep notch test or Crack Tip Opening Displacement (CTOD) test is to be carried out and the result is to be reported.</u></li><li data-bbox="1238 462 1977 523">(b) <u>CTOD test is to be carried out in accordance with ISO 15653 or equivalent.</u></li><li data-bbox="1238 526 1977 587">(c) <u>When performing the deep notch test, manufacturer is to submit the detailed test procedure to the Society.</u></li><li data-bbox="1238 590 1977 651">(d) <u>Manufacturer is to be consulted with the Society the dimension of test specimen, test condition, etc.</u></li></ul></li></ul>

## Present

### 405. Tests for fillet welded joints

1. <Omitted>

#### 2. Kinds of test

Fillet weld joints are to be subjected to visual inspection, surface crack detection, macro-structure inspection, hardness test and fracture test. Additional tests may be required if found necessary by the Society. **[See Guidance]**

## Amendment

### 405. Tests for fillet welded joints

1. <Same as the present Rules>

#### 2. Kinds of test

Fillet weld joints are to be subjected to visual inspection, surface crack detection, macro-structure inspection, hardness test and fracture test. The kinds of test for machinery installations are to be in accordance with **Table 2.2.11**. Additional tests may be required if found necessary by the Society. **[See Guidance]** (2019)

**Table 2.2.11 Kinds of Test for machinery installations's fillet welded joints (2019)**

Divisions		Kinds of test and number of specimens taken from test assemblies <sup>(1)(2)</sup>		
		Macro-structure inspection	Visual insp.	Fracture test
Welding of boiler and pressure vessel	Boiler and class 1 pressure vessel	1	welding position	2
	Class 2 pressure vessel			
	Class 3 pressure vessel	The tests may be omitted according to the discretion of the Surveyor.		
Welding of piping	The pipes for ordinary piping	1	-	2
	The pipes used for high temperature and high pressure <sup>(3)</sup>			

**Notes :**

- (1) In a case where special materials are used, special welding procedure is employed or where deemed necessary by the Society, the other tests or test conditions than those specified in this Section for the welding procedure qualification may be required
- (2) For the welding procedure qualification tests on materials used at high temperature, the Society may require a creep test or high temperature tensile test.
- (3) For steam pipes and flanges to be used in the place where the design pressure is not less than 30 kgf/cm<sup>2</sup> and the design temperature exceeds 400 °C.

Present	Amendment
<p>3. &lt;Omitted&gt;</p> <p><b>4. Visual inspection</b></p> <p><del>Fillet welding is to have a regular and uniform surface, and is to be free from cracks, undercuts, overlaps and other injurious defects.</del></p> <p><b>5. Non-destructive inspection</b></p> <p>(1) Test assemblies are to be examined by visual and by non-destructive testing prior to the cutting of test specimen. In case that any post-weld heat treatment is required or specified non-destructive testing is to be performed after heat treatment.</p> <p>(2) For weldable high strength steel with specified minimum yield strength of 420 N/mm<sup>2</sup> and above the non-destructive testing is to be delayed for a minimum of 48 hrs, unless heat treatment has been carried out.</p> <p>(3) NDT procedures are to be agreed with the Society. The results of non-destructive testing are to show that there are no cracks or other injurious defects, <del>and acceptance criteria is to be in accordance with the relevant requirements of the relevant Rules.</del></p> <p>(4) <u>&lt;New&gt;</u></p> <p>6. &lt;Omitted&gt;</p>	<p>3. &lt;Same as the present Rules&gt;</p> <p>4. <u>&lt;Deleted&gt;</u></p> <p><b>4. Visual &amp; non-destructive inspection</b></p> <p>(1) Test assemblies are to be examined by visual and by non-destructive testing (PT or MT) prior to the cutting of test specimen. In case that any post-weld heat treatment is required or specified non-destructive testing and <u>visual inspection</u> are to be performed after heat treatment. (2019)</p> <p>(2) For weldable high strength steel with specified minimum yield strength of 420 N/mm<sup>2</sup> and above the non-destructive testing and <u>visual inspection</u> are to be delayed for a minimum of 48 hrs, unless heat treatment has been carried out. (2019)</p> <p>(3) NDT procedures are to be agreed with the Society. The results of <u>visual &amp; non-destructive testing</u> are to show that there are no cracks or other injurious defects. (2019)</p> <p>(4) <u>The imperfections detected by visual or non-destructive testing are to be assessed in accordance with ISO 5817, class B, except for imperfection type such as excessive convexity and excessive throat thickness for which level C applies (2019)</u></p> <p>5. &lt;Same as the present Rules&gt;</p>

## Present

### 7. Hardness test

For weldable high strength steel and hull structural rolled steels with specified minimum yield strength of  $ReH \geq 355 \text{ N/mm}^2$ , hardness test(Hv 10) is to be carried out in accordance with the requirement in **404. 10.** [See Guidance]

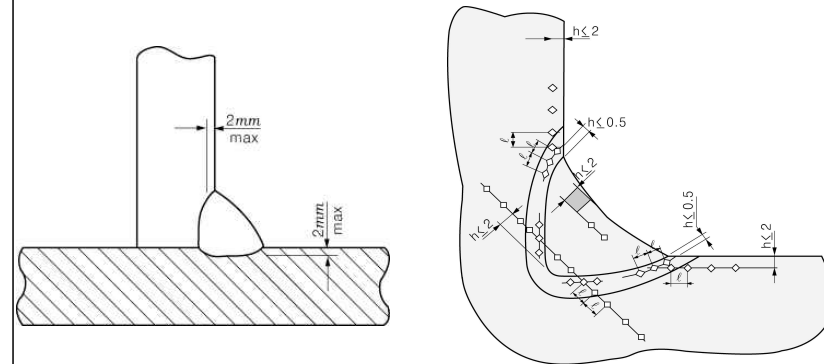
8. <Omitted>

406. <Omitted>

## Amendment

### 6. Hardness test (2019)

(1) Hardness distribution at positions shown in **Fig 2.2.11** is to be measured.



#### Note

1. Measuring load is to be 10 kg vickers and measuring intervals are to be 1 mm.

**Fig 2.2.11 Hardness test for fillet welded joint (unit : mm) (2019)**

(2) The results from the hardness test are to be in accordance with **Table 2.2.10.** (2019)

7. <Same as the present Rules>

406. <Same as the present Rules>



Present	Amendment
<p><b>407. Validity of qualified welding procedure specification</b></p> <p><b>1. General</b></p> <p>(1) ~ (3) &lt;Omitted&gt;</p> <p><del>(4) Validity of welding variables for the welding procedure specification of aluminium alloy is to be in accordance with the Guidance relating to Rules. — [See Guidance] —</del></p> <p><b>2. Validity of variables for qualified WPS is as follows. However, it may be considered as equivalent for the requirements of the standard internationally recognized(AWS, ASME etc.) are applied.</b></p> <p>(1) <b>Base metal</b> Kind of base metal and their validity are as follows. Other materials not specified herein is to be in accordance with the requirements of the standard internationally recognized as deemed appropriate by the Society. <b>[See Guidance]</b></p> <p>(a) <b><u>Normal and higher strength hull structural steels and weldable high strength steels</u></b></p> <p>① Normal strength steel(A, B, D and E) or equivalent structural steels with tensile strength 400 ~ 520 N/mm<sup>2</sup>.</p> <p>② Higher strength steels and YP47 steel plates(AH 32, DH 32, EH 32, FH 32, AH 36, DH 36, EH 36, FH 36, AH 40, DH 40, EH 40, FH 40 and EH47-H) or equivalent structural steels with minimum specified yield strength 315 ~ 460 N/mm<sup>2</sup>. (2018)</p> <p>③ <u>Weldable high strength steels (Pt 2, Ch 1, 308. of the Rules) or equivalent structural steels with minimum specified yield strength 365~960 N/mm<sup>2</sup>.</u></p> <p>(i) For each strength level, welding procedures are considered applicable to the same and lower toughness grades as that tested.</p> <p>(ii) For each toughness grade of normal and higher strength hull structural steels, welding procedures are considered applicable to the same and two lower strength levels as that tested.</p>	<p><b>407. Validity of qualified welding procedure specification</b></p> <p><b>1. General</b></p> <p>(1) ~ (3) &lt;Same as the present Rules&gt;</p> <p><u>(4) &lt;Deleted&gt;</u></p> <p><b>2. Validity of variables for qualified WPS is as follows. However, it may be considered as equivalent for the requirements of the standard internationally recognized(AWS, ASME etc.) are applied.</b></p> <p>(1) <b>Base metal</b> Kind of base metal and their validity are as follows. Other materials not specified herein is to be in accordance with the requirements of the standard internationally recognized as deemed appropriate by the Society. <b>[See Guidance]</b></p> <p>(a) <b><u>Normal and higher strength hull structural steels</u></b></p> <p>① Normal strength steel(A, B, D and E) or equivalent structural steels with tensile strength 400 ~ 520 N/mm<sup>2</sup>.</p> <p>② Higher strength steels and YP47 steel plates(AH 32, DH 32, EH 32, FH 32, AH 36, DH 36, EH 36, FH 36, AH 40, DH 40, EH 40, FH 40 and EH47-H) or equivalent structural steels with minimum specified yield strength 315 ~ 460 N/mm<sup>2</sup>. (2018)</p> <p>(i) For each strength level, welding procedures are considered applicable to the same and lower toughness grades as that tested.</p> <p>(ii) For each toughness grade, welding procedures are considered applicable to the same and two lower strength levels as that tested.</p> <p>(iii) For applying the above (i) and (ii) to high heat input processes above 50 kJ/cm, e.g. the two-run technique with either submerged arc or gas shielded metal arc welding, electro slag and electro gas welding, welding procedure is applicable to that toughness grade tested and one strength level below.</p>

Present	Amendment
<p>(b) ~ (c) &lt;Omitted&gt;</p> <p>(d) Rolled steels for low temperature service and Steel pipes for low temperature service</p> <p>(e) Rolled stainless steels and Stainless steel pipes</p>	<p>(iv) For <i>EH47-H</i>, welding procedure is applicable to that same and lower toughness grade tested and one strength level below. (<i>AH40</i>, <i>DH40</i> and <i>EH40</i>)</p> <p>(b) <b>Weldable high strength steels (Pt 2, Ch 1, 308.</b> of the Rules) or equivalent structural steels with minimum specified yield strength 365~960 N/mm<sup>2</sup>.</p> <p>(i) For each strength level, welding procedures are considered applicable to the same and lower toughness grades as that tested.</p> <p>(ii) For each toughness grade, welding procedures are considered applicable to the same and one lower strength level as that tested.</p> <p>(iii) For applying the above (i) and (ii) to high heat input processes above 50 kJ/cm, e.g. the two-run technique with either submerged arc or gas shielded metal arc welding, electro slag and electro gas welding, welding procedure is applicable to that toughness grade tested and one strength level below.</p> <p>(iv) For each heat treatment of weldable high strength steels, welding procedures are not applicable other heat treatment. (2017)</p> <p>(c) ~ (d) &lt;Same as the present Rules&gt;</p> <p>(e) <b>Rolled steels for low temperature service and Steel pipes for low temperature service (2019)</b></p> <p>(i) For carbon steels, welding procedures are considered applicable to the same and lower strength level as that tested, and the same and lower toughness grades as that tested.</p> <p>(ii) For nickel alloy steels, welding procedures are considered applicable to the same and lower strength level as that tested, and the same and lower toughness grades as that tested.</p> <p>(f) <b>Rolled austenitic stainless steels and austenitic stainless steel pipes (2019)</b>  Welding procedures are considered applicable to the equivalent and lower strength level as that tested, and the equivalent and lower level of alloying elements as that tested.</p>

Present	Amendment
<p>(g) &lt;New&gt;</p> <p>(h) &lt;New&gt;</p> <p>(i) &lt;New&gt;</p>	<p>(g) <b>Aluminium alloys (2019)</b></p> <p>① Group A: aluminium-magnesium alloys with Mg content = 3.5 % (alloy 5754)</p> <p>② Group B: aluminium-magnesium alloys with 4% = Mg = 5.6 % (alloys 5059, 5083, 5086, 5383 and 5456)</p> <p>③ Group C: aluminium-magnesium-silicon alloys (alloys 6005A, 6061 and 6082)</p> <p>(i) For each Group, the qualification made on one alloy qualifies the procedure also for the other alloys of the same Group with equal or lower specified tensile strength after welding.</p> <p>(ii) The qualification made on Group B alloy qualifies the procedure also for Group A alloys.</p> <p>(h) <b>Rolled steel plates for boiler (2019)</b></p> <p>Welding procedures are considered applicable to the same and lower strength level as that tested.</p> <p>(i) <b>Rolled steel plates for pressure vessel (2019)</b></p> <p>(i) Welding procedures are considered applicable to the same and lower strength level as that tested, and the same and lower toughness grades as that tested.</p> <p>(ii) The approval of quenched and tempered steels does not qualify other steels and vice versa.</p>

### Present

**(2) Thickness and outer diameter of base metal**

(a) The qualification of a WPS carried out on a plate or pipe test assembly of thickness  $t$  is valid for the thickness range given in **Table 2.2.9**.

**Table 2.2.9 Qualified thickness range for butt, T-joint and fillet welds**

Thickness of test piece, $t$ (mm) <sup>(1)</sup>	Range of approval $t$ (mm)	
	Butt and T-joint welds with single run or single run from both sides	Butt and T-joint welds with multi-run and fillet welds <sup>(2)</sup>
$t \leq 3$	$0.8t \sim 1.1t$	$t \sim 2t$
$3 < t \leq 12$	$0.7t \sim 1.1t$	$3 \sim 2t$
$12 < t \leq 100$	$0.7t \sim 1.1t$ <sup>(3)</sup>	$0.5t \sim 2t$ (max.150)
$100 < t$	$0.8t \sim 1.1t$ <sup>(3)</sup>	$0.5t \sim 1.5t$

Notes ;

- (1) For multi process procedures, the recorded thickness contribution of each process is to be used as a basis for the range of approval for the individual welding process.
- (2) For fillet welds, the range of approval is to be applied to both base metals.
- (3) For high heat input processes over 50 kJ/cm, the upper limit of range of approval is to be  $1.0 \times t$ .

### Amendment

**(2) Thickness and outer diameter of base metal**

(a) The qualification of a WPS carried out on a plate or pipe test assembly of thickness  $t$  is valid for the thickness range given in **Table 2.2.12** and **Table 2.2.13**. (2019)

**Table 2.2.12 Qualified thickness range for butt, T-joint and fillet welds (2019)**

Thickness of test piece, $t$ (mm) <sup>(1)</sup>	Range of approval $t$ (mm) <sup>(2)</sup>	
	Butt and T-joint welds with single run or single run from both sides	Butt and T-joint welds with multi-run and fillet welds
$t \leq 3$	$0.7t \sim 1.1t$	$0.7t \sim 2t$
$3 < t \leq 12$	$0.7t \sim 1.1t$	$3 \sim 2t$
$12 < t \leq 100$	$0.7t \sim 1.1t$ <sup>(3)</sup>	$0.5t \sim 2t$ (max.150)
$100 < t$	$0.7t \sim 1.1t$ <sup>(3)</sup>	$0.5t \sim 2t$

Notes ;

- (1) For multi process procedures, the recorded thickness contribution of each process is to be used as a basis for the range of approval for the individual welding process.
- (2) For the vertical-down welding, the test piece thickness "t" is always taken as the upper limit of the range of application.
- (3) For high heat input processes over 50 kJ/cm, the upper limit of range of approval is to be  $1.0 \times t$ .

**Present**

(b) <New>

(b) In addition to the requirements of **Table 2.2.9**, the range of approval of throat thickness "a" for fillet welds is to be as follows:

- (i) Single run ; "0.75 x a" to "1.5 x a"
- (ii) Multi-run ; as for butt welds with multi-run (i.e. a=t)

**Amendment**

**Table 2.2.13 Range of qualification for parent material thickness (2019)**

Thickness of the test piece t (mm)	Range of approval
$t \leq 3$	$0.5t \sim 2t$
$3 < t \leq 20$	$3 \sim 2t$
$t > 20$	$\geq 0.8t$

(b) The thickness t is defined for range of qualification as follows (2019)

(i) Butt welded joint

The thickness t is based on the thinner material.

(ii) T-joint with full penetration weld

The thickness t is based on the material with bevelling.

(iii) Fillet welded joint and T-joint with partial penetration weld

The thickness t is based on the both base materials.

(c) In addition to the requirements of **Table 2.2.12** and **Table 2.2.13**, the range of approval of throat thickness "a" for fillet welds is given in **Table 2.2.14**. (2019)

**Table 2.2.14 Range of qualifications for the throat thickness of fillet welds (2019)**

Kind(a=throat thickness)		Range of approval(mm)
<u>Base material other than Aluminium alloys</u>	<u>Single-run</u>	$0.75a \sim 1.5a$
	<u>Multi-run</u>	as for butt welds with multi-run (i.e. a=t)
<u>Aluminium alloys(1)</u>	$a < 10$	$0.75a \sim 1.5a$
	$a \geq 10$	$\geq 7.5$

Note

(1) Where a fillet weld is qualified by means of a butt weld test, the throat thickness range qualified should be based on the thickness of the deposited weld metal.

**Present**

(c) The qualification of a WPS carried out on a pipe test assembly is valid for the outer diameter range given in **Table 2.2.10**.

**Table 2.2.10 Qualified outer diameter range for pipe welds**

Outer diameter $D$ (mm)	Qualified range
$D \leq 168.3$	$0.5 D \sim 2 D$
$D > 168.3$	$\geq 0.5 D$

- ~~(d) For the vertical-down welding, the test piece thickness "t" is always taken as the upper limit of the range of application.~~
- ~~(e) For unequal plate thickness of butt welds the lesser thickness is ruling dimension.~~
- ~~(f) <Omitted>~~

**Amendment**

(d) The qualification of a WPS carried out on a pipe test assembly is valid for the outer diameter range given in **Table 2.2.15**.

**Table 2.2.15 Qualified outer diameter range for pipe welds (2019)**

Outer diameter $D$ (mm)	Qualified range (mm) <sup>(1)</sup>
$D \leq 25$	$0.5 D \sim 2 D$
$D > 25$	$\geq 0.5 D$ (min. 25)

Note

(1) When the test for plate is approved, the welding for the pipes over 500 mm in outer diameter is permitted.

~~(d) <Deleted>~~

~~(e) <Deleted>~~

(e) <Same as the present Rules>

**Present**

**(3) Welding positions**

Approval for a test made in any position is restricted to that position (see **Table 2.2.16-2** and **Table 2.2.16-3** of the Rules). To qualify a range of positions, test assemblies are to be welded for highest heat input position and lowest heat input position and all applicable tests are to be made on those assemblies. For plates butt welds with full penetration, the highest heat input position is normally the vertical upwards position and the lowest heat input position is normally the horizontal position.

(b) <New>

**Amendment**

**(3) Welding positions**

(a) Approval for a test made in any position is restricted to that position (see **Table 2.2.16-2** and **Table 2.2.16-3** of the Rules). Approval range for aluminium alloys is given in **Table 2.2.16**. (2019)

**Table 2.2.16 Range of qualifications for aluminium alloys's welding position (2019)**

<u>Test Position</u>	<u>Welding positions in actual welding position</u>
PA(flat)	PA
PC(horizontal)	PA, PC
PE(overhead)	PA, PC, PE
PF(vertical-up)	PA, PC, PF

NOTES:

(1) A qualification position performed on a butt weld will also qualify for fillet welding within the thickness ranges specified for fillet welds specified in (2) (a) above but not vice versa.

(b) To qualify a range of positions, test assemblies are to be welded for highest heat input position and lowest heat input position and all applicable tests are to be made on those assemblies. For plates butt welds with full penetration, the highest heat input position is normally the vertical upwards position and the lowest heat input position is normally the horizontal position. And for pipes butt welds with full penetration, all positions for pipes are permitted by the qualified welding procedure with PH-45(inclined upwards). But PG(vertical-down), PJ(downwards) and PJ-45(inclined downwards) are required separate qualification testing and only be acceptable for that position. (2019)

**Present**

(c) <New>

(4) <Omitted>

**(5) Welding consumables**

(a) Welding consumables cover other approved welding consumables having the same grade mark including all suffixes specified in **Pt 2, Ch 2, Sec 6** of the Rules with the welding consumable tested. For WPQT has high heat input processes over 50 kJ/cm, no change in the grade mark or brand name of the consumables is permitted. (2017)

(b) ~ (c) <Omitted>

**Amendment**

(c) Fillet weld joints, T-joints with full penetration and T-joints with partial penetration are permitted by the approval of butt welding in accordance with **Table 2.2.17. (2019)**

**Table 2.2.17 Correlation with Fillet joints, T-joints(with full penetration and partial penetration) welding and butt welding (2019)**

Approved position for butt welding	Actual welding position for fillet joints, T-joints with full penetration & partial penetration
PA(flat)	PA(flat), PB(horizontal vertical)
PC(horizontal)	PB(horizontal vertical), PC(horizontal)
PE(overhead)	PD(horizontal overhead), PE(overhead)
PF(vertical-up)	PF(vertical-up)
PG(vertical-down)	PG(vertical-down)

(4) <Same as the present Rules>

**(5) Welding consumables**

(a) Welding consumables cover other approved welding consumables having the same grade mark including all suffixes specified in **Pt 2, Ch 2, Sec 6** of the Rules with the welding consumable tested. For WPQT has high heat input processes over 50 kJ/cm, no change in the grade mark or brand name of the consumables is permitted. For welding procedure over hull structural and weldable construction, the approval range of welding consumables is left to the discretion of the Society. (2017) (2019)

(b) ~ (c) <Same as the present Rules>



Present	Amendment
<p>(6) <b>Welding condition</b></p> <p>(a) <u>Change from short circuiting transfer to spray arc or pulsed arc or vice versa.</u></p> <p>(b) <del>Change of welding voltage, current and/or travel speed are to be at the discretion of the Society. [See Guidance]</del></p> <p>(c) <u>The minimum preheating temperature is not to be 15 °C less than that used in the qualification. The maximum interpass temperature is not to be 56 °C higher than that used in the qualification</u></p> <p>(d) <u>The heat treatment used in the qualification test is to be maintained during manufacture. Holding time may be adjusted as a function of thickness.</u></p> <p>(7) &lt;Omitted&gt;</p>	<p>(6) <b>Welding condition</b></p> <p>(a) <u>Changes in the type of current (AC, DC, pulsed) and polarity require a new welding procedure qualification. (2019)</u></p> <p>(b) &lt;Deleted&gt;</p> <p>(b) <u>The lower limit of approval is the preheat temperature applied at the start of the welding procedure test. The upper limit of approval is the interpass temperature reached in the welding procedure test. (2019)</u></p> <p>(c) <u>The heat treatment used in the qualification test is to be maintained during manufacture. Holding time may be adjusted as a function of thickness. Addition or deletion of post weld heat treatment or ageing is not permitted except that artificial ageing for 6000 series alloys gives approval for prolonged natural ageing. (2019)</u></p> <p>(7) &lt;Same as the present Rules&gt;</p>

**Present**

**(8) Type of joint**

- (a) Range of approval depending on type of welded joints for test assembly is to be specified in **Table 2.2.11**
- (b) A qualification test performed on a butt weld will also qualify for fillet welding within the thickness ranges specified for fillet welds specified in (2) (a) above.

**Table 2.2.11 Range of approval for type of welded joint**

Type of welded joint for test assembly			Range of approval	
Butt welding	One side	With backing	A	A, C
		Without backing	B	A, B, C, D
	Both side	With gouging	C	C
		Without gouging	D	C, D

(c) <Omitted>

(9) <Omitted>

**3.** <Omitted>

**~~408. Welding procedure qualification test for YP47 Steel Plates~~**

~~The welding procedure qualification test for YP47 Steel Plates is to be in accordance with the Guidance in relating to Rules. [See Guidance]~~

**Amendment**

**(8) Type of joint**

- (a) Range of approval depending on type of welded joints for test assembly is to be specified in **Table 2.2.18.**
- (b) A qualification test performed on a butt weld will also qualify for fillet welding, T-joints with full/partial penetration within the thickness ranges specified for fillet welds specified in (2) (a) above. *(2019)*

**Table 2.2.18 Range of approval for type of welded joint (2019)**

Type of welded joint for test assembly			Range of approval	
Butt welding	One side	With backing	A	A, C
		Without backing	B	A, B, C, D
	Both side	With gouging	C	C
		Without gouging	D	C, D <sup>(1)</sup>

NOTES:

(1) For aluminium alloys, range of approval includes "A"

(c) <Same as the present Rules>

(9) <Same as the present Rules>

**3.** <Same as the present Rules>

**~~408. <Deleted>~~**

<b>Present</b>	<b>Amendment</b>
<p><b>504. General requirements for qualification validity</b></p> <p>1. &lt;Omitted&gt;</p> <p><b>2. Maintenance of the approval</b></p> <p>(1) ~ (2) &lt;Omitted&gt;</p> <p>(3) &lt;New&gt;</p>	<p><b>504. General requirements for qualification validity</b></p> <p>1. &lt;Same as the present Rules&gt;</p> <p><b>2. Maintenance of the approval</b></p> <p>(1) ~ (2) &lt;Same as the present Rules&gt;</p> <p>(3) <u>Welders who are not engaged in plates welding for hull structural may omit the revalidation of qualifications. At this time, the manufacturer(shipbuilder) is to distinguish between the welders engaged in hull structural plate welding and the other welders. (2019)</u></p>