

RULES  
R002AM01-2026



CHINA CLASSIFICATION SOCIETY

# **RULES FOR MATERIALS AND WELDING**

AMENDMENTS

**2026**

Effective from 1 July 2026

**Beijing**

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# PART ONE METALLIC MATERIALS

## CHAPTER 2 MATERIAL TESTS

### Section 6 DUCTILITY TESTS FOR PIPES AND TUBES

2.6.2.2 Testing is to be carried out at room temperature and is to consist of flattening the specimen in a direction perpendicular to the longitudinal axis of the pipe. Flattening is to be carried out between two parallel plain rigid platens which extend over both the full length and the full width after flattening of the test specimen.

Flattening is to be continued until the distance  $H$  between the platens, measured under load, is not greater than the value given by the formula:

$$H = \frac{t(1+C)}{C + \frac{t}{D}} \quad \text{mm}$$

where:  $t$  — thickness of the pipe, mm;

$D$  — external diameter of the pipe, mm;

$C$  — constant, ~~dependent on the steel type and detailed in the specific requirements~~ (see Chapter 4 [or Chapter 9](#) of this PART).

After flattening, the specimens are to be free from cracks or other flaws. Small cracks at the ends of the test specimens may be disregarded.

### Section 7 INTERGRANULAR CORROSION TESTS OF STAINLESS STEEL

2.7.2.3 For butt weld joint, test piece is to be cut from a test specimen of the same base material, welding material and welding procedures as the weld joint under investigation. Longitudinal bending test piece with thickness not more than 6 mm is to be used, and base material, heat affected zone and weld metal are to be included as far as possible. Where the thickness of the test piece is more than 6 mm, the test piece is to be machined down to 6 mm from one side. The retained surface is in contact with corroding media and is to be stretched during bending test. The requirements for the sizes of test pieces of plate joint and tube joint are as follows:

(1) For flat plates with welded butt joint, longitudinal bending test pieces of 50 mm wide and 100 mm long are to be selected.

(2) For welded tubes with outer diameter over 60 mm and with welded butt joint, test pieces are to be selected in a boat shape [or in an arc shape](#) in parallel with the weld bead. The size of the test pieces is shown in the above (1).

(3) For welded tubes with outer diameter over 60 mm and with longitudinal weld bead, longitudinal bending test pieces in parallel with the weld bead are to be selected, with width of at least 20 mm and length of at least 50 mm.

(4) For welded tubes up to 60 mm outside diameter, test pieces can be subject to a flattening test.

## CHAPTER 3 STEEL PLATES, FLAT BARS AND SECTIONS

### Section 2 NORMAL STRENGTH HULL STRUCTURAL STEELS

3.2.4.2 The number of test specimens is to be as follows:

(1) [Except where specially agreed by CCS, f](#)For each batch presented, one tensile test specimen is to be made from the thickest piece unless the weight of finished material is greater than 50 t, in which case one extra test specimen is to be made from a different piece from each 50 t or fraction thereof. Additional tests are to be made for every variation of 10 mm in thickness or diameter of products from the same cast. For sections, the thickness to be considered is the thickness of the product at the point where samples are taken for mechanical tests. A piece is to be regarded as the rolled product from a single ingot (or a single slab or billet).

(2) The number of impact test specimens is to comply with the requirements in Table 3.2.3.1.

## CHAPTER 4 STEEL PIPES AND TUBES

### Section 1 GENERAL PROVISIONS

4.1.6.2 For pipes for Class I and II pressure systems and boiler and superheater tubes, the requirements of Table 4.1.6.2 are to be followed. Test specimens are to be cut from at least one pipe selected at random from each batch or part thereof.

**Number in Batch of Pipes Table 4.1.6.2**

Grade	Outside diameter $D$ (mm)	Number in batch (piece) <sup>①</sup>
Class I <sup>②</sup>	All	50
Class II	$D > 325$	100
	$D \leq 325$	200

Note: ① If a steel pipe is made from one slab by rolling and is not subject to heat treatment after saw-cut, all of the sections cut from this pipe can be regarded as one pipe during calculation:-;

② [Both boiler pipes and superheater pipes are to be batch sampled as Class I pipes.](#)

### Section 2 SEAMLESS PRESSURE PIPES

**Mechanical and Technical Properties of Seamless Pressure Pipes Table 4.2.4.1**

Steel type	Grade (N/mm <sup>2</sup> )	Tensile strength $R_m$ min. (N/mm <sup>2</sup> )	Yield strength $R_{eH}$ min. (N/mm <sup>2</sup> )	Elongation $A_5$ min. (%)	Flattening test constant $C$	Bend test diameter of former <sup>③</sup> (mm)
Carbon and carbon-manganese	320	320	195	25	0.10	4t (t being thickness)
	360	360	215	24	0.10	
	410	410	235	22	0.08	
	460	460	265	21	0.07	
	490	490	285	21	0.07	
1Cr0.5Mo	440	440	275	22	0.07	4t
2.25Cr1Mo	410	410	135	20	0.07	4t
	490	490	275	16		
0.5Cr0.5Mo0.25V	460	460	275	15	0.07	4t

Notes: ① For carbon and carbon-manganese steels, the tensile strength range for all grades in the Table is 120 N/mm<sup>2</sup>:-;

② For alloy steels, the tensile strength range for all grades in the Table is 150 N/mm<sup>2</sup>:-;

③ [The bending angle is 180°.](#)

## **Section 4 BOILER AND SUPERHEATER TUBES**

4.4.4.2 The mechanical properties at elevated temperatures of carbon and carbon-manganese steels Grades 320 N/mm<sup>2</sup> to 460 N/mm<sup>2</sup> and 1Cr0.5Mo and 2.25Cr1Mo alloy steels [for design purpose](#) are to comply with the requirements given in Tables 4.2.4.2(1) and (2) of this Chapter.

## **CHAPTER 8 ALUMINIUM ALLOYS**

### **Section 1 GENERAL PROVISIONS**

8.1.2.2 Aluminum alloys [ingots](#) may be manufactured by an approved continuous or semi-continuous casting process. Plates and sheets are to be formed by hot or cold rolling according to the mechanical properties required. Sections may be formed by extrusion, and pipes may be formed by extrusion or drawing.

## **CHAPTER 9 OTHER NON-FERROUS MATERIALS**

### **Section 3 COPPER TUBES**

9.3.6.2 The tests and number of test specimens for each batch are to be as follows:

- (1) Tensile test: at least one specimen from each batch;
- (2) Flattening test: at least one specimen from each batch;
- (3) Drift expanding test ([for copper tubes with an outer diameter  \$\leq 100\text{mm}\$](#) ): at least one specimen from each batch.

Where the tubes are supplied in reels, at least one reel is to be selected from each batch. One test sample is to be taken from every ten circles of tubes or fraction thereof.

## **CHAPTER 10 EQUIPMENT**

### **Section 4 STEEL WIRE ROPES**

10.4.4.3 Torsion test is to comply with the following requirements:

- (1) The length of the sample is to be such as to allow a length between the grips of 100 times the wire diameter or 300 mm, whichever is less.
- (2) The wire is to be twisted by causing one or both of the vices to be revolved. A tensile load not exceeding 2% of the nominal breaking load of the wire may be applied to keep the wire stretched.
- (3) The speed of the twisting is to comply with the recognized standards, and the number of

complete twists is to meet the requirements of Table 10.4.4.3(3).

		Minimum Number of Twists of Torsion Test				Table 10.4.4.3(3)			
Diameter $d$ of galvanized wire (mm)	Minimum number of twists								
	Grade 2 zinc coating				Grade 1 or 3 zinc coating				
	Nominal tensile strength grade (N/mm <sup>2</sup> )								
	1570	1670/1770	1870	1960/2160	1420	1570	1670/1770	1870/1960	
$< 1.3$	19	17	<u>13</u>	<u>13</u>	31	29	27	23	
$1.3 \leq d < 2.3$	17	16	<u>12</u>	<u>12</u>	28	26	24	21	
$2.3 \leq d < 3.0$	14	12	<u>8</u>	<u>8</u>	26	24	22	19	
$3.0 \leq d < 3.5$	11	10	<u>6</u>	<u>6</u>	24	22	20	16	
$3.5 \leq d < 4.0$	9	8	<u>5</u>	<u>5</u>	22	20	18	13	

# PART TWO NON-METALLIC MATERIALS

## CHAPTER 2 PLASTICS MATERIALS

### Section 2 RAW MATERIALS

#### 2.2.8 Synthetic bearing materials for rudder stocks, rudder pintles, rudder axles and stern shafts

2.2.8.1 The requirements of this paragraph apply to [elastomeric \(such as rubber, polyurethane, etc.\) and non-elastomeric \(such as nylon, fiber-reinforced phenolic resin, etc.\) synthetic nylon \(polyamide\) and modified nylon materials](#) used in manufacturing bearings of rudder stocks, rudder pintles, rudder axles and stern shafts. [In addition to the provisions of the Rules, the above products are also to comply with the requirements of CCS Guidelines for Polymer Bearing Materials. For other types of bearing materials, details of the technical specification are to be submitted to CCS for examination.](#)

2.2.8.2 Synthetic bearing materials for rudder stocks, rudder pintles, rudder axles and stern shafts are to be approved by CCS before use.

2.2.8.3 Synthetic bearing materials for rudder stocks, rudder pintles, rudder axles and stern shafts may generally be shaped into cylinders, strips or half.

2.2.8.4 The following physical [and mechanical](#) properties of bearing materials are to be inspected:

- (1) compressive [strength stress](#) and elastic modulus ([only applicable to non-elastomeric materials](#));
- (2) tensile strength [and tensile elongation at break](#) ([only applicable to elastomeric materials](#));
- (3) temperature resistance ([at 60±2°C or the maximum working temperature, whichever is greater, to determine the compressive strength and modulus for non-elastomeric materials, and determine the tensile strength and tensile elongation at break for elastomeric materials](#))~~compressive stress and modulus at 50°C~~);
- (4) volumetric swelling in [substitute](#) ocean water ([ASTM D1141](#)) (at [20±2°C, 60°C±2°C or maximum working temperature, whichever is higher, for 4 weeks/672 h and 80°C for 4 weeks/672 h](#))[\(only applicable to water lubrication\)](#));
- (5) volumetric swelling in oil ([No.3 oil in ISO1817](#)) (at [20±2°C for 4 weeks/672 h](#)) ([only applicable to oil lubrication](#));
- (6) water resistance ([for water-lubricated bearings, after immersion in substitute seawater \(ASTM D1141\) at 20±2°C after 4 weeks/672 h, to determine the compressive strength and modulus for non-elastomeric materials, and to determine the tensile strength and tensile elongation at break for](#)

- ~~elastomeric materials compressive stress and modulus after 4 weeks/672 h in ocean water);~~  
 (7) linear heat expansion coefficient (vertical to the compression side);  
 (8) wear rate (volume);  
 (9) hardness;  
 (10) impact strength (only applicable to non-elastomeric materials);  
 (11) friction coefficient (~~dynamic and static friction coefficients at both 20°C and 80°C in dry and wet conditions of the material~~);  
 (12) ~~limit PV value (a product of the bearing pressure intensity and the linear velocity of relative slide on bearing surfaces)~~;  
 (12~~3~~) density;  
 (13) aging resistance; (only applicable to elastomeric synthetic materials. Test specimens are to be in the oven subjected to circulating air at 60°C±2°C or maximum working temperature, whichever is higher, for 96 hours. Tensile strength and elongation at break are to be tested within 20 to 48 hours after removal from the aging environment.)  
 (14) metal adhesion strength. (ISO 813 applies only to elastomeric synthetic bearing materials that need to be bonded to metal components.)

2.2.8.5 The physical and mechanical properties of synthetic bearing materials for rudder stocks, rudder pintles, rudder axles and stern shafts are to comply with the requirements of Table 2.2.8.5(1) and 2.2.8.5(2). For items not mentioned in the table, the results are to comply with limit values specified in the standards or by the manufacturer.

**Requirements for Physical and Mechanical Properties of Non-elastomeric Synthetic Bearing Materials Table 2.2.8.5(1)**

<u>Compressive strength stress</u> N/mm <sup>2</sup>	<u>Compressive elastic modulus</u> N/mm <sup>2</sup>	<u>Friction coefficient</u>	<u>Temperature and water resistance</u>	<u>Volumetric swelling in lubricating medium<sup>®</sup></u> %	<u>Tensile strength</u> N/mm <sup>2</sup>
ISO 604	ISO 604	=	–	ISO 175	ISO 527-2
<del>≥12085<sup>①</sup></del> ≥100 <sup>②</sup> (vertical to the compressed surface) ≥85 <sup>②</sup> (paralleled to the compressed surface)	≥1500850 <sup>①</sup> ≥1000 <sup>①</sup> (vertical to the compressed surface) ≥850 <sup>①</sup> (paralleled to the compressed surface)	≤0.25	Not less than 80% of the minimum value specified in this Table test value in 2.2.8.4(1)	≤3	≥70

Notes:

- ① Vertical to the compression side. For homogeneous bearing materials.
- ② Parallel to the compression side, only for bearings of strip shape. For heterogeneous bearing materials.
- ③ For test of volumetric swelling in lubricating medium, the size of test sample is 50 mm × 50 mm × t, the minimum thickness of t is generally 4 mm, and minimum product thickness may also be adopted. The swelling is to be measured immediately in a wet condition after extraction from the immersion medium.

**Requirements for Physical and Mechanical Properties of Elastomeric Synthetic Bearing Materials Table 2.2.8.5(2)**

<u>Compressive strength</u> (N/mm <sup>2</sup> )	<u>Tensile elongation at break</u> (N/mm <sup>2</sup> )	<u>Friction coefficient</u>	<u>Temperature and water resistance</u>	<u>Volumetric swelling in lubricating medium<sup>®</sup></u> (%)	<u>Aging resistance</u>
ISO 37	ISO 37	-	-	ISO 175	ISO 37
≥10 <sup>①</sup> ≥30 <sup>②</sup>	≥150 <sup>①</sup> ≥60 <sup>②</sup>	≤0.25	Not less than 80% of the minimum value specified in this Table	≤3	Not less than 75% of the minimum value specified in this Table

Notes: ① Rubber materials.

[② Non-rubber elastomeric materials.](#)

[③ For test of volumetric swelling in lubricating medium, the size of test sample is 50 mm × 50 mm × t, the minimum thickness of t is 4 mm, and minimum product thickness may also be adopted. Swelling is to be measured immediately in a wet condition after extraction from the immersion medium.](#)

2.2.8.6 The maximum permissible surface pressure of synthetic bearing materials for rudder stocks, rudder pintles, and rudder axles and stern shafts is generally not greater than 5.5 N/mm<sup>2</sup>. If a permissible surface pressure greater than 5.5 N/mm<sup>2</sup> need to be approved, in addition to complying with the requirements of 2.2.8.4 and 2.2.8.5, immersion tests of the material in alternate dry and wet conditions are to be carried out, with volumetric swelling not exceeding 3%.

2.2.8.7 The following are to be inspected for delivery of each batch of products:

- (1) compressive [strength-stress](#) and module ([only for non-elastomeric materials](#));
- (2) hardness;
- (3) tensile strength [and elongation at break \(only for elastomeric materials\)](#);
- (4) density.

## **2.2.9 Cast epoxy putty for low-temperature tanks**

2.2.9.1 Bi-component thermosetting epoxy putty used to bind saddle of low-temperature liquid cargo (such as LEG, LPG, LNG) tanks and supporting frame is subject to CCS approval before use.

2.2.9.2 Product manufacturers are to provide complete construction technical files, including recommended design principle, construction methods and requirements for reference.

2.2.9.3 Samples are to be cast in accordance with the construction procedures and the following performances are to be tested after the samples are set ([-196°C refers to the liquid nitrogen immersion temperature, while the actual test temperature is not to be higher than -168°C](#)), and the result is to meet the standards or the limits set by the manufacturer:

- (1) Barcol hardness;
- (2) density;
- (3) compressive strength and compressive modulus of elasticity (20°C, -196°C);
- (4) shearing strength (20°C, -196°C);
- (5) linear expansion coefficient (-30°C~+30°C);
- (6) creep (at 70°C, for 2000 h, creep under 2.5 MPa and 7 MPa are tested respectively);
- (7) compressive deformation (20°C, -196°C);
- (8) compressive yield strength (20°C, -196°C).

## **2.2.10 Cargo bearer**

2.2.10.1 Cargo bearer refers to a laminated product made of beech, birch and other hardwood sheets impregnated in thermosetting resin and pressed at high temperature. It is used for support of LEG, LPG, LNG and other low temperature liquid cargo tanks.

2.2.10.2 Cargo bearer is to be approved by CCS.

2.2.10.3 The size, density, type of wood used and and type of resin used are to be indicated in the quality certification documents and packaging of cargo bearer.

2.2.10.4 Cargo bearer is to be free from bubbling, cracks, dead joints, wormholes, decay, pollution and attached foreign matters, etc. The surface of the machined cuts are to be smooth and the lamination be even. There are not to be defects such as separation of adhesive layer, stripping of surface and bulging.

2.2.10.5 The designer is to take into account that deformation of the cargo bearer after long-term dynamic compression can still meet the design requirements.

2.2.10.6 The cargo bearer is to be tested for the following properties ([-196°C refers to the liquid nitrogen immersion temperature, while the actual test temperature is not to be higher than -168°C](#)) and the results are to meet the standards or limits set by the manufacturer:

- (1) density;
- (2) compressive strength (perpendicular and parallel) (20°C, -196°C);
- (3) deformation (perpendicular and parallel) (20°C, -196°C);

# PART THREE WELDING

## CHAPTER 3 APPROVAL OF WELDING PROCEDURES

### Section 1 GENERAL PROVISIONS

#### 3.1.3 Approval

3.1.3.7 Any changes to the approved welding procedure specification are to be submitted to CCS for approval. CCS will decide whether a new welding procedure test is necessary [according to the application scope of 3.1.4 of this section depending on the nature and extent of such changes](#).

#### 3.1.4 Application of approved welding procedures

3.1.4.3 The application of a welding procedure specification to steel is specified as follows:

- (1) For each strength level, welding procedures are considered applicable to the same and lower toughness grades as that tested.
- (2) For each toughness grade where the minimum value of the specified yield strength of steel is not more than 390 N/mm<sup>2</sup>, except for (1) above, welding procedures are considered applicable to the same and two lower strength levels as that tested (H27 steel is not considered as a separate grade here. For example, the welding procedure for AH36 steel is applicable to AH32, AH27, B and A steel). For high strength steel for welded structures, welding procedures are considered applicable to the same and one lower strength level as that tested.
- (3) For high heat input processes above 50 kJ/cm, the welding procedure is only applicable to that toughness grade tested and one strength level below.
- (4) For steel forgings and castings (carbon steel and carbon-manganese steel), welding procedures are considered applicable to the same or lower strength level as that tested.
- (5) For steels with delivery conditions other than those tested, unless specified [in Table 3.1.4.3 below](#), CCS will put forward test requirements as appropriate:

- ① ~~the approval of quenched and tempered steels does not qualify steels with other delivery conditions and vice versa;~~
- ② ~~in general the approval of normalized, as rolled and controlled rolling steels qualifies TMCP steels but not vice versa.~~

**Applicable Scope of Steel Delivery Conditions      Table 3.1.4.3**

<u>Tested base material delivery conditions</u>	<u>Delivery conditions qualified</u>
<u>Quenched and tempered</u>	<u>Quenched and tempered</u>
<u>Normalized, as rolled, controlled rolling</u>	<u>Normalized, as rolled, controlled rolling, TMCP</u>
<u>TMCP</u>	<u>TMCP</u>
<u>TMCP (for steels with specified minimum yield strength less than or equal to 390N/mm<sup>2</sup>)<sup>①</sup></u>	<u>Normalized, as rolled, controlled rolling, TMCP</u>

Note: ① [Applicable only when the heat input is ≤ 50kJ/cm.](#)

3.1.4.13 The range of approval for the type of welded joints is to be in accordance with Table 3.1.4.13. In general, qualified butt weld procedures are also applicable to fillet welds for corresponding thicknesses. For aluminum alloys ~~and for steels with yield strength not less than 355 N/mm<sup>2</sup>~~, however, the fillet weld test is to be carried out [according to structural requirements](#).

**Range of Approval for Type of Welded Joint**      **Table 3.1.4.13**

Type of welded joint for test assembly			Range of approval	
Welding process	Name	Code	Structural steel	Aluminum alloy

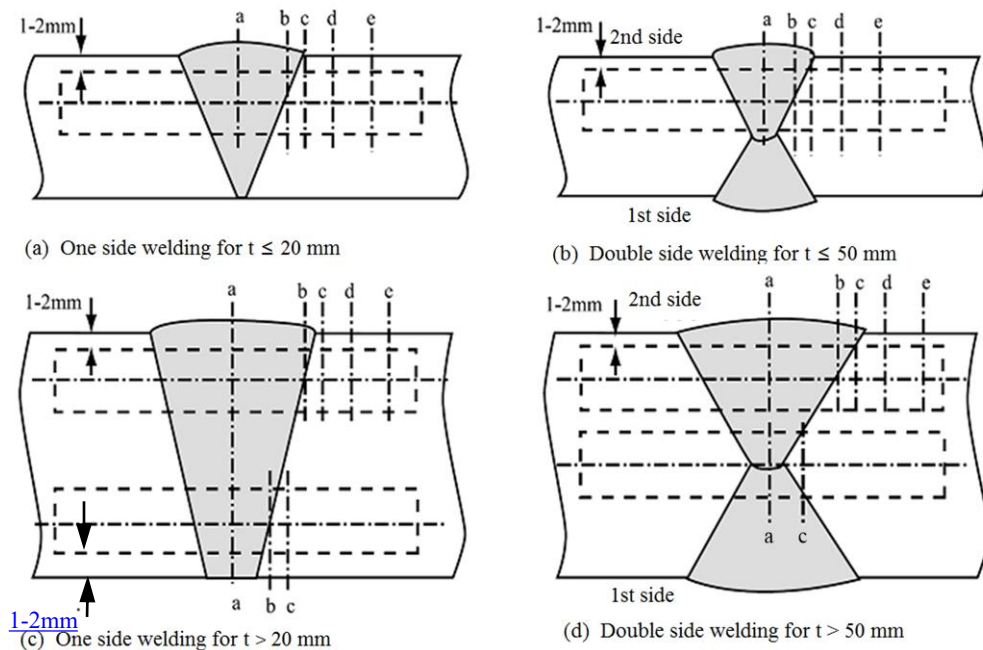
Butt weld	Both sides	With gouging	C	C	C
		Without gouging	D	D, C	D, C, A
	Single side	With backing	A	A, C	A, C
		Without backing	B	B, A, C, D	B, A, C, D

## Section 2 WELDING PROCEDURE APPROVAL TESTS FOR BUTT WELDS

### 3.2.4 Butt welding procedure test items

3.2.4.1 For butt welding procedure tests regarding steels, the following specimens are generally to be taken from the test assembly as shown in Figure 3.2.4.1 and the dimensions of specimens are to comply with the relevant requirements in Section 2, Chapter 1 of this PART:

- (1) two transverse tensile test specimens;
- (2) two transverse face and two transverse root bend specimens. They may be substituted by four side-bend specimens where the thickness of the test assembly is not less than 12 mm. For butt joints in heterogeneous steel plates, face and root longitudinal bend test specimens may be used instead of the transverse bend test specimens;
- (3) several sets of impact specimens (three specimens each set) are to be taken at positions shown in Figure 3.2.4.1(3) based on heat input range, welding procedure and plate thickness of the test assembly and according to the requirements of Table 3.2.4.1(3);
- (4) one specimen for macro examination and one specimen for hardness test (usually cut at welded joints). Steels with specified yield strength less than 355 N/mm<sup>2</sup> may be exempted from hardness test;
- (5) one longitudinal tensile test specimen of weld metal (only where the welding consumable is not approved). Where more than one welding process or type of consumables 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.



In the Figure, a, b, c, d and e are notch locations of impact specimens where: a – center of weld, b – fusion line, c – heat affected zone, 2 mm from fusion line, d – heat affected zone, 5 mm from fusion line, e – heat affected zone, 10 mm from fusion line.

**Figure 3.2.4.1(3) Sampling Positions of Impact Specimens**

# CHAPTER 4 QUALIFICATION TESTS OF WELDERS

## Section 3 SCOPE OF APPLICATION OF WELDER'S QUALIFICATION

### 4.3.7 Welding positions

4.3.7.1 The welding positions qualified as a result of the actual welding position used in a satisfactory welder's qualification test, are shown in Tables 4.3.7.1a, 4.3.7.1b, 4.3.7.1c and 4.3.7.1d (Diagrams showing the definitions of weld position used in these Tables are shown in Figure 4.3.7.1 and Table 4.3.7.1e).

A qualification test with fillet welding may be required for welders who are employed to perform fillet welding only. Welders engaged in welding of T joints / pipe-to-plate fillet welding with partial or full penetration are to be qualified for butt welding.

Qualified welding positions for the pipe-to-plate welds of insertion type dedicated to boilers and pressure vessels are shown in Table 4.3.7.1d. Pipe-to-plate welds of insertion type can also qualify pipe-to-plate/pipe-to-pipe fillet welding and plate fillet welding at the corresponding welding positions.

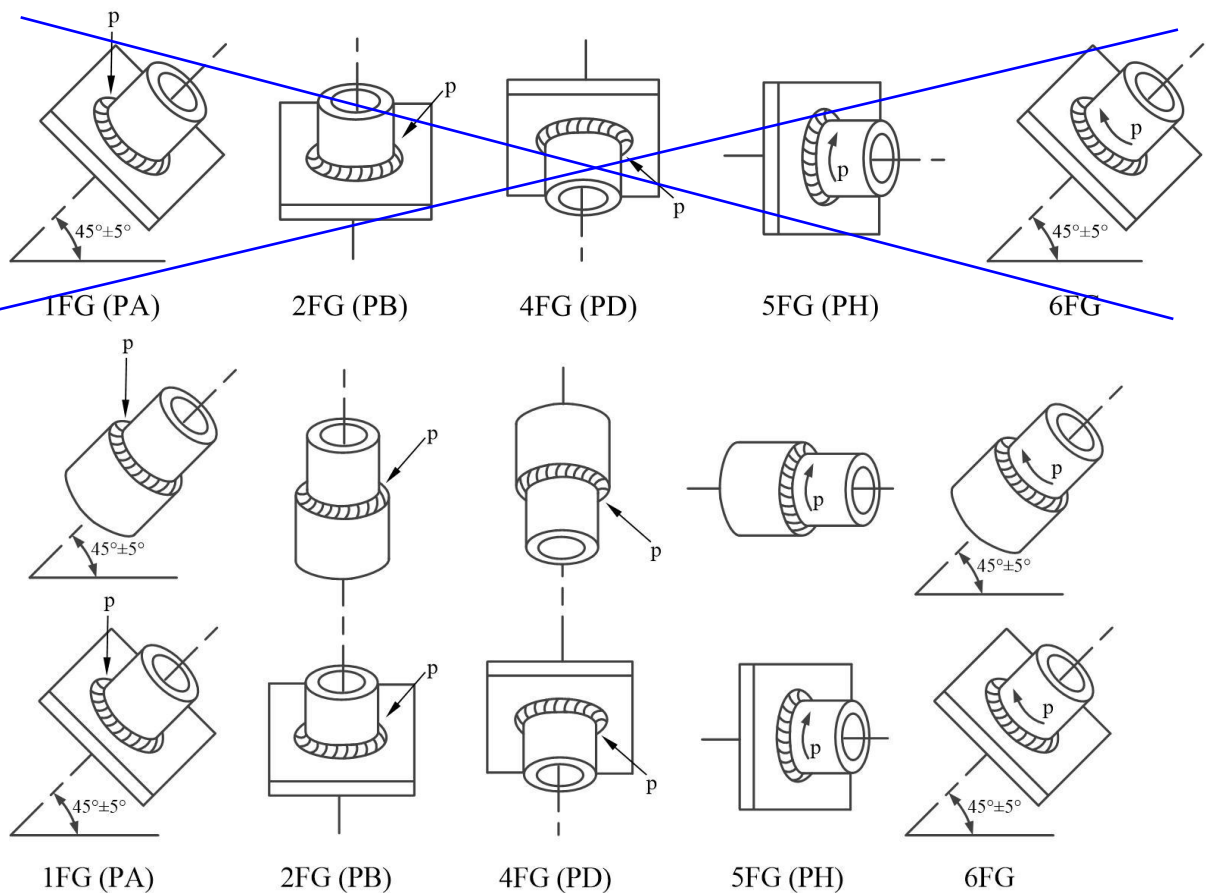


Figure 4.3.7.1 Welding Positions (Partial)

**Qualified welding positions when testing with pipe-to-plate/pipe-to-pipe fillet welding**  
**Table 4.3.7.1d**

Qualification Test Position with pipe-to-plate/ <u>pipe-to-pipe</u> fillet weld	Qualified fillet welding positions in actual welding works	
	Pipe-to-plate/ <u>pipe-to-pipe</u> fillet welding	Fillet welding of plates
1FG	1FG	FF
2FG	1FG, 2FG	FF, FH
4FG	1FG, 2FG, 4FG	FF, FH, FHa, FO, FOa
5FG	1FG, 2FG, 4FG, 5FG	FF, FH, FHa, FVu, FO, FOa
6FG	1FG, 2FG, 4FG, 5FG, 6FG	FF, FH, FHa, FVu, FO, FOa
4FG+5FG	1FG, 2FG, 4FG, 5FG, 6FG	FF, FH, FHa, FVu, FO, FOa

**4.3.8 Tack welding**

4.3.8.2 Qualification tests are not required for tack welds that do not fuse into the final weld seam.

## CHAPTER 5 WELDING OF HULL STRUCTURES

### Section 1 GENERAL PROVISIONS

**5.1.5 Preparations before welding and temperature control**

5.1.5.5 The preheating temperature is generally to be measured on the backside of the heated surface of the weldment. If conditions do not permit, heating source is to be moved at first, and the temperature is to be measured after the temperature is uniform along the thickness direction of the base metal. The time for temperature homogenization is to be calculated at a ratio of 2 minutes per 25mm of base metal thickness (rounded up to 25 mm if less than 25 mm). The temperature measurement point is generally to be 4 times the plate thickness away from the groove edge, and is not to exceed 50mm. When the thickness of the weldment is greater than 50mm, the temperature measurement point is to be at least 75mm away from the groove edge or at the corresponding position. An example of preheating temperature measurement point locations is shown in Figure 5.1.5.5, where d represents the distance of the measurement point.

The interpass temperature is to be measured on the weld metal or the adjacent base metal. For welding procedures with preheating requirements, if welding is interrupted during the process, preheating is to be reapplied before resuming welding.

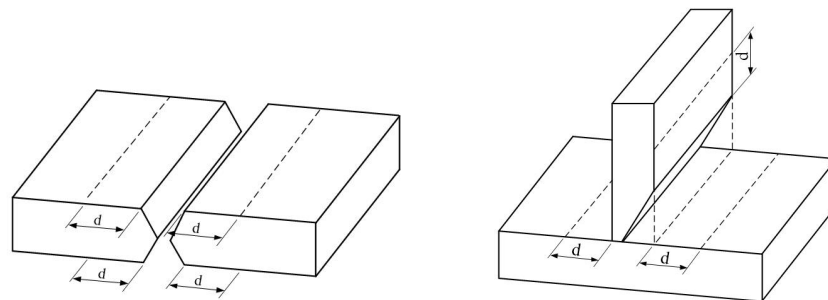


Figure 5.1.5.5 Example of Preheating Temperature Measurement Point Locations

## Section 3 INSPECTION AND REPAIRING OF WELDS

### 5.3.2 Inspection

5.3.2.13 100% surface non-destructive testing and at least 80% internal non-destructive testing are to be conducted on the joining welds between the surface shell plates of the energy-saving appendages in front of the propeller (including the external support structures) and the hull.

## CHAPTER 6 WELDING OF OFFSHORE STRUCTURES

### Section 2 WELDING OF STRUCTURES

#### 6.2.7 Post-weld heat treatment

6.2.7.1 Post-weld heat treatment for stress relieving is generally required for weld joints with thickness greater than 50 mm and pipe joints subjected to complicate loading, unless adequate fracture toughness of the weld joints is documented or an engineering critical assessment has been satisfactorily conducted.

## CHAPTER 7 WELDING OF PRESSURE SHELLS

### Section 2 PRODUCTION WELDING TESTS OF PRESSURE SHELLS

#### 7.2.3 Specimens and testing

7.2.3.1 The test specimens for various classes of pressure shells are to be taken as required by Figure 7.2.3.1 and Table 7.2.3.1.

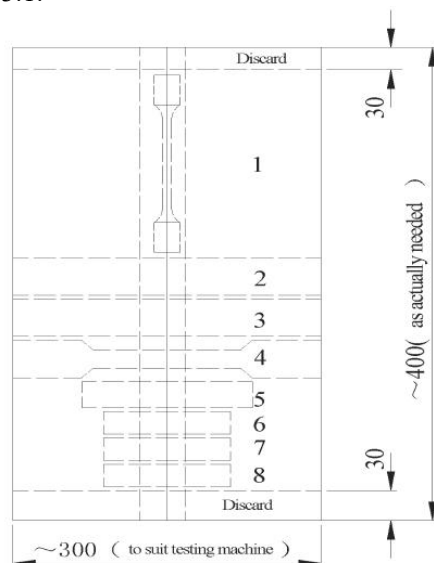


Figure 7.2.3.1

**Specimens for Classes of Pressure Shells****Table 7.2.3.1**

No.	Specimen	Pressure shell	
		Class I	Class II
1	Deposited metal longitudinal tensile	Required	Required
2	Face bend <sup>①</sup>	Required	Required
3	Root bend <sup>①</sup>	Required	Required
4	Butt weld transverse tensile	Required	Required
5	Macro examination	Required	Required
6, 7, 8	Impact test for center of the weld <sup>②</sup>	Required	

Notes: ① Where a test plate is not less than 12mm in thickness, a side bend test specimen may be substituted for the face or root bend specimen.

② An additional set of 3 impact specimens with the notch located on the fusion line is to be tested in [any of](#) the following conditions:

- a. pressure shells of diving systems and submersibles;
- b. all pressure shells with design temperature at 0°C and below;
- c. pressure shells made of alloy steels (excluding austenitic stainless steel).

## CHAPTER 9 WELDING OF PRESSURE PIPES

### Section 3 INSPECTION OF WELDING QUALITY

#### 9.3.3 Non-destructive testing

9.3.3.8 The welds are to meet an acceptable standard. Unacceptable defects are to be removed and repaired as required. [Unless otherwise agreed by CCS, the number of weld repairs in the same area is generally not to exceed two times.](#)

## CHAPTER 11 WELDING AND RIVETING OF NON-FERROUS MATERIALS

### Section 2 WELDING OF ALUMINUM ALLOYS

#### 11.2.2 Preparations before welding

11.2.2.2 Aluminum alloys may be cut by machining, ~~or~~ plasma [or laser](#) technique. Edge preparation may be performed by machining such as planing or grinding. Any other proposed method is to be agreed by CCS Surveyor.