



RULES
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CHINA CLASSIFICATION SOCIETY

RULES FOR MATERIALS AND WELDING

AMENDMENTS

2024

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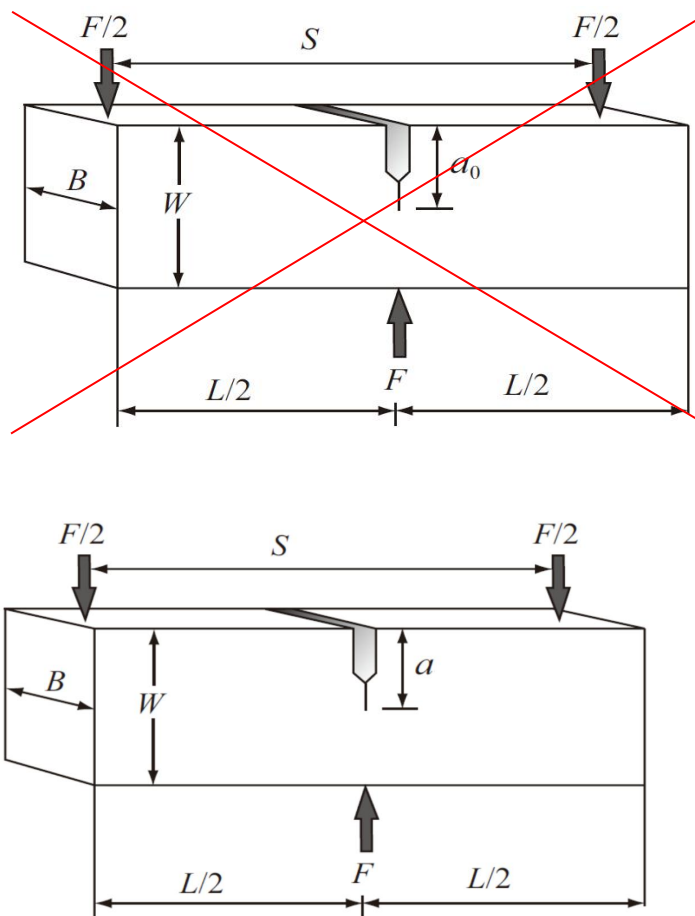
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PART ONE METALLIC MATERIALS

CHAPTER 2 MATERIAL TESTS

Section 8 CRACK TIP OPENING DISPLACEMENT (CTOD) TESTS FOR METALLIC MATERIALS

2.8.2.2 Unless agreed otherwise, tests are to be made on specimens of the full section thickness. Main dimensions of specimens are to comply with the provisions in Figure 2.8.2.2 and Table 2.8.2.2 and other dimensions are to comply with the requirements of recognized standards.



[Figure 2.8.2.2](#)

Dimensions of CTOD Specimens

Table 2.8.2.2

Name	Symbol	Rectangular specimens	Square specimens	Deviation
Specimen thickness	B	B	B	$\pm 0.5\%B$
Specimen width	W	$2B$	B	$\pm 0.5\%W$
Loading span	S	$4W$	$4W$	$\pm 0.5\%S$

Specimen length	L	$\geq 4.5W$	$\geq 4.5W$	
<u>Effective-Nominal</u> crack length*	a	$0.45W \sim 0.55W$	$0.45W \sim 0.55W$	

Note: For specimens of deposited metal test, the range of effective crack length may be $0.45W \sim 0.70W$.

CHAPTER 3 STEEL PLATES, FLAT BARS AND SECTIONS

Section 1 GENERAL PROVISIONS

3.1.1.1 This Chapter applies to steel plates, flats, sections, ~~and~~ bars and pipes intended for use in the construction of hull, machinery, boilers, pressure vessels and offshore installations, etc.

3.1.1.3 Normal and higher strength corrosion resistant hull structural steels used as the alternative means of coating for crude oil tanks are to comply with, in addition to the relevant requirements of this Chapter, the relevant requirements of CCS Guidelines for Survey of Corrosion Resistant Steel of Cargo Oil Tanks in Crude Oil Tankers.

Under Thickness Tolerance of Steel Plates and Wide Flats for Machinery Table 3.1.3.4(4)

Nominal thickness t (mm)	Minus tolerance (mm)
$3 \leq t < 5$	< 0.3
$5 \leq t < 8$	< 0.4
$8 \leq t < 15$	< 0.5
$15 \leq t < 25$	< 0.6
$25 \leq t < 40$	< 0.7
$40 \leq t < 80$	< 0.9
$80 \leq t < 150$	< 1.1
$150 \leq t < 250$	< 1.2
$t \geq 250$	< 1.3

Section 4 HIGH STRENGTH STEELS FOR WELDED STRUCTURES

3.4.1.1 These requirements apply to hot-rolled, fine-grain, weldable high strength structural steels intended for use in marine and offshore structural applications. These requirements do not apply to steels intended for hull structures as specified in sections 2 and 3 of this Chapter.

The requirements of this Section may apply to products other than steel plates, such as sections or seamless tubulars, etc.

3.4.1.3 The maximum thickness applicable to steel plates as specified in this section is shown in Table 3.4.6.2. The requirements of this section apply to steel plates and flats with thickness not greater than 250 mm, the sections with thickness not greater than 50 mm and bars with diameter/thickness not exceeding 250 mm. Steels with a thickness beyond the maximum thickness as given above are to be subject to the special consideration of CCS.

3.4.6.2 Maximum thickness of plates, sections, bars and tubulars over which a specific delivery condition is applicable are shown in Table 3.4.6.2.

Maximum thickness limits for Different Forms of Products **Table 3.4.6.2**

Delivery condition	Maximum thickness/diameter (mm)			
	Plates	Sections	Bars	Tubulars
N	250 ^②	50	250	65
NR	150	①		
TM	150	50	Not applicable	Not applicable
QT	150 ^②	50	Not applicable	50

Notes: ① The maximum thickness limits of sections, bars and tubulars produced by NR process route are generally less than those manufactured by N route, and is to be at the discretion of CCS.

② Approval for N steels with thickness larger than 250 mm and QT steels with thickness larger than 150 mm is subject to the special consideration of CCS.

3.4.7.2 In addition to the following requirements, the position and direction of the specimens taken for mechanical property tests are to be in accordance with the relevant requirements of 3.1.4 of this chapter.

(1) Where round cross-sectional tensile specimens are used for the steel with thickness above 100 mm, the specimens are to be located at a position lying at a distance of $t/4$ from the surface and additionally at $t/2$.

(2) The Charpy V-notch impact test specimens for plates and wide flats over 600 mm in width are to be taken with their axes transverse to the final rolling direction; for other product forms, the impact tests are to be in the longitudinal direction.

(3) Sub-surface impact test specimens will be taken in such a way that one side is not further away than 2 mm from a rolled surface, however, for material with a thickness in excess of 50 mm, impact test specimens shall be taken at the quarter thickness ($t/4$) location and mid-thickness ($t/2$).

(4) Impact test for a nominal thickness less than 6 mm is normally not required.

(5) For steel plates in QT condition and with a thickness greater than 50mm, a group of specimens may be additionally taken not greater than 2mm from the rolled surface to carry out Charpy V notch impact test if deemed necessary by CCS.

3.4.7.4 The results of the tests are to comply with the appropriate requirements of Table 3.4.7.4. In the case of product forms other than plates and wide flats where longitudinal tests are agreed, the elongation values are to comply with the longitudinal requirements as listed in Table 3.4.7.4.

CHAPTER 4 STEEL PIPES AND TUBES

Section 1 GENERAL PROVISIONS

4.1.1.5 Pipes and tubes for ship structures. Pipes and tubes for submarine piping systems and pipes and tubes for offshore engineering steel structures or for transfer of liquid may be manufactured, tested and accepted in accordance with relevant recognized standards.

CHAPTER 5 STEEL FORGINGS

Section 2 FORGINGS FOR HULL STRUCTURES

Mechanical Properties for Hull Steel Forgings **Table 5.2.4.2**

Steel type	Tensile strength ^{①②} R_m	Yield strength R_{eH}	Elongation A_5 min. (%)	Reduction of area Z min. (%)	Charpy V-notch impact test Minimum average energy ^③ (J)
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	min. (N/mm ²)	min. (N/mm ²)	Long.	Tang.	Long.	Tang.	Test temperature (°C)	Long.	Tang.
Carbon and carbon-manganese	400	200	26	19	50	35	0	27	18
	440	220	24	18	50	35			
	480	240	22	16	45	30			
	520	260	21	15	45	30			
	560	280	20	14	40	27			
	600	300	18	13	40	27			
Alloy	550	350	20	14	50	35			
	600	400	18	13	50	35			
	650	450	17	12	50	35			

- Notes: ① For forgings with a specified minimum tensile strength < 600 N/mm², the tensile strength range may be 120 N/mm²;
for forgings with a specified minimum tensile strength ≥ 600 N/mm², the tensile strength range may be 150 N/mm².
- ② Where it is proposed to use a steel with a specified minimum tensile strength intermediate to those given, corresponding minimum values for the other properties may be obtained by interpolation.
- ③ Alternative acceptance requirements may be accepted, depending on design and application, and subject to agreement of CCS.
- ④ For ships navigating in ice with an Ice Class Notation B1*, B1, B2 and B3, the forgings for the hull structure exposed to air are, ~~in addition to the tests required by 5.2.4.1 of this Section~~, to be subjected to Charpy V-notch impact tests at -10°C. A set of three impact test specimens is to be provided, and the average longitudinal impact energy is not to be lower than 20 J.

Section 3 FORGINGS FOR SHAFTING AND MACHINERY

5.3.2.1 The chemical composition of ladle samples for forgings is to comply with the requirements of Table 5.3.2.1.

Chemical Composition of Forgings for Shafting and Machinery **Table 5.3.2.1**

Steel type	Chemical composition (%)									
	C	Si	Mn	S	P	Cr ^③	Mo ^③	Ni ^③	Cu ^{②③}	Total residuals
Carbon and carbon-manganese	≤0.23 ^{①②④}	≤0.45	0.30~1.50	≤0.035	≤0.035	≤0.30 ^④	≤0.15 ^④	≤0.40 ^④	≤0.30	≤0.85
Alloy ^{③④}	≤0.45	≤0.45	0.30~1.00	≤0.035	≤0.035	≥0.40 ^{④⑤}	≥0.15 ^{④⑤}	≥0.40 ^{④⑤}	≤0.30	–

- ① The carbon content of carbon and carbon-manganese steel forgings **not** intended for welded construction is to be 0.65% maximum.
- ② The carbon content may be increased above 0.23% provided that the carbon equivalent (C_{eq}) is not more than 0.41%, calculated using the following formula:
- $$C_{eq} = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15} \quad (\%)$$
- ③ Elements are considered as residual elements unless shown as a minimum.
- ④ Where alloy steel forgings are intended for welded constructions, the proposed chemical composition is subject to approval by CCS.
- ⑤ One or more of the elements is to comply with the minimum content.

Section 4 FORGINGS FOR CRANKSHAFTS

5.4.6.2 The Charpy V-notch impact tests for [carbon steel](#), [carbon manganese steel](#) and alloy steel forgings for crankshafts are to [respectively](#) comply with the requirements of Table 5.3.5.1 and Table 5.4.6.2.

Impact Test Requirements for Alloy Forgings for **Table 5.4.6.2**

Crankshafts at Ambient Temperature^①

Specified min. tensile strength R_m (N/mm ²)			600	700	800	900	1000	1100
Minimum average energy (J) for Charpy V-notch impact test ^②	Normalized and tempered	Long.	27	27	27	–	–	–
		Tang.	18	18	18	–	–	–
	Quenched and tempered	Long.	41	32	30	27	27	27
		Tang.	24	22	20	18	18	18

Note: ① Where it is proposed to use a steel with a specified minimum tensile strength intermediate to those given, corresponding minimum average energy may be obtained by interpolation;

② [Alternative acceptance requirements may be accepted, depending on design and application, and subject to agreement of CCS.](#)

Section 5 FORGINGS FOR GEARING

5.5.5.1 Each forging, from which specimens are to be taken, is to provide test material sufficient for the preparation of at least one group of specimens, including one tensile specimen and a set of three impact specimens. The specimens are to be taken as follows:

(1) For pinion forgings where the finished diameter of the toothed portion exceeds 200 mm, test specimens are to be taken in a tangential direction and adjacent to the toothed portion (test position B in Figure 5.5.5.1(1)). Where the dimensions preclude the preparation of test specimens from position B, specimens in a tangential direction are to be taken from the end of the journal (test position C in Figure 5.5.5.1(1)). If, however, the journal diameter does not exceed 200 mm, test specimens are to be taken in a longitudinal direction (test position A in Figure 5.5.5.1(1)). Where the finished length of the toothed portion exceeds 1.25 m or the **finished** weight of the gear exceeds 4 tonnes, test specimens are to be taken from each end.

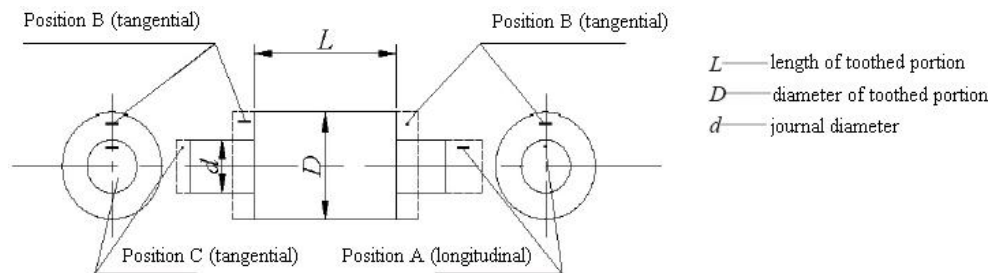


Figure 5.5.5.1(1)

Section 9 AUSTENITIC AND DUPLEX STAINLESS STEEL FORGINGS

5.9.4.1 Stainless steel forgings are to be sampled according to the following requirements:

- (1) Sampling of shaft forgings is to meet the requirements of 5.3.4.1 of Section 3 of this Chapter;
- (2) For pipe and valve forgings, [forgings of similar shape and size from the same furnace number and the same heat treatment are to be sampled as a batch, and](#) at least one tensile specimen is to be taken for each [heat treatment](#) batch [from each cast](#), with each batch weighing up to 5 t.

CHAPTER 6 STEEL CASTINGS

Section 1 GENERAL PROVISIONS

6.1.4.2 The content of ~~relevant added elements~~ ~~grain refining elements~~ adopted by the manufacturer is to be at the discretion of the manufacturer or as agreed with by CCS.

Section 2 CASTINGS FOR HULL STRUCTURES

Chemical Composition of Castings for Hull Structures Table 6.2.2.1

Steel type	Applications	Chemical Composition (%)								
		C	Mn ^①	Si	P	S	Residual elements ^②			
							Cu	Cr	Ni	Mo
C, C-Mn	Castings for welded construction	≤0.23 ^③	0.50~1.60	≤0.60	≤0.035	≤0.035	≤0.30	≤0.30	≤0.40	≤0.15
	Castings for non-welded construction	≤0.40	0.50~1.60	≤0.60	≤0.035	≤0.035	≤0.30	≤0.30	≤0.40	≤0.15
Alloy	Castings for welded construction	May be accepted according to recognized standards subject to agreement of CCS								
	Castings for non-welded construction	≤0.45	0.50~1.60	≤0.60	≤0.035	≤0.035	Alloying elements ^④			
							≤0.30	≤0.30	≤0.40	≤0.15

Notes: ① The manganese content is not to be less than 3 times the actual carbon content.

② The total content of residual elements of C and C-Mn castings is to be not more than 0.80%.

③ If carbon equivalent C_{eq} calculated according to following formula is not more than 0.41%, the carbon content of castings may exceed the limit of 0.23%.

$$C_{eq} = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15} \quad (\%)$$

④ At least one of the elements is to comply with the minimum content.

Section 3 CASTINGS FOR MACHINERY CONSTRUCTION

Chemical Composition of Castings for Machinery Construction Table 6.3.2.1

Steel type	Application	Chemical Composition (%)								
		C	Mn ^①	Si	P	S	Residual elements ^②			
							Cu	Cr	Ni	Mo
C, C-Mn	Castings for welded construction	≤0.23 ^③	0.50~1.60	≤0.60	≤0.035	≤0.035	≤0.30	≤0.30	≤0.40	≤0.15
	Castings for non-welded construction	≤0.40	0.50~1.60	≤0.60	≤0.035	≤0.035	≤0.30	≤0.30	≤0.40	≤0.15
Alloy	Castings for welded construction	May be accepted according to recognized standards subject to agreement of CCS								
	Castings for	≤0.45	0.50~1.60	≤0.60	≤0.035	≤0.035	Alloying elements ^④			

	non-welded construction						≤0.30	≤0.30	≤0.40	≤0.15
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Note: ① The manganese content is not to be less than 3 times the actual carbon content.

② The total content of residual elements of C and C-Mn castings is not to be more than 0.80%.

③ If carbon equivalent C_{eq} calculated according to following formula is not more than 0.41%, the carbon content of castings may exceed the limit of 0.23%.

$$C_{eq} = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15} \quad (\%)$$

④ At least one of the elements is to comply with the minimum content.

CHAPTER 8 ALUMINIUM ALLOYS

Section 1 GENERAL PROVISIONS

8.1.7 Identification

8.1.7.1 All aluminum alloy products accepted by CCS are to be clearly marked, at least at one position, by the manufacturer with CCS [stamp mark](#) and the following particulars:

Section 6 FRICTION STIR WELDED ALUMINIUM ALLOY STIFFENED PLATE

8.6.1 Application

8.6.1.1 This Section applies to friction stir welded aluminum alloy stiffened panel for marine and offshore engineering.

8.6.2 General requirements

8.6.2.1 Friction stir welded aluminum alloy stiffened panels are to be produced by a manufacturer approved by CCS.

8.6.2.2 The aluminum alloy material is generally to be marine aluminum alloy that complies with the relevant requirements of Section 2 of this Chapter.

8.6.3 Manufacture

8.6.3.1 A friction stir welded aluminum alloy stiffened panel is to be composed of several stiffened slats connected by friction stir welding.

8.6.4 Visual testing, non-destructive testing, dimensional testing and macro metallographic testing

8.6.4.1 Friction stir welded aluminum alloy stiffened panels may be subjected to visual testing, non-destructive testing, dimensional testing or macro metallographic testing.

8.6.4.2 One macro metallographic specimen is to be taken from each batch of stiffened plates of not more than 5 tons produced of the same material and with the same friction stir welding process. The methods and results of visual inspection, non-destructive testing, dimensional testing and macro metallographic testing are to comply with the requirements of CCS Guidelines for Inspection of Hull Welds or relevant recognized standards.

8.6.5 Mechanical tests

8.6.5.1 Stiffened plates of not more than 5 tons produced of the same material and with the same friction stir welding process may be tested in batches. One weld transverse tensile specimen is to be taken from each batch, 50 mm or 3 times the thickness of the welded joint (whichever is greater) away from the starting position of the welding test plate, and the size of the specimen is to comply with the provisions of Table 2.2.2.1 in Chapter 2 of this PART.

8.6.5.2 Batches of bend test are to comply with the requirements of 8.6.5.1, and bend specimens are to be taken as follows:

(1) For a plate with no more than 10 welds, 2 sets of bend specimens (the first weld and the second last weld) are to be taken, and the bend specimens are to be taken from 50mm or 3 times the thickness of the welded joint (whichever is greater) away from the starting position of the welding test plate;

(2) For the plate with more than 10 welds, 3 sets of bend specimens (the first weld, the middle weld and the second last weld) are to be taken from 50mm or 3 times the thickness of the welded joint (whichever is greater) away from the starting position of the welding test plate;

(3) The diameter of the former of the bend specimens is to comply with the requirements of 1.2.4.2(2) of PART THREE of this Rules.

8.6.5.3 The methods for the above tests are to comply with the requirements of this PART or relevant recognized standards.

8.6.5.4 Mechanical test results are to comply with the requirements of Table 8.6.5.4.

Table 8.6.5.4 Requirements for mechanical properties of weld joints

Thickness of weld joint	Condition	Tensile strength not less than ^{①②}	Bending property ^③
<5mm	T4 ^④	0.8R _m	The bending angle is at least 150°, and after the test, the test specimens are not to reveal any open defect exceeding 3mm in length on the surface in tension
	T5 and T6	0.7R _m	
>5mm	T4 ^④	0.7R _m	

Note: ① R_m is the specified tensile strength of the parent material.

② If no heat treatment is performed after welding, the requirement of natural aging is to be complied with;

③ When agreed by CCS, it may be accepted in accordance with the recognized standards or the technical specifications of the manufacturer;

④ T4 delivery condition is naturally aged after solution heat-treated.

8.6.5.5 Where the result of any mechanical test does not comply with the requirements, twice the number of the specimens may be additionally taken from the same plate for retests. If retest results are all satisfactory, this batch may be accepted. If any of the retest results is unsatisfactory, each item of the batch is to be examined one by one.

CHAPTER 10 EQUIPMENT

Section 1 ANCHORS

10.1.2.2 Cast steel anchors are to be of steel castings ~~fine grain~~ treated with aluminum for welded construction, and manufactured and tested in accordance with the relevant requirements of Sections 1 and 2, Chapter 6 of this PART.

10.1.7.2 Accepted anchors are to be stamped with CCS ~~approval mark~~ and other markings as follows on the fluke and the shank:

Section 2 MARINE ANCHOR CHAIN CABLES AND ACCESSORIES

10.2.3.2 The chain cables and accessories are to be designed and manufactured in accordance with recognized standards, and their typical designs are shown in Figures 10.2.3.2(1) to (7). The numbers in the Figures represent multiples of the nominal diameter d . A length of chain cable is to comprise an odd number of links. Where accessories are of a construction and produced by a welding process other than those required in these Figures, the whole set of drawings giving details of dimensions, manufacturing process and heat treatment together with technological specifications are to be submitted to CCS for approval.

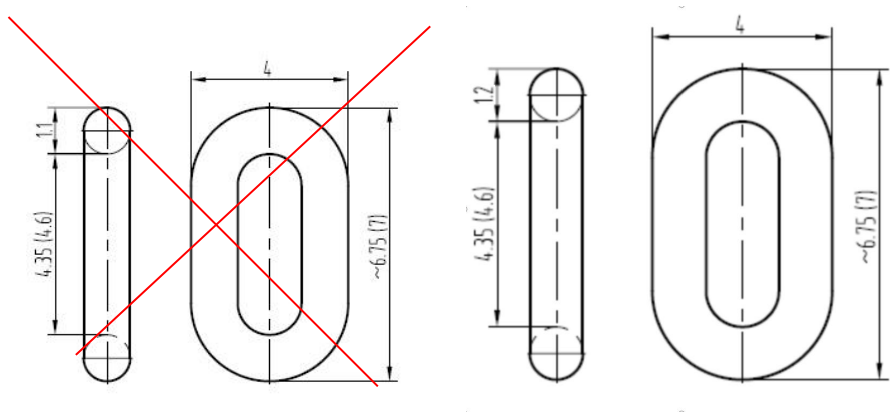


Figure 10.2.3.2(3) End link

10.2.8.2 Breaking load test: From each manufacturing batch (the same cast, diameter and heat treatment) of 25 units or less of shackles, swivels, swivel shackles, enlarged links and end links and from each manufacturing batch of 50 units or less of Kenter shackle, one unit is to be subjected to the breaking load test at the break load specified in Table 10.2.7.2. Parts tested in this way may not be put to further use.

~~Enlarged links and end links need not be subject to breaking test and mechanical test provided that they are manufactured, heat treated and tested together with the chain cable. Enlarged links and end links need not be tested provided that they are manufactured and heat treated together with the chain cable.~~

10.2.9.2 ~~The manufacturer is to provide a certificate giving the following particulars for chain cables or accessories which meet the requirements: Chain cables or accessories which meet the requirements are to be provided by the manufacturer certified by CCS at least with the following items:~~

- (1) name of manufacturer;
- (2) grade;
- (3) cast number (applicable to accessories);
- (4) chemical composition (including total aluminum content);
- (5) nominal diameter/weight;
- (6) proof load and breaking load;
- (7) heat treatment;
- (8) marks on chain cables or accessories;
- (9) length (applicable to chain cables);
- (10) mechanical properties (where applicable).

Section 3 OFFSHORE MOORING CHAINS AND ACCESSORIES

10.3.3.1 The rolled steel bars intended for welded mooring chains and accessories are to comply with the relevant requirements of Section ~~12+0~~, Chapter 3 of this PART.

10.3.10.3 The chain is to be marked on the studs as follows:

- (1) chain grade;
- (2) certificate number;
- (3) CCS [inspection mark stamp](#).

PART TWO NON-METALLIC MATERIALS

CHAPTER 2 PLASTICS MATERIALS

Section 2 RAW MATERIALS

2.2.6.3 The test data to the following items, as applicable, are to be submitted for each type of foam core materials [involved in the structural strength calculation](#):

- (1) density;
- (2) water absorption;
- (3) compressive strength;
- (4) compressive modulus of elasticity;
- (5) tensile strength;
- (6) tensile modulus of elasticity;
- (7) shear strength;
- (8) shear modulus of elasticity;
- (9) maximum recommended service temperature;
- (10) ~~linear shrinkage~~ (dimensional stability);
- (11) [flexural modulus of elasticity](#).

CHAPTER 3 FIBER-REINFORCED PLASTIC HULL MATERIALS

Section 3 LAMINATING PROCEDURE

3.3.3.2 Laminating premises are to comply with the following basic conditions:

(1) The premises are to be ~~fully~~ enclosed, dry, clean, free of dust, adequately ventilated and well lighted. Precautions are to be taken to avoid any sunlight or artificial lighting that affects the resin cure.~~any effects on the resin cure due to direct sunlight or artificial lighting.~~

(2) Temperature is generally to be maintained between 15°C and 32°C and the relative humidity generally kept at less than 80%. In the area used for spray molding, the humidity is generally not to be less than 40%, or follow the construction temperature and humidity conditions recommended by the resin manufacturer, and the temperature and relative humidity are to remain stable.~~and these values are to remain stable to prevent dewfall or condensation. In the area used for spray molding, the humidity is in general not to be less than 40%.~~

CHAPTER 4 PLASTIC PIPES AND FITTINGS

Section 1 GENERAL PROVISIONS

4.1.2 Definitions and terms

4.1.2.1 *Plastic(s)* ~~means both thermoplastic polymers and thermosetting resins with or without reinforcement.~~means both thermoplastic and thermosetting plastic materials with or without reinforcement, such as PVC and fiber reinforced plastics – FRP. Plastic(s) includes synthetic rubber and materials of similar thermos/mechanical properties.

4.1.2.2 *Pipes/piping systems* mean those made of plastics and include the pipes, fittings, system joints, method of joining and any internal or external liners, coverings and coatings required to comply with the performance criteria.

4.1.2.3 *Fittings* mean bends, elbows, telescoping pipelines, fabricated branch pieces etc., of plastic materials.

4.1.2.4 *Joint* ~~means joining pipes by adhesive bonding, laminating, welding, etc.~~means the location at which two pieces of pipe or a pipe and a fitting are connected together. The joint may be made by adhesive bonding, laminating, welding, flanges, etc.

4.1.2.5 *Fire endurance* means the capability of piping to maintain its strength and integrity (i.e. capable of performing its intended function) for some predetermined period of time while exposed to fire.

4.1.3 General requirements

4.1.3.1 The main material of which plastic pipes and fittings are made, construction and design strength of the pipe, manufacturing process, method of joining are to be approved by CCS.

4.1.3.2 Plastic pipes are to be selected according to their chemical composition, temperature limits, mechanical and physical properties, chemical properties and pressure rating of fluid being conveyed.

4.1.3.3 The permissible working temperature depending on the working pressure is to be in accordance with manufacturer's recommendations, but in each case it is to be at least 20°C lower than the minimum heat distortion temperature of the pipe material.~~Except as validated by reliable data, plastic pipes and fittings are generally not used in a piping system with carried fluid temperature over 60°C or below 0°C.~~

Section 4 IDENTIFICATION

4.4.1 Identification

4.4.1.1 All pipes and fittings are to be identified in such a way that traceability to all the component materials used in their manufacture is ensured.

4.4.1.2 All plastic pipes and fittings satisfactorily inspected by CCS are to be permanently

marked by the manufacturer by molding, spray painting or by any other suitable method such as printing, at least at one clearly visible position with ~~the identification of~~ CCS inspection mark and the following:

- (1) type or specifications of the pipe;
- (2) manufacturer's name or trade mark;
- (3) pressure rating;
- (4) base material(s) of which the pipe is made;
- (5) the standard applied;
- (6) recommended service temperature;
- (7) batch number or production number;
- (8) fire endurance and/or low flame spread characteristics (if any).

CHAPTER 7 FIBER ROPES

Section 1 MARINE FIBER ROPES

7.1.5 Marking and certificate

7.1.5.1 Each coil of rope which has been accepted is to be attached marked at a clearly visible position with an attached label detailing the rope name, model, no., material, construction, diameter and length, ~~and~~ the maker's name, and CCS inspection mark ~~additionally identified with CCS stamp~~.

7.1.5.2 The maker is to provide qualified fiber ropes with a qualification certificate detailing at least:

- (1) product name, type and no.;
- (2) material of fiber ropes;
- (3) linear density of fiber ropes;
- (4) length and diameter of a whole fiber rope coil;
- (5) construction of fiber ropes;
- (6) minimum breaking load of fiber ropes (actual breaking load to be added when necessary).

Section 2 FIBER ROPES FOR OFFSHORE MOORING

7.2.7 Marking and certificate

7.2.7.1 Each coil of completed rope is to be marked printed at a clearly visible position (such as protective jacket) with the rope name, diameter and length and the maker's name (or brand name).

7.2.7.2 The fiber ropes which have been accepted are to be identified with securely attached labels (lead sealing recommended) detailing at least the rope no., material, construction and CCS inspection mark ~~additionally identified with CCS stamp~~ at the end of each rope.

7.2.7.3 The manufacturer is to provide qualified fiber ropes with a qualification certificate detailing at least:

- (1) product name, type and no.;
- (2) material of fiber ropes;
- (3) linear density of fiber ropes;
- (4) length and diameter of a whole fiber rope coil;
- (5) construction of fiber ropes;
- (6) nominal breaking load of fiber ropes and actual wet breaking load;
- (7) date of manufacture and inspection;
- (8) highest service temperature;
- (9) shelf-life of product.

PART THREE WELDING

CHAPTER 2 WELDING CONSUMABLES

Section 1 GENERAL PROVISIONS

2.1.2 Works approval

2.1.2.1 Welding consumables are to be made at works which have been approved by CCS, and the steels used for making the welding consumables are also generally to be supplied by steelmakers which have been approved by CCS.

2.1.5 Markings and instructions for use

2.1.5.1 Each box or package of welding consumables approved by CCS is to be clearly marked with CCS approval logo-approved product logo.

Section 2 MECHANICAL PROPERTIES OF WELDING CONSUMABLES

2.2.2 Consumables for welding structural steels

2.2.2.3 The mechanical properties of consumables for welding structural steels are to comply with the requirements given in Table 2.2.2.3.

Mechanical Properties of Consumables for Welding Structural Steels Table 2.2.2.3

Grade of welding consumables		1,2,3	1Y 2Y 3Y 4Y ^①	2Y40 3Y40 4Y40 5Y40	3Y42 4Y42 5Y42	3Y46 4Y46 5Y46	3Y50 4Y50 5Y50	3Y55 4Y55 5Y55	3Y62 4Y62 5Y62	3Y69 4Y69 5Y69	3Y89 4Y89 5Y89	3Y96 4Y96 5Y96	1.5Ni	3.5Ni	5Ni	9Ni	
Deposited metal test	Yield strength ^② R_{eH} (N/mm ²)	≥305	≥375	≥400	≥420	≥460	≥500	≥550	≥620	≥690	≥890	≥960	≥375			≥400	
	Tensile strength ^② R_m (N/mm ²)	400-560	490-660	510-690	520-680	540-720	590-770	640-820	700-890	770-940	940-1100	980-1150	≥460	≥420	≥500	≥600 40	
	Elongation A(%)	≥22			≥20			≥18			≥17	≥14	≥13	≥22	≥25		
	Charpy V-notch impact test	②															
	Test temp. (°C)													-80	-100	-120	-196
	Average impact energy ^② (J)	≥47 ^③			≥47			≥50	≥55	≥62	≥69	≥69	≥69	≥34			
Butt butt weld test	Transverse tensile strength (N/mm ²)	≥400	≥490	≥510	≥520	≥540	≥590	≥640	≥700	≥770	940	980	≥490	≥450	≥540	≥640	
	Charpy V-notch	②															
	Test temp. (°C)													-80	-100	-120	-196

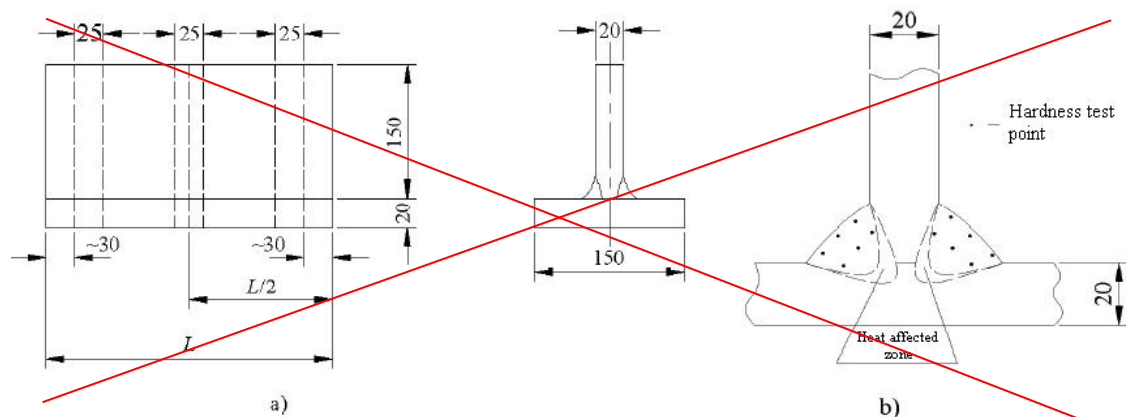
impact test	Average impact energy ^⑥ (J)	≥47 ^⑦	≥47	≥50	≥55	≥62	≥69	≥69	≥69	≥34
Bend test	After testing, the test specimens are not to reveal any open defects in any direction greater than 3 mm ^⑧									

- Notes: ① Manual arc welding electrodes are to comply with Grade 2Y and above.
- ② The temperature of impact test for welding consumables of Grade 1 and Grade 1Y is to be 20°C; for those of Grades 2, 2Y, 2Y40 to be 0°C; for those of Grades 3, 3Y, 3Y40, 3Y42, 3Y46, 3Y50, 3Y55, 3Y62, 3Y69, 3Y89, 3Y96 to be -20°C; for those of Grades 4Y, 4Y40, 4Y42, 4Y46, 4Y50, 4Y55, 4Y62, 4Y69, 4Y89, 4Y96 to be -40°C; for those of Grades 5Y40, 5Y42, 5Y46, 5Y50, 5Y55, 5Y62, 5Y69, 5Y89, 5Y96 to be -60°C.
- ③ The average impact energy of deposited metal test of submerged arc automatic welding is not to be less than 34 J for welding consumables with $R_{eH} < 400$ N/mm²; not to be less than 39 J for those with $R_{eH} \geq 400$ N/mm².
- ④ The average impact energy of butt joints of vertical welding and submerged arc automatic welding is not to be less than 34 J for welding consumables with $R_{eH} < 400$ N/mm²; not to be less than 39 J for those with $R_{eH} \geq 400$ N/mm².
- ⑤ Except for 5Ni and 9Ni steel specimens to be bend tested with a former of diameter four times the plate thickness, the diameter of former is to comply with the requirements of 1.2.4.2 of this PART.
- ⑥ Energy values from individual impact test specimens are not to be less than 70% of the specified values. The acceptance values of impact test for 5Y89 and 5Y96 grades will be specially considered by CCS.
- ⑦ In case of no marked yield stress, the proof stress $R_{p0.2}$ is to be reported.
- ⑧ Where the tensile strength exceeds the specified maximum value, special consideration is to be given by CCS.

Section 3 ELECTRODES FOR MANUAL ARC WELDING

2.3.5 Fillet weld tests

2.3.5.3 As shown in Figure 2.3.5.3(1), three macro-sections, each about 25 mm thick, are to be taken from the test assembly and examined for root penetration, satisfactory profile, freedom from cracking and reasonable freedom from porosity, and slag inclusions. The end faces of the three macro-sections are to be polished and subject to hardness tests as shown in Figure 2.3.5.3(2) to determine the hardness of the welded joints. The hardness test results are to be recorded in the report for reference. The central macro-section is to be polished for hardness tests as shown in Figure 2.3.5.3(2), for the purpose of determining the hardness of the welded joint. One of the two remaining sections is to have the weld on the first side gouged or machined. On the other remaining section, the weld on the second side is to be gouged or machined. The two sections are then to be subjected to fracture tests in accordance with the requirements given in 1.2.4.4 of this PART. The fractured surfaces are to show satisfactory penetration, freedom from cracks and porosity.



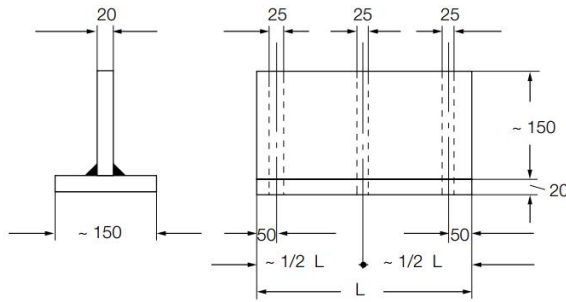


Figure 2.3.5.3(1)

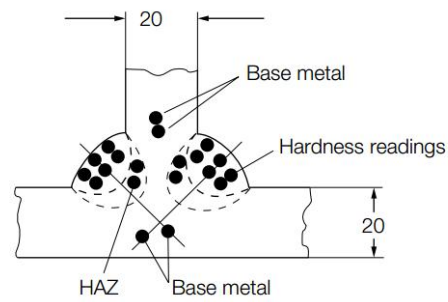


Figure 2.3.5.3(2)

Section 5 WIRES AND WIRE-GAS COMBINATIONS FOR MANUAL, SEMI-AUTOMATIC AND AUTOMATIC WELDING

2.5.1 General requirements

2.5.1.1 Wires (for use with or without a shielding gas) and wire-gas combinations [for manual, semi-automatic and automatic welding](#) may be divided into the following categories according to the process used:

- (1) for wires and wire-gas combinations used in semi-automatic multi-run welding, the suffix “S” is to be added after the grade mark;
- (2) for wires and wire-gas combinations used in single electrode automatic multi-run welding, the suffix “M” is to be added after the grade mark;
- (3) for wires and wire-gas combinations used in single electrode automatic two-run welding, the suffix “T” is to be added after the grade mark;
- (4) for wires and wire-gas combinations used in both two-run and multi-run welding, the suffix “TM” is to be added after the grade mark;
- (5) for wires and wire-gas combinations used in both semi-automatic and automatic welding, the suffix “SM” is to be added after the grade mark.

[2.5.1.5 The wires and the wire-gas combinations used in manual tungsten inert gas \(TIG\) welding are to be subject to approval tests in accordance with the provisions of this section for semi-automatic multi-run welding.](#)

Section 8 WELDING CONSUMABLES FOR STAINLESS STEEL

2.8.3 Deposited metal tests

2.8.3.2 The deposited weld metal is to be subjected to chemical analysis, mechanical test and metallographic examination.

2.8.3.3 The chemical composition of the deposited weld metal, including all significant elements, is to be reported. The analysis results are to comply with recognized standards or the manufacturer’s specifications.

2.8.3.4 The mechanical properties of the deposited weld metal is to comply with the relevant requirements in Table 2.8.3.4.

2.8.3.5 Specimens [of deposited metal for metallographic examination](#) are to be taken at the center of the deposited metal, and the ferrite content of the deposited metal is to be measured by metallographic or magnetic means. For welding consumables for austenitic stainless steels, the ferrite content is to comply with the manufacturer’s specifications. For welding consumables for austenitic/ferritic duplex stainless steels, the ferrite content is to be within the range of 35% to 65%.

CHAPTER 3 APPROVAL OF WELDING PROCEDURES

Section 1 GENERAL PROVISIONS

3.1.1 Application

3.1.1.1 This Chapter applies to the approval of welding procedures prior to the commencement of production welding of structures of normal weldable steels and aluminum alloys at building yards of ships and offshore installations, and manufacturing works of marine products. [Duplex stainless steel described in this chapter include lean duplex stainless steel.](#)

3.1.4 Application of approved welding procedures

3.1.4.8 Approval for a test made in any position is restricted to that position. To qualify a range of positions, test assemblies are to be welded for the highest heat input position (generally vertical upward) and the lowest heat input position (generally horizontal-vertical), and all applicable tests are to be made on those assemblies, except for welding in the vertical downward position. Butt weld joints of pipes with an external diameter more than 25 mm apply to butt weld joints of plates at corresponding positions. [See 4.3.7.1 of this PART for welding position.](#)

Section 2 WELDING PROCEDURE APPROVAL TESTS FOR BUTT WELDS

3.2.7 Additional requirements for welding procedures approval tests of stainless steels

3.2.7.1 For austenitic stainless steel, in addition to the relevant requirements of 3.2.4.1 and 3.2.5 above, the following requirements are to be complied with:

- (1) generally only the center of the weld is subject to the impact test (test temperature is -20°C). In deep cold condition, the center of the weld, fusion line ~~and~~, heat affected zones 21 mm, 3mm and 5mm from the fusion line respectively are to be subject to a set of three impact tests ~~the impact test~~ individually (test temperature is -196°C). The impact energy is not to be less than 27 J;
- (2) the hardness test may be omitted;
- (3) the intergranular corrosion test of welds is to be carried out in accordance with the requirements of Section 7, Chapter 2, PART ONE of the Rules (for austenitic stainless steel used in non-corrosive medium, it may be omitted).

CHAPTER 5 WELDING OF HULL STRUCTURES

Section 2 WELDING OF HULL STRUCTURAL MEMBERS

5.2.4 Welding of hull structural members made from steel castings and forgings

5.2.4.1 Where the hull structural members such as stems, stern frames, rudder stocks and propeller shaft brackets are made from steel castings or forgings, the welding is to comply with the following:

- (1) Where the members to be welded have a carbon content not exceeding 0.23% or are highly rigid, due measures are to be taken for preheating and temperature keeping prior to and after the welding.

(2) Where manual arc welding and CO₂ shielded arc welding are employed, stems, stern frames, rudder stocks and propeller shaft brackets are to be subjected to [tempering stress relief treatment](#) on completion of welding. Where electro-slag welding is employed, stems, stern frames and rudder stocks are to be subjected to normalizing and tempering on completion of welding. Where stems, stern frames, rudder stocks and propeller shaft brackets are of such dimensions that the whole body cannot be heat-treated at the same time, an efficient local heat treatment process may be accepted.

Section 3 INSPECTION AND REPAIRING OF WELDS

5.3.2 Inspection

5.3.2.7 Following locations are to be sampled for non-destructive testing:

- (1) restart/stop points of automatic butt welds (electro slag, electro gas, submerged arc welding);
- (2) butt connections of bilge keel;
- (3) butt welds on inner hull and watertight bulkhead of oil tanker;
- (4) butt welds on longitudinal continuous hatch coaming and top plate of container ship;
- (5) butt connection of longitudinal continuous hatch coaming (including the top plate) more than 0.15L in length, of ships other than container ships;
- (6) butt welds at structure change near superstructure;
- (7) welds of critical locations determined by direct calculation of structural strength or fatigue strength evaluation;
- (8) full penetration welds which are inaccessible or very difficult to inspect in service (such as welds at inner sharp angle within bulb bow of ship);
- (9) [transverse erection welds for catamarans](#);
- (10) other strength welds which are deemed important, subject to high stress or may have significant impact after failure.

CHAPTER 6 WELDING OF OFFSHORE STRUCTURES

Section 3 INSPECTION OF WELDS

6.3.1 General requirements

6.3.1.10 For ~~high strength quenched and tempered steels~~ [high strength steels for welded structures](#) with yield strength not less than 420 N/mm², [the timing of non-destructive testing of welds is to comply with the requirements of 2.4 in Appendix 1 of this PART. non-destructive testing is to be carried out no earlier than 48 h after the completion of the welds in question. When the weldment is to undergo heat treatment, non-destructive testing is to be carried out after the completion of the heat treatment.](#)

CHAPTER 8 WELDING OF IMPORTANT MACHINERY COMPONENTS

Section 4 NON-DESTRUCTIVE INSPECTION AND WELD REPAIRS OF PROPELLERS

8.4.4 General requirements for repairs

8.4.4.7 Weld repairs of defects in zone B are to be as follows:

- (1) With the prior approval by CCS, repair welding is generally allowed in zone B, but avoidance of such repairs is preferred. Detailed and complete information of defects/damages and the intended weld repair procedure is to be submitted for each approval.
- (2) Defects that are not deeper than $t/40$ mm (t being the minimum local thickness according to the approved drawing) or 2 mm (whichever is greater) are generally to be removed by grinding.
- (3) Those defects which are deeper than those referred to in (2) above may be repaired by welding.