GUIDANCE FOR THE APPROVAL AND TYPE APPROVAL OF MATERIALS AND EQUIPMENT FOR MARINE USE

Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use 2017 AMENDMENT NO.1

Notice No.33 1st June 2017
Resolved by Technical Committee on 30th January 2017

ClassNK
NIPPON KAIJI KYOKAI

Notice No.33 1st June 2017
AMENDMENT TO THE GUIDANCE FOR THE APPROVAL AND TYPE APPROVAL OF MATERIALS AND EQUIPMENT FOR MARINE USE

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

Amendment 1-1

Part 4 NON-METALLIC MATERIALS AND COATING MATERIALS FOR HULL

Chapter 1 APPROVAL OF FIRE PROTECTION MATERIALS

1.1 General

Paragraph 1.1.1 has been amended as follows.

1.1.1 Scope

The requirements of this Chapter apply to the tests and inspections for the approval of fire protection material specified in **(1)** through **(~~9~~10)** below in accordance with the requirements of **Part R of the Rules for the Survey and Construction of Steel Ships** (hereinafter referred to as "the Rules").

(1) Non-combustible materials
(2) "*A*" class divisions
(3) "*B*" class divisions
(4) Continuous "*B*" class divisions
(5) Fire retardant base materials
(6) Fire retardant veneers
(7) Fire retardant surface floorings
(8) Primary deck coverings
(9) Fire retardant coatings
(10) Low smoke generation materials

1.2 Definitions

Paragraphs 1.2.10 to 1.2.12 have been renumbered to Paragraphs 1.2.11 to 1.2.13, and Paragraph 1.2.10 has been added as follows.

1.2.10 Low Smoke Generation Materials

"Low smoke generation materials" are the combustible materials used for the purpose of reducing the hazards to life from smoke and toxic products generated during a fire in spaces where persons normally work or live, and which are not to be capable of producing excessive quantities of smoke and toxic products.

1.2.~~10~~11 Fire-resisting Divisions for High-speed Craft

(Omitted)

1.2.~~11~~12 Fire-restricting Materials for High-speed Craft
(Omitted)

1.2.~~12~~13 *FTP* Code
(Omitted)

1.3 Requirements

Paragraphs 1.3.10 and 1.3.11 have been renumbered to Paragraphs 1.3.11 and 1.3.12, and Paragraph 1.3.10 has been added as follows.

1.3.10 Low Smoke Generation Materials
The test procedures for low smoke generation materials are to be in accordance with "Smoke and Toxicity Test" specified in **1.13.2**.

1.3.~~10~~11 Fire-resisting Divisions for High-speed Craft
(Omitted)

1.3.~~11~~12 Fire-restricting Materials for High-speed Craft
(Omitted)

1.4 Application Procedure for Approval

1.4.3 Submission of Attached Documents to the Application

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

1 When obtaining the approval of fire protection materials other than fire retardant coatings, the documents including the following data are submitted to the Society together with the application specified in **1.4.1**:
(1) Historical record of the company
(2) Outline of the facilities of works
(3) If applicable, the documents (a copy of the certificate or the document of compliance) on Quality control system of the company (both of the applicant and the manufacturer)
(4) Kinds of materials (names and trade names of the materials specified in **1.1** and **1.2**)
(5) Constituent materials and their properties
(6) Specifications of the products (including detail drawings)
(7) Test report of the required fire tests specified in **1.3.1** through **1.3.~~11~~12**
(8) Records of service
(9) Marking (label, etc.)
(10) Other items which the Society considers necessary

1.10 Periodical Test

1.10.2 Periodical Tests for Approved Materials other than Fire Retardant Coatings

Sub-paragraph -2 has been amended as follows.

2 The tests specified in **1.3.1** to **1.3.8** as well as **1.3.10** ~~and~~to **1.3.~~11~~12** are to be carried out. However, the tests may be omitted in accordance with the provision 5.2 or 8.3 of the *FTP* Code if the Society considers appropriate.

EFFECTIVE DATE AND APPLICATION (Amendment 1-1)

1. The effective date of the amendments is 1 June 2017.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to ships the keels of which were laid or which were at *a similar stage of construction* before the effective date.
(Note) The term "*a similar stage of construction*" means the stage at which the construction identifiable with a specific ship begins and the assembly of that ship has commenced comprising at least 50 *tonnes* or 1%* of the estimated mass of all structural material, whichever is the less.
* For high speed craft, "1%" is to be read as "3%".

Amendment 1-2

Part 6 MACHINERY

Chapter 8 APPROVAL OF USE OF DIESEL ENGINES

8.2 Application and Approval of Submitted Documents

8.2.2 Drawings and Data

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

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

(2) Drawings and data to be submitted for information for approval

((a) to (m) are omitted.)

(n) Construction of accumulators ~~(common rail)~~ (for electronically controlled engine)

(o) Construction of common accumulators ~~(common rail)~~ (for electronically controlled engine)

((p) to (w) are omitted.)

Sub-paragraph -4 has been amended as follows.

4 In addition to those required by **-1** to **-3** above, those listed in the following **(1)** to **(6)** are to be submitted, each in triplicate, for the purpose of ~~assessing~~ confirming whether the manufacturing facility (including production and assembly lines, machining units, special tools and devices, assembly and testing rigs as well as all lifting and transportation devices) is equipped in a way which allows it to consistently produce engines and relevant engine components of a stable quality in accordance with required standards~~presented in accordance with **Chapter 11** of this Part~~.

(1) Outline of the manufacturing plant

(2) Information on the manufacturing facility and the manufacture and quality control of the diesel engine

(3) Records of manufacture and delivery of the diesel engine

(4) Approval test plan (the place and scheduled date of the test are to be included)

(5) Test records (when a preliminary test is carried out)

(6) Other data considered necessary by the Society

EFFECTIVE DATE AND APPLICATION (Amendment 1-2)

1. The effective date of the amendments is 1 June 2017.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to diesel engines for which the date of application for approval is before the effective date.

Amendment 1-3

Part 1 METALLIC MATERIALS

Chapter 1 APPROVAL OF MANUFACTURING PROCESS OF ROLLED STEELS

1.2 Approval Application

Paragraph 1.2.2 has been amended as follows.

1.2.2 Documents to be Submitted

1 Three copies each of the documents given in **(1)** and **(2)** are to be submitted together with the appropriate application form specified in **1.2.1**.

(1) Approval test plan

(2) Technical data given in the following **(a)** through **(k)**

(a) Data on works
- i) Name and location of the works
- ii) General indications relevant to the background
- iii) Dimension and size of the works
- iv) Organizational chart and number of staff employed
- v) Estimated total annual production of finished and semi-finished products (for shipbuilding and for other applications)

(b) Data on quality control system
- i) Organization and number of staff employed of the quality control department
- ii) Qualification of the personnel involved in activities related to the quality of the products
- iii) Items and methods for quality control system
- iv) Outline of system used for identification of materials
- v) Outline of testing machines and relevant calibration procedures and records
- vi) Outline of equipment for chemical analyses and metallography and relevant calibration procedures
- vii) Outline of equipment for non-destructive tests and relevant calibration procedures
- viii) Certification of compliance of the quality system with *ISO* 9001, if any
- ix) Where approval has already been granted for **viii)** by other classification societies, certification (a copy) of such approval

(c) Data on steel products
- i) Type of product ~~and~~, grade of steel and condition of heat treatment
- ii) Maximum manufacturing thickness or dimensions
- iii) Deoxidation practice and grain refining elements
- iv) Manufacturing control standard for each chemical composition (if the system of constituent depends on grade, thickness, heat treatment etc., the different ranges are to be specified, as appropriate. In cases where grain refining, micro alloying and residual elements, including *Zr*, *Ca* or rare earth metals, are added, the manufacturing control standard for each element is to be specified along with the aim of addition. For high strength rolled steels for offshore structures, details regarding nitrogen binding elements are to also be included.)
- v) Maximum carbon equivalent ~~(C_{eq})~~ (in cases where specified otherwise, this value is to be calculated by the formula specified in **1.5.2-2(6)**, **Part K of the Rules**)

vi) Maximum cold cracking susceptibility (P_{cm}) for higher strength grades with low carbon content $C \leq 0.13\%$ (this value is to be calculated by the formula specified in **1.5.2-2(6)**, **Part K of the Rules**)

vii) Actual manufacturing records within the specific period (chemical composition, mechanical properties and thickness or dimension are expressed in the form of histogram or statistics for each heat treatment)

(d) Data on manufacturing process

i) Origin and storage of raw materials

ii) Flow chart of the manufacturing process

iii) Outline of major manufacturing facilities (including control methods)

iv) Storage of finished and semi-finished products

(e) Data on steel making process

i) Outline of steel making process

ii) Type and capacity of steel making furnace and the number of daily charge

iii) Raw materials and sub materials

iv) Deoxidation ~~and~~, grain refining, ~~practice~~ refining and secondary refining practice

v) ~~Secondary refining practice~~ Nitrogen binding practice (for high strength rolled steels for offshore structures only, if any)

vi) Type of desulphurisation, dehydrogenation, sulphide treatment, ladle refining or vacuum degassing installations

~~vi~~ vii) Casting methods (ingot casting or continuous casting)

viii) Casting/Solidification cooling rate control

~~vii~~ ix) Scarfing and discarding procedures of ingot or semi-finished products

~~viii~~ x) Size and weight of ingot or semi-finished products

(f) Additional data in the case of applying continuous casting

i) Outline of continuous casting machine (including type of casting machine, number of strand, casting practice, casting temperature, casting speed etc.)

ii) Preventive methods for re-oxidation of charge

iii) Reduction methods for non-metallic inclusions

iv) Preventive methods for segregation

v) Presence of electromagnetic stirring

vi) Presence of soft reduction system

(g) Data on ingot or semi-finished product reheating process

i) Outline of heating furnace (including type and capacity)

ii) Heating temperature and holding time

(h) Data on rolling process

i) Outline of rolling machine (including type and capacity of rolling machine and control methods of thickness and temperature)

ii) Starting and finishing temperature of rough and finish rolling (if the temperature depends upon grade of steel and thickness, the differences are to be clearly indicated)

iii) Reduction ratio (if the ratio depends upon grade of steel and thickness, the differences are to be clearly indicated)

iv) Outline of descaling device

(i) Additional data in case of applying *CR/NR* or *TMCP*.

i) Outline of *CR/NR* or *TMCP* process (including control method of thickness and temperature and calibration method of the control equipment)

ii) Re-crystallization temperature, *Ar*3 temperature and its determination methods

iii) ~~Rolling pass schedule~~ Control standards for controlled rolling (including control

ranges for thickness and temperature at the beginning and the end of~~passes besides at each pass~~ rough and finish rolling)

iv) Outline of Accelerated Cooling (*AcC*) (including outline of cooling system, cooling method, temperature range, cooling speed and a cooling measure in a uniform way)

v) Actual manufacturing records within the specific period (in addition to **(c)vii)** above, description of relation between tensile strength and carbon equivalent, and variation of mechanical properties in direction of rolling, direction of the steel width and direction of thickness)

vi) Recommendation relevant to cold and hot working after shipment (where only the case of the special attention is needed)

vii) Range of available welding heat input (where the upper limit of welding heat input exceeds 50 *kJ*/*cm*)

viii) Minimum and maximum heat input and recommended pre-heat/interpass temperatures for welding work (for high strength rolled steels for offshore structures only)

(j) Data on heat treatment process

i) Outline of heat treatment furnace (including type and capacity)

ii) The methods used to determine austenitizing temperature, re-crystallization temperature and *Ar*3 temperature

~~ii~~ iii) Rate of temperature increase, ~~H~~heating temperature and ~~holding~~ unit holding time per *mm* (if these depend upon grade of steel and thickness, the differences are to be clearly indicated)

iv) Cooling method and cooling rate (if these depend upon grade of steel and thickness, the differences are to be clearly indicated)

~~iii~~ v) Accuracy and calibration of temperature control device

vi) Measurement methods of temperature for each process

(k) Data on product surface inspection

i) Acceptance criteria and applicable standards for surface inspections

ii) Number of operators, personnel arrangement, distances between operators and products during inspection (including diagram)

iii) Luminance of inspection site

(l) Data on product internal soundness

i) Test procedures and applicable standards for verification of internal soundness

ii) Acceptance criteria and applicable standards for internal imperfections

iii) Verification method of internal soundness (including frequency of internal inspections, and steel grade, thickness, etc., of applicable steel.)

(~~k~~m) Additional documents related to the approval of the manufacturing process of corrosion resistant steel for cargo oil tanks specified in **3.13, Part K of the Rules for the Survey and Construction of Steel Ships**

i) Test plan for the corrosion resistance test for cargo oil tanks (including the timing of the Surveyor's presence)

ii) Details of test equipment and test environment

iii) Technical data for assessment criteria of the chemical composition range of elements to be added for improving the corrosion resistance for pre-shipment inspection

iv) Technical background of the chemical composition range described in **iii)** above

v) The grades, brand names and maximum thickness of the corrosion resistant steel for cargo oil tanks

vi) The welding consumables (the brand names and the approval certificate numbers) and the welding methods to be applied

(~~l~~n) Where approval has already been granted by other Classification Societies, documentation of such approval tests performed

(~~m~~o) Other data deemed necessary by the Society

2 Where any part of manufacturing process is assigned to other works, additional information relevant to the name and address of the works in question together with the organization and method of inspection for the materials of which the manufacturing process is assigned are to be included.

3 Notwithstanding the requirements in preceding **-1**, where the documents are duplicated by the ones at the previous approval for the same type of products, grades, deoxidation practice, etc., part or all of the documents may be omitted. However, approval test specified in **1.4** is required, approval test plan specified in **-1(1)** is not be exempted from submission.

1.4 Approval Test

Paragraph 1.4.1 has been amended as follows.

1.4.1 Extent of the Approval Tests

1 Approval for the manufacturing process of rolled steels is to be the following **(1)** and **(2)** if deemed appropriate by the Society.

(1) Rolled steels for hull, rolled steels for low temperature service and high strength ~~quenched and tempered~~ rolled steels for offshore structures

Approval for any grade of steels may also covers approval for any lower grade of steels (of which specific temperature of impact test is higher than that of test sample) in the same strength level provided that kind, deoxidation practice, grain refining and micro-alloying elements, heat treatment, steel making process, steel casting process and maximum manufacturing thickness or dimensions are same. For higher tensile steels for hull, in addition to above, approval of one strength level may also covers the approval of the same grade and below in the strength level immediately below. In addition, in cases where this provision is being applied to high strength rolled steels for offshore structures this provision, technical documents deemed necessary by the Society may also be required.

(2) Rolled steels other than those of preceding **(1)**

Approval for any strength level of steels may also covers approval for any lower strength of steels (of which specific yield strength level is lower than that of test sample) provided that kind, deoxidation practice, heat treatment, steel making process, steel casting process and maximum manufacturing thickness or dimensions are same and the range of manufacturing control standards of chemical composition is similar.

2 Those manufacturers manufacturing rolled steels in accordance with the approved processes given in this Chapter are also considered to have obtained the approval of the Society based upon the requirements of **Chapter 1B** with regard to semi-finished products manufactured by approved processes.

3 In the case of manufacturing rolled steels from semi-finished products manufactured by other plants, manufacturers are to carry out approval tests in accordance with the requirements given in **1.4**, and the manufacturing processes of such semi-finished products are to be approved by the Society.

Paragraph 1.4.2 has been amended as follows.

1.4.2 Selection of Test Samples

1 Test samples used for approval test of rolled steels are to be selected according to the following **(1)** ~~and~~ through **(~~2~~5)** :

(1) Test samples are generally to be selected for each grade and kind by each charge of rolled steels of which deoxidation practice, grain refining and micro-alloying elements, heat treatment, steel making process and steel casting process are same, based upon typical chemical composition (including the desired carbon equivalent or cold cracking susceptibility values if applicable).

(2) In case of ingot casting, test samples are to be selected from the steels ~~which are directly rolled from top of a~~ corresponding to the top of the ingot~~, and in case of continuous casting, test samples are to be selected from the steels which are directly rolled from one of any semi-finished products~~, except where specially approved by the Society. ~~Test samples of semi-finished products are also to be selected corresponding to each casting process.~~

(3) Notwithstanding the requirements in the preceding **(2)**, in the case of high strength rolled steels for offshore structures, test samples are to be selected from steels corresponding to the tops and bottoms of ingots.

(4) In the case of continuous casting, test samples are to be selected from the steels which are directly rolled from a semi-finished product.

(5) Test samples of ingots or semi-finished products are also to be selected according to each casting process.

2 The plate thicknesses or dimensions of test samples are to be the maximum manufacturing thicknesses or dimensions. Moreover, in case of the steel plates are manufactured from the continuous casting slabs, the maximum manufactured thickness is to be determined, with the reduction ratio is 6 as standard. However, upon consideration of the manufacturing process, the reduction ratio may be reduced to 4 (in case of steel plate of over 50*mm* thickness may be reduced to 3).

3 Where the maximum manufacturing thickness of rolled steels for hull, rolled steels for low temperature service and ~~quenched and tempered~~ high ~~tensile~~ strength rolled steels for offshore structures is more than 50 *mm*, 40 *mm* and ~~70~~ 50 *mm* respectively, and in the case of first approval of at least one item of deoxidation practice, grain refining and micro-alloying elements, heat treatment, steel making process and steel casting process, Society may request an additional test samples of which thickness is indicated with a ● mark in **Table 1.1-1** or other proper thickness, in addition to the test samples in accordance with **-2**.

4 Notwithstanding the requirements in the preceding **-2,** ~~T~~the rolled reduction ratio ~~of~~ is to be at least 5 for rolled bars for offshore mooring chains (hereinafter referred to as "offshore chains") ~~are to be at least 5~~, and at least 3 for high strength rolled steels for offshore structures.

Table 1.1-1 has been amended as follows.

Table 1.1-1 Standard Thickness and Dimensions of Test Samples

Material symbol			Deoxidation, grain refining etc.	Thickness[(1)] (*mm*)	
				0 10 20 30 40 50 60 70	
Rolled steels for hull	*KA*		Any method except rimmed	● ●	(2)
	KB		Any method except rimmed	● ●	
	KD		Killed and fine grain treated	● ●	
	KE		Killed and fine grain treated	● ● (35)	
	*KA*32	*KA*36	Killed and fine grain: without *Nb* and/or *V*	● (12.5)	
			Killed and fine grain: with *Nb* and/or *V*	● ●	
	*KD*32	*KD*36	Killed and fine grain: without *Nb* and/or *V*	● ●	
			Killed and fine grain: with *Nb* and/or *V*	● ●	
	*KE*32	*KE*36	Killed and fine grain treated	● ●	
	*KA*40		Killed and fine grain treated	● ●	
	*KD*40			● ●	
	*KE*40			● ●	
	*KF*32			● ●	
	*KF*36			● ●	
	*KF*40			● ●	
	*KE*47			● ●	
Rolled steels for low temperature service	*KL*24*A*		Aluminium treated killed and fine grain treated	● ●	(2)
	*KL*24*B*			● ●	
	*KL*27			● ●	
	*KL*33			● ●	
	*KL*37			● ●	
	*KL2N*30			● ●	
	*KL3N*32			● ●	
	*KL5N*43			● ●	
	*KL9N*53			● ●	
	*KL9N*60			● ●	70
~~Quenched and tempered~~ high ~~tensile~~ strength rolled steels for offshore structure	*KA*420, *KD*420 *KE*420, *KF*420		Killed and fine grain treated	● ●	(2)
	*KA*460, *KD*460 *KE*460, *KF*460			● ●	
	*KA*500, *KD*500 *KE*500, *KF*500			● ●	
	*KA*550, *KD*550 *KE*550, *KF*550			● ●	
	*KA*620, *KD*620 *KE*620, *KF*620			● ●	
	~~*KA620N, KD620N KE620N, KF620N*~~			● ●	
	*KA*690, *KD*690 *KE*690, *KF*690			● ●	
	~~*KA690N, KD690N KE690N, KF690N*~~			● ●	
	*KA*890, *KD*890 *KE*890			● ●	
	*KA*960, *KD*960 *KE*960			● ●	

Notes :

(1) The colored portion (and) show the range or thickness for which normalizing of quenching and tempering treatment have been specified for steel plates respectively, while the uncolored portion shows the as-rolled condition. However, quenching and tempering is included for *KE*40, *KF*32, *KF*36 and *KF*40, and normalizing and tempering is

included for *KL2N*30, *KL3N*32 and *KL5N*43, and *KL9N*53 is to be double normalized and tempered.

(2) See **1.4.2-3**.

Table 1.1-2 has been amended as follows.

Table 1.1-2 Approval Test Items for Rolled Steels

Rolled steels		Kind of test (See Note[1])																							
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)
Rolled steels for hulls	*KA*	○	○			○	○		○	○		○													○
	KB	○	○			○	○		○	○		○	○												○
	KD	○	○			○	○		○	○		○	○												○
	KE	○	○			○	○		○	○		○	○		○		○	○	○	○					○
	*KA*32, *KA*36, *KA*40	○	○			○	○		○	○		○	○					○	○	○					○
	*KD*32, *KD*36, *KD*40	○	○			○	○		○	○		○	○					○	○	○					○
	*KE*32, *KE*36, *KE*40	○	○			○	○		○	○		○	○		○		○	○	○	○					○
	*KF*32, *KF*36, *KF*40	○	○			○	○		○	○		○	○		○		○	○	○	○					○
	*KE*47	○	○			○	○		○	○		○	○		○	○	○	○	○	○	○	○			○
Rolled steels for boilers	*KP*42 ~ *KPA*56	○	○			○	○		○	○		○								○					○
Rolled steels for pressure vessels	*KPV*24~*KPV*50	○	○			○	○		○	○		○	○				○			○					○
Rolled steels for low temperature service	*KL*24*A*~*KL*9*N*60	○	○			○	○		○	○		○	○		○		○	○	○	○					○
Rolled stainless steels	*KSUS*304~*KSUS*347	○	○			○	○		○	○		○											○		○
Round bars for chains	*KSBC*31~*KSBC*70	○	○			○	○		○	○		○								○					○
	*KSBCR*3, *KSBCR*3*S*, *KSBCR*4, *KSBCR*4*S*, *KSBCR*5	○	○			○	○		○	○		○	○	○	○					○				○	○
Rolled steel bars for boilers	*KPS*42*B*~*KPS*46*B*	○	○			○	○		○	○		○													○
Rolled carbon steel bars	*KSFR*41~*KSFR*78	○	○			○	○		○	○		○													○
Rolled low alloy steel bars	*KSFAR*60~*KSFAR*110	○	○			○	○		○	○		○													○
~~Quenched and tempered HT~~ High strength rolled steels for offshore structures	*KA*420, *KD*420, *KA*460, *KD*460, *KA*500, *KD*500, *KA*550, *KD*550, *KA*620, ~~*KA620N,*~~ *KD*620, ~~*KD620N,*~~ *KA*690, ~~*KA690N,*~~ *KD*690, ~~*KD690N*~~ *KA*890, *KD*890, *KA*960, *KD*960,	○	○			○	○		○	○		○	○				○	○	○	○	○	○			○

~~Quenched and tempered~~	*KE*420, *KF*420, *KE*460, *KF*460, *KE*500, *KF*500, *KE*550, *KF*550, *KE*620, ~~*KE620N,*~~ *KF*620, ~~*KF620N,*~~ *KE*690, ~~*KE690N,*~~ *KF*690, ~~*KF690N*~~ *KE*890, *KE*960,		○	○			○	○		○	○		○	○		○		○	○	○	○	○	○			○
Stainless clad steels	Base metal	*KA*~*KF*40																									
	Cladding metal	*KSUS*304~ *KSUS*347	○	○	○	○	○	○	○	○	○	○	○											○	○	○

Notes :

(1) Kind of Test

Base metal test

(a) Chemical analysis
(b) Sulphur print
(c) Macro-structure
(d) Micro-structure
(e) Austenite grain size
(f) Ferrite grain size
(g) Hardness test
(h) Tensile test
(i) Bend test
(j) Shearing strength test
(k) Charpy impact test
(l) Strain aging Charpy impact test
(m) Hydrogen embrittlement test

Brittle fracture test

(n) *CTOD* test (Crack Tip Opening Displacement test) or deep notch test
(o) Temperature gradient *ESSO* test or double tension tests
(p) *NRL* drop weight test

Weldability test

(q) Butt welding tensile test
(r) Butt welding impact test
(s) Welding hardness test
(t) Y-shape weld crack test (Hydrogen crack test)
(u) *CTOD* test (Crack Tip Opening Displacement test) or deep notch test

Corrosion resistance test

(v) Corrosion test

Non-destructive test

(w) Ultrasonic test

Dimensional measurement

(x) Dimensional measurement

(2) Approval test items for semi-finished products are to be chemical analysis, sulphur print and macro-structure.

(3) For the rolled steel which is applied *TMCP* heat treatment may be requested *SR* tensile test in addition to those tests given in the table.

(4) For the high strength rolled steels for offshore structures specified in **3.8**, **Part K of the Rules**, microscope examinations for non-metallic inclusions are required in addition to those tests given in the table.

(~~4~~5) For steel materials with through thickness properties as specified in **3.11**, **Part K of the Rules**, the thickness directional tensile test, microscope examination for non-metallic inclusions, ultrasonic test are required in addition to those tests given in the table.

(~~5~~6) For steel materials with brittle crack arrest properties as specified in **3.12**, **Part K of the Rules**, temperature gradient *ESSO* tests or double tension tests are required.

(~~6~~7) For kind of product other than steel plates, the strain aging Charpy impact test, *NRL* drop weight test, *CTOD* test or deep notch test are not required, unless otherwise specified. However, where cast piece from the continuous casting method is used, each test item of the macro-structure of the cast piece and its sulpher print may need to be added.

(~~7~~8) The *CTOD* test, the strain aging Charpy impact test are required by the Table for round of offshore chains, these tests may be omitted in case appropriate records prepared by the manufacture are available. In this case, such records and documents on heat treatment sensitivity, resistant to strain aging, temper embrittlement are to be submitted to the Society.

(~~8~~9) The *CTOD* test or deep notch test are, in principle, to be conducted in cases where thickness is more than 50*mm*.

(~~9~~10) The *CTOD* test and double tension test, temperature gradient *ESSO* test, deep notch test etc. as specified in the table are performed for the purpose of evaluating low temperature toughness, and these tests may be omitted in case appropriate records prepared by the manufacturer are available or in case the Society deems the tests unnecessary.

(~~10~~11)For the corrosion resistant steel for cargo oil tanks specified in **3.13, Part K of the Rules for the Survey and Construction of Steel Ships**, corrosion resistance test for cargo oil tanks is required in addition to those tests for rolled steels for hull given in the table.

(~~11~~12)Both *CTOD* tests and deep notch tests may be required in cases where deemed necessary by the Society.

(13) For the high strength rolled steels for offshore structures specified in **3.8**, **Part K of the Rules** whose strength levels are *K*420, *K*460 or *K*500, test specimens selected from butt weld assemblies to which post weld heat treatment are applied are required to be tested in addition to the test items for applicable weldability tests given in the table.

Table 1.1-3 has been amended as follows.

Table 1.1-3 Approval Testing Method and Acceptance Criteria

Approval test item		Selected location of test samples (1) (2)	Length direction of test specimen (3) (4)	Testing method	Acceptance criteria	Notes
Base metal test	Chemical analysis	Top	–	*JIS G* 0320, *JIS G* 0321 or equivalent method. Ladle analysis and product analysis (5) are to be performed for elements specified in **Part K of the Rules**, and other elements (4) as deemed necessary. In cases where a carbon equivalent or cold cracking susceptibility value is to be satisfied, the value is to be specified.	Chemical composition by ladle analysis is to comply with the requirements in **Chapter 3, Part K of the Rules**.(6)	・ The sample is to be selected from tensile test specimens. ・ Excessive differences in the chemical compositions between ladle analysis and product analysis are not to be accepted. ・ Analysis is to be carried out for grain refining and micro-alloying elements (including *Zr*, *Cr*, or rare earth metals) ・ In the case of rolled steels for hulls, analysis is to be carried out for *As*, *Sn*, *B* and *Sb*. (for *B* and *Sb* in the case of steel making by electric furnace or open hearth furnace) ・ In the case of high strength rolled steels for offshore structures, if applicable, analysis is to be carried out for *As*, *Sn*, *B*, *Sb*, *Bi*, *Pb* and *H*, and nitrogen binding elements are also to be included.
	Sulphur print	Top	Transverse	*JIS G* 0560, *ISO* 4968 or equivalent method. ~~Length is to be 600 mm or greater.~~ Sulphur prints are to be taken from plate edges which are perpendicular to the axis of the ingot or slab. These sulphur prints are to be approximately 600 *mm* long taken from the centre of the edge selected, i.e. on the ingot centreline, and are to include the full plate thickness.	Bias etc. deemed to have negative effects are not to be present.	-
	Microscopic examination for non-metallic inclusions	Top	Parallel	*JIS G* 0555, *ISO* 4967 or equivalent method.	To be as deemed appropriate by the Society.	-
		Bottom	Parallel			
	Macro-structure	Top	Transverse	*JIS G* 0553, *ISO* 4969 or equivalent method.		・ For continuous casting billets before rolling, macrostructure tests may be omitted for bottom portions.
		Bottom(7)	Transverse			
	Micro-structure	Top	–	Microscopic photographs (approx. 100x) of base metal, joining part and cladding metal are to be taken.		-
		Bottom	–			

Approval test item		Selected location of test samples (1) (2)	Length direction of test specimen (3) (4)	Testing method	Acceptance criteria	Notes
Base metal test	Austenite grain size Ferrite grain size	Top	–	*JIS G* 0551, *ISO* 643, *ASTM E* 112 or equivalent method.(8) Magnification of microscopic photographs are to be, as a rule, 100x(9). The grain size is required for each microscopic photographs. In the case of austenite grain sizes which cannot be measured, pre-austenite grain size is to be determined.	For decisions other than those specified according to **Chapter 3**, **Part K of the Rules**, to be as appropriate by the Society.	▪ In case of steels over 40 *mm* in thickness, tests are to be carried out on the surface, the position 1/4 of thickness and the middle of the thickness. ▪ In the case of ferrite grain size numbers over 10, microscopic photographs (500x) are to be taken. ▪ In the case of high strength rolled steels for offshore structures, microscopic photographs (x100 and 500x) are to be taken.
	Hardness test	Top	–	In accordance with the requirements in **Part K of the Rules**. Hardness distribution in the thickness direction is to be measured in the case of stainless clad steel.	For decisions other than those specified according to **Chapter 3**, **Part K of the Rules**, to be as appropriate by the Society.	-
	Tensile test	Top(10)	Transverse	In accordance with the requirements in **Part K of the Rules**.(11)	To meet the requirements in **Chapter 3**, **Part K of the Rules**.	▪ In the case of hot coils, test samples are also to be selected from the middle of the length direction specified in **1.4.2-1**. ▪ In the case of high strength rolled steels for offshore structures, test specimens are to be taken with their longitudinal axis parallel and transverse to the final direction of rolling from top and bottom ▪ In cases where deemed necessary by Society, additional test specimens are taken with their longitudinal axis parallel to the final direction of rolling ▪ In the case of round tensile test specimens of bars taken from steels over 40 *mm* in thickness, test specimens are to be taken from 1/4 and 1/2 of thickness. ▪ In the case of high strength rolled steels for offshore structures, reduction of area and yield to tensile ratio are to be reported for reference.

Approval test item		Selected location of test samples (1) (2)	Length direction of test specimen (3) (4)	Testing method	Acceptance criteria	Notes
Base metal test	Bend test	Bottom	Transverse	In accordance with the requirements in **Part K of the Rules**.~~(12)~~	To meet the requirements in **Chapter 3**, **Part K of the Rules**.~~(12)~~	・ When approved by the Society, test samples taken from the top may be used. ・ Shapes and sizes of test specimens, testing methods and acceptance criteria for materials for which bend tests are not prescribed in the **Part K of the Rules** are to be as deemed appropriate by the Society.
	SR tensile test	Top	Parallel	To be as deemed appropriate by the Society. However, the test specimens which have been maintained for 2 *minutes* per 1 *mm* of thickness at 600 °C (minimum 60 *minutes*), as a rule, to be used	To be as deemed appropriate by the Society.	–
		Bottom	Parallel			
	Thickness directional tensile test	Top	Thickness direction	In accordance with the requirements in **Part K of the Rules**.	To meet the requirements in **Chapter 3**, **Part K of the Rules**.	–
		Bottom				
	Shearing strength test	Top	–	In accordance with the requirements in **Part K of the Rules**.	To meet the requirements in **Chapter 3**, **Part K of the Rules**	–
		Bottom	–			
	V-notch Charpy impact test ~~(13)~~	Top~~(10)~~	Parallel	Using *U*4 test specimen~~(14)~~, the transition temperature curve of the absorbed energy and fracture surface ratio is to be deter mined by testing three pieces at each temperature in addition to the lateral expansion of test specimen. Furthermore, the test temperature is to include the temperature~~(15)~~ as specified in **Part K of the Rules**, and its interval is to be 10 ~ 20℃.(7)	For decisions other than those specified according to **Chapter 3**, **Part K of the Rules** to be as appropriate by the Society.	・ In the case of hot coils, test samples are also to be selected from the middle of length direction specified in **1.4.2-1**. ・ In the case of high strength rolled steels for offshore structures, additional test specimens are to be taken with their longitudinal axis parallel to the final direction of rolling from samples selected at bottoms. ・ *V*-notch charpy impact test specimens for stainless clad steels are to be taken from the base material. ・ In the case of steels over 40 *mm* in thickness, test specimens are to be taken from 1/4 and 1/2 of thickness. ・ In the case of rolled steels for hull, the test temperatures are to include at least the temperatures in **Table 1.1-4**. ・ In the case of high strength rolled steels for offshore structures, the test temperatures are to include at least the temperatures in **Table 1.1-5**.
			Transverse			
		Bottom	Parallel			

Approval test item		Selected location of test samples (1) (2)	Length direction of test specimen (3) (4)	Testing method	Acceptance criteria	Notes
Base metal test	Strain aging charpy impact test[16]	Top[10]	Parallel	Using *U*4 test specimen[14], the transition temperature curve of the absorbed energy and fracture surface ratio is to be determined by testing three pieces at each temperature in addition to the lateral expansion of test specimen. Furthermore, the test temperature is to include the temperature[15] as specified in **Part K of the Rules**, and the test specimens which have been maintained for one hour at 250℃ after strain of 5% or 10% have been applied is, as a rule, to be used.	To be as deemed appropriate by the Society.	・ In the case of hot coils, test samples are also to be selected from the middle of length direction specified in **1.4.2-1**. ・ In the case of steel other than steel plates (including flat bars not less than 600 *mm* in width), the test may be omitted. ・ In the case of high strength rolled steels for offshore structures, additional test specimens are to be taken with their longitudinal axis parallel to the final direction of rolling ・ In the case of steels over 40 *mm* in thickness, test specimens are to be taken from 1/4 and 1/2 of thickness. ・ In the case of rolled steels for hulls, the test temperatures are to include at least the temperatures in **Table 1.1-4**. ・ In the case of high strength rolled steels for offshore structures, the test temperatures are to include at least the temperatures in **Table 1.1-5**. ・ In the case of high strength rolled steels for offshore structures, this test may be carried out on the thickest plate.
	Hydrogen embrittlement test	Top	Parallel	In accordance with the requirements in **Part K of the Rules**.	In accordance with the requirements in **Part K of the Rules**	-
		Bottom	Parallel			
Brittle fracture test	*CTOD* test or deep notch test	Top	Parallel	To be consulted with the Society the dimension of test specimen, test condition etc. When newly performing tests at the time of approval.	To be as deemed appropriate by the Society.	-
	Temperature gradient *ESSO* test or double tension test	—	—	In accordance with **Annex K3.12.2-1, Part K of the Rules.**		-
	NRL drop weight test	Top	Parallel	*ASTM E* 208 or equivalent method.[17]		・ Nil-ductility transition temperatures (*NDTT*) and photographs of test specimens after testing are to be included in test reports.

Approval test item		Selected location of test samples (1) (2)	Length direction of test specimen (3) (4)	Testing method	Acceptance criteria	Notes
Weldability (5) (~~18~~6) (7)	Butt welding tensile test (~~16~~)(~~19~~)	Top	Transverse for welding direction	Tensile test is to be carried out for one test specimen of *U*2*A* or *U*2*B*	In accordance with the requirements in **Chapter 4**, **Part M of the Rules**.	・ In the case of steels other than steel plates (including flat bars not less than 600 *mm* in width), the test may be omitted. ・ Test specimens are, in principle, to be selected from each test sample specified in **Table 1.1.-6**. ・ When the capacity of a test machine is exceeded by the use of a full-thickness specimen, the test specimen may be divided in the thickness direction to be tested.
	Butt welding impact test (~~16~~)(~~19~~)	Top		One set of three *U*4 test specimens is to be selected from at weld junction, 2 *mm* from weld junction, 5 *mm* from weld junction and 20 *mm* from weld junction of position of notch respectively (Refer to **Fig. 1.1-2**), and tested at temperature in accordance with **Part K of the Rules**. (~~20~~)	To be as deemed appropriate by the Society.	・ In the case of steels other than steel plates (including flat bars not less than 600 *mm* in width), the test may be omitted. ・ Test specimens are, in principle, to be selected from each test sample specified in **Table 1.1.-6**. ・ Test specimens are to be taken at 1-2 *mm* below the face sides of test samples. ・ For *KE*47 steel, test specimens are taken at positions of 1/4 thickness from the face sides and the root sides, and the transition temperature curves of absorbed energy and fracture surface ratios are to be determined. The temperature interval is to be 10°C to 20°C. ・ For high strength rolled steels for offshore structures, specimens whose notches are located at the weld metal are to be tested in addition to the specimens specified in the left column. In addition, in cases where plate thickness is not less than 50 *mm*, test specimens at root sides are required for each aforementioned position.

Approval test item		Selected location of test samples (1) (2)	Length direction of test specimen (3) (4)	Testing method		Acceptance criteria	Notes
Weldability (5) ~~(6)~~ (7)	Welding hardness test	Top	–	Rolled steels for hull Rolled steels for low temperature service High strength ~~quenched and tempered~~ rolled steel ~~plates~~ for offshore structures (Each plate is to includ~~ing~~e steel flats not less than 600 *mm* in width)	At section of butt welding joint, welding hardness test is measured 0.7 *mm* pitch ~~by HV5~~ from weld junction to base metal along with the two parallel line which are 1 *mm* inside from the both surface of base metal.	~~In case of rolled steels for hull, the~~Values of maximum hardness ~~is~~ are not to ~~be over~~ exceed ~~350. For *KE*47, the value is not to be over 380~~ the values specified in **Table 1.1.-8**. For other steel plates are to be as deemed appropriate by the Society.	• Test specimens are, in principle, to be selected from each test sample specified in **Table 1.1.-6**. • Sketches of weld joints depicting groove dimensions, number of passes, and hardness indentations are to be attached to test reports together with photomacrographs of weld cross sections. • Hardness tests are carried out at HV5 for rolled steels for hulls, and at HV10 for high strength rolled steels for offshore structures.
				Rolled steels other than the mentioned above	*JIS Z* 3101 or equivalent method.	To be as deemed appropriate by the Society.	-
	Y-shape weld crack test (Hydrogen crack test)	Top	–	To be in accordance with internationally recognized standards such as *JIS Z* 3158, etc.		To be as deemed appropriate by the Society.	• In the case of steels other than steel plates (including flat bars not less than 600 *mm* in width), the test may be omitted. • For high strength rolled steels for offshore structures, the relationship between minimum preheat temperature and thickness is to be described.
	CTOD test or deep notch test	Top	~~Parallel~~ Transverse for welding direction	*CTOD* tests are to be carried out in accordance with *ISO* 15653 or the equivalent. Three test specimens notched in the through thickness direction in grain coarsened *HAZ* (*CGHAZ*) are to be selected for each butt weld test assembly and tested at -10°C. When performing deep notch tests at the time of approval, the Society is to be consulted about the dimensions of test specimens, test conditions, etc.		To be as deemed appropriate by the Society.	• In the case steels of other than steel plates (including flat bars not less than 600 *mm* in width), the test may be omitted. • The *CTOD* specimen for the high strength rolled steel for offshore structures is taken from test samples **(b)** and **(c)** specified in **Table 1.1.-6**. Dimension of specimen comply with **Table 1.1.-9**.

Approval test item		Selected location of test samples (1) (2)	Length direction of test specimen (3) (4)	Testing method		Acceptance criteria	Notes
Corrosion resistance test	Corrosion test	Top	–	To be in accordance with internationally recognized standards such as *JIS G* 0575, *G* 0576 and *G* 0591~~ or equivalent method~~ , etc.		To be as deemed appropriate by the Society.	-
Non-destructive test	Ultrasonic test or Eddy current test	All surface	–	Stainless clad steels	*JIS G* 0601 or equivalent method.	To meet the requirements of class *F* of *JIS G* 0601	-
				Steel with consideration for thickness directional characteristics	In accordance with the requirements in **Chapter 3**, **Part K of the Rules**.	In accordance with the requirements in **Chapter 3**, **Part K of the Rules**.	-
				Round bars for chains	*JIS G* 0801 and *JIS G* 0202 or equivalent method.	To be free from any defects deemed to have negative effect.	-
Corrosion resistance test for cargo oil tanks~~(21)(22)~~		Top	–	In accordance with the requirements in **Annex 1.1**.		In accordance with the requirements in **Annex 1.1**.	• The chemical composition of test specimens for corrosion resistance tests of cargo oil tanks is to be set in accordance with the documents specified in **1.2.2** to make it possible to confirm the validity of the chemical composition range (upper and lower limits) of elements to be added for improving corrosion resistance. • With respect to corrosion resistance tests for cargo oil tanks, IACS Unified Interpretation SC258 as amended is to be applied in addition to **Annex 1.1**.

Notes :

(1) In the case of ingot casting, "~~T~~top" means edge of top side of ingot for length direction specified in **1.4.2-1(2)**, "~~B~~bottom" means edge of another side. In case of continuous casting, any edge is available of both edge for length direction specified in **1.4.2-1(2)**. However, in the case of ingot casting for high strength rolled steels for offshore structures, "top" and "bottom" mean the edge corresponding to the top and bottom of the ingot specified in **1.4.2-1(3)**.

(2) Selected position at width direction or section for each kind is to meet the requirements in **3.1.6-4**, **Part K of the Rules**.

(3) "Length direction of test specimen" denotes the direction of the test sample to the direction of final rolling.

(~~3~~4) For steel products other than steel plate (i.e. steel sections, steel bars), when it is difficult to be taken test specimens with their longitudinal axis transverse to the rolling direction, test specimens may be taken parallel to the rolling direction subject to the approval with the Society.

~~(4) In case of rolled steels for hull, the analysis is to be carried out for *As*, *Sn*, *B* and *Sb*. (for *B* and *Sb* in case of steel making by electric furnace or open hearth furnace)~~

~~(5) The sample is to be selected from tensile test specimen.~~

~~(6) Excess difference on the chemical compositions between ladle analysis and product analysis is not to be accepted.~~

~~(7) For the continuous casting billet before rolling, macrostructure test may be omitted at the bottom portion.~~

~~(8) In case of the steels over 40*mm* in thickness, the tests are to be carried out at the surface, the position of one forth in thickness and the middle of thickness.~~

~~(9) In case of the ferrite grain size number over 10, microscopic photographs (500x) is to be taken.~~

~~(10) In case of hot coil, test sample is to be selected from middle of length direction specified in **1.4.2-1** in addition.~~

~~(11) In case of tensile test specimens of bar taken from the steels over 40*mm* in thickness, test specimens are to be taken from the middle of thickness in addition to the position in accordance with the requirements of **Part K of the Rules**.~~

~~(12) Shapes and sizes of test specimen, testing method and judging criteria for the materials for which bend test is not prescribed in the **Part K of the Rules**, are left to the discretion of the Society.~~

~~(13) V-notch Charpy impact test specimens for stainless clad steels are to be taken from the base material.~~

~~(14) In case of tensile test specimens over 40*mm* in thickness, test specimens are to be taken from the middle of thickness in addition to the position in accordance with the requirements of **Park K of the Rules**.~~

~~(15) In case of rolled steels for hull, at least test temperature is to be included the temperature of **Table 1.1-4**.~~

~~(16) In case of other than steel plates (including steel flats not less than 600*mm* in width), the test may be omitted.~~

~~(17) The photograph of test specimen after the test is to be taken.~~

(5) The bevel preparation is to be 1/2V or K related to thickness, and the test sample is to be welded by procedures commonly used for the relevant steels in consideration of the welding heat inputs specified in **Table 1.1.-6**.

(~~18~~6) In test records, the figure indicated the details of edge preparations, layer or pass sequence and measuring position of hardness are to be included, in addition to macroscopic photograph of welded section, welding procedure, welding consumables (brand, mark, shielded gas, backing etc.), welding parameter (amperage, voltage, welding speed, heat input, current etc.), preheating temperature and interpass temperature. However, where only requested maximum hardness test, these requirement may not be applied.

~~(19) The test is generally to be carried out by each test specimen sampling from two butt weld test assemblies which are different of welding heat input (about 15 *kJ/cm* and 50 *kJ/cm*). Welding direction is to be transverse to the direction of rolling of test assemblies for rolled steels for hull and to be parallel to the direction of rolling of assemblies for rolled steels for low temperature service and high strength quenched and tempered rolled steel plates for structure.~~

~~(20) Test specimens are to be taken at a position of 1/4 thickness from the face side and the root side, and the transition temperature curve of the absorbed energy is to be determined. Test temperature is to include -40°C and the temperature interval is to be 10°C to 20°C.~~

~~(21) The chemical composition of test specimens for corrosion resistance test for cargo oil tanks is to be set in accordance with the documents specified in **1.2.2** to make it possible to confirm the validity of the chemical composition range (upper limit, lower limit) of the elements to be added for improving the corrosion resistance.~~

~~(22) With respect to corrosion resistance tests for cargo oil tanks, IACS Unified Interpretation SC258 as amended is to be applied in addition to **Annex 1.1**.~~

(7) Weldability tests are, in principle, to be carried out on the thickest plate.

Table1.1-4 has been amended as follows.

Table 1.1-4 Impact Test Temperature for Rolled Steel for Hull

Strain aging	Grade	Direction of the test specimens(1)	Test temperature (℃)			
Non strain aging specimens	*KA*, *KB*, *KA*32, *KA*36, *KA*40	Parallel	+20	0	-20	
		Transverse	+20	0	-20	
	KD, *KD*32, *KD*36, *KD*40	Parallel	0	-20	-40	
		Transverse	0	-20	-40	
	KE, *KE*32, *KE*36, *KE*40, *KE*47	Parallel	0	-20	-40	-60
		Transverse	-20	-40	-60	
	*KF*32, *KF*36, *KF*40	Parallel	-20	-40	-60	-80
		Transverse	-40	-60	-80	
Strain aging specimens	*KA*32, *KA*36, *KA*40	Parallel	+20	0	-20	
	KD, *KD*32, *KD*36, *KD*40	Parallel	0	-20	-40	
	KE, *KE*32, *KE*36, *KE*40, *KE*47	Parallel	-20	-40	-60	
	*KF*32, *KF*36, *KF*40	Parallel	-40	-60	-80	

Note:
(1) "Direction of the test specimens" denotes the direction of the test sample to the final rolling direction.

Table1.1-5 has been added as follows.

Table1.1-5 Impact Test Temperature for High Strength Rolled Steel for Offshore Structures

Strain aging	Grade	Direction of test specimen(1)	Test temperature (°C)			
Non strain aging specimens	*KA*420, *KA*460, *KA*500, *KA*550, *KA*620, *KA*690, *KA*890, *KA*960	Parallel and Transverse	+20	0	-20	-
	*KD*420, *KD*460, *KD*500, *KD*550, *KD*620, *KD*690, *KD*890, *KD*960		0	-20	-40	-
	*KE*420, *KE*460, *KE*500, *KE*550, *KE*620, *KE*690, *KE*890, *KE*960		0	-20	-40	-60
	*KF*420, *KF*460, *KF*500, *KF*550, *KF*620, *KF*690		-20	-40	-60	-80
Strain aging specimens	*KA*420, *KA*460, *KA*500, *KA*550, *KA*620, *KA*690, *KA*890, *KA*960	Parallel or Transverse	+20	0	-20	-
	*KD*420, *KD*460, *KD*500, *KD*550, *KD*620, *KD*690, *KD*890, *KD*960		0	-20	-40	-
	*KE*420, *KE*460, *KE*500, *KE*550, *KE*620, *KE*690, *KE*890, *KE*960		0	-20	-40	-60
	*KF*420, *KF*460, *KF*500, *KF*550, *KF*620, *KF*690		-20	-40	-60	-80

Note:
(1) "Direction of the test specimens" denotes the direction of the test sample to the final rolling direction.

Table1.1-6 has been added as follows.

Table1.1-6 Test Samples for Weldability Tests

Kind of rolled steels			Welding direction of test samples to the direction of final rolling direction of base metal	Test samples [1] [2]
Rolled steel for hulls			Transverse	(a) Butt weld test assembly welded with 15*kJ/cm* heat input (b) Butt weld test assembly welded with 50*kJ/cm* heat input
Rolled steel for low temperature service			Parallel	Same as above
High strength rolled steel for offshore structures	*KA*420, *KD*420, *KE*420, *KF*420, *KA*460, *KD*460, *KE*460, *KF*460, *KA*500, *KD*500, *KE*500, *KF*500 [3]	*N, NR*	Transverse	(a) Butt weld test assembly welded with 15±2*kJ/cm* heat input (b) Butt weld test assembly welded with 50±5*kJ/cm* heat input (c) Butt weld test assembly welded with same heat input given in **(b)**, but with post-weld heat treatment (PWHT)
		TMCP	Parallel	
		QT	Parallel	(a) Butt weld test assembly welded with 15±2*kJ/cm* heat input (b) Butt weld test assembly welded with 35±3.5*kJ/cm* heat input (c) Butt weld test assembly welded with same heat input given in **(b)**, with post-weld heat treatment (PWHT)
	*KA*550, *KD*550, *KE*550, *KF*550, *KA*620, *KD*620, *KE*620, *KF*620, *KA*690, *KD*690, *KE*690, *KF*690, *KA*890, *KD*890, *KE*890, *KA*960, *KD*960, *KE*960	*TMCP*	Parallel	(a) Butt weld test assembly welded with 10±2*kJ/cm* heat input (b) Butt weld test assembly welded with the maximum heat input proposed by the manufacturer [4] (c) Butt weld test assembly welded with same heat input given in **(b)**, but with post-weld heat treatment (PWHT) [5]
		QT	Parallel	

Notes:

(1) Unless otherwise specified in this table, test samples are not subjected to any heat treatment.

(2) PWHT is to be carried out in accordance with the condition specified in **Table 1.1-7**.

(3) In cases where the high heat input welding over the value specified in the table is to be included in the approval requested by the manufacture, the test sample is to be assembly **(a)** specified in this table: a butt weld test assembly in the as-welded condition and a test assembly in the PWHT condition, both welded with the maximum heat input being approved.

(4) The applicable maximum heat input is to be indicated in the approval application.

(5) If the manufacturer also requests approval for PWHT condition, this test assembly may be included as a test sample.

Table1.1-7 has been added as follows.

Table1.1-7 Post Weld Heat Treatment Procedures for High Strength Rolled Steels for Offshore Structures

Heat treatmen	Holding temperature [1]	Holding time [1]	Control of temperature
N, NR, TMCP	580°C max.	Steels are to be heat treated for a minimum 1 hour per 25 *mm* in thickness (but not less than 30 minutes and need not be more than 150 minutes)	Heating and cooling above 300°C is to be carried out in a controlled manner in order to uniformly heat or cool the material. The cooling rate from the max. holding temperature to 300°C is to be not slower than 55°C/hr.
QT	550°C max. However, maximum holding temperature is to be at least 30°C below the tempering temperature.		

Note:

(1) Not applicable in cases where approved by the Society.

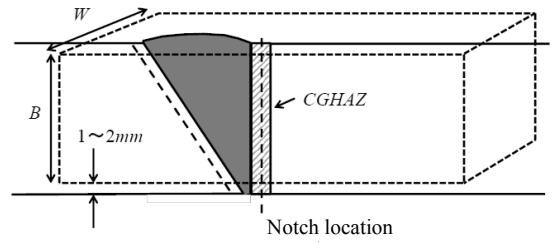
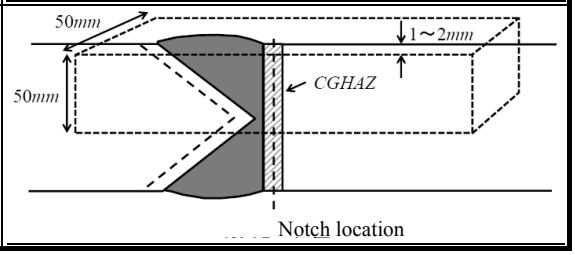
Table1.1-8 has been added as follows.

Table1.1-8 Maximum Hardness of Welding Hardness Test

Kind of rolled steel		Vickers hardness
Rolled steels for hulls	*KE*47	380 *HV* max.
	Other than the above	350 *HV* max
High strength rolled steels for offshore structures	*KA*420, *KD*420, *KE*420, *KF*420, *KA*460, *KD*460, *KE*460, *KF*460	350 *HV* max
	*KA*500, *KD*500, *KE*500, *KF*500, *KA*550, *KD*550, *KE*550, *KF*550, *KA*620, *KD*620, *KE*620, *KF*620, *KA*690, *KD*690, *KE*690, *KF*690	420 *HV* max
	*KA*890, *KD*890, *KE*890, *KA*960, *KD*960, *KE*960	450 *HV* max

Table1.1-9 has been added as follows.

Table1.1-9 Selection of *CTOD* Test Specimens for Weldability Tests of High Strength Rolled Steels for Offshore Structurers

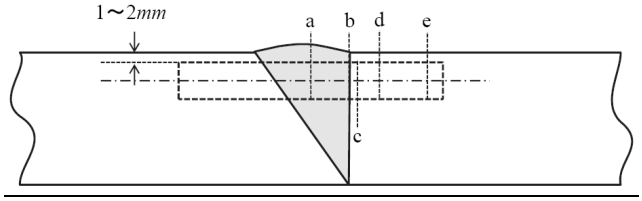
Thickness of test sample	Dimensions of test specimen (1)	Example of selection of test specimen
50 *mm* max.	Cross sections of test specimen are to be square (*B* = *W*). Specimens are to be taken so as to maximize the thickness from 1-2 *mm* below the surfaces of test samples.	
Over 50 *mm*	Cross sections for test specimen whose dimensions are *B* = 50 *mm* and *W*=50 *mm* are permitted. Specimens are to be taken from 1-2 *mm* below the surfaces of test samples.	

Note:

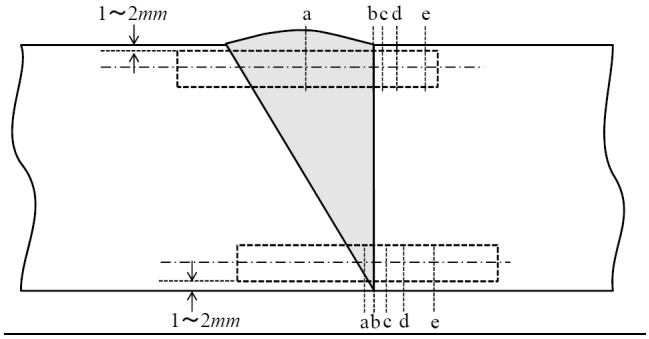
(1) For grades *K*690 and above, PWHT of as-welded test pieces may be carried out by a low temperature heat treatment prior to *CTOD* testing. Heat treatment at 200°C for 4 hours is recommended, and the exact parameters are included with the *CTOD* test results.

Fig1.1-2 has been added as follows.

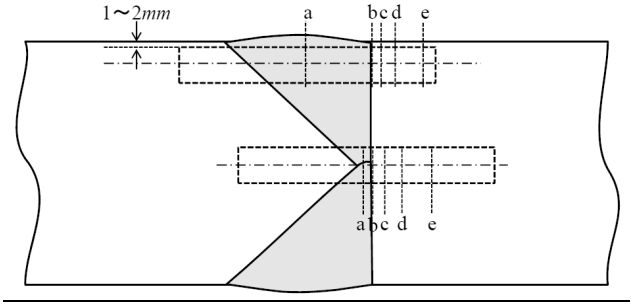
Fig1.1-2 Examples of Notch Locations for Butt Welding Impact Tests



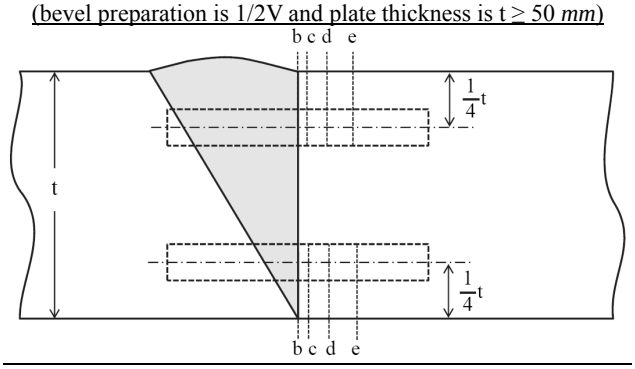
(1) High strength rolled steels for offshore structures
(plate thickness is t < 50 *mm*)



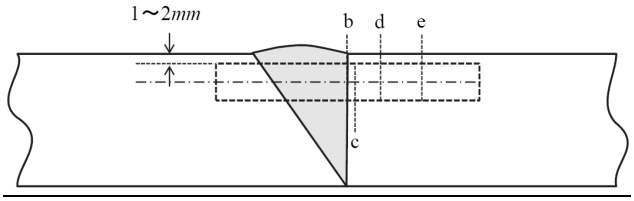
(2) High strength rolled steels for offshore structures
(bevel preparation is 1/2V and plate thickness is t ≥ 50 *mm*)



(3) High strength rolled steels for offshore structures
(bevel preparation is K and plate thickness is t ≥ 50 *mm*)



(4) *KE*47 steels



(5) Steels other than **(1)** through **(4)** specified in this table

Notch location:
a: Centre of weld metal
b: On fusion line
c: In HAZ, 2 *mm* from fusion line
d: In HAZ, 5 *mm* from fusion line
e: In HAZ, 20 *mm* from fusion line

1.5 Approval

Paragraph 1.5.1 has been amended as follows.

1.5.1 Notification and Announcement of Approval

1 The Society grants approval of the manufacturing process of rolled steels or semi-finished products which have been deemed appropriate on the basis of the reports of the Surveyor and documents submitted in accordance with requirements in **1.2** through **1.4**. In this case, a "Certificate of Approval" is published including the name of works, kind of rolled steels, term of validity of approval etc. and the approved content etc. is described in "Particulars of Approval Conditions".

2 In addition to **-1**, for the high strength rolled steels for offshore structures specified in **3.8, Part K of the Rules for the Survey and Construction of Steel Ships**, the maximum heat input applied to test assemblies for weldability tests in of the manufacturing process approval is to be described in the "Particulars of Approval Conditions". In addition, where weldability tests are carried out for test assemblies to which post-weld heat treatments are applied, the weldability of the test assembly to which post-weld heat treatment is applied it to be confirmed and the maximum heat input applied to test assembly is to be described in the "Particulars of Approval Conditions".

~~2~~**3** Notwithstanding **-1** above, for the corrosion resistant steel for cargo oil tanks specified in **3.13, Part K of the Rules for the Survey and Construction of Steel Ships**, the Society grants approval of the manufacturing process for corrosion resistant steel for cargo oil tanks which have been deemed appropriate on the basis of the reports of the Surveyor and documents submitted in accordance with requirements in **1.2** through **1.4**. In this case, a "Type Approval Certificate" is published including the name of works, kind of corrosion resistant steel for cargo oil tanks, term of validity of approval etc. and at least the following items are described in "Particulars of Approval Conditions".

(1) Brands name and approval number
(2) Chemical composition range (additive elements for ensuring corrosion resistance) and corrosion resistance process of the steel
(3) Maximum thickness
(4) Applicable welding consumables (the brand names and the approval certificate numbers) and welding methods
(5) Applicable area

~~3~~**4** Among those data submitted in accordance with the requirements in **1.2.2** and **1.4.5** which the Society deems necessary, a seal of approval is stamped and returned to the applicant.

~~4~~**5** Once a year, the Society announces rolled steels and semi-finished products which have been granted approval in the form of a table.

Paragraph 1.5.2 has been amended as follows.

1.5.2 Validity of Approval

Valid term of the "Certificate of Approval" specified in **1.5.1-1** and the "Type Approval Certificate" specified in **1.5.1-~~2~~3** will be 5 *years* from the date of approval. In case when the renewal of approval is carried out in accordance with the requirements in **1.5.3**, valid term will be 5 *years* from the next day after the expiry date of the previous validity (hereinafter referred to as "date of renewal").

EFFECTIVE DATE AND APPLICATION (Amendment 1-3)

1. The effective date of the amendments is 1 July 2017.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to high strength rolled steel for offshore structures for which the application for approval is submitted to the Society before the effective date.

Amendment 1-4

Part 1 METALLIC MATERIALS

Chapter 1 APPROVAL OF MANUFACTURING PROCESS OF ROLLED STEELS

1.4 Approval Test

1.4.3 Details of Test

Table 1.1-2 has been amended as follows.

Table 1.1-2 Approval Test Items for Rolled Steels

Rolled steels		Kind of test (See Note(1))																								
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)
(Omitted)																										
Round bars for chains	*KSBC*31~*KSBC*70	○	○			○	○		○	○		○								○					○
	*KSBCR*3, *KSBCR*3*S*, *KSBCR*4, *KSBCR*4*S*, *KSBCR*5	○	○	○		○	○		○	○		○	○	○	○					○				○	○
(Omitted)																										

Notes :

(1) Kind of Test

Base metal test

(a) Chemical analysis
(b) Sulphur print
(c) Macro-structure
(d) Micro-structure
(e) Austenite grain size
(f) Ferrite grain size
(g) Hardness test
(h) Tensile test
(i) Bend test
(j) Shearing strength test
(k) Charpy impact test
(l) Strain aging Charpy impact test
(m) Hydrogen embrittlement test

Brittle fracture test

(n) *CTOD* test (Crack Tip Opening Displacement test) or deep notch test
(o) Temperature gradient *ESSO* test or double tension tests
(p) *NRL* drop weight test

Weldability test

(q) Butt welding tensile test
(r) Butt welding impact test
(s) Welding hardness test
(t) Y-shape weld crack test (Hydrogen crack test)
(u) *CTOD* test (Crack Tip Opening Displacement test) or deep notch test

Corrosion resistance test

(v) Corrosion test

Non-destructive test

(w) Ultrasonic test

Dimensional measurement

(x) Dimensional measurement

(2) Approval test items for semi-finished products are to be chemical analysis, sulphur print and macro-structure.

(3) For the rolled steel which is applied *TMCP* heat treatment may be requested *SR* tensile test in addition to those tests given in the table.

(4) For steel materials with through thickness properties as specified in **3.11**, **Part K of the Rules**, the thickness directional tensile test, microscope examination for non-metallic inclusions, ultrasonic test are required in addition to those tests given in the table.

(5) For steel materials with brittle crack arrest properties as specified in **3.12**, **Part K of the Rules**, temperature gradient *ESSO* tests or double tension tests are required.

(6) For kind of product other than steel plates, the strain aging Charpy impact test, *NRL* drop weight test, *CTOD* test or deep notch test are not required, unless otherwise specified. However, where cast piece from the continuous casting method is used, each test item of the macro-structure of the cast piece and its sulpher print may need to be added.

(7) The *CTOD* test, the strain aging Charpy impact test are required by the Table for round of offshore chains, these tests may be omitted in case appropriate records prepared by the manufacture are available. In this case, such records and documents on heat treatment sensitivity, resistant to strain aging, temper embrittlement are to be submitted to the Society. For *KSBC*4*S* and *KSBCR*5, micro-structure test is carried out.

(8) For *KSBC*4*S* and *KSBCR*5, in addition to tests specified in this table, the results of microscopic examinations for non-metallic inclusions, hardenability tests, heat treatment sensitivity and temper embrittlement in cases where offshore chains are treated tempering are to be submitted.

(~~8~~9) The *CTOD* test or deep notch test are, in principle, to be conducted in cases where thickness is more than 50*mm*.

(~~9~~10)The *CTOD* test and double tension test, temperature gradient *ESSO* test, deep notch test etc. as specified in the table are performed for the purpose of evaluating low temperature toughness, and these tests may be omitted in case appropriate records prepared by the manufacturer are available or in case the Society deems the tests unnecessary.

(1~~0~~1)For the corrosion resistant steel for cargo oil tanks specified in **3.13, Part K of the Rules for the Survey and Construction of Steel Ships**, corrosion resistance test for cargo oil tanks is required in addition to those tests for rolled steels for hull given in the table.

(1~~1~~2)Both *CTOD* tests and deep notch tests may be required in cases where deemed necessary by the Society.

Part 2 EQUIPMENT

Chapter 2 APPROVAL OF MANUFACTURING PROCESS OF CHAINS

2.2 Application Procedures

Paragraph 2.2.2 has been amended as follows.

2.2.2 Reference Data to be Submitted

1 The reference data to be attached to the appropriate application form and to test procedure for the approval of the manufacturing process are to cover the items shown below:

(1) Flash butt welded chains
  (a) (Omitted)
  (b) Welding machines
    i) Name and type welding machine, and name of his manufacture
    ii) Particulars of welding machine (output, pressurizing force, retaining force)
    iii) Pressurizing mechanism (drawing are to be attached)
    iv) Diameter of chain link weldable
    v) Maintenance procedure and program for welding machine
  (c) Working standards
    i) Inspection organization chart
    ii) Contents of inspection at the reception of ~~raw~~bar materials
    iii) Working standards applicable to each size of chain link for cutting ~~raw~~bar materials, heating, bending and folding, flash butt welding (welding conditions, flash allowance, upsetting allowance, preheating temperature and period), post-welding removal of burrs, applications process of studs, etc.
    iv) Stud manufacturing process and dimensions
    v) Stud welding standards
    vi) Procedures of heat treatments and their control standards (For offshore chains, ~~standards of heat treatment and standards between~~ the method of controlling and recording the temperature of chains and chain speed ~~to obtained specific mechanical properties~~as well as the allowable limits, quenching bath and agitation, cooling method and measurement procedure for furnace temperatures are to be included)
    vii) Details of product inspection (dimensional tolerances, proof test, breaking test, mechanical test and non-destructive test for offshore chains are to be included. Moreover, the means of horizontal support and method of measurement and recording are to be clearly indicated for proof tests and mechanical tests)
    viii) Repairing procedures
    ix) Surface quality requirement adopted by manufacturer
    x) The manufacturer procedure for removing and replacing defective links without heat treatment of the entire chain (it is to be applied for offshore chains and submitted for each grade and the largest diameter desired for approval)

(2) (Omitted)

2 (Omitted)

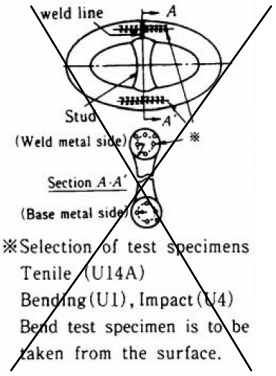
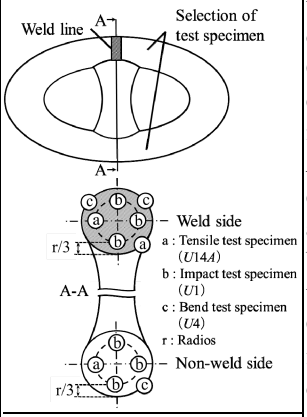
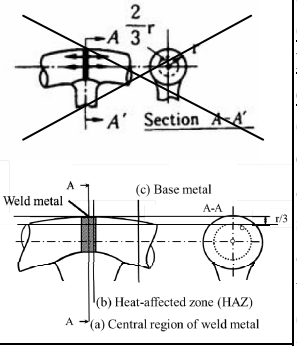
3 For approval of the manufacturing process of grade *R*4*S* and *R*5 chains, reports which include relevant supporting data about the steel (fatigue tests, hot ductility tests, welding parameter research, heat treatment ~~study~~sensitivity, strain age resistance, temper embrittlement study, stress corrosion cracking data and hydrogen embrittlement study etc.) are to be submitted.

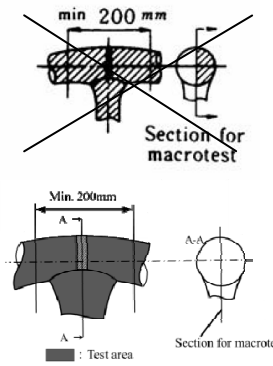
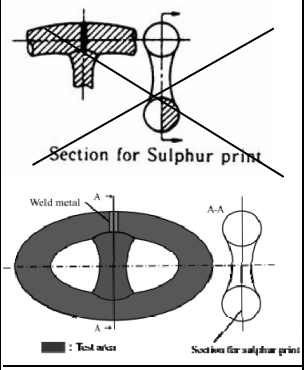
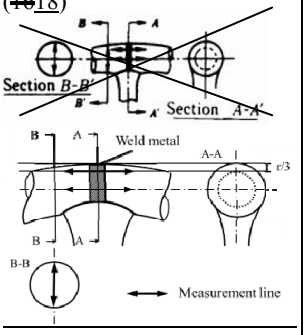
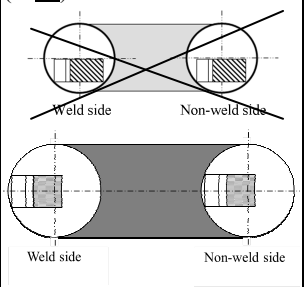
2.4 Approval Test

2.4.1 Approval Test

Table 2.2-1 has been amended as follows.

Table 2.2-1 Approval Test Items and Acceptance Criteria for Chains

Test chains for approval test						
Test item			Numbers of test specimens	Selection of test specimen and details of test specimen	Test procedure	Acceptance criteria
Test of testing object of chains		(Omitted)		(7),(8),(9),~~(10),~~(11),(12),(13) 	(Omitted)	
Mechanical properties test of link	Base metal	(7) Tensile test	1 piece		(7), (8), (~~10~~11) and (~~11~~12): To confirm to **Part K of the Rules**. However, in bending test, it is to be bent in such a way that the chain surface assumes out-side. The bending radius of Grades 3, *R*3, *R*3*S* and *R*4 chains is to be 25 *mm*. Grades *R*4*S* and *R*5 chains are to be as deemed appropriate by the Society. And bending angle is to be not less than following degree: 30 for Grade *R*4, 45 for Grade *R*3*S*, 60 for Grade *R*3, and 120-180 for other ~~G~~grades. Grades *R*4*S* and *R*5 chains are to be as deemed appropriate by the Society. (9) and (~~12~~13): See Note (3). (10) and (17): To conform to **Part L of the Rules**. (offshore chains only) (~~13~~14): To be examined at its center and the point 2/3 *r* for the structure of *HAZ*, base~~d~~ metal and weld zone. (x 100) (~~14~~15): Welded part of link in longitudinal section is to be macro-etched. (~~15~~16): Sulphur print of longitudinal section of link is to be taken. (~~16~~18): Hardness distribution of base metal and weld zone is to	To conform to **Part K of the Rules**.
		(8) Bending test	1 piece			To be free of harmful defects.
		(9) Impact test	See Note (3)			See Note (3).
		(10) Austenitic grain size	3 parts			To conform to **Part L of the Rules**.
	Weld zone	(~~10~~11) Tensile test	2 piece			Measured tensile strength is to exceed that of the base metal. Elongation is to be for reference only.
		(~~11~~12) Bending test	2 piece			To be free of harmful defects.
		(~~12~~13) Impact test	See Note (3)			See Note (3).
		(~~13~~14) Micro test	2 parts of 1 piece	(~~13~~14) 		Coarse grain area in *HAZ* and degree of heat treatment are to be examined.
		(~~14~~15) Macro test	1 piece	(~~14~~15)		To be free of harmful defects.
		(~~15~~16) Sulphur print	1 piece			To be free of harmful defects.
		(17) Austenitic grain size	6 parts			To conform to **Part L of the Rules**.
		(~~16~~18) Hardness test	3 parts of 1 piece			To be for reference only. However, hardness is to be max 330 *HBW* at the base metal for Grade *R*4*S*, and 340 *HBW* at the base metal for Grade *R*5.
		(~~17~~19) *CTOD* test	6 pieces for offshore chain (from 3 links, ~~on~~ one each on the			The lowest CTOD value of each set of 3 specimens is to meet the minimum values

			weld side and non-weld side)	 (~~15~~16)  (~~16~~18)  (~~17~~19)  <u>The minimum cross section of the *CTOD* test piece:</u> Chain diameter is less than 120 *mm*: 50 *mm* x 25 *mm* Chain diameter is 120 *mm* and above: 80 *mm* x 40 *mm*	be measured at proper intervals. See Note (7). (~~17~~19): See Note (4).	<u>indicated below in ~~To conform to~~ **Table 2.2-3**.</u>

Notes:

(1) The test links used in the approval test are to, in principle, be of the desired largest diameter for approval.

(2) In the case of cast links, their mechanical properties tests are to be carried out in a manner corresponding to those applied to weld zone. Of those items of test of the testing object, the tensile test and compression test may be

substituted by magnetic particles testing.

(3) Impact test temperatures and minimum mean absorbed energy are to be in accordance with **Table 2.2-2**.

(4) The *CTOD* test as in specified in **Table 2.2-1** is ~~performed~~carried out for ~~the purpose of evaluating low-temperature toughness characteristics~~offshore chains, and this test may be omitted in case appropriate records prepared by the manufacturer are available and in case appropriate to the Society. For the initial approval test, a *CTOD* test is to be carried out~~. Tests are to be taken at -20℃.~~in accordance with *BS* 7488 *Part* 1, *BS EN ISO*15653:2010 or other standard deemed appropriate by the Society. The notch of the *CTOD* specimen is to be located as close to the surface as practicable. The *CTOD* test is to be taken at -20°C.

(5) In the case of the approval test in association with the change in the manufacturing process as shown in **2.7**, the diameter and number of test link, or the approval test items may be reduced.

(6) When steel materials, manufacturing process or heat treatment methods which are not specified in the rules are to be employed, the Society may request other tests or submission of reference materials in addition to the specified test items.

(7) For chains other than offshore chains, hardness tests of base metal may be omitted in cases deemed appropriate by the Society.

Paragraph 2.4.3 has been amended as follows.

2.4.3 Omission of Approval Test for Manufacturing Process

1 Studless chains and Grades 1, 2 and 3 chains are to comply with the following:

(1) ~~When~~In cases where the test for Grade 1 chains has been passed, the approval test for manufacturing process for studless chains of the same or of the smaller diameter manufactured by the same flash butt welding method may be omitted.

(2) ~~When~~In cases where the test for Grade 2 chains has been passed, the approval test for manufacturing process for studless chains of the same or of the smaller diameter manufactured by the same flash butt welding method may be omitted.

(3) The manufacturing process of the enlarged link and end link may be approved up to those with the diameter corresponding to that of common link provided that they are manufactured by the same manufacturing process of the common link or by the flash butt welding method.

2 Grades *R*3, *R*3*S*, *R*4, *R*4*S* and *R*5 chains are to comply with the following:

(1) In cases where the test for an offshore chain has been passed, the approval tests for the manufacturing process for offshore chains of the same or of a smaller diameter and of a lower grade manufactured by the same manufacturing procedure using the same chemical composition and heat treatment and using bar materials from the same suppliers may be omitted in cases where deemed appreciate by the Society.

Paragraph 2.4.4 has been added as follows.

2.4.4 Measurement of Furnace Temperature

1 The manufacturers are to submit measurement procedures for furnace temperatures to the Society prior to measurement.

2 Furnace temperatures are to be checked by conveying a monitoring link instrumented with two thermocouples through the furnace at representative travel speed. Links are to be of the largest diameter desired for approval. One thermocouple is to be attached to the surface of the straight part and one thermocouple is to be imbedded in a drilled hole located at the mid thickness position of the straight part of the calibration block.

3 The manufacturers are to measure to furnace temperature in accordance with the measurement procedures for furnace temperatures specified in **-1** above and to confirm that the temperature throughout the cross section and the soaking times are within specified limits as given in the heat treatment procedure and to submit the results of the measurements.

Chapter 3 APPROVAL OF MANUFACTURING PROCESS OF CHAIN ACCESSORIES

3.2 Approval Application Procedures

Paragraph 3.2.2 has been amended as follows.

3.2.2 Reference Data to be Submitted

1 The reference data to be attached to the appropriate application form and the test procedures for the approval of the manufacturing process are to be as follows:

(1) Cast chain accessories

~~To be in accordance with the provisions in **2.2.2-1(2)**~~

(a) Manufacturing process and manufacturing facilities

i) Explanations on manufacturing process

ii) Outline of the manufacturing factory

iii) Principal manufacturing and inspection facilities

(b) Steelmaking

i) Type and capacity of steelmaking furnace

ii) Steelmaking process

iii) Range of chemical composition

(c) Work standards

i) Moulding work

ii) Casting procedure (drawing showing the location and its dimensions of riser to be attached)

iii) Procedure of heat treatment and its control standards (including position of products in furnace and the measurement procedure for furnace temperature)

iv) Finishing work

v) Details of product inspection (including dimensional tolerances, proof test, breaking test, mechanical test and non-destructive test)

vi) Repairing procedures

(2) Forged chain accessories

(a) Manufacturing process and facilities

i) Explanations on manufacturing process and process controls

ii) Outline of the manufacturing factory

iii) Principal forging facilities and their capacity

iv) Type and capacity of the furnace for heat treatments

v) Inspection and testing facilities

(b) Work standards

i) Details of acceptance inspection for raw materials (bloom, billet, round bar materials, etc.) and means of their suppliers

ii) Forging procedures (including drawings, heat cycling during forging and reheating, the degree of upsetting and the forging ratio)

iii) Heat treatment procedure and their control standards (including position of products in the furnace and the measurement procedure ~~for the calibration of furnaces~~ for furnace temperature)

iv) Details of product inspection (including dimensional tolerances, proof test, breaking test, mechanical test and non-destructive test)

v) Control standards of forging facilities

2 When an enlarged link or end link complying with the provisions of **3.1.1-3** is manufactured

by flash butt welding, the provisions in **2.2.2-1(1)** are to apply.

3 For the approval of the manufacturing process of the semi-finished products and ingots using offshore mooring chain accessories, reports which include relevant supporting data about the steel (e.g., heat treatment sensitivity, strain age resistance and temper embrittlement study) are to be submitted. For Grades *R*4*S* and *R*5, in addition to above data, data for hydrogen embrittlement is to be submitted.

~~3~~**4** For the approval of the manufacturing process of ~~s~~Grades *R*4*S* and *R*5 chain accessories, reports which include relevant supporting data about the steel (e.g., fatigue tests, hot ductility tests, welding parameter research, heat treatment ~~study~~sensitivity, strain age resistance, temper embrittlement study, stress corrosion cracking data and hydrogen embrittlement study etc.) are to be submitted.

5 In cases where alternative breaking tests are carried out in accordance with the requirements in **L3.2.11-1, Part L of the Guidance for the Survey and Construction of Steel Ships**, strain gauges during the proof and breaking tests are to be measured and reports which include the results, method and location of measurement are to be submitted.

3.4 Approval Test

3.4.1 Approval Test

Sub-paragraph -5 has been added as follows.

5 The forging ratio of offshore mooring chain accessories is to be at least 3.

Paragraph 3.4.3 has been amended as follows.

3.4.3 Omission of Approval Test for Manufacturing Process

1 Grades 2 and 3 chain accessories are to comply with the following:

(1) When the test for chain ~~has~~ accessories of higher grade has been passed, the approval test for manufacturing process for chain accessories of the same or of the smaller diameter manufactured by the same casting or forging method may be omitted. When enlarged links and end links complying with the provisions of **3.1.1-3** are manufactured by flash butt welding, the provisions in **2.4.3** are to apply.

(2) When the test either for swivel or for kenter shackle has been passed, the approval test for manufacturing process for another product not subjected to approval test may be omitted provided that discrimination between the casting procedure and forging procedure is specified.

(3) When the test either for swivel or for kenter shackle has been passed, the approval test for manufacturing process for the enlarged link and end link of the same diameter as that of the swivel and kenter shackle or less may be omitted provided that they are manufactured by the same manufacturing process used for the swivel or kenter shackle.

(4) When the test for end shackle has been passed, the approval test for manufacturing process of the connecting shackle of the same diameter thereof or less may be omitted.

(5) When the test either for connecting shackle of end shackle has been passed, the approval test for manufacturing process of the enlarged link and end link of the same diameter thereof or less may be omitted provided that they are manufactured by the same manufacturing process used for the connecting shackle or end shackle.

(6) The diameter of the chain accessories shown in items **(1)** through **(5)** above corresponding to that of the common link to which they are fitted.

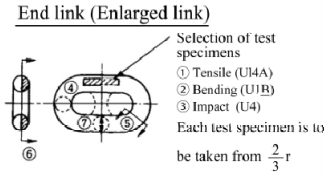
2 Grades *R*3, *R*3*S*, *R*4, *R*4*S* and *R*5 chain accessories are to comply with the following:

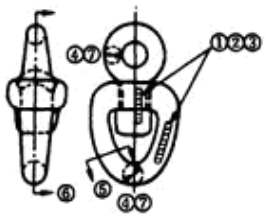
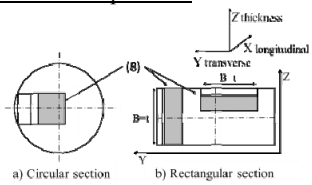
(1) In cases where a test for chain accessories of higher grade has been passed, the approval test for the manufacturing process of chain accessories of the same or of the smaller diameter manufactured by the same manufacturing standards and heat treatment from the same suppliers (only cast offshore chain accessories) may be omitted.

(2) For forged offshore mooring chain accessories, in cases where the test for chain accessories of a lower forging ratio has been passed in addition to the requirements in **(1)** above, the approval test for manufacturing process for chain accessories of the same geometry may be omitted in cases where multiple chain accessories are to be approved.

Table 2.3-1 has been amended as follows.

Table 2.3-1 Approval Test Items and Acceptance Criteria for Accessories

	Test item	Numbers of test specimens	Selection of test specimen and details of test specimen	Test procedure	Acceptance criteria
Mechanical properties test for chain accessories:	(1) Tensile test	2 piece		(1) and (2): To conform to **Part K of the Rules**. However in bending test, However, in bending test, the bending radius of Grades 3, *R*3, *R*3*S* & *R*4 chains accessories is to be 25 *mm*. Grades *R*4*S* and *R*5 chains are to be as deemed appropriate by the Society. And bending angle is to be not less than following degree~~:~~ 30 for Grade *R*4, 45 for Grade *R*3*S*, 60 for Grade *R*3, and 120-180 for other g~~G~~rades. ~~And, G~~rades *R*4*S* and *R*5 chain accessories are to be as deemed appropriate by the Society. (3): See Note (2). (4): To be examined at its surface, 2/3 *r* and center (x 10) (5): Areas shown in the figure are to be macroetched. (6): Sulphur print of the chain accessories in longitudinal section is to be taken. (7): Hardness distribution in diametric direction is to be measured at proper intervals See Note (7). (8): See Note (5). (9) and (10): To conform to **Part K of the Rules**. (offshore chain accessories only)	To conform to **Part K of the Rules**.
	(2) Bending test	2 piece			To be free of harmful defects.
	(3) Impact test	See Note (2)			See Note (2)
	(4) Micro test	3 parts of 1 piece			The degree of heat treatment is diametric direction is to be examined.
	(5) Macro test	1 part			To be free of harmful defects.
	(6) Sulphur print	1 piece			To be free of harmful defects.
	(7) Hardness test	1 piece			To be for reference only. However, hardness is to be max 330 *HBW* for Grade *R*4*S*, and 340 *HBW* for Grade *R*5.
	(8) *CTOD* test	3 pieces			~~To be as deemed appropriate by the Society.~~ The lowest CTOD value of each set of 3 specimens is to meet the minimum values indicated below in **Table 2.3-3**.
	(9) Austenitic grain size	Circular section:1piece Non-circular			To conform to **Part K of the Rules**.

		section:1piece	Swivel 		
	(10) Hydrogen embrittlement test	2 pieces			To conform to **Part K of the Rules**.
Test on testing object of chain accessories	(~~9~~11) Proof test	1 piece		~~(9), (10),~~ (11) ~~and~~, (12) (13) and (14): To conform to **Part L of the Rules**. (~~13~~15): Non-destructive tests consist of ultrasonic test and magnetic particle test.	To conform to **Part L of the Rules**.
	(~~10~~12) Breaking test	1 piece	*CTOD* test specimen  (Notes) For b), the grain flow is to be considered in the longitudinal direction X. Location of test specimen may be whichever indicated in b).		See Note (6)
	(~~11~~13) Dimension inspection	1 piece			To conform to **Part L of the Rules**. In addition, dimensional changes are to be measured.
	(~~12~~14) Visual inspection	1 piece			To be free of harmful defects.
	(~~13~~15) Non-destructive test	1 piece	The minimum cross section of *CTOD* test specimen: Circular section: Diameter is less than 120 *mm*: 50 *mm* x 25 *mm* Diameter is 120 *mm* and above: 80 *mm* x 40 *mm* Rectangular section: The desired maximum thickness for approval is specimen thickness *B* and transverse *W*=2*B* is standard.		To be free of harmful defects.

Notes:

(1) The test chain accessories used for approval test are to, in principle, be two or three, in number, of the larges diameter under application.

(2) The number of impact test specimens, test temperatures and minimum mean absorbed energy are to be in accordance with **Table 2.3-2**.

(3) In the case of the approval test required in connection with the change in the manufacturing as shown in **3.5**, the Society may reduce the requirements in the diameter and number of test chain accessories with respect to the test items.

(4) When any steel materials, manufacturing process or heat treatment not specified in the Rules are intended to be used, the Society may request other testing procedure or submission of reference data in addition to those specified in the Rules.

(5) *CTOD* tests are required for the initial approval of offshore mooring chain accessories. ~~Test pieces are to be taken from the quarter thickness location. Test piece dimensions and test procedure are to conform to **Table 2.2-1**.~~This test may be omitted in cases where appropriate records prepared by the manufacturer are available and in cases deemed appropriate to the Society. The *CTOD* test is to be carried out in accordance with *BS* 7488 *Part* 1, *BS EN ISO*7488:2010 or other standard deemed appropriate by the Society. The notch of the *CTOD* specimen is to be located as close to the surface as practicable. The *CTOD* test is to be taken at -20°C.

(6) Each specimen is to be capable of withstanding 1.1 times of the specified breaking test load specified in **Table L3.10**. In case of offshore chain accessories, each specimen is to be capable of withstanding their breaking test loads without fracturing for at least 30 *seconds*.

(7) For chain accessories other than offshore mooring chain accessories, hardness tests may be omitted in cases deemed appropriate by the Society.

Table 2.3-3 has been added as follows.

Table 2.3-3 Standard Value of *CTOD* test

Chain accessory type	*R3*（*mm*）	*R3S*（*mm*）	*R4*（*mm*）	*R4S* and *R5*（*mm*）
CTOD minimum value	0.20	0.22	0.24	0.26

Paragraph 3.4.4 has been added as follows.

3.4.4 Measurement of Furnace Temperature

1 The manufacturers of offshore mooring chain accessories are to submit measurement procedures for furnace temperatures to the Society prior to measurement.

2 Furnace temperatures are to be checked in accordance with *API* Spec. 6A/*ISO* 10423, Annex M or *ASTM A*991. Test pieces are to be of the largest diameter desired for approval. One thermocouple is to be attached to the surface and one thermocouple is to be imbedded in a drilled hole located at the mid thickness position of the calibration block.

3 The manufacturers of offshore mooring chain accessories are to measure furnace temperature in accordance with the measurement procedures for furnace temperatures specified in **-1** above and to confirm that the quench bath maximum temperature and the maximum heat treatment transfer times from furnace to quench are within specified limits as given in the heat treatment procedure.

EFFECTIVE DATE AND APPLICATION (Amendment 1-4)

1. The effective date of the amendments is 1 July 2017.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to offshore mooring chains and accessories for offshore mooring chains for which the application for approval is submitted to the Society before the effective date.

Amendment 1-5

Part 2 EQUIPMENT

Chapter 2 APPROVAL OF MANUFACTURING PROCESS OF CHAINS

Section 2.9 has been added as follows.

2.9 Dealing after Approval

The manufacturers which have been approved are to measure to furnace temperatures in accordance with the measurement procedures for furnace temperatures specified in **2.4.4** at least once a year and are to submit the results of such measurements.

Chapter 3 APPROVAL OF MANUFACTURING PROCESS OF CHAIN ACCESSORIES

Section 3.9 has been added as follows.

3.9 Dealing after Approval

1 The manufacturers of offshore mooring chain accessories which have been approved are to measure to furnace temperatures in accordance with the measurement procedures for furnace temperatures specified in **3.4.4** at least once a year and are to submit the results of such measurements. The initial measurement is to be carried out with maximum charge (load) in the furnace. Subsequent measurements may be carried out with no furnace charge.

2 Heat treatment during production is to be carried out within specified limits as given in the heat treatment procedure and the quench bath maximum temperature and the maximum heat treatment transfer times from furnace to quench are to be recorded.

EFFECTIVE DATE AND APPLICATION (Amendment 1-5)

1. The effective date of the amendments is 1 July 2017.