RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

RULES

Part K Materials

2009 AMENDMENT NO.1

Rule No.19 15th April 2009

Resolved by Technical Committee on 4th February 2009

Approved by Board of Directors on 24th February 2009

Rule No.19 15th April 2009
AMENDMENT TO THE RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

"Rules for the survey and construction of steel ships" has been partly amended as follows:

Part K MATERIALS

Chapter 1 GENERAL

1.5 Marking and Test Certificate

1.5.2 Test Certificate

Sub-paragraph -2(7) has been added as follows.

1 The manufacturer is to submit test certificate on the rolled steel materials which have passed the specified test and inspection requirements for each material mark for the Surveyor's signature. However, another method may be used instead of Surveyor's signature, provided that it is deemed appropriate by the Society.
2 The test certificate specified in **-1** are to contain, in addition to the dimensions, mass, etc., of the steel material, at least items **(1)** through **(9)** of the following particulars :
(1) Purchaser's order number and if known the ship number which the material is intended;
(2) Identification number or symbol;
(3) Identification of manufacturer;
(4) Identification of grade of material;
(5) Chemical Composition (ladle analysis on elements specified in the requirement and added when necessary)
(6) Carbon equivalent (C_{eq}) or cold cracking susceptibility (P_{cm}) calculated from the following formula using ladle analysis (only in such a case as specified in this Part.);

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

$$P_{cm} = C + \frac{Si}{30} + \frac{Mn}{20} + \frac{Cu}{20} + \frac{Ni}{60} + \frac{Cr}{20} + \frac{Mo}{15} + \frac{V}{10} + 5B \quad (\%)$$

(7) Mechanical test results (including any standards, in cases where standards differing from those specified in this Part are used);
(8) Condition of heat treatment (e.g. normalized or controlled roll except for as rolled);
(9) Deoxidation practice is to be stated (rimed steel only).
(Omitted)

Chapter 2 TEST SPECIMENS AND MECHANICAL TESTING PROCEDURES

2.2 Test Specimens

2.2.4 Impact Test Specimens

1 Impact test specimens are to be provided in a set of three pieces.

2 Impact test specimens are to be of size and dimensions given in **Fig. K2.1** and **Table K2.5**. The notch is to be cut in a face of the specimen which was originally perpendicular to the rolled surface.

3 The position of the notch is not to be nearer than 25 *mm* to a flame-cut or sheared edge.

4 Where *U*4 impact test specimen having the size specified in above **-2** can not be taken because of the thickness of material, the width *W* of the test specimen may be reduced to the dimensions given in **(1)** or **(2)** below, according to the thickness of material.

(1) Refer to **Table K2.6** for rolled steel materials.

(2) Refer to **Table K2.7** for steel pipes.

Table K2.7 has been amended as follows.

Table K2.7 Width of Subsize Test Specimens (for steel tubes)

Thickness of plate c (*mm*)	Width of impact test specimens W (*mm*)
$c<5$ (2)	— ~~(2)~~
$5 \le c < 7.5$	5 ± 0.06
$7.5 \le c < 10$	7.5 ± 0.11

Notes:

(1) c is to be calculated by the following formula

$$c = at - 1 - \frac{d - \sqrt{d^2 - b}}{2}$$

a and b : Constants determined according to the kind of steel pipe and the point of collection of test specimen. Refer to **Table K2.8.**

t : Nominal thickness (*mm*) of steel pipe

d : Outside diameter (*mm*) of steel pipe

(2) ~~The impact test may be omitted.~~ Refer to **note (6) of Table K4.28** in cases where thickness of plate is less than 5*mm*.

Chapter 3 ROLLED STEELS

3.6 Round Bars for Chains

3.6.2 Kinds

The chain bars are classified into 6 grades as given in **Table K3.20**.

Table K3.20 has been amended as follows.

Table K3.20 Grades of Chain Bars

Grade		Application
Grade 1 chain bar	*KSBC*31	Studless chain, Grade 1 chain
Grade 2 chain bar	*KSBC*50	Grade 2 chain
Grade 3 chain bar	*KSBC*70	Grade 3 chain
Grade *R*3 chain bar	*KSBCR*3	Grade *R*3 chain
Grade *R*3*S* chain bar	*KSBCR*3*S*	Grade *R*3*S* chain
Grade *R*4 chain bar	*KSBCR*4	Grade *R*4 chain
Grade *R*4*S* chain bar	*KSBCR*4*S*	Grade *R*4*S* chain
Grade *R*5 chain bar	*KSBCR*5	Grade *R*5 chain

3.6.3 Deoxidation Practice and Chemical Composition

The deoxidation practice and chemical composition of each grade are to comply with the requirements given in **Table K3.21**. Elements other than specified in **Table K3.21** may be added subject to a special approval by the Society.

Table K3.21 has been amended as follows.

Table K3.21 Deoxidation Practice and Chemical Composition (%)

Grade	Deoxidation	*C*	*Si*	*Mn*	*P*	*S*	$Al_{(1)}$
*KSBC*31	Killed	0.20max.	0.15~0.35	0.40min.	0.040max.	0.040max.	—
*KSBC*50	Fine grained killed	0.24max.	0.15~0.55	1.60max.	0.035max.	0.035max.	0.020min.
*KSBC*70		0.36max.	0.15~0.55	1.00~1.90	0.035max.	0.035max.	0.020min.
*KSBCR*3 *KSBCR*3*S* *KSBCR*4 *KSBCR*4*S* *KSBCR*5	Fine grained killed	Detailed chemical composition is to be approved by the Society. For Grade *KSBCR*4, *KSBCR*4*S* and *KSBCR*5 the steel should a minimum of 0.2% molybdenum.					

Note :

(1) *Al* content is to be represented by the total *Al* content and may be replaced partly other fine graining elements.

3.6.4 Mechanical Properties

The mechanical properties of steel bars are to comply with the requirements given in **Table K3.22**.

Table K3.22 has been amended as follows.

Table K3.22 Mechanical Properties

Grade	Tensile test				Impact test[1],[2]	
	Yield point or proof stress[3] (N/mm^2)	Tensile strength[3] (N/mm^2)	Elongation (L=5d) (%)	Reduction of area (%)	Testing temperature (℃)	Minimum mean absorbed energy(J)
*KSBC*31	—	370～490[4]	25 min.	—	—	—
*KSBC*50	295 min.	490～690	22 min.	—	0	27
*KSBC*70	410 min.	690 min.	17 min.	40 min.	0	60
*KSBCR*3	410 min.	690 min.	17 min.	50 min.	-20[5]	40[5]
*KSBCR*3*S*	490 min.	770 min.	15 min.	50 min.	-20[5]	45[5]
*KSBCR*4	580 min.	860 min.	12 min.	50 min.	-20	50
*KSBCR*4*S*	700 min.	960 min.	12 min.	50 min.	-20	56
*KSBCR*5	760 min.	1000 min.	12 min.	50 min.	-20	58

Notes :

(1) When the absorbed energy of two or more test specimens among a set of test specimens is less in value than the specified minimum mean absorbed energy or when the absorbed energy of a single test specimen is less in value than 70% of the specified minimum mean absorbed energy, the test is considered to have failed.

(2) For *KSBC*50 intended for Grade 2 chain which will be heat-treated according to the provision **3.1.5 of Part L**, no impacttesting is required.

(3) Aim value of yield to tensile ratio for grades *KSBCR*3, *KSBCR*3*S* ~~and~~, *KSBCR*4, *KSBCR*4*S* and *KSBCR*5 is to be maximum 0.92.

(4) Lower limit of tensile strength of grade *KSBC*31 may be 300N/mm^2 with the approval of the Society.

(5) Impact test of grade *KSBCR*3 and *KSBCR*3*S* may be carried out at the temperature 0 ℃ where approved by the Society. In this case, minimum mean absorbed energy is to be not less than 60 *J* for grade *KSBCR*3 and 65 *J* for grade *KSBCR*3*S*.

3.6.5 Selection of Test Samples

1 Steel bars not greater in weight than 50 *tonnes* (from the same cast manufactured by the same process) are to be treated as one lot, and one test sample largest in diameter is to be taken from each lot.

2 The heat treatment of the test samples is to comply with the requirements given in **Table K3.23** for each grade. In this case, the same heat treatment applied to chain bars after welding is to be carried out on the test sample.

Table K3.23 has been amended as follows.

Table K3.23 Heat Treatment of Test Sample

Grade	Heat treatment
*KSBC*31	As rolled or Normalized[1]
*KSBC*50	As rolled or Normalized[1]
*KSBC*70, *KSBCR*3, *KSBCR*3*S*, *KSBCR*4, *KSBCR*4*S*, *KSBCR*5	Normalized, Normalized and tempered, or Quenched and tempered

Note :

(1) The round bars for chains which will not be heat treated according to the provision **3.1.5 of Part L** are to be treated as rolled.

3.6.6 Selection of Test Specimens

Sub-paragraph 3.6.6-2 has been amended as follows.

1 Test specimens are to be taken in accordance with **Table K3.24** from test samples specified in **3.6.5**.
2 For grades *KSBCR*3*S* ~~and~~, *KSBCR*4, *KSBCR*4*S* and *KSBCR*5 in addition to the test specimen required by **-1**, two tensile test specimens having diameter of 20 *mm* in principle are to be taken the hydrogen embrittlement test. In this case, test specimen is to be taken from the central region of bar materials which have been simulated heat treated shown as **(1)** or **(2)**.
(1) In case of continuous casting, test samples representing both the beginning and the end of the charge are to be taken.
(2) In case of ingot casting, test samples representing two different ingots are to be taken.
3 The test specimens are to be taken with their longitudinal axis parallel to the final direction of rolling.
4 The tensile and impact test specimens are to be taken from the test sample in the longitudinal direction at a depth of 1/6 diameter from the surface or as close as possible to this position (See **Fig. K3.2**).
5 The longitudinal axis of the notch is to correspond approximately to the radial direction of each test specimen.

Table K3.24 has been amended as follows.

Table K3.24 Number of Test Specimens

Grade	Number of tensile test specimens	Number of impact test specimens
*KSBC*31	1 piece	—
*KSBC*50	1 piece	1 set (3 pieces)(1)
*KSBC*70, *KSBCR*3, *KSBCR*3*S*, *KSBCR*4, *KSBCR*4*S*, *KSBCR*5	1 piece	1 set (3 pieces)

Note :
(1) In case where **Note (2)** of **Table K3.22** is applied, no impact test specimen need to be taken.

3.6.8 Surface Inspection, Non-destructive Test and Verification of Dimentions

Sub-paragraph 3.6.8-2 and -3 have been amended as follows.

1 Surface inspection for all grades is to be carried out it is to be confirmed that there is no harmful defect.
2 For grades *KSBCR*3, *KSBCR*3*S* ~~and~~, *KSBCR*4, *KSBCR*4*S* and *KSBCR*5, all bar materials are subjected to ultrasonic examination at an appropriate stage of the manufacture and it is to be confirmed that there is no harmful defect.
3 For grades *KSBCR*3, *KSBCR*3*S* ~~and~~, *KSBCR*4, *KSBCR*4*S* and *KSBCR*5, one hundred persent of bar material is to be examined by magnetic particle or eddy current methods and it is to be confirmed that there is no harmful defect.

4 Notwithstanding the requirements of **-2** and **-3**, the frequency of non-destructive test may be reduced where approved by the Society considering quality control of manufacturer is consistently achieved. However, non-destructive test to the test samples required by **3.6.5** is to be carried out in any case.

5 Dimensional tolerance of round bars refers to **Table K3.25**.

Table K3.25 has been amended as follows.

Table K3.25 Dimensional Tolerance

Nominal diameter (*mm*) (1)	Tolerance on diameter (*mm*)	Tolerance on roundness ($d_{max.} - d_{min.}$) (*mm*)(2)
$d < 25$	-0 ～ +1.0	0.60 max.
$25 \leq d \leq 35$	-0 ～ +1.2	0.80 max.
$36 \leq d \leq 50$	-0 ～ +1.6	1.10 max.
$51 \leq d \leq 80$	-0 ～ +2.0	1.50 max.
$81 \leq d \leq 100$	-0 ～ +2.6	1.95 max.
$101 \leq d \leq 120$	-0 ～ +3.0	2.25 max.
$121 \leq d \leq 160$	-0 ～ +4.0	3.00 max.
~~161~~ $\leq d \leq$ 210	-0 ～ +5.0	4.00 max.

Notes :

(1) For bar materials of nominal diameter which has more than ~~161~~211*mm*, dimensional tolerance is to be as deemed appropriate by the Society.

(2) $d_{max.}$ and $d_{min.}$ are the maximum and minimum diameter of a single bar material.

3.8 High Strength Quenched and Tempered Rolled Steel Plates for Structures

3.8.10 Marking

Sub-paragraph 3.8.10(1) and (2) have been amended as follows.

Steel plates which have satisfactorily complied with the required tests are to be marked with identification mark in accordance with the requirements in **1.5.1** and in addition the followings **(1)** and **(2)**:

(1) For steels to which the requirements given in the provision to **3.8.5-1** have been applied, "-*M*" is to be suffixed to the marking (Example: *KA~~63~~*620-*M*).

(2) For steels to which the requirements given in **Note (5)** to **Table K3.28** have been applied, "-*PV*" is to be suffixed to the marking (Example: *KA~~63~~*620-*PV*).

Table K3.27 has been amended as follows.

Table K3.27 Grades, Deoxidation Practice and Chemical Composition of Steels

Grade	Deoxidation practice	Chemical composition(%)												Cold cracking Susceptibility (%)	
		C	*Si*	*Mn*	*P*	*S*[(1)]	*Cu*	*Ni*	*Cr*	*Mo*	*V*	*B*	*N*	Thickness *t* (*mm*)	
														$t \leq 50$	$50<t \leq 70$
KA~~43~~ 420	Fully killed and fine grain treated	0.21 max.	0.55 max.	1.70 max.	0.035 max.	0.035 max.	These elements may be added when necessary subject to approval of the Society.						0.020 max.	0.25 max.	0.27 max.
KD~~43~~ 420 *KE*~~43~~ 420		0.20 max.			0.030 max.	0.030 max.									
KF~~43~~ 420		0.18 max.		1.60 max.	0.025 max.	0.025 max.									
KA~~47~~ 460		0.21 max.	0.55 max.	1.70 max.	0.035 max.	0.035 max.								0.26 max.	0.28 max.
KD~~47~~ 460 *KE*~~47~~ 460		0.20 max.			0.030 max.	0.030 max.									
KF~~47~~ 460		0.18 max.		1.60 max.	0.025 max.	0.025 max.									
KA~~51~~ 500		0.21 max.	0.55 max.	1.70 max.	0.035 max.	0.035 max.								0.26 max.	0.28 max.
KD~~51~~ 500 *KE*~~51~~ 500		0.20 max.			0.030 max.	0.030 max.									
KF~~51~~ 500		0.18 max.		1.60 max.	0.025 max.	0.025 max.									
KA~~56~~ 550		0.21 max.	0.55 max.	1.70 max.	0.035 max.	0.035 max.								0.28 max.	0.30 max.
KD~~56~~ 550 *KE*~~56~~ 550		0.20 max.			0.030 max.	0.030 max.									
KF~~56~~ 550		0.18 max.		1.60 max.	0.025 max.	0.025 max.									
KA~~63~~ 620		0.21 max.	0.55 max.	1.70 max.	0.035 max.	0.035 max.	0.50 max.	—	1.00 max.	0.60 max.	0.10 max.	0.006 max.	0.020 max.	0.29 max.	0.31 max.
KD~~63~~ 620 *KE*~~63~~ 620		0.20 max.			0.030 max.	0.030 max.									

KF~~63~~ 620		0.18 max .		1.60 max .	0.025 max.	0.025 max.										
KA~~63~~ 620*N*		0.21 max .	0.55 max .	1.70 max .	0.035 max.	0.035 max.		0.30 ~ 1.30	0.70 max.							
KD~~63~~ 620*N* *KE~~63~~* 620*N*		0.20 max .			0.030 max.	0.030 max.										
KF~~63~~ 620*N*		0.18 max .		1.60 max .	0.025 max.	0.025 max.		0.30 ~ 2.00								
KA~~70~~ 690		0.21 max .	0.55 max .	1.70 max .	0.035 max.	0.035 max.		—	1.20 max.						0.30 max.	0.32 max.
KD~~70~~ 690 *KE~~70~~* 690		0.20 max .			0.030 max.	0.030 max.										
*KF~~70~~*6 90		0.18 max .		1.60 max .	0.025 max.	0.025 max.										
KA~~70~~ 690*N*		0.21 max .	0.55 max .	1.70 max .	0.035 max.	0.035 max.		0.30 ~ 1.50	0.80 max.							
KD~~70~~ 690*N* *KE~~70~~* 690*N*		0.20 max .			0.030 max.	0.030 max.										
KF~~70~~ 690*N*		0.18 max .		1.60 max .	0.025 max.	0.025 max.		0.30 ~ 2.20								

Note:

(1) For steels complying with the requirements specified in **3.11** the maximum content of sulphur is to be 0.008% determined by the ladle analysis.

Table K3.28 has been amended as follows.

Table K3.28 Heat Treatment and Mechanical Properties

Grade	Heat treatment	Tensile test			Impact test[3][4][5]		
		Yield point or proof stress (N/mm^2)	Tensile strength (N/mm^2)	Elongation ($L = 5.65\sqrt{A}$)(%)[2]	Testing temperature (℃)	Minimum mean absorbed energy(J)	
						L	*T*
KA~~43~~420	Quenched and tempered[1]	420min.	530~680	18min.	0	42	28
KD~~43~~420					-20		
KE~~43~~420					-40		
KF~~43~~420					-60		
KA~~47~~460		460min.	570~720	17min.	0	46	31
KD~~47~~460					-20		
KE~~47~~460					-40		
KF~~47~~460					-60		
KA~~51~~500		500min.	610~770	16min.	0	50	33
KD~~51~~500					-20		
KE~~51~~500					-40		
KF~~51~~500					-60		
KA~~56~~550		550min.	670~830	16min.	0	55	37
KD~~56~~550					-20		
KE~~56~~550					-40		
KF~~56~~550					-60		
KA~~63~~620, *KA*~~63~~620*N*		620min.	720~890	15min.	0	62	41
KD~~63~~620, *KD*~~63~~620*N*					-20		
KE~~63~~620, *KE*~~63~~620*N*					-40		
KF~~63~~620, *KF*~~63~~620*N*					-60		
KA~~70~~690, *KA*~~70~~690*N*		690min.	770~940	14min.	0	69	46
KD~~70~~690, *KD*~~70~~690*N*					-20		
KE~~70~~690, *KE*~~70~~690*N*					-40		
KE~~70~~690, *KF*~~70~~690*N*					-60		

Notes :

(1) Heat treatment may be conducted according to *TMCP*, instead of quenching and tempering, subject to the approval by the Society.

(2) The minimum elongation for *U*1 test specimen is to be in compliance with requirements given in **Table K3.29**.

(3) *L* (or *T*) denotes that the longitudinal axis of the test specimen is arranged parallel (or transverse) to the final direction of rolling.

(4) When the absorbed energy of two or more test specimens among a set of test specimens is less in value than the specified minimum mean absorbed energy or when the absorbed energy of a single test specimen is less in value than 70% of the specified minimum mean absorbed energy, the test is considered to be failed.

(5) Impact test for steels specified in **Part N** is given in **Table K3.30**.

Table K3.29 has been amended as follows.

Table K3.29 Minimum Elongation for *U*1 Specimen (%)

Grade	Thickness *t* (*mm*)						
	$t \leq 10$	$10 < t \leq 15$	$15 < t \leq 20$	$20 < t \leq 25$	$25 < t \leq 40$	$40 < t \leq 50$	$50 < t \leq 70$
KA~~43~~420, *KD*~~43~~420, *KE*~~43~~420, *KF*~~43~~420	11	13	14	15	16	17	18
KA~~47~~460, *KD*~~47~~460, *KE*~~47~~460, *KF*~~47~~460	11	12	13	14	15	16	17
KA~~51~~500, *KD*~~51~~500, *KE*~~51~~500, *KF*~~51~~500	10	11	12	13	14	15	16
KA~~56~~550, *KD*~~56~~550, *KE*~~56~~550, *KF*~~56~~550	10	11	12	13	14	15	16
KA~~63~~620, *KD*~~63~~620, *KE*~~63~~620, *KF*~~63~~620, *KA*~~63~~620*N*, *KD*~~63~~620*N*, *KE*~~63~~620*N*, *KF*~~63~~620*N*	9	11	12	12	13	14	15
KA~~70~~690, *KD*~~70~~690, *KE*~~70~~690, *KF*~~70~~690, *KA*~~70~~690*N*, *KD*~~70~~690*N*, *KE*~~70~~690*N*, *KF*~~70~~690*N*	9	10	11	11	12	13	14

Table K3.30 has been amended as follows.

Table K3.30 Impact Test for Steels Specified in Part N

Grade	Thickness *t* (*mm*)	Impact test		
		Testing temperature (℃)	Minimum mean absorbed energy(*J*)	
			L	*T*
KA~~43~~420, *KD*~~43~~420,	$t \leq 20$	0	41	27
KA~~47~~460, *KD*~~47~~460,	$20 < t \leq 40$	-20		
KA~~51~~500, *KD*~~51~~500,	$40 < t \leq 50$	-30		
KA~~56~~550, *KD*~~56~~550, *KA*~~63~~620, *KD*~~63~~620, *KA*~~63~~620*N*, *KD*~~63~~620*N*, *KA*~~70~~690, *KD*~~70~~690, *KA*~~70~~690*N*, *KD*~~70~~690*N*	$50 < t$	as deemed appropriate by the Society.		

3.12 Additional Requirements for Brittle Crack Arrest Properties

3.12.2 Brittle Crack Arrest Properties etc.

1 The brittle crack arrest properties of steel plates are to conform to the requirements in **Table K3.39** as the result of temperature gradient *ESSO* tests or double tension tests. Any requirements for the test procedure are left to the discretion of the Society.

2 A brittle fracture test deemed appropriate by the Society may be substituted for temperature gradient *ESSO* tests or double tension tests specified in **-1**.

Table K3.39 has been amended as follows.

Table K3.39 Brittle Crack Arrest Properties

Kinds of Steels			~~Kinds of properties~~ classification	Temperature gradient *ESSO* tests and double tension tests	
				Evaluation Temperature (℃)	Brittle Crack Arrest Toughness Value Kca ($N/mm^{1.5}$)
Rolled Steels for Hull	*KE*, *KE*32, *KE*36, *KE*40	*KF*32, *KF*36, *KF*40	*A*400	-10	min. ~~3900~~4000
			A500	-10	min 5000
			*A*600	-10	min. ~~5900~~6000

Notes:

In cases where deemed appropriate by the Society, a new classification division for those properties exceeding *A*600 may be permitted

Chapter 4 STEEL PIPES

4.5 Steel Pipes for Low Temperature Service

4.5.5 Mechanical Properties

1 The steel pipes are to comply with the following requirements as to mechanical properties :

(1) Tensile test

The steel pipes are to be subjected to tensile test and to comply with the requirements in **Table K4.28**.

(2) Impact test

The steel pipes are to be subjected to impact test and to comply with the requirements in **Table K4.28**.

(Omitted)

Table K4.28 has been amended as follows.

Table K4.28 Heat Treatment and Mechanical Properties

Grade	Heat treatment	Tensile test (1)(2)(3)				Bend test		Impact test	
		Yield point or proof stress (N/mm^2)	Tensile strength (N/mm^2)	Elongation ($L = 5.65\sqrt{A}$) (%)		Inside radius of bend	Angle of bend (°)	Testing temperature (℃)	Mean absorbed energy (J)(4)
				L	T				
KLPA	Normalized,	205 min.	380 min.	26 min.	19 min.	6 times the outside diameter of pipe	90	-40(5)	27
KLPB	normalized							-50(5)	
KLPC	followed by tempering							-60(5)	
*KLP*2	or quenched	245 min.	450 min.	20 min.	14 min.			-70	34
*KLP*3	And tempered							-95	
*KLP*9	Double normalized followed by tempering or quenched and tempered	520 min.	690 min.	15 min.	11 min.			-196	41

Notes :

(1) L (or T) denotes that the longitudinal axis of the test specimen is arranged parallel (or normal) to the final direction of rolling.

(2) Where the nominal diameter of steel pipes is 200 *mm* and over, the tensile test specimen may be taken transversely.

(3) Where test specimen of non-tubular section is taken from electric resistance welded pipes, the test specimen is to be taken from the part that does not include the welded line.

(4) Where absorbed energy of more than one of a set of test specimens is under the required minimum mean absorbed energy, or where the absorbed energy of one test specimen is under 70% of the required value, the test is considered to be failed.

(5) Impact test temperature for steel pipes specified in **Part N** is to be 5℃ below the design temperature or -20℃, whichever is the lower.

(6) In case where the width of test specimens required by **Table K2.5** and **K2.7** cannot be taken, impact tests may be omitted subject to satisfying the following **(a)** and **(b)**:

(a) Chemical composition contains not less than 0.010% of acid soluble aluminium or not less than 0.015% total aluminium.

(b) In cases where the actual impact test records of material which is manufactured on a like-for-like basis regarding manufacturing process and chemical composition are found to be satisfactory.

Chapter 5 CASTINGS

5.2 Steel Castings for Chains

5.2.2 Kinds

The steel castings are classified into 5 grades as specified in **Table K5.3**

Table K5.3 has been amended as follows.

Table K5.3 Grades of Steel Castings

Grades		Application
Grade 2 steel casting	*KSCC*50	Grade 2 chain
Grade 3 steel casting	*KSCC*70	Grade 3 chain
Grade *R*3 steel casting	*KSCCR*3	Grade *R*3 chain
Grade *R*3*S* steel casting	*KSCCR*3*S*	Grade *R*3*S* chain
Grade *R*4 steel casting	*KSCCR*4	Grade *R*4 chain
Grade *R*4*S* steel casting	*KSCCR*4*S*	Grade *R*4*S* chain
Grade *R*5 steel casting	*KSCCR*5	Grade *R*5 chain

5.2.5 Mechanical Properties

1 The mechanical properties of steel castings are to comply with the requirements specified in **Table K 5.4**.

Table K5.4 has been amended as follows.

Table K5.4 Mechanical Properties

Grade	Tensile test				Impact test(1)	
	Yield point or proof stress(2) (N/mm^2)	Tensile strength(2) (N/mm^2)	Elongation (%) ($L=5d$)	Reduction of area (%)	Testing temperature (℃)	Minimum mean absorbed energy (J)
*KSCC*50	295 min.	490~690	22 min.	—	0(3)	27(3)
*KSCC*70	410 min.	690 min.	17 min.	40 min.	0	60
*KSCCR*3	410 min.	690 min.	17 min.	~~5~~40 min.	-20(4)	40(4)
*KSCCR*3*S*	490 min.	770 min.	15 min.	~~5~~40 min.	-20(4)	45(4)
*KSCCR*4	580 min.	860 min.	12 min.	~~50~~35 min.	-20	50
*KSBCR*4*S*	700 min.	960 min.	12 min.	35 min.	-20	56
*KSBCR*5	760 min.	1000 min.	12 min.	35 min.	-20	58

Notes :

(1) When the absorbed energy of two or more test specimens among a set of test specimens is less in value than the specified minimum mean absorbed energy or when the absorbed energy of a single test specimen is less in value than 70% of the specified minimum mean absorbed energy, the test is considered to have failed.

(2) Aim value of yield to tensile ratio for grades *KSCCR*3, *KSCCR*3*S* ~~and~~, *KSCCR*4, *KSBCR*4*S* and *KSBCR*5 is to be maximum 0.92.

(3) Impact test is only required for accessories, enlarged links and end links made by casting excluding enlarged links and end links which are connected to chains made by casting and are made therewith.

(4) Impact test of grade *KSCCR*3 and *KSCCR*3*S* may be carried out at the temperature of 0℃ where approved by the Society. In this case, minimum mean absorbed energy is to be not less than 60*J* for grade *KSCCR*3 and 65*J* for grade *KSCCR*3*S*.

5.2.9 Non-destructive Test

Sub-paragraph 5.2.9-1 has been amended as follows.

1 For grades *KSCCR*3, *KSCCR*3S ~~and~~, *KSCCR*4, *KSBCR*4*S* and *KSBCR*5, all steel castings are subjected to ultrasonic examination at an appropriate stage of the manufacture and it is to be confirmed that there is no harmful defect.
2 For grades *KSCC*50 and *KSCC*70, a suitable non-destructive test such as an ultrasonic examination may be required where deemed necessary by the Society.

Chapter 6 STEEL FORGING

6.3 Steel Forgings for Chains

6.3.2 Kinds

The steel forgings are classified into 5 grades as specified in **Table K6.6**.

Table K6.6 has been amended as follows.

Table K6.6 Grades of Steel Forgings

Grade		Application
Steel forging for Grade 2 chain	*KSFC*50	Grade 2 chain
Steel forging for Grade 3 chain	*KSFC*70	Grade 3 chain
Grade *R*3 steel forgings	*KSFCR*3	Grade *R*3 chain
Grade *R*3*S* steel forgings	*KSFCR*3*S*	Grade *R*3*S* chain
Grade *R*4 steel forgings	*KSFCR*4	Grade *R*4 chain
Grade *R*4*S* steel forgings	*KSFCR*4*S*	Grade *R*4*S* chain
Grade *R*5 steel forgings	*KSFCR*5	Grade *R*5 chain

6.3.4 Deoxidation Practice and Chemical Composition

The deoxidation practice and chemical composition of each grade are to comply with the requirements given in **Table K6.7**. Elements other than specified in **Table K6.7** may be added subject to a special approval by the Society.

6.3.5 Mechanical Properties

The mechanical properties of each grade are to comply with the requirements specified in **Table K6.8**.

Table K6.7 has been amended as follows.

Table K6.7 Deoxidation Practice and Chemical Composition (%)

Grade	Deoxidation	*C*	*Si*	*Mn*	*P*	*S*	*Al*(1)
*KSFC*50	Fine grained	0.24max.	0.15~0.55	1.60max.	0.035max.	0.035max.	0.020min.
*KSFC*70	Killed	0.36max.	0.15~0.55	1.00~1.90	0.035max.	0.035max.	0.020min.
*KSFCR*3		Detailed chemical composition is to be approved by the Society. For Grade *KSFCR*4, *KSFCR*4*S* and *KSFCR*5, the steel should contain a minimum of 0.2% molybdenum.					
*KSFCR*3*S*							
*KSFCR*4							
*KSFCR*4*S*							
*KSFCR*5							

Note:

(1) *Al* content is to be represented by the total *Al* content and may be replaced partly by other fine graiming elements.

Table K6.8 has been amended as follows.

Table K6.8 Mechanical Properties

Grade	Tensile test				Impact test(1)	
	Yield point or proof stress(2) (N/mm^2)	Tensile strength(2) (N/mm^2)	Elongation (L=5d) (N/mm^2)	Reduction of area (%)	Testing temperature (℃)	Minimum mean absorbed energy (J)
*KSFC*50	295min.	490~690	22min.	—	0	27
*KSFC*70	410min.	690min.	17min.	40min.	0	60
*KSFCR*3	410min.	690min.	17min.	50min.	-20(3)	40(3)
*KSFCR*3*S*	490min.	770min.	15min.	50min.	-20(3)	45(3)
*KSFCR*4	580min.	860min.	12min.	50min.	-20	50
*KSFCR*4*S*	700min.	960min.	12min.	50min.	-20	56
*KSFCR*5	760min.	1000min.	12min.	50min.	-20	58

Notes:

(1) When the absorbed energy of two or more test specimens among a set of test specimens is less in value than the specified minimum mean absorbed energy or when the absorbed energy of a single test specimen is less in value than 70% of the specified minimum mean absorbed energy, the test is considered to have failed.

(2) Aim value of yield to tensile ratio for grades *KSFCR*3, *KSFCR*3*S* ~~and~~, *KSFCR*4, *KSFCR*4*S* and *KSFCR*5 is to be maximum 0.92.

(3) Impact test of grade *KSFCR*3 and *KSFCR*3*S* may be carried out at the temperature 0℃ where approved by the Society. In this case, minimum mean absorbed energy is to be not less than 60*J* for grade *KSFCR*3 and 65*J* for grade *KSFCR*3*S*.

6.3.6 Selection of Test Specimens

Sub-paragraph 6.3.6-1 has been amended as follows.

1 One sample steel forging is to be selected from every number of steel forgings for Grade 2 and 3 steel forgings specified in **Table K6.9** or a fraction thereof and for Grade *R*3, *R*3*S* ~~and~~, *R*4, *R*4*S* and *R*5 steel forgings specified in **Table K6.10** or a fraction thereof, which belong to the same heat, according to the nominal diameter of the common links to which the steel forgings are intended to link. Where specially approved by the Society, the test sample may be taken from representative part of the steel forgings at a proper time during manufacturing, or separate sample forged to the forge ratio equivalent to that of the steel forgings. In this case, the test samples is to be heat-treated simultaneously with the steel forgings.

2 The test specimens from one test sample prepared according to **-1** are to be cut with their longitudinal axis parallel to the direction of steel forging and to consist of one tensile test specimen at one set (3 pieces) of impact test specimens.

3 The tensile and impact test specimens are to be taken from the test sample in the longitudinal direction at a depth of 1/6 diameter from the surface or as close as possible to this position (*See* **Fig. K3.2**).

4 Tensile and impact test specimens are to comply with the requirements specified in **Table K2.1** and **Table K2.5** respectively.

Title of Table K6.10 has been amended as follows.

Table K6.10 Number of Steel Forgings for Selection of One Sample of Grade *R*3, *R*3*S* ~~and~~, *R*4, *R*4*S* and *R*5 Chain

Normal diameter *d* (*mm*) of common links to which steel forgings are linked	Number of steel forgings belonging to the same heat
$50 \leq d < 75$	75
$75 \leq d < 100$	50
$100 \leq d < 125$	25
$125 \leq d < 150$	20
$150 \leq d$	15

Paragraph 6.3.8 has been amended as follows.

6.3.8 Non-Destructive Test

For grades *KSFCR*3, *KSFCR*3*S* ~~and~~, *KSFCR*4, *KSFCR*4*S* and *KSFCR*5, all steel forgings are subjected to ultrasonic examination at an appropriate stage of the manufacture and it is to be confirmed that there is no harmful defect.

EFFECTIVE DATE AND APPLICATION

1. The effective date of the amendments is 15 April 2009.

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE

Part K Materials

2009 AMENDMENT NO.1

Notice No.18 15th April 2009

Resolved by Technical Committee on 4th February 2009

Notice No.18 15th April 2009
AMENDMENT TO THE GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

"Guidance for the survey and construction of steel ships" has been partly amended as follows:

Part K MATERIALS

K1 GENERAL

K1.1 General

Sub-paragraph K1.1.1-3 has been added as follows.

K1.1.1 Application
1 Stiffeners for boiler used the rolled steel bar are to comply with the **Annex K1.1.1-1** "GUIDANCE RELATING TO ROLLED STEEL BAR FOR BOILERS".
2 Seamless shells of boilers made of steel forgings are to comply with the **Annex K1.1.1-2** "GUIDANCE FOR SEAMLESS FORGED STEEL DRUMS" of this Part.
3 In the application of **1.1.1-2**, **Part K of the Rules for the Survey and Construction of Steel Ships**, those pipes made from metallic materials other than steels (for example titanium pipes, including primary material of pipes) are to be accordance with **Chapter 2**, **Part 1 of the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**.

EFFECTIVE DATE AND APPLICATION

1. The effective date of the amendments is 15 April 2009.