RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

RULES

Part K Materials

2013 AMENDMENT NO.2

Rule No.80 27th December 2013

Resolved by Technical Committee on 29th July 2013

Approved by Board of Directors on 24th September 2013

Rule No.80 27th December 2013

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 3 ROLLED STEELS

3.10 Additional Requirements for Rolled Steel Plates for Hull with Thickness above 50*mm* up to 100*mm*

3.10.3 Deoxidation Practice and Chemical Composition

Table K3.32 has been amended as follows.

Table K3.32 Kinds, Deoxidation Practice and Chemical Composition Steel Plates (%)

Kind	Grade	Deoxidation practice	Chemical Composition (%)[1]														Carbon Equivalent C_{eq} (%)[8]	Cold cracking Susceptibility P_{cm} (%)
			C	*Si*	*Mn*	*P*	*S*[9]	*Cu*	*Cr*	*Ni*	*Mo*	*Al*[3]	*Nb*	*V*	*Ti*	*N*		
Mild Steels	*KA*	Killed	0.21 max.[2]	0.50 max.	2.5×C min.[2]	0.035 max.	0.035 max.	—	—	—	—	—	—	—	—	—	—	—
	KB			0.35 max.	0.60 min.[2]													
	KD	Killed and fine grain treated										0.015 min.[6]						
	KE		0.18 max.[2]		0.70 min.[2]													
High Tensile Steels	*KA*32	Killed and fine grain treated	0.18 max.	0.50 max.	0.90 ~ 1.60	0.035 max.	0.035 max.	0.35 max.	0.20 max.	0.40 max.	0.08 max.	0.015 min.[4]	0.02 ~ 0.05[4][5]	0.05 ~ 0.10[4][5]	0.02 max.[5]	—	0.38 max.[11]	—
	*KD*32																	
	*KE*32																	
	*KA*36																0.40 max.[11]	
	*KD*36																	
	*KE*36																	
	*KA*40																0.42 max.[11]	
	*KD*40																	
	*KE*40																	
	*KF*32		0.16 max.			0.025 max.	0.025 max.			0.80 max.						0.009 max.[7]	0.38 max.[11]	
	*KF*36																0.40 max.[11]	

	*KF*40			0.42 max.(11)	
	*KE*47		(10)	0.49 max.	0.22 max.

Notes:

(1) Where additions of any other element have been made as part of the steel making practice, the content is to be indicated on the test certificate.

(2) The value of $C + Mn/6$ is not to exceed 0.40%.

(3) Aluminium content is to be represented by the acid soluble aluminium content, but may be determined by the total aluminium content. In such case, the total aluminium content is not to be less than 0.020%.

(4) The steel is to contain aluminium, niobium, vanadium or other suitable grain refining elements, either singly or in any combination. When used singly, the steel is to contain the specified minimum content of the grain refining element. When used in combination, the specified minimum content of each grain refining element is not applicable.

(5) The total niobium, vanadium and titanium content is not to exceed 0.12%.

(6) Upon the approval by the Society, grain refining elements other than aluminium may be used.

(7) The maximum content of nitrogen may be increased to 0.012% if aluminium is contained.

(8) Carbon equivalent is to be recorded on test certificate. ~~When any grade of higher strength steel is supplied in the *TMCP* condition, the carbon equivalent is to comply with the requirements of **Table K3.33.**~~

(9) 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.

(10) The chemical composition of *KE*47 is to be as deemed appropriate by the Society.

(11) Only in cases where *TMCP* is applied for heat treatment.

Table K3.33 has been deleted, and Table K3.34 to Table K3.40 have been renumbered to Table K3.33 to Table K3.39.

~~Table K3.33 Carbon Equivalent for Steels Produced by *TMCP*~~

~~Grade~~	~~Carbon equivalent(%)(1)~~
~~*KA32, KD32, KE32, KF32*~~	~~0.38max.~~
~~*KA36, KD36, KE36, KF36*~~	~~0.40max.~~
~~*KA40, KD40, KE40, KF40*~~	~~0.42max.~~

~~Note:~~

~~(1) It is a matter for the manufacturer and shipbuilder to mutually agree in individual cases as to whether they wish to specify a more stringent carbon equivalent.~~

Paragraph 3.10.4 has been amended as follows.

3.10.4 Heat Treatment

The heat treatment of each grade is to comply with the requirements given in **Table K3.3~~4~~3.**

Paragraph 3.10.5 has been amended as follows.

3.10.5 Mechanical Properties

The mechanical properties of steel plates are to comply with requirements given in **Table K3.3~~4~~3**.

Table K3.33 has been amended as follows.

Table K3.3~~4~~3 Heat Treatment and Mechanical Properties

Grade	Heat treatment[1]	Tensile test			Impact test[4]						
		Yield point or proof stress (N/mm^2)	Tensile strength (N/mm^2)	Elongation ($L = 5.65\sqrt{A}$) (%)	Testing temperature (°C)	Minimum mean absorbed energy (J)[5]					
						Thickness t (mm)					
						$50<t\leq 70$		$70<t\leq 85$		$85<t\leq 100$	
						L	*T*	*L*	*T*	*L*	*T*
KA	*TMCP*, *N*[2]	235min.	400~520	22min.	+20[6]	34[6]	24[6]	41[6]	27[6]	41[6]	27[6]
KB					0	34	24	41	27	41	27
KD	*TMCP*, *N*[3]				-20						
KE	*TMCP*, *N*				-40						
*KA*32	*TMCP*, *N*	315min.	440~590	22min.	0	38	26	46	31	46	31
*KD*32					-20						
*KE*32					-40						
*KF*32	*TMCP*, *N*, *QT*				-60						
*KA*36	*TMCP*, *N*	355min.	490~620	21min.	0	41	27	50	34	50	34
*KD*36					-20						
*KE*36					-40						
*KF*36	*TMCP*, *N*, *QT*				-60						
*KA*40	*TMCP*, *N*, *QT*	390min.	510~650	20min.	0	46	31	55	37	55	37
*KD*40					-20						
*KE*40					-40						
*KF*40					-60						
*KE*47	*TMCP*	460 min.	570~720	17 min.	-40	53	(7)	64	(7)	75	(7)

Notes:

(1) *See* **Note (3)** of **Table K3.3.**

(2) *AR* or *CR* (hereinafter referred to as "*ARS*" or "*CRS*" in **3.10**) may be accepted, subject to the approval by the Society.

(3) *CRS* may be accepted.

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

(5) 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.

(6) It may be applied in case where the heat treatment is *ARS* or *CRS*. (*See*, **Note (2)**)

(7) Standards deemed appropriate by Society.

Paragraph 3.10.6 has been amended as follows.

3.10.6 Selection of Test Samples

The test samples are to be taken according to the following **(1)** and **(2)**.

(1) In the case of ingot casting the test samples are to be taken from a position representing the top of the ingot.

(2) The lot for the impact test is given in **Table K3.3~~5~~4**.

Table K3.34 has been amended as follows.

Table K3.3~~5~~4 Size of Lot for Impact Test

Grade	Heat treatment and size of lot
KA	*TMCP* < − >, *N* < − >, *CRS*<50>, *ARS*<50>
KB	*TMCP*<50>, *N*<50>, *CRS*<25>, *ARS*<25>
KD	*TMCP*<50>, *N*<50>, *CRS*<25>
KE	*TMCP*<*P*>, *N*<*P*>
*KA*32, *KA*36	*TMCP*<50>, *N*<50>
*KD*32, *KD*36	
*KE*32, *KE*36	*TMCP*<*P*>, *N*<*P*>
*KA*40, *KD*40	*TMCP*<50>, *N*<50>, *QT*<*PH*>
*KE*40, *KF*32, *KF*36, *KF*40	*TMCP*<*P*>, *N*<*P*>, *QT*<*PH*>
*KE*47	*TMCP*<*P*>

Note:

In the Table, "mark" put at the end of each "symbol" for heat treatment (*See* **Notes (1)** and **(2)** of **Table K3.34**) stand for the volume of each lot. For examples, <50> and <25> each indicate that steel plates not greater in mass than 50 and 25 *tonnes* (belonging to the same manufacturing process in the same charge) are to be taken as one lot; <*P*> indicates that steel plate rolled directly from one slab or steel ingot (belonging to the same heat treatment condition) is to be taken as one lot; <*PH*> indicates that steel plate rolled directly from one slab or steel ingot and heat treated simultaneously in the same furnace including continuous furnace is to be taken as one lot; and <->indicates that no impact test is required.

3.11 Additional Requirements for Through Thickness Properties

Paragraph 3.11.2 has been amended as follows.

3.11.2 Through Thickness Properties

1 The through thickness properties of steels are to conform to the requirements in **Table K3.3~~6~~5** as the result of tensile tests whose specimens are taken in the through thickness direction of the product.

Table K3.3~~6~~5 Through Thickness Properties

Kinds of Steels	Suffix	Tensile test in the through thickness direction	
		Reduction of area (%)	
		Average value of three specimens	One individual value (1)
Rolled Steels for Hull	Z25	25min.	15min.
High Strength Quenched and Tempered Rolled Steels for Structures	Z35	35min.	25min.

Note:

(1) If two or more individual results are less than the specified average value, the test is considered to be failed.

3.11.3 Selection of Test Samples

Sub-paragraph -1 has been amended as follows.

1 For steel, of same thickness, belonging to the same charge and same heat treatment condition, one test sample is to be taken from each lot specified in **Table K3.3~~7~~6**.

Table K3.3~~7~~6 Lot for Tensile Test in the Through Thickness Direction

Product	Content of *S*	
	$S \leq 0.005\%$	$0.005\% < S$
Plates		＜*P*＞
Wide flats of nominal thickness ≤ 25*mm*	＜50＞	＜10＞
Wide flats of nominal thickness > 25*mm*		＜20＞

Note:

In the Table, <50>, <20> and <10> each indicate that steels not greater in mass than 50, 20 and 10 *tonnes* are to be taken as one lot; <*P*> indicates that steel rolled directly from one slab or steel ingot is to be taken as one lot.

3.11.4 Selection of Test Specimens

Sub-paragraph -2 has been amended as follows.

1 Three tensile test specimens are to be taken from one test sample in the through thickness direction.
2 The test specimens are to be taken according to the requirements for dimensions provided in **Table K3.3~~8~~7**.
3 Where the product thickness dose not allow to prepare specimens of sufficient length suitable for the gripping jaws of the testing machine, the ends of the specimens may be built up by suitable welding methods. The welding is not to impair the portion of the specimen within the parallel length.

Table K3.3~~8~~7 Dimensions of Specimen

Product thickness *t* (*mm*)	Diameter of test specimen *d* (*mm*)	Parallel length *L* (*mm*)
$15 \leq t \leq 25$	d =6	$9 \leq L$
25<*t*	d =10	$15 \leq L$

Paragraph 3.11.7 has been amended as follows.

3.11.7 Marking

For the products complying with the requirements specified in **3.11**, "*Z*25" or "*Z*35" given in **Table K3.3~~6~~5** is to be suffixed to the markings. (Example : *KD*36-*Z*25 for *KD*36.)

3.12 Additional Requirements for Brittle Crack Arrest Properties

3.12.1 Application

Sub-paragraph -2 has been amended as follows.

1 The provisions given in **3.12** are to apply to the steels which are specially considered so as to have brittle crack arrest properties relating to the structural design.
2 The requirements are to apply to hull structural rolled steels for plates (*KE*, *KE*32, *KE*36, *KE*40, *KE*47, *KF*32, *KF*36 and *KF*40).
3 The requirements are applicable to steels other than those specified in **-2** above, where

deemed appropriate by the Society.

3.12.2 Brittle Crack Arrest Properties etc.

Sub-paragraph -1 has been amended as follows.

1 The brittle crack arrest properties of steel plates are to conform to the requirements in **Table K3.3~~9~~8** 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 K3.38 has been amended as follows.

Table K3.3~~9~~8 Brittle Crack Arrest Properties

Kinds of Steels		classification	Temperature gradient *ESSO* tests or double tension tests	
			Evaluation Temperature (°C)	Brittle Crack Arrest Toughness Value Kca ($N/mm^{1.5}$)
Rolled Steels for Hull	*KE*, *KE*32, *KF*32, *KE*36, *KF*36, *KE*40 *KF*40 *KE*47	*A*400	-10	min. 4000
		*A*500	-10	min. 5000
		*A*600	-10	min. 6000

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

Paragraph 3.12.6 has been amended as follows.

3.12.6 Marking

For the products complying with the requirements specified in **3.12**, "*A*400" or "*A*600" given in **Table K3.3~~9~~8** is to be suffixed to the markings. (Example : *KE*40-*A*400 for *KE*40.)

3.13 Additional Requirements for Corrosion Resistant Steel for Cargo Oil Tanks

Paragraph 3.13.2 has been amended as follows.

3.13.2 Kinds

The steels are classified into kinds and grades as given in **Table K3.~~40~~39**.

Table K3.~~40~~39 Kinds of Corrosion Resistant Steel for Cargo Oil Tanks

Kind	Grade
For upper decks	The grade is to be indicated by adding the suffix "*RCU*" to the grade specified in **Table K3.1** (*ex. KA*36-*RCU*)
For inner bottom plating	The grade is to be indicated by adding the suffix "*RCB*" to the grade specified in **Table K3.1** (*ex. KA*36-*RCB*)
For both upper decks and inner bottom plating	The grade is to be indicated by adding the suffix "*RCW*" to the grade specified in **Table K3.1** (*ex. KA*36-*RCW*)

EFFECTIVE DATE AND APPLICATION

1. The effective date of the amendments is 1 January 2014.

2. Notwithstanding the amendments to the Rules, the current requirements may apply to ships for which the date of contract for construction* is before the effective date.

* "contract for construction" is defined in the latest version of IACS Procedural Requirement (PR) No.29.

IACS PR No.29 (Rev.0, July 2009)

1. The date of "contract for construction" of a vessel is the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. This date and the construction numbers (i.e. hull numbers) of all the vessels included in the contract are to be declared to the classification society by the party applying for the assignment of class to a newbuilding.

2. The date of "contract for construction" of a series of vessels, including specified optional vessels for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective owner and the shipbuilder.

For the purpose of this Procedural Requirement, vessels built under a single contract for construction are considered a "series of vessels" if they are built to the same approved plans for classification purposes. However, vessels within a series may have design alterations from the original design provided:

(1) such alterations do not affect matters related to classification, or

(2) If the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the shipbuilder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to the Society for approval.

The optional vessels will be considered part of the same series of vessels if the option is exercised not later than 1 year after the contract to build the series was signed.

3. If a contract for construction is later amended to include additional vessels or additional options, the date of "contract for construction" for such vessels is the date on which the amendment to the contract, is signed between the prospective owner and the shipbuilder. The amendment to the contract is to be considered as a "new contract" to which **1.** and **2.** above apply.

4. If a contract for construction is amended to change the ship type, the date of "contract for construction" of this modified vessel, or vessels, is the date on which revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder.

Note:
This Procedural Requirement applies from 1 July 2009.

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE

Part K Materials

2013 AMENDMENT NO.2

Notice No.69 27th December 2013

Resolved by Technical Committee on 29th July 2013

Notice No.69 27th December 2013
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

K3 ROLLED STEELS

K3.12 Additional Requirements for Brittle Crack Arrest Properties

K3.12.2 Brittle Crack Arrest Properties etc.

Sub-paragraph -1 has been amended as follows.

1 In **3.12.2-1, Part K of the Rules**, "the discretion of the Society" can be regarded as **Annex K3.12.2-1** "GUIDANCE FOR ~~BRITTLE CRACK ARREST TOUGHNESS K_{ca} TEST METHOD~~ TEMPERATURE GRADIENT ESSO TEST" in the case of temperature gradient ESSO tests.

2 For **3.12.2-1** and **3.12.4-4**, **Part K of the Rules**, test plan, containing information on the items mentioned below, are to be submitted for approval of the Society.

(1) Testing machine specifications (including testing machine capacity and distance between pins)
(2) Details of test specimen (including types and dimensions of test specimen and method of joint with tab plate)
(3) Types, dimensions and mechanical properties of tab plate and load jig
(4) Measurement specifications (including whether dynamic measurements are necessary and positions on which the thermocouples, strain gauges and crack gauges are fitted)
(5) Test conditions (including how to generate a brittle crack, impact energy, temperature of test specimen, temperature gradient, preload stress and test stress)

Title of Annex K3.12.2-1 has been amended as follows.

Annex K3.12.2-1 GUIDANCE FOR ~~BRITTLE CRACK ARREST TOUGHNESS K_{ca} TEST METHOD~~ TEMPERATURE GRADIENT ESSO TEST

Section 1.1 has been amended as follows.

1.1 Scope

This test method is used to estimate the brittle crack arrest toughness value K_{ca} of rolled steel plates for hull of thicknesses of ~~90*mm*~~ 100*mm* or less. The brittle crack arrest toughness value K_{ca} of rolled steel plates for hull of thicknesses more than ~~90*mm*~~ 100*mm* is left to the discretion of the Society.

1.4 Standard test specimen

Table 2 has been amended as follows.

Table 2 Thickness and width of test specimen

Thickness, t_S	~~90*mm*~~ 100*mm* and below
Width of test specimen, W_S	500*mm*

Note:
If the width of the test specimen cannot be made at 500*mm*, it may be taken as 600*mm*.

EFFECTIVE DATE AND APPLICATION

1. The effective date of the amendments is 1 January 2014.

2. Notwithstanding the amendments to the Guidance, the current requirements may apply to ships for which the date of contract for construction* is before the effective date.

* "contract for construction" is defined in the latest version of IACS Procedural Requirement (PR) No.29.

IACS PR No.29 (Rev.0, July 2009)

1. The date of "contract for construction" of a vessel is the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. This date and the construction numbers (i.e. hull numbers) of all the vessels included in the contract are to be declared to the classification society by the party applying for the assignment of class to a newbuilding.

2. The date of "contract for construction" of a series of vessels, including specified optional vessels for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective owner and the shipbuilder.

For the purpose of this Procedural Requirement, vessels built under a single contract for construction are considered a "series of vessels" if they are built to the same approved plans for classification purposes. However, vessels within a series may have design alterations from the original design provided:

(1) such alterations do not affect matters related to classification, or

(2) If the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the shipbuilder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to the Society for approval.

The optional vessels will be considered part of the same series of vessels if the option is exercised not later than 1 year after the contract to build the series was signed.

3. If a contract for construction is later amended to include additional vessels or additional options, the date of "contract for construction" for such vessels is the date on which the amendment to the contract, is signed between the prospective owner and the shipbuilder. The amendment to the contract is to be considered as a "new contract" to which **1.** and **2.** above apply.

4. If a contract for construction is amended to change the ship type, the date of "contract for construction" of this modified vessel, or vessels, is the date on which revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder.

Note:
This Procedural Requirement applies from 1 July 2009.