RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

RULES

Part K Materials

2017 AMENDMENT NO.2

Rule No.92 25 December 2017

Resolved by Technical Committee on 26 July 2017

An asterisk (*) after the title of a requirement indicates that there is also relevant information in the corresponding Guidance.

Rule No.92 25 December 2017
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

Amendment 2-1

Chapter 3 ROLLED STEEL

3.5 Rolled Stainless Steels

3.5.2 Kinds

Table K3.18 has been amended as follows.

Table K3.18 Grades and Chemical Composition of Stainless Steels

Grade	Chemical composition (%)									
	C	*Si*	*Mn*	*P*	*S*	*Ni*	*Cr*	*Mo*	*N*	Others
*KSUS*304	0.08 max.	1.00 max.	2.00 max.	0.045 max.	0.030 max.	8.00~10.50	18.00~20.00	—	—	—
*KSUS*304*L*	0.030 max.					9.00~13.00				
*KSUS*304*N*1	0.08 max.		2.50 max.			7.00~10.50			0.10~0.25	
*KSUS*304*N*2						7.50~10.50			0.15~0.30	*Nb* ≤ 0.15
*KSUS*304*LN*	0.030 max.		2.00 max.			8.50~11.50	17.00~19.00		0.12~0.22	—
*KSUS*309*S*	0.08 max.					12.00~15.00	22.00~24.00		—	
*KSUS*310*S*		1.50 max.				19.00~22.00	24.00~26.00			
*KSUS*316		1.00 max.				10.00~14.00	16.00~18.00	2.00~3.00		
*KSUS*316*L*	0.030 max.					10.00~14.00				
*KSUS*316*N*	0.08 max.					10.00~14.00			0.10~0.22	
*KSUS*316*LN*	0.030 max.					10.50~14.50	16.50~18.50		0.12~0.22	
*KSUS*317	0.08 max.					11.00~15.00	18.00~20.00	3.00~4.00	—	
*KSUS*317*L*	0.030 max.									
*KSUS*317*LN*									0.10~0.22	
*KSUS*321	0.08 max.					9.00~13.00	17.00~19.00	—	—	*Ti* ≥ 5 × *C*
*KSUS*323*L*	0.030 max.	1.00 max.	2.50 max.	0.040 max.	0.030 max	3.00~5.50	21.50~24.50	0.05~0.60	0.05~0.20	0.05 ≤ *Cu* ≤ 0.60
*KSUS*329*J*1	0.08 max.	1.00 max.	1.50 max.	0.040 max.	0.030 max.	3.00~6.00	23.00~28.00	1.00~3.00	—	—
*KSUS*329*J*3*L*	0.030 max.	1.00 max.	2.00 max.	0.040 max.	0.030 max.	4.50~6.50	21.00~24.00	2.50~3.50	0.08~0.20	—

Grade	Chemical composition (%)									
	C	*Si*	*Mn*	*P*	*S*	*Ni*	*Cr*	*Mo*	*N*	Others
*KSUS*329*J*4*L*	0.030 max.	1.00 max.	1.50 max.	0.040 max.	0.030 max.	5.50~7.50	24.00~26.00	2.50~3.50	0.08~0.30	—
*KSUS*347	0.08 max.	1.00 max.	2.00 max.	0.045 max.	0.030 max.	9.00~13.00	17.00~19.00	—	—	$Nb \geq 10 \times C$
*KSUS*821*L*1	0.030 max.	0.75 max.	2.00 ~4.00	0.040 max.	0.020 max	1.50~2.50	20.50~21.50	0.60 max.	0.15~0.20	$0.50 \leq Cu \leq 1.50$

3.5.5 Mechanical Properties*

Table K3.19 has been amended as follows.

Table K3.19 Mechanical Properties of Stainless Steels

Grade	Tensile test			Hardness test		
	Proof stress (N/mm^2)	Tensile strength (N/mm^2)	Elongation ($L = 5.65\sqrt{A}$)(%)	Brinell hardness *HBW*	Rockwell hardness *HRB*	Vickers hardness *HV*
*KSUS*304	205 min.	520 min.	40 min.	187 max.	90 max.	200 max.
*KSUS*304*L*	175 min.	480 min.				
*KSUS*304*N*1	275 min.	550 min.	35 min.	217 max.	95 max.	220 max.
*KSUS*304*N*2	345 min.	690 min.		248 max.	100 max.	260 max.
*KSUS*304*LN*	245 min.	550 min.	40 min.	217 max.	95 max.	220 max.
*KSUS*309*S*	205 min.	520 min.		187 max.	90 max.	200 max.
*KSUS*310*S*						
*KSUS*316						
*KSUS*316*L*	175 min.	480 min.				
*KSUS*316*N*	275 min.	550 min.	35 min.	217 max.	95 max.	220 max.
*KSUS*316*LN*	245 min.		40 min.			
*KSUS*317	205 min.	520 min.		187 max.	90 max.	200 max.
*KSUS*317*L*	175 min.	480 min.				
*KSUS*317*LN*	245 min.	550 min.		217 max.	95 max.	220 max.
*KSUS*321	205 min.	520 min.		187 max.	90 max.	200 max.
*KSUS*323*L*	400 min.	600 min.	25 max. (2)	290 max.	32 max. (1)	310 max.
*KSUS*329*J*1	390 min.	590 min.	18 min.	277 max.	29 max. (1)	292 max.
*KSUS*329*J*3*L*	450 min.	620 min.	18 min.	302 max.	32 max. (1)	320 max.
*KSUS*329*J*4*L*	450 min.	620 min.	18 min.	302 max.	32 max. (1)	320 max.
*KSUS*347	205 min.	520 min.	40 min.	187 max.	90 max.	200 max.
*KSUS*821*L*1	400 min.	600 min.	25 max. (2)	290 max.	32 max. (1)	310 max.

Notes:

(1) Rockwell hardness of *KSUS*323*L*, *KSUS*329*J*1, *KSUS*329*J*3*L*, ~~and~~ *KSUS*329*J*4*L* and *KSUS*821*L*1 is to *C* scale value (*HRC*).

(2) For steels 2.0 *mm* or less in thickness, elongation is not to be less than 20%.

EFFECTIVE DATE AND APPLICATION (Amendment 2-1)

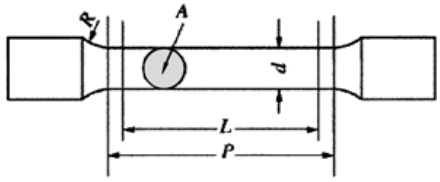
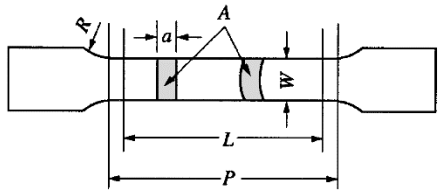
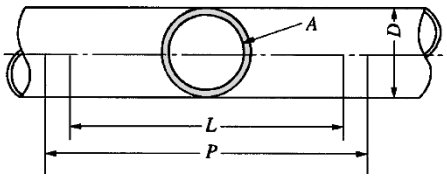
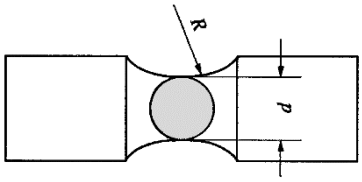
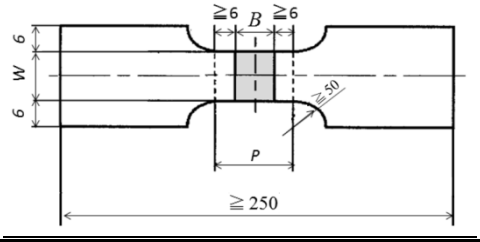
1. The effective date of the amendments is 25 December 2017.

Amendment 2-2

Chapter 2 TEST SPECIMENS AND MECHANICAL TESTING PROCEDURES

Table K2.1 has been amended as follows.

Table K2.1 Size and Dimensions of Tensile Test Specimens (Unit: *mm*)

kind	Size of specimens	Dimensions[(1)(2)]	Material to be applied
*U*14A		$L=70$, $d=14$, $P\cong 80$, $R\geq 10$ (For spheroidal or nodular graphite iron castings, $R\geq 20$). The above-mentioned specimen is generally used, however, a specimen having the following dimensions may also be used: $L=5d$, $P\cong L+0.5d$, $R\geq 10$ (For spheroidal or nodular graphite iron castings, $R\geq 20$).	Rolled steels (Chapter 3) Steel pipes (Chapter 4) Steel castings (Chapter 5) Spheroidal or nodular graphite iron castings (Chapter 5) Steel forgings (Chapter 6) Copper alloys (Chapter 7) Aluminium alloys[(3)] (Chapter 8)
*U*14B		$L=5.65\sqrt{A}$, $a=t$, $W\geq 12$ $P\cong L+2W$, $R\geq 25$	Steel pipes (Chapter 4) Copper pipes (Chapter 7)
		$L=5.65\sqrt{A}$, $a=t$, $W=25$ $P\cong L+2\sqrt{A}$, $R\geq 25$	Rolled steels 3 *mm* and over in thickness (Chapter 3) Aluminium alloys (Chapter8)
*U*1		$L=200$, $a=t$, $W=25$ $P\cong 220$, $R\geq 25$	
*U*13B		$L=50$, $a=t$, $W=12.5$ $P\cong 75$, $R\geq 25$	Rolled steels under 3 *mm* in thickness (Chapter 3)
*U*14C		$L=5.65\sqrt{A}$, $P\cong L+0.5D$, where P is the distance between the end grips	Steel pipes (Chapter 4) Copper pipes (Chapter 7)
11		$L=50$, $P\cong L+0.5D$, where P is the distance between the end grips	Aluminium alloy seamless pipes (Chapter 8)
*U*8		$d=20$, $R=25$ The specimen is to be prepared from test assembly, 30 *mm* in diameter, separately casted.	Grey iron casting（Chapter 5）
1		(1) $W=40$ （$a<20$） (2) $W=25$ （$a\geqq 20$）	Aluminium alloy longitudinally welded pipes (Chapter 8)

Notes:

(1) The following designations are used;

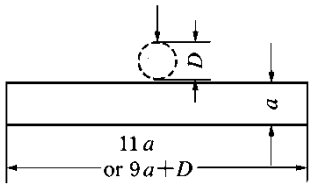
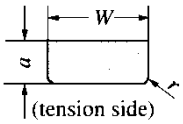
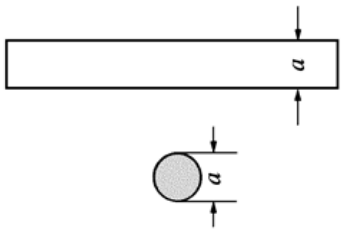
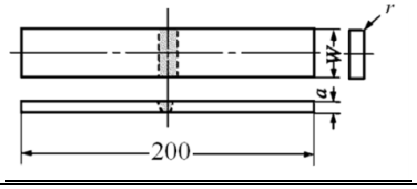
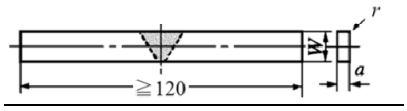
d: diameter, *a*: thickness, *W*: width, *L*: gauge length (Recommended to be 20 *mm* and over), *P*: parallel part length, *A*: cross-section, *R*: transition radius, *D*: extermal tube-diameter, *t*: thickness of material

(2) When $L = 5d$ or $5.65\sqrt{A}$, the specimen is called a proportional test specimen. The gauge length may be rounded off the nearest 5 *mm* provided that the difference between this length and L is less than 10% of L.

(3) Except Aluminium alloys of thickness 12.5 *mm* and less.

Table K2.4 has been amended as follows.

Table K2.4 Size and Dimensions of Bend Test Specimens (Unit : *mm*)

kind	Size of specimens	Dimensions(1)	Material to be applied
*U*1A		$a = t$ $W = 30$ $r = 1 \sim 2$	——(2)
*U*1B		$a = 20$ $W = 25$ $r = 1 \sim 2$	Headers (Chapter 4)
2		$a = d$ Where the diameter or the width across flat of materials exceeds 35 *mm*, they may be machined finished to a circular section of diameter not less than 35 *mm*.	——(2)
B-1	Face and root bend specimen 	$a = t$ $W = 40$ $r < 0.2a$ (however, r is not to exceed 3 *mm*.)	Aluminium alloy longitudinally welded pipes (Chapter 8)
B-2	Side bend specimen 	$a = 8$ $W = t$ $r < 1.6$	

Notes:

The following designations are used;

(1) a: Thickness, diameter or width of test specimen, W: Width of test specimen
d: Diameter or width across flats, r: Edge radius of test specimen
D: Diameter of mandrel, t: Material thickness

(2) Materials deemed necessary by the Society.

Chapter 8 ALUMINIUM ALLOYS

Section 8.2 has been added as follows.

8.2 Aluminium Alloy pipes

8.2.1 Application

1 The requirements in this section apply to aluminium alloy seamless pipes and aluminium alloy longitudinally welded pipes (hereinafter referred as "aluminium alloy pipes") intended to be used for the cargo and process piping of ships carrying liquefied gases in bulk and for the fuel and process piping of ships using low-flashpoint fuels.

2 Aluminium alloy longitudinally welded pipes are not required to be subjected to approval of manufacturing process. Such pipes are, however, to comply with the following requirements:

(1) Aluminium alloy plates approved in accordance with the requirement of **8.1** are to be used.

(2) Welding procedure tests for aluminium alloy longitudinally welded pipes are to be carried out according to the requirements of **6.5.4**, **Part N of the Rules** in cases where the pipes are used for the cargo and process piping of liquefied gas carriers, or the requirements of **16.3.4**, **Part GF of the Rules** in cases where the pipes are used for the fuel and process piping of ships using low-flashpoint fuels.

(3) Welding work for pipe welds is to be performed by welders who have passed the welder qualification tests related to aluminium alloys specified in **Chapter 5** of **Part M of the Rules**.

(4) Welding consumables approved in accordance with the requirements in **Chapter 6** of **Part M of the Rules** are to be used

3 Aluminium alloy pipes having characteristics differing from those specified in **8.2** are to comply with the requirements in **1.1.1-3**.

8.2.2 Kinds

The aluminium alloy pipes are classified as specified in **Tables K8.5**.

Table K8.5 Kind of Aluminium Alloy Pipes

Products	Material grade
Seamless Pipes	5083*TE/TD*
Longitudinally Welded Pipes	5083*TWA*

Notes:

(1) *TE* : Extruded pipes

(2) *TD* : Drawn pipes

(3) *TWA* : Longitudinally welded pipes

8.2.3 Chemical Composition

The chemical composition of aluminium alloy pipes is to comply with the requirements given in **Table K8.6**.

8.2.4 Heat Treatment

The heat treatment (hereinafter referred to as "temper condition") of aluminium alloy pipes is subject to in **Table K8.7**.

8.2.5 Mechanical Properties*

1 Aluminium alloy pipes are to comply with the following requirements with respect to their mechanical properties.

(1) Tensile tests

Aluminium alloy seamless pipes are to be subjected to tensile tests and are to comply with the requirements in **Table K8.7(a)** and **Table K8.7(b)**.

Welds of aluminium alloy longitudinally welded pipes are to be subjected to tensile tests and are to comply with the requirements in **Table K8.7(c)**.

(2) Bend tests

Aluminium alloy longitudinally welded pipes are to be subjected to bend tests carried out in accordance with standards deemed appropriate by the Society. There are to be no cracks greater than or equal to 3 *mm* in length on the outer surface of welds of bended specimens.

The radius of the plunger is to be $\frac{10}{3}$ times test specimen thickness.

(3) Hydraulic tests

(a) Aluminium alloy longitudinally welded pipes are to be subjected to hydraulic tests at their place of manufacture at pressures of at least 1.5 times maximum working pressure specified by the manufacturer for at least 10 minutes with satisfactory results.

(b) In cases where each aluminium alloy longitudinally welded pipes is hydraulically tested as a regular procedure during the process of manufacturing at their place, which makes a number of the pipes continually, and the results are forwarded to the Surveyor, the test in the presence of the Surveyor may be dispensed with.

(c) A non-destructive test deemed appropriate by the Society may be substituted for the hydraulic test specified in **(a)**.

2 Where deemed necessary by the Society, other tests may be required in addition to the specified tests according to their application.

8.2.6 Non-destructive Test*

1 Welds of aluminium alloy longitudinally welded pipes are to be subjected to radiographic tests.

2 The criteria of the test specified in **-1** above is to be as deemed appropriate by the Society.

Table K8.6 Chemical Composition

	Chemical composition (%)										
Material grade	*Si*	*Fe*	*Cu*	*Mn*	*Mg*	*Cr*	*Zn*	*Ti*	Others(1)		*Al*
									Each	Total	
5083*TE*/*TD*/*TWA*	≤0.40	≤0.40	≤0.10	0.40～1.0	4.0～4.9	0.05～0.25	≤0.25	≤0.15	≤0.05	≤0.15	Remainder

Note:

(1) When the existence of the other elements is presumed in the course of routine analysis, further analysis thereof is to be conducted.

Table K8.7(a) Temper Conditions and Mechanical Properties[1] (Extruded pipes)

Material grade	Temper condition[2]	Thickness t (*mm*)	Tensile test			
			Sectional area (cm^2)	Proof strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation(%) ($L=50$)
5083*TE*	*O*	$t \leq 25$	200 max.	110 min.	275～355	14 min.

Notes:

(1) Aluminium alloy seamless pipes may be subject to any other standards in lieu of the requirements given in this Table where they are approved by the Society.

(2) Indication symbols used in temper condition are as follows.

O : Annealing

Table K8.7(b) Temper Conditions and Mechanical Properties[1] (Drawn pipes)

Material grade	Temper condition[2]	Thickness t (*mm*)	Tensile test		
			Proof strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation(%) ($L=50$)
5083*TD*	*O*	$0.6 \leq t \leq 12$	110 min.	275～355	14 min.

Notes:

(1) Aluminium alloy seamless pipes may be subject to any other standards in lieu of the requirements given in this Table where they are approved by the Society.

(2) Indication symbols used in temper condition are as follows.

O : Annealing

Table K8.7(c) Temper Conditions and Mechanical Properties[1] (Longitudinally welded pipes)

Material grade	Temper condition[2]	Thickness t (*mm*)	Tensile test
			Tensile strength (N/mm^2)
5083*TWA*	*O*	$t \leq 25$	275～350

Notes:

(1) Aluminium alloy longitudinally welded pipes may be subject to any other standards in lieu of the requirements given in this Table where they are approved by the Society.

(2) Indication symbols used in temper condition are as follows.

O : Annealing

8.2.7 Selection of Test Specimen

1 For aluminium alloy seamless pipes, one sampling pipe is to be selected from each grade and each size which has been heat treated at the same time in the same heating furnace. The selection is to be conducted for each lot of 1,000 *kg* or fraction thereof in cases where the weight per one meter is not more than 1 *kg*, each lot of 2,000 *kg* or fraction thereof in cases where the weight per one meter is more than 1 *kg* and not more than 5 *kg*, or each lot of 3,000 *kg* or fraction thereof in cases where the weight per one meter is more than 5 *kg*. One tensile test specimen is to be taken from each of the sampling pipes and the specimen is to comply with the requirements specified in Table **K2.1**.

2 For aluminium alloy longitudinally welded pipes, specimens for tensile, face bend, root bend and side bend tests are to be selected from one test sample made for each 60 *m* or fraction thereof of the weld length.

(1) Test sample

Plates having the same material and same thickness as pipes are to be fitted on a pipe end and are to be welded at the same time as the welding of the pipe seam with the plate welded line located on the same line as the pipe seam. At least 50 *mm* of both ends of the plate are to be discarded after the welding. (See **Fig. K8.1**)

(2) Tensile test specimen

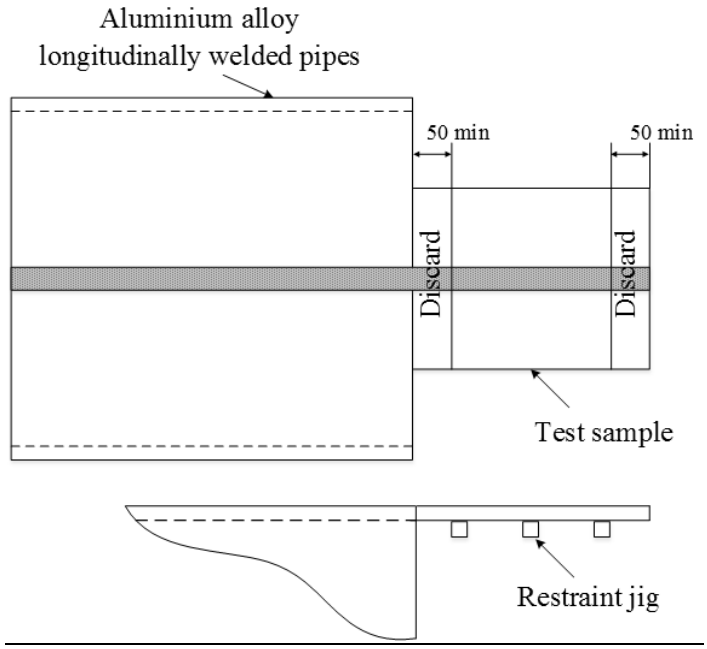
One tensile test specimen is to be taken from a test sample and to be of the size and dimensions given in Table **K2.1**.

(3) Bend test specimen

One face bend and root bend test specimen each is to be taken from a test sample and to be of the size and dimensions given in **B-1**, **Table K2.4**. In cases where pipe thickness is not less than 20 *mm*, two side bend test specimens are to be taken from a test sample and to be of the size and dimensions given in B-2, **Table K2.4**.

3 Radiographic tests for welds of aluminium alloy longitudinally welded pipes are to be carried out per 50 pipes.

Fig. K8.1 Aluminium alloy longitudinally welded pipe test sample



8.2.8 Dimension*

1 Verification of dimension is left to the responsibility of the manufacturer.

2 Dimensional tolerance is left to the discretion of the Society.

8.2.9 Quality

1 Aluminium alloy pipes are to be of uniform quality and free from harmful defects. For aluminium alloy longitudinally welded pipes, the height of reinforcement of the weld is to be not more than that given in **Table K8.15**. In cases where the height of reinforcement of the weld may make the pipe difficult to use, it is to be reduced to an appropriate height.

2 Surface defects may be removed by local grinding. The thickness of the portions where defects have been removed, however, is to remain within the tolerances specified in **8.2.8-2**.

Table K8.15 Allowable height of reinforcement

Thickness (t)	Height
up to 6	2
over 6 up to 15	$\frac{1}{3}t$
over 15 up to 25	5

8.2.10 Additional Tests before Rejection

1 Where the mechanical tests from the first test specimens selected fail to meet the requirements, additional tests may be conducted according to the requirements given in **1.4.4**.

8.2.11 Marking

The name of the manufacturer, material grade, temper condition and size are to be legibly stamped or stenciled onto each pipe prior to shipment. The Society's brand indicating compliance with the requirements is to be stamped in the vicinity of the aforementioned markings. Pipes which cannot be individually stamped or stenciled in accordance with this requirement due to their small size may be bundled together and each bundle is to be properly stamped and marked.

EFFECTIVE DATE AND APPLICATION (Amendment 2-2)

1. The effective date of the amendments is 25 June 2018.

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE

Part K Materials

2017 AMENDMENT NO.2

Notice No.96 25 December 2017

Resolved by Technical Committee on 26 July 2017

Notice No.96 25 December 2017
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

Amendment 2-1

K3 ROLLED STEEL

Section K3.9 has been added as follows.

K3.9 Stainless Clad Steel Plates

K3.9.9 Surface Inspection and Verification of Dimension

1 The wording "to the discretion of the Society" specified in **3.9.9-2, Part K of the Rules** means the following **(1)** to **(3)**.

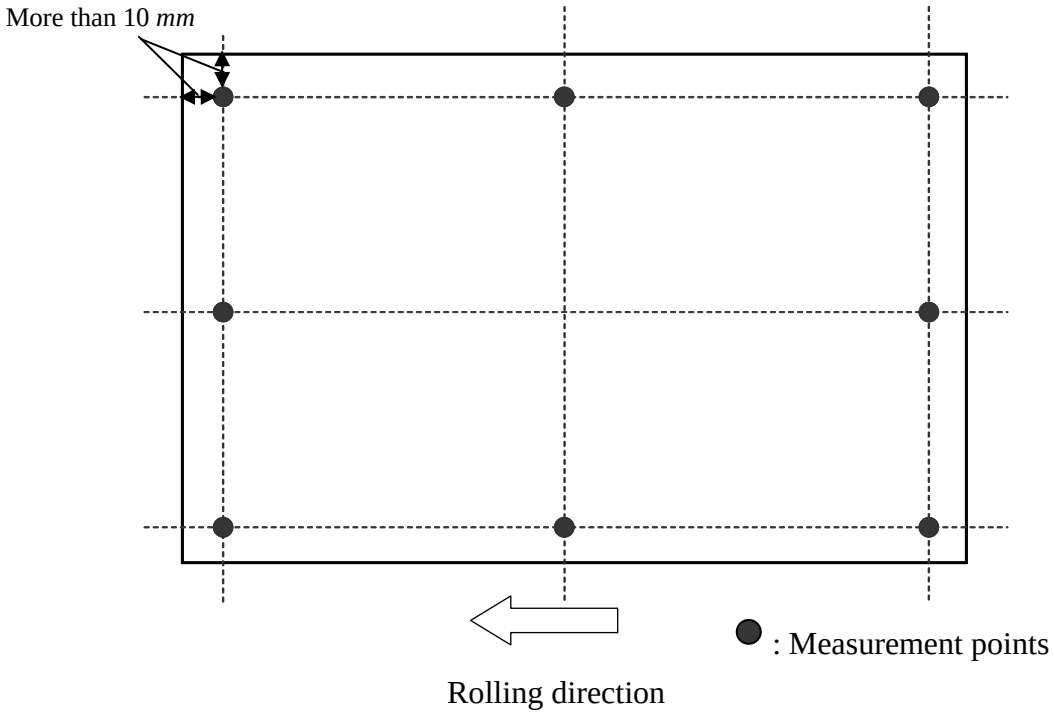
(1) The minus tolerance for the nominal thickness of the plate is to be 0.3 *mm* or less.

(2) The minus tolerance for the nominal thickness of the cladding metal is to be 10% or less of this thickness, but is not to exceed 0.25 *mm*.

(3) The minus tolerance for the nominal thickness of the base metal is to be 0.3 *mm* or less. However, application of this requirement is to be limited to cases where the minimum proof stress and tensile strength of the cladding metal are respectively lower than the minimum yield point or proof stress, and the minimum tensile strength of the base metal.

2 Thickness measuring locations, as shown in **Fig. K3.9.9-1**, are all corners of the plate and the central regions of each side whose distance from an edge is at least 10 *mm*. However, local surface depressions resulting from imperfections (such as parts affected by shearing) and ground areas resulting from the elimination of defects may be disregarded.

Fig. K3.9.9-1 Locations of Thickness Measuring Points



EFFECTIVE DATE AND APPLICATION (Amendment 2-1)

1. The effective date of the amendments is 25 June 2018.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to stainless clad steel plates for which the application for survey is submitted to the Society before the effective date or stainless clad steel plates being used on ships for which the date of contract for construction is before the effective date.

Amendment 2-2

K8 ALUMINIUM ALLOYS

Section K8.2 has been added as follows.

K8.2 Aluminium Alloy Pipes

K8.2.5 Mechanical Properties

1 The wording "standards deemed appropriate by the Society" given in **8.2.5-1(2)**, **Part K of the Rules** means *JIS* Z3122 or *ISO* 5173.

2 The non-destructive tests to be substituted for the hydraulic tests specified in **8.2.5-1(3)**, **Part K of the Rules** are to be tightness tests. In such cases, aluminium alloy longitudinally welded pipes are, in principle, to be subjected to the tests at their place of manufacture at pressures of at least 1.1 times maximum working pressure for at least 10 minutes with satisfactory results.

K8.2.6 Non-destructive Test

1 The wording "the discretion of the Society" given in **8.2.6**, **Part K of the Rules** means at least class 2 specified in the appendix 4, *JIS* Z3105.

K8.2.8 Dimension

Dimensional tolerance is, as a standard, to comply with *JIS* H4080 and *JIS* H4090.

EFFECTIVE DATE AND APPLICATION (Amendment 2-2)

1. The effective date of the amendments is 25 June 2018.