RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

RULES

Part M Welding

2019 AMENDMENT NO.1

Rule No.39 14 June 2019

Resolved by Technical Committee on 30 January 2019

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

Rule No.39 14 June 2019
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 M WELDING

Amendment 1-1

Chapter 4 WELDING PROCEDURE AND RELATED SPECIFICATIONS

4.1 General

Paragraph 4.1.4 has been amended as follows.

4.1.4 Range of Approval*

1 (Omitted)

2 The scope of approval of the welding procedure and related specifications of steel pipes are to be in accordance with the following **(1)** through **(7)** on the condition that the other welding conditions are the same.

(1) Kind of weld joint
The kind of weld joint is to be in accordance with in **Table M4.1**.

(2) Thickness
The range of the thickness is to be in accordance with in **Table M4.2**.

(3) Outside diameter
(a) The range of the outside diameter is to be in accordance with in **Table M4.4**.
(b) In cases where plates are used as the test assembly in accordance with **4.2.3-4**, the lowest limit of the range is to be not less than 300 *mm*, notwithstanding **(a)**.

(4) Leg length of fillet welding
The range of the leg length of fillet welding is to be in accordance with in **Table M4.3**.

(5) Kind of base metal
(a) The kinds of steel tubes for boilers and heat exchangers, steel pipes for pressure piping, headers and steel pipes for low temperature service are to be as specified in **Table M4.5**.
(b) Other than for the pipes specified in **(a)**, the welding procedures are considered applicable only for grades which are the same as the grade of the test assembly.

(6) Kind of welding consumable
The welding consumable is to be selected according to grade (including all suffixes) not brand, except for the large heat inputs specified in **Note (5) of Table M4.2**.

(7) Welding position
(a) The welding position is to be in accordance with **Table M5.11**. The welding position of T-joints with full penetration is to be the same as the welding position for fillet weld joints.
(b) Approval tests are to be performed each welding position. However, to qualify a range of positions, test assemblies are to be welded for highest heat input position and lowest heat input position and all applicable tests are to be made on those assemblies. The above excludes welding in the tube position for welding downwards which will always require

separate tests and only are acceptable for that position.

~~2~~3 The restriction of welding procedure condition (e.g. heat input welding and preheating) in actual work is to be deemed appropriate by the Society.

~~3~~4 Where deemed necessary by the Society for welding procedure, restrictions on the heat treatment of base metals, carbon equivalent or cold cracking susceptibility and the locations of application of the welding procedure may be imposed.

~~4~~5 The range of approval of materials other than rolled steels for hull ~~and,~~ high strength rolled steels for offshore structures and steel pipes is to be as deemed appropriate by the Society.

Table M4.1 has been amended as follows.

Table M4.1 Range of Approval for Type of Weld Joint

Type of weld joint for test assembly				Range of approval											
				A	B	C	~~C~~ D	~~D~~ E	~~E~~ F	~~F~~ G	H	~~G~~ I	~~H~~ J	~~I~~ K	~~J~~ L
Butt Welded joints	One side	With backing	A	○			○		○			○		○	○
		Without backing	B	○	○	○	○	○	○	○	○	○	○	○	○
		Gas backing (1)	C	○		○	○		○		○	○		○	○
	Both side	With gouging	~~C~~D				○					○		○	○
		Without gouging	~~D~~E				○	○				○	○	○	○
T-joints with full penetration	One side	With backing	~~E~~F						○			○		○	○
		Without backing	~~F~~G						○	○	○	○	○	○	○
		Gas backing (1)	H						○		○	○		○	○
	Both side	With gouging	~~G~~I									○		○	○
		Without gouging	~~H~~J									○	○	○	○
T-joints with partial penetration			~~I~~K												
Fillet weld joints			~~J~~L												

Note:

(1) C and H apply to welding procedures and related specifications for pipes.

Table M4.2 has been amended as follows.

Table M4.2 Approved Range of Thickness(1), (8)

Thickness of test assemblies t (*mm*) (2), (3), (4)	Approved range of thickness (*mm*) (9)			
	Butt welding(4)			Fillet welding
	Multi-run technique	Single-run technique or Two-run technique	Large heat input welding process(5)	
$t \leq 100$	0.5t to 2t (6), (7) (100 max)	0.7t to 1.1t (6), (7) (100 max)	0.7t to t	0.5t to 2t (6), (7) (100 max)

Notes:

(1) Welding procedure used by dissimilar process (combination welding) is to be correspondingly applied to **Table M4.2**. In this case, thickness or throat thickness of each welding method is to be *t*.

(2) For unequal plate thickness or pipe wall thickness of butt welds the lesser thickness is ruling dimension.

(3) For fillet welds, the range of approval shall be applied to the web thickness and flange thickness of test piece.

(4) For T-joints with full penetration and T-joints with partial penetration, *t* is the thickness of test assembly on the open edge side and the requirements are correspondingly applied to the requirements of butt welding.

(5) Large heat input welding means the welding with a welding heat input of not less than 50 *kJ/cm*.

(6) For the vertical-down welding and tube positions for welding downwards, the test piece thickness *t* is always taken

as the upper limit of the range of application.

(7) For test assembly thickness not more than 12 *mm*, the specified minimum content is not applicable.

(8) For the kinds of test assemblies specified in **Table M4.~~10~~12**, even though the test specimen has passed the hardness test specified in **4.2.9**, **4.3.6** and **4.4.6**, the upper limit of the thickness range of approval is to be restricted to the thickness of the test assembly when three or more of the hardness values in the heat affected zone are less than 25*HV* lower than the values specified in **Table M4.~~10~~12**.

(9) For steel pipes for low temperature service, the upper limit is to be a maximum of 25 *mm* unless another value is considered appropriate by the Society.

Notes of Table M4.3 has been amended as follows.

Table M4.3 Applicable Leg Length of Fillet Welding

Approved range of leg length (*mm*)	
Single-run technique	Multi-run technique
0.75*f* to 1.5*f* (1)(2)	0.5*f* to 2*f* (1)(2)

Notes:

(1) *f*: leg length of test piece

(2) Where welding in vertical downward position or tube position for welding downwards is applied, the approved range of thickness is to be *f*.

Table M4.4 and Table M4.5 have been added as follows.

Table M4.4 Range of Approval Related to Outside Diameter of a Pipes

Outside diameter *D* of test assembly (*mm*)(1)	Range of approval related to outside diameter (*mm*)
D ≦ 25	0.5 *D* to 2 *D*
D ＞ 25	0.5 *D* or more(2)

Notes:

(1) For non-circular sections, *D* is the dimension of the smaller side.

(2) Lower limit of "0.5 *D*" is not to be less than 25 *mm*.

Table M4.5 Range of Approval Related to Kind of Pipe

Kind and grade of test assembly		Approval range of grade
Steel tubes for boilers and heat exchangers	*KSTB*33	*KSTB*33
	*KSTB*35	*KSTB*33, *KSTB*35
	*KSTB*42	*KSTB*33(2), *KSTB*35(2), *KSTB*42 *KSTPG*38, *KSTS*38, *KSTPT*38 *KSTPG*42, *KSTS*42, *KSTPT*42 *KBH*-1
	*KSTB*12	*KSTB*12 *KSTPA*12 *KBH*-3
	*KSTB*22 *KSTB*23	*KSTB*22, *KSTB*23 *KSTPA*22, *KSTPA*23 *KBH*-4, *KBH*-5
	*KSTB*24	*KSTB*24 *KSTPA*24 *KBH*-6
Steel pipes for pressure piping	*KSTPG*38 *KSTS*38 *KSTPT*38	*KSTB*33, *KSTB*35 *KSTPG*38, *KSTS*38, *KSTPT*38
	*KSTPG*42	*KSTB*33(2), *KSTB*35(2)

	KSTS42 KSTPT42	KSTPG38, KSTS38, KSTPT38 KSTPG42, KSTS42, KSTPT42 KBH-1
	KSTS49 KSTPT49	KSTPG38[2], KSTS38[2], KSTPT38[2] KSTPG42, KSTS42, KSTPT42 KSTS49, KSTPT49 KBH-1[2], KBH-2
	KSTPA12	KSTB12 KSTPA12 KBH-3
	KSTPA22 KSTPA23	KSTB22, KSTB23 KSTPA22, KSTPA23 KBH-4, KBH-5
	KSTPA24	KSTB24 KSTPA24 KBH-6
Headers	KBH-1	KSTB33, KSTB35 KBH-1
	KBH-2	KSTB33[2], KSTB35[2] KSTPG38, KSTS38, KSTPT38 KBH-1, KBH-2
	KBH-3	KSTB12 KSTPA12 KBH-3
	KBH-4 KBH-5	KSTB22, KSTB23 KSTPA22, KSTPA23 KBH-4, KBH-5
	KBH-6	KSTB24 KSTPA24 KBH-6
Steel pipes for low temperature service[1]	KLPA	KLPA
	KLPB	KLPA[2], KLPB
	KLPC	KLPA[2], KLPB[2], KLPC
	KLP2	KLP2
	KLP3	KLP3
	KLP9	KLP9

Notes:

(1) Only when the same kind of heat treatment is used.

(2) For the large heat inputs specified in **Note (5) of Table M4.2**, the welding procedures are not considered applicable to these grades.

4.2 Tests for Butt Welded Joints

Paragraph 4.2.1 has been amended as follows.

4.2.1 Application

The requirements in **4.2** apply to the butt welded joints of materials prescribed shown in **Table M4.~~4~~6** or equivalent materials by a manual, semi-automatic welding or automatic welding method, etc.

Table M4.4 has been renumbered to Table M 4.6.

Table M4.~~4~~6 Kinds of Butt Welded Joint Test and Number of Specimens
(Table and notes are omitted.)

Paragraph 4.2.2 has been amended as follows.

4.2.2 Kinds of Test*

The kinds of butt welded joint test and number of specimens are to be in accordance with the requirements specified given in **Table M4.~~4~~6**.

4.2.3 Test Assemblies

1 (Omitted)

2 The dimensions and types of test assembly are to be as indicated in **(A)**, **(B)**, **(C)**, **(D)**, **(E)** and **(F)** of **Fig. M4.1**

(-3 to -7 are omitted.)

Notes of Fig. M4.1 has been amended as follows.

Fig. M4.1 Welding Procedure Qualification Test Assemblies (Unit: *mm*)

(A) Test Assembly for Plates (materials indicated in **(D)**, **(E)** and **(F)** are excluded)

(Figure is omitted.)

(B) Test Assembly for Pipes up to 20 *mm* in Thickness

(Figure is omitted.)

(C) Test Assembly for Pipes over 20 *mm* in Thickness

(Figure is omitted.)

Notes:

((1) and (2) are omitted.)

(3) Measurement of ferrite content at the weld surface (including weld metal and heat affected zone) is to be carried out in accordance with kind and grade of test assembly specified in **Table M4.~~4~~6**.

(4) (Omitted)

(D) Test Assembly for *KL*9*N*53 or *KL*9*N*60

(Figure is omitted.)

(E) Test Assemblies for Aluminium Alloy Plates

(Figure is omitted.)

(F) Test Assemblies for Rolled Stainless Steel Plates

(Figure is omitted.)

Notes:

((1) to (3) are omitted.)

(4) Measurement of ferrite content at the weld surface (including weld metal and heat affected zone) is to be carried out in accordance with kind and grade of test assembly specified in **Table M4.~~4~~6**.

(5) (Omitted)

Paragraph 4.2.5 has been amended as follows.

4.2.5 Tensile Tests*

1 Tensile tests are to be carried out with the *U*2*A*, *U*2*B*, 2*C* and 2*D* shown in **Table M3.1**. However, where other test specimens are used, they are to be approved by the Society. The ultimate tensile strength is not to be less than the minimum ultimate tensile strength specified for the base metal except for those specified in **Table M4.~~5~~7**.

2 The number of tensile test specimens taken from each test assembly is to be as shown in **Table M4.~~4~~6**.

3 (Omitted)

Table M4.5 has been amended as follows.

Table M4.~~5~~7 Tensile Test Requirements for Butt Welded Joint
(Table is omitted.)

Notes:
((1) to (4) are omitted.)
(5) **Notes (13)** of **Table M4.~~4~~6**.

Paragraph 4.2.6 has been amended as follows.

4.2.6 Bend Tests
1 Bend tests are to be carried out with the face bend and root bend or side bend test specimen shown in *UB*-1, *UB*-2, *B*-3, *B*-4, or *B*-5 of **Table M3.2**, and the test specimens are to be bent by the jig shown in **Table M4.~~6~~8**. There is to be no crack nor any other defect greater than 3 *mm* in length in any direction on the surface of bent specimen.
2 The number of bend test specimens taken from each test assembly is to be as shown in **Table M4.~~4~~6**.

Table M4.6 has been amended as follows.

Table M4.~~6~~8 Bend Test Requirements for Butt Welded Joint
(Table is omitted.)

Notes:
(1) (Omitted)
(2) See **Notes (11)** of **Table M4.~~4~~6**.
(3) See **Notes (12)** of **Table M4.~~4~~6**.
(4) See **Notes (13)** of **Table M4.~~4~~6**.
(5) (Omitted)

Paragraph 4.2.7 has been amended as follows.

4.2.7 Impact Tests*
1 (Omitted)
2 The number of specimens taken from each test assembly and the position of notch for the specimen are to be as shown in **Table M4.~~4~~6** and **Fig. M4.2** to **Fig. M4.4**. The longitudinal direction of the notch of the test specimen is to be in the direction of the thickness of test material.
3 The testing temperature and the minimum mean absorbed energy of three specimens are to be as specified in **Table M4.~~7~~9** to **Table M4.~~9~~11** and the percent brittle fracture of the specimens is to be measured.
(-4 to -7 are omitted.)

Table M4.7, Table M4.8 and Table M4.9 have been amended as follows.

Table M4.~~7~~9 Impact Test Requirements for Butt Weld Joint
(Rolled Steel for Hull, where thickness of test assemblies is not greater than 50 *mm*)(1)
(Table and notes are omitted.)

Table M4.~~8~~10 Impact Test Requirements for Butt Welded Joint
(Rolled Steels for Lower Temperature Service and Steel Pipes for Low Temperature Service)
(Table and notes are omitted.)

Table M4.~~9~~11 Impact Test Requirements for Butt Weld Joints
(High Strength Rolled Steels for Offshore Structures)
(Table and notes are omitted.)

Paragraph 4.2.9 has been amended as follows.

4.2.9 Hardness Test

1 Vickers hardness is to be measured at the position shown in **Fig. M4.5**. The kinds of specimens for Vickers hardness are to be in accordance with the requirements specified given in **Table M4.~~10~~12**.

2 The number of specimens for hardness test is to be in accordance with the requirements specified given in **Table M4.~~4~~6**.

Table M4.10 has been renumbered to Table M 4.12.

Table M4.~~10~~12 Requirements of Hardness Test
(Table is omitted.)

4.2.11 Measurement of ferrite content at weld surface

Sub-paragraph -1 has been amended as follows.

1 Measurement of ferrite content at weld surface (including weld metal and heat affected zone) is to be carried out in accordance with kind and grade of test assembly specified in **Table M4.~~4~~6**.

4.3 Tests for Fillet Weld Joints

Paragraph 4.3.1 has been amended as follows.

4.3.1 Application*

The requirements in **4.3** apply to the fillet weld joints of materials prescribed in shown in **Table M4.~~4~~6** or equivalent materials welded by a manual, semi-automatic or automatic welding method, etc.

4.3.3 Test Assemblies and Welding*

1 (Omitted)

2 The dimensions and type of test assembly are to be as indicated in **Fig. M4.6**.

(-3 to -6 are omitted.)

Notes of Fig. M4.6 has been amended as follows.

Fig. M4.6 Test Assembly for Fillet Weld Joints (Unit: *mm*)
(Figure is omitted.)

Notes:

(1) (Omitted)

(2) Measurement of ferrite content at the weld surface (including weld metal and heat affected zone) is to be carried out in accordance with kind and grade of test assembly specified in **Table M4.~~4~~6**.

(3) (Omitted)

Paragraph 4.3.6 has been amended as follows.

4.3.6 Hardness Test

1 Vickers hardness is to be measured at the position shown in **Fig. M4.7**. The kinds of specimens for Vickers hardness are to be in accordance with the requirements specified given in **Table M4.~~10~~12**.

2 The number of specimens for hardness test are to be in accordance with the requirements specified given in **Table M4.~~4~~6**.

4.3.9 Measurement of Ferrite Content at Weld Surface

Sub-paragraph -1 has been amended as follows.

1 Measurement of ferrite content at the weld surface (including weld metal and heat affected zone) is to be carried out in accordance with kind and grade of test assembly specified in **Table M4.~~4~~6**.

4.4 Tests for T-joints with Full Penetration

Paragraph 4.4.1 has been amended as follows.

4.4.1 Application

The requirements in **4.4** apply to the T-joints with full penetration of materials prescribed in **Table M4.~~4~~6** or equivalent materials welded by a manual, semi-automatic or automatic welding method, etc.

4.4.3 Test Assemblies

1 (Omitted)

2 The dimensions and type of test assembly are to be as indicated in **Fig. M4.8**.

(-3 and -4 are omitted.)

Notes of Fig. M4.8 has been amended as follows.

Fig. M4.8 Test Assembly for T-joints with Full Penetration
(Figure is omitted.)

Notes:

(1) (Omitted)

(2) Measurement of ferrite content at the weld surface (including weld metal and heat affected zone) is to be carried out in accordance with kind and grade of test assembly specified in **Table M4.~~4~~6**.

(3) (Omitted)

Paragraph 4.4.6 has been amended as follows.

4.4.6 Hardness Test

1 Vickers hardness is to be measured at the position shown in **Fig. M4.9**. The kinds of specimens for Vickers hardness are to be in accordance with the requirements specified given in **Table M4.~~10~~12**.

2 The number of specimens for hardness tests is to be in accordance with the requirements specified in **Table M4.~~4~~6**.

4.4.8 Measurement of Ferrite Content at Weld Surface

Sub-paragraph -1 has been amended as follows.

1 Measurement of ferrite content at the weld surface (including weld metal and heat affected zone) is to be carried out in accordance with kind and grade of test assembly specified in **Table M4.~~4~~6**.
2 (Omitted)

4.5 Tests for T-joints with Partial Penetration

Paragraph 4.5.1 has been amended as follows.

4.5.1 Application

The requirements in **4.5** apply to the T-joints with partial penetration of materials prescribed in **Table M4.~~4~~6** or equivalent materials welded by a manual, semi-automatic or automatic welding method, etc.

4.5.3 Test Assemblies and Welding

1 (Omitted)
2 The dimensions and type of test assemblies are to be as indicated in **Fig. M4.10**.
(-3 and -4 are omitted.)

Notes of Fig. M4.10 has been amended as follows.

Fig. M4.10 Test Assemblies for T-joints with Partial Penetration (Unit: *mm*)
(Figure is omitted.)

Notes:
((1) to (3) are omitted.)
(4) Measurement of ferrite content at the weld surface (including weld metal and heat affected zone) is to be carried out in accordance with kind and grade of test assembly specified in **Table M4.~~4~~6**.
(5) (Omitted)

Paragraph 4.5.6 has been amended as follows.

4.5.6 Hardness Test

1 Vickers hardness is to be measured at the position shown in **Fig. M4.11**. The kinds of specimens for Vickers hardness are to be in accordance with the requirements specified given in **Table M4.~~10~~12**.
2 The number of specimens for hardness test is to be in accordance with the requirements specified given in **Table M4.~~4~~6**.

4.5.9 Measurement of Ferrite Content at Weld Surface

Sub-paragraph -1 has been amended as follows.

1 Measurement of ferrite content at the weld surface (including weld metal and heat affected zone) is to be carried out in accordance with kind and grade of test assembly specified in **Table M4.~~4~~6**.

EFFECTIVE DATE AND APPLICATION (Amendment 1-1)

1. The effective date of the amendments is 14 June 2019.

2. Notwithstanding the amendments to the Rules, the current requirements apply to welding procedures for which the application for approval is submitted to the Society before the effective date.

Amendment 1-2

Chapter 2 WELDING WORKS

2.4 Welding Process

2.4.1 Selection of Welding Consumables*

Sub-paragraph -1(3) has been added as follows.

1 The welding consumables used for rolled steels for hulls, rolled steels for low temperature service and high strength rolled steels for offshore structures are to be selected in accordance with the requirements provided below.

(1) The selection of welding consumables is to be in accordance with the requirements provided in **Table M2.1**. The selection for steels not specified in **Table M2.1** is to be as deemed appropriate by the Society.

(2) For the requirement specified in preceding **(1)**, welded joints of different grades of steel may be used as the followings.
   (a) Welding consumables for lower grade of steel may be used for welded joints of different grades of steel of the same specified strength.
   (b) Welding consumables required for the steel of lower specified strength may be used for welded joints of different specified strength, provided that the adequate measures to prevent cracks are taken.
   (c) Low hydrogen electrodes are to be used for the welding of the high tensile steels or for the welding of the high tensile steel and mild steel. Where the high tensile steels with thermo-mechanical control process are used as base metal, non-low hydrogen electrodes may be used as the welding consumables provided that it is deemed to be appropriate by the Society.

(3) For the welding consumables used for high strength rolled steels for offshore structures, welding consumables different from those given in **Table M2.1** may be selected where deemed appropriate by the Society.

Table M2.1 has been amended as follows.

Table M2.1 Selection of Welding Consumables (Rolled Steel Plate)

Kind and grade of steel to be welded		Grade of applicable welding consumables (1) (4)
Rolled Steel for Hull	*KA*	1, 2, 3, 51, 52, 53, 54, 52*Y*40, 53*Y*40, 54*Y*40, 55*Y*40, *L*1, *L*2, *L*3
	KB,*KD*	2, 3, 52, 53, 54, 52*Y*40, 53*Y*40, 54*Y*40, 55*Y*40, *L*1, *L*2, *L*3
	KE	3, 53, 54, 53*Y*40, 54*Y*40, 55*Y*40, *L*1, *L*2, *L*3
	*KA*32, *KA*36	51, 52, 53, 54, 52*Y*40, 53*Y*40, 54*Y*40, 55*Y*40, *L*2(2), *L*3, 2*Y*42, 3*Y*42, 4*Y*42, 5*Y*42
	*KD*32, *KD*36	52, 53, 54, 52*Y*40, 53*Y*40, 54*Y*40, 55*Y*40, *L*2(2), *L*3, 2*Y*42, 3*Y*42, 4*Y*42, 5*Y*42
	*KE*32, *KE*36	53, 54, 53*Y*40, 54*Y*40, 55*Y*40, *L*2(2), *L*3, 2*Y*42, 3*Y*42, 4*Y*42, 5*Y*42
	*KF*32, *KF*36	54, 54*Y*40, 55*Y*40, *L*2(2), *L*3, 4*Y*42, 5*Y*42
	*KA*40, *KD*40	52*Y*40, 53*Y*40, 54*Y*40, 55*Y*40, 3*Y*42, 4*Y*42, 5*Y*42, 2*Y*46, 3*Y*46, 4*Y*46, 5*Y*46, 63*Y*47
	*KE*40	53*Y*40, 54*Y*40, 55*Y*40, 3*Y*42, 4*Y*42, 5*Y*42, 3*Y*46, 4*Y*46, 5*Y*46, 63*Y*47
	*KF*40	54*Y*40, 55*Y*40, 4*Y*42, 5*Y*42, 4*Y*46, 5*Y*46
	*KE*47	63*Y*47
Rolled Steel for Low Temperature Service	*KL*24*A*	*L*1, *L*2, *L*3, 54, 54*Y*40, 55*Y*40
	*KL*24*B*, *KL*27, *KL*33	*L*2, *L*3, 55*Y*40, 5*Y*42(3)
	*KL*37	*L*3, 55*Y*40, 5*Y*42
	*KL*9*N*53, *KL*9*N*60	*L*91, *L*92
High strength rolled steels for offshore structures	*KA*420	2*Y*42, 3*Y*42, 4*Y*42, 5*Y*42, 2*Y*46, 3*Y*46, 4*Y*46, 5*Y*46, 2*Y*50, 3*Y*50, 4*Y*50, 5*Y*50
	*KD*420	3*Y*42,4*Y*42, 5*Y*42, 3*Y*46, 4*Y*46, 5*Y*46, 3*Y*50, 4*Y*50, 5*Y*50
	*KE*420	4*Y*42, 5*Y*42, 4*Y*46, 5*Y*46, 4*Y*50, 5*Y*50
	*KF*420	5*Y*42, 5*Y*46, 5*Y*50
	*KA*460	2*Y*46, 3*Y*46, 4*Y*46, 5*Y*46, 2*Y*50, 3*Y*50, 4*Y*50, 5*Y*50
	*KD*460	3*Y*46, 4*Y*46, 5*Y*46, 3*Y*50, 4*Y*50, 5*Y*50
	*KE*460	4*Y*46, 5*Y*46, 4*Y*50, 5*Y*50
	*KF*460	5*Y*46, 5*Y*50
	*KA*500	2*Y*50, 3*Y*50, 4*Y*50, 5*Y*50, 2*Y*55, 3*Y*55, 4*Y*55, 5*Y*55
	*KD*500	3*Y*50, 4*Y*50, 5*Y*50, 3*Y*55, 4*Y*55, 5*Y*55
	*KE*500	4*Y*50, 5*Y*50, 4*Y*55, 5*Y*55
	*KF*500	5*Y*50, 5*Y*55
	*KA*550	2*Y*55, 3*Y*55, 4*Y*55, 5*Y*55, 2*Y*62, 3*Y*62, 4*Y*62, 5*Y*62
	*KD*550	3*Y*55, 4*Y*55, 5*Y*55, 3*Y*62, 4*Y*62, 5*Y*62
	*KE*550	4*Y*55, 5*Y*55, 4*Y*62, 5*Y*62
	*KF*550	5*Y*55, 5*Y*62
	*KA*620	2*Y*62, 3*Y*62, 4*Y*62, 5*Y*62, 2*Y*69, 3*Y*69, 4*Y*69, 5*Y*69
	*KD*620	3*Y*62, 4*Y*62, 5*Y*62, 3*Y*69, 4*Y*69, 5*Y*69
	*KE*620	4*Y*62, 5*Y*62, 4*Y*69, 5*Y*69
	*KF*620	5*Y*62, 5*Y*69
	*KA*690	2*Y*69, 3*Y*69, 4*Y*69, 5*Y*69
	*KD*690	3*Y*69, 4*Y*69, 5*Y*69
	*KE*690	4*Y*69, 5*Y*69
	*KF*690	5*Y*69
	*KA*890	2*Y*89, 3*Y*89, 4*Y*89, 2*Y*96, 3*Y*96, 4*Y*96
	*KD*890	3*Y*89, 4*Y*89, 3*Y*96, 4*Y*96
	*KE*890	4*Y*89, 4*Y*96
	*KA*960	2*Y*96, 3*Y*96, 4*Y*96
	*KD*960	3*Y*96, 4*Y*96
	*KE*960	4*Y*96

(Notes are omitted.)

Chapter 4 WELDING PROCEDURE AND RELATED SPECIFICATIONS

4.1 General

4.1.4 Range of Approval*

Table M4.2 has been amended as follows.

Table M4.2 Approved Range of Thickness(1), (8)

Thickness of test assemblies t (*mm*) (2), (3), (4)	Approved range of thickness (*mm*)			
	Butt welding(4)			Fillet welding
	Multi-run technique	Single-run technique or Two-run technique(9)	Large heat input welding process(5)	
$t \leq 100$	0.5t to 2t (6), (7) (100 max)	0.7t to 1.1t (6), (7) (100 max)	0.7t to t	0.5t to 2t (6), (7) (100 max)

Notes:

(1) Welding procedure used by dissimilar process (combination welding) is to be correspondingly applied to **Table M4.2**. In this case, thickness or throat thickness of each welding method is to be *t*.

(2) For unequal plate thickness of butt welds the lesser thickness is ruling dimension.

(3) For fillet welds, the range of approval shall be applied to the web thickness and flange thickness of test piece.

(4) For T-joints with full penetration and T-joints with partial penetration, *t* is the thickness of test assembly on the open edge side and the requirements are correspondingly applied to the requirements of butt welding.

(5) Large heat input welding means the welding with a welding heat input of not less than 50 *kJ/cm*.

(6) For the vertical-down welding, the test piece thickness *t* is always taken as the upper limit of the range of application.

(7) For test assembly thickness not more than 12 *mm*, the specified minimum content is not applicable.

(8) For the kinds of test assemblies specified in **Table M4.10**, even though the test specimen has passed the hardness test specified in **4.2.9**, **4.3.6** and **4.4.6**, the upper limit of the thickness range of approval is to be restricted to the thickness of the test assembly when three or more of the hardness values in the heat affected zone are less than 25*HV* lower than the values specified in **Table M4.10**.

(9) Two-run technique refers to a welding process involving a single pass on both sides.

4.2 Tests for Butt Welded Joints

4.2.5 Tensile Tests*

Sub-paragraph -4 has been added as follows.

4 Notwithstanding **-1** above, the ultimate tensile strength of the welded joints of steels where welding consumables different from those given in **Table M2.1** are selected in accordance with **2.4.1-1(3)** is not to be less than the minimum ultimate tensile strength of the selected welding consumable.

Chapter 6 WELDING CONSUMABLES

6.2 Electrodes for Manual Arc Welding for Mild and High Tensile Steels and Steels for Low Temperature Service

6.2.2 Grades and Marks of Electrode

Table M6.1 has been amended as follows.

Table M6.1 Grades and Marks

For mild steel	For high tensile steel			For steel for low temperature service	
*KMW*1	*KMW*52~~,~~	*KMW*52*Y*40	*KMW*63*Y*47	*KMWL*1~~,~~	*KMWL*91
*KMW*2	*KMW*53~~,~~	*KMW*53*Y*40		*KMWL*2~~,~~	*KMWL*92
*KMW*3	*KMW*54~~,~~	*KMW*54*Y*40		*KMWL*3	
		*KMW*55*Y*40			

6.2.4 General Provisions for Tests*

Table M6.4 has been amended as follows.

Table M6.4 Grades of Steel Used for Test Assembly

Grade of electrode	Grade of steel used for test assembly(1) (2)
*KMW*1	*KA*
*KMW*2	*KA*, *KB* or *KD*
*KMW*3	*KA*, *KB*, *KD* or *KE*
*KMW*52	*KA*32, *KA*36, *KD*32 or *KD*36
*KMW*53	*KA*32, *KA*36, *KD*32, *KD*36, *KE*32 or *KE36*
*KMW*54	*KA*32, *KA*36, *KD*32, *KD*36, *KE*32, *KE*36, *KF*32 or *KF*36
*KMW*52*Y*40	*KA*40 or *KD*40
*KMW*53*Y*40	*KA*40, *KD*40 or *KE*40
*KMW*54*Y*40, *KMW*55*Y*40	*KA*40, *KD*40, *KE*40 or *KF*40
*KMW*63*Y*47	*KE*47
*KMWL*1	*KE* or *KL*24*A*
*KMWL*2	*KE*, *KL*24*A*, *KL*24*B*, *KL*27 or *KL*33
*KMWL*3	*KL*27, *KL*33 or *KL*37
*KMWL*91	*KL*9*N*53 or *KL*9*N*60
*KMWL*92	*KL*9*N*53 or *KL*9*N*60

Notes:

(1) Notwithstanding the requirements in this Table, mild or high tensile steels may be used for deposited metal test assembly. In this case, appropriate buttering is to be carried out for *KMWL*91 and *KMWL*92.

(2) The tensile strength of high tensile steels *KA*32, *KD*32, *KE*32 and *KF*32 used in the butt weld test assemblies are to be greater than 490 N/mm^2.

6.2.6 Deposited Metal Tensile Test

Table M6.5 has been amended as follows.

Table M6.5 Tensile Test Requirements for Deposited Metal

Grade of electrode	Tensile Strength (N/mm^2)	Yield point (N/mm^2)	Elongation (%)
*KMW*1	400～560	305 min.	22 min.
*KMW*2			
*KMW*3			
*KMW*52	490～660	375 min.	
*KMW*53			
*KMW*54			
*KMW*52*Y*40	510～690	400 min.	
*KMW*53*Y*40			
*KMW*54*Y*40			
*KMW*55*Y*40			
*KMW*63*Y*47	570～720	460 min.	19 min.
*KMWL*1	400～560	305 min.	22 min.
*KMWL*2	440～610	345 min.	
*KMWL*3	490～660	375 min.	21 min.
*KMWL*91	590 min.	375[(1)]min.	25 min.
*KMWL*92	660 min.	410[(1)]min.	

Note:
(1) 0.2% proof stress

6.2.7 Deposited Metal Impact Test

Table M6.6 has been amended as follows.

Table M6.6 Impact Test Requirements for Deposited Metal

Grade of electrode	Testing temperature (℃)	Minimum mean absorbed energy (*J*)
*KMW*1	20	47
*KMW*2	0	
*KMW*3	-20	
*KMW*52	0	
*KMW*53	-20	
*KMW*54	-40	
*KMW*52*Y*40	0	
*KMW*53*Y*40	-20	
*KMW*54*Y*40	-40	
*KMW*55*Y*40	-60	
*KMW*63*Y*47	-20	53
*KMWL*1	-40	34
*KMWL*2	-60	
*KMWL*3	-60	
*KMWL*91	-196	27
*KMWL*92	-196	

6.2.8 Butt Weld Tensile Test

Table M6.7 has been amended as follows.

Table M6.7 Tensile Test Requirements for Butt Weld

Grade of electrode	Tensile Strength (N/mm^2)
*KMW*1, *KMW*2, *KMW*3	400 min.
*KMW*52, *KMW*53, *KMW*54	490 min.
*KMW*52*Y*40, *KMW*53*Y*40, *KMW*54*Y*40, *KMW*55*Y*40	510 min.
*KMW*63*Y*47	570 min.
*KMWL*1	400 min.
*KMWL*2	440 min.
*KMWL*3	490 min.
*KMWL*91	630 min.
*KMWL*92	670 min.

6.2.10 Butt Weld Impact Test

Table M6.8 has been amended as follows.

TableM6.8 Impact Test Requirements for Butt Weld

Grade of electrode	Testing temperature (℃)	Minimum mean absorbed energy (*J*)	
		Flat, Horizontal, Overhead	Vertical upward, Vertical downward
*KMW*1	20	47	34
*KMW*2	0		
*KMW*3	-20		
*KMW*52	0		
*KMW*53	-20		
*KMW*54	-40		
*KMW*52*Y*40	0		39
*KMW*53*Y*40	-20		
*KMW*54*Y*40	-40		
*KMW*55*Y*40	-60		
*KMW*63*Y*47	-20	53	
*KMWL*1	-40	27	27
*KMWL*2	-60		
*KMWL*3	-60		
*KMWL*91	-196		
*KMWL*92	-196		

6.3 Automatic Welding Consumables for Mild Steels, High Tensile Steels and Steels for Low Temperature Service

6.3.2 Grades and Marks of Automatic Welding Consumables

Table M6.12 has been amended as follows.

Table M6.12 Grades and Marks

For mild steel	For high tensile steel			For steel for low temperature service	
*KAW*1	*KAW*51~~,~~	*KAW*52*Y*40	*KAW*63*Y*47	*KAWL*1~~,~~	*KAWL*91
*KAW*2	*KAW*52~~,~~	*KAW*53*Y*40		*KAWL*2~~,~~	*KAWL*92
*KAW*3	*KAW*53~~,~~	*KAW*54*Y*40			*KAWL*3
	*KAW*54~~,~~	*KAW*55*Y*40			

6.3.4 General Provisions for Tests

Table M6.15 has been amended as follows.

Table M6.15 Kind of Test of Automatic Welding Consumables

<table>
<tr><th rowspan="2">Welding process</th><th colspan="2" rowspan="2">Kinds of test[8]</th><th rowspan="2">Grade of welding consumable</th><th colspan="3">Test assembly</th><th rowspan="2">Kind and number of test specimens taken from test assembly</th></tr>
<tr><th>Number</th><th>Dimension</th><th>Thickness (mm)[3][9]</th></tr>
<tr><td rowspan="2">Multi-run technique</td><td colspan="2">Deposited metal test</td><td>KAW1, KAWL1
KAW2, KAWL2
KAW3, KAWL3
KAW51, KAWL91
KAW52, KAWL92</td><td>1</td><td>Fig. M6.7</td><td>20</td><td>Tensile test specimen : 2
Impact test specimen : 3</td></tr>
<tr><td colspan="2">Butt weld test</td><td>KAW53,
KAW54,
KAW52Y40
KAW53Y40
KAW54Y40
<u>KAW55Y40</u>
KAW63Y47</td><td>1[4]</td><td>Fig. M6.8</td><td>20～25</td><td>Tensile test specimen : 2[4]
Face bend test specimen : 2[4][6]
Root bend test specimen : 2[4][6]
Impact test specimen : 3</td></tr>
<tr><td rowspan="6">Two-run technique</td><td rowspan="3">Butt Weld test</td><td rowspan="2">Submerged arc welding</td><td rowspan="2">KAW1, KAW51</td><td>1</td><td rowspan="6">Fig. M6.9</td><td>12～15</td><td rowspan="3">Tensile test specimen : 2
Longitudinal tensile test specimen : 1[5]
Face bend test specimen : 1
Root bend test specimen : 1
Impact test specimen : 3</td></tr>
<tr><td>1</td><td>20～25</td></tr>
<tr><td>KAW2, KAW52Y40
KAW3, KAW53Y40
KAW52, KAW54Y40</td><td>1</td><td>20～25</td></tr>
<tr><td rowspan="2">Gas shielded arc and self-shielded arc welding</td><td>KAW53, <u>KAW55Y40</u>
KAW54, KAW63Y47</td><td>1</td><td>30～35</td><td>Impact test specimen : 3</td></tr>
<tr><td rowspan="2">KAW1, KAW2
KAW3
KAW51, KAW52
KAW53, KAW54
KAW52Y40
KAW53Y40
KAW54Y40
<u>KAW55Y40</u>
KAW63Y47</td><td>1</td><td>12～15[1]</td><td>Tensile test specimen : 2</td></tr>
<tr><td>20[2]</td><td>Longitudinal tensile test specimen : 1[5]</td></tr>
<tr><td colspan="2" rowspan="2">Butt weld test</td><td rowspan="2">KAWL1, KAWL2
KAWL3, KAWL91
KAWL92</td><td>1</td><td>12～15</td><td rowspan="2">Tensile test specimen : 2
Longitudinal tensile test specimen : 1[5]
Face bend test specimen : 1
Root bend test specimen : 1
Impact test specimen : 3</td></tr>
<tr><td>1</td><td>20～25</td></tr>
<tr><td rowspan="2">Multi-run and two-run technique</td><td colspan="2">Deposited metal test</td><td rowspan="2">KAW1, KAWL1
KAW2, KAWL2
KAW3, KAWL3
KAW51, KAWL91
KAW52, KAWL92
KAW53
KAW54
KAW52Y40
KAW53Y40
KAW54Y40
<u>KAW55Y40</u>
KAW63Y47</td><td colspan="4" rowspan="2">[7]</td></tr>
<tr><td colspan="2">Butt weld test</td></tr>
</table>

(Notes are omitted.)

Table M6.16 has been amended as follows.

Table M6.16 Grades of Steel Used for Test Assembly

Grade of welding consumable	Grade of steel used for test assembly[(1)(2)]
*KAW*1	*KA*
*KAW*2	*KA*, *KB* or *KD*
*KAW*3	*KA*, *KB*, *KD* or *KE*
*KAW*51	*KA*32 or *KA*36
*KAW*52	*KA*32, *KA*36, *KD*32 or *KD*36
*KAW*53	*KA*32, *KA*36, *KD*32, *KD*36, *KE*32 or *KE*36
*KAW*54	*KA*32, *KA*36, *KD*32, *KD*36, *KE*32, *KE*36, *KF*32 or *KF*36
*KAW*52*Y*40	*KA*40 or *KD*40
*KAW*53*Y*40	*KA*40, *KD*40 or *KE*40
*KAW*54*Y*40, *KAW*55*Y*40	*KA*40, *KD*40, *KE*40 or *KF*40
*KAW*63*Y*47	*KE*47
*KAWL*1	*KE* or *KL*24*A*
*KAWL*2	*KE*, *KL*24*A*, *KL*24B, *KL*27 or *KL*33
*KAWL*3	*KL*27, *KL*33 or *KL*37
*KAWL*91	*KL*9*N*53 or *KL*9*N*60
*KAWL*92	*KL*9*N*53 or *KL*9*N*60

Notes:

(1) Notwithstanding the requirements in this Table, mild or high tensile steels may be used for deposited metal test assembly. In this case, appropriate buttering is to be carried out for *KAWL*91 and *KAWL*92.

(2) The tensile strength of high tensile steels *KA*32, *KD*32, *KE*32 and *KF*32 used in the butt weld test assemblies is to be greater than 490 N/mm^2.

6.3.6 Deposited Metal Tensile Test with Multi-run Technique

Table M6.17 has been amended as follows.

Table M6.17 Tensile Test Requirements for Deposited Metal

Grade of welding consumable	Tensile strength (N/mm^2)	Yield point (N/mm^2)	Elongation (%)
*KAW*1	400～560	305 min.	22 min.
*KAW*2			
*KAW*3			
*KAW*51	490～660	375 min.	
*KAW*52			
*KAW*53			
*KAW*54			
*KAW*52*Y*40	510～690	400 min.	
*KAW*53*Y*40			
*KAW*54*Y*40			
*KAW*55*Y*40			
*KAW*63*Y*47	570～720	460 min.	19 min.
*KAWL*1	400～560	305 min.	
*KAWL*2	440～610	345 min.	
*KAWL*3	490～660	375 min.	21 min.
*KAWL*91	590 min.	375[(1)] min.	25 min.
*KAWL*92	660 min.	410[(1)] min.	

Note:

(1) 0.2% proof stress

6.3.7 Deposited Metal Impact Test with Multi-run Technique

Table M6.18 has been amended as follows.

Table M6.18 Impact Test Requirements for Deposited Metal

Grade of Welding consumable	Testing temperature (℃)	Minimum mean absorbed energy (*J*)
*KAW*1	20	34
*KAW*2	0	
*KAW*3	-20	
*KAW*51	20	
*KAW*52	0	
*KAW*53	-20	
*KAW*54	-40	
*KAW*52*Y*40	0	39
*KAW*53*Y*40	-20	
*KAW*54*Y*40	-40	
*KAW*55*Y*40	-60	
*KAW*63*Y*47	-20	53
*KAWL*1	-40	27
*KAWL*2	-60	
*KAWL*3	-60	
*KAWL*91	-196	
*KAWL*92	-196	

6.3.8 Butt Weld Tensile Test with Multi-run Technique

Table M6.19 has been amended as follows.

Table M6.19 Tensile Test Requirements for Butt Weld

Grade of welding consumable	Tensile Strength (N/mm^2)
*KAW*1, *KAW*2, *KAW*3	400 min.
*KAW*51, *KAW*52, *KAW*53, *KAW*54	490 min.
*KAW*52*Y*40, *KAW*53*Y*40, *KAW*54*Y*40, *KAW*55*Y*40	510 min.
*KAW*63*Y*47	570 min.
*KAWL*1	400 min.
*KAWL*2	440 min.
*KAWL*3	490 min.
*KAWL*91	630 min.
*KAWL*92	670 min.

6.3.15 Annual Inspections

Table M6.20 has been amended as follows.

Table M6.20 Kind of Test for Annual Inspection

Grade of welding consumable	Welding process	Kinds of test		Test assembly			Kind and number of test specimens taken from test assembly
				Number	Dimension	Thickness(2) (*mm*)	
*KAW*1 *KAW*2 *KAW*3 *KAW*51 *KAW*52 *KAW*53 *KAW*54 *KAW*52*Y*40 *KAW*53*Y*40 *KAW*54*Y*40 *KAW*55*Y*40 *KAW*63*Y*47 *KAWL*1 *KAWL*2 *KAWL*3 *KAWL*91 *KAWL*92	Multi-run technique	Deposited metal test		1	**Fig. M6.7**	20	Tensile test specimen : 1 Impact test specimen : 3
	Two-run technique	Butt weld test	Submerged arc welding	1	**Fig. M6.9**	20	Tensile test specimen : 1 Longitudinal tensile test specimen : 1 Face bend test specimen : 1 Root bend test specimen : 1 Impact test specimen : 3
			Gas shielded arc and shield arc welding	1		20～25	Tensile test specimen : 1 Longitudinal tensile test specimen : 1 Face bend test specimen : 1 Root bend test specimen : 1 Impact test specimen : 3
	Multi-run and two-run technique	Deposited metal test		1	**Fig. M6.7**	20	Tensile test specimen : 1 Impact test specimen : 3
		Butt(1) weld test	Submerged arc welding	1	**Fig. M6.9**	20	Tensile test specimen : 1 Face bend test specimen : 1 Root bend test specimen : 1 Impact test specimen : 3
			Gas shielded arc and shield arc welding	1		20～25	Tensile test specimen : 1 Face bend test specimen : 1 Root bend test specimen : 1 Impact test specimen : 3

Notes:

(1) Butt weld test for multi-run and two-run technique is to be carried out by two-run technique.

(2) Thicknesses of *KE*47 steel used as test specimens may be reduced to the thicknesses in the table by machining before welding.

6.4 Semi-automatic Welding Consumables for Mild Steels, High Tensile Steels and Steels for Low Temperature Service

6.4.2 Grades and Marks of Semi-automatic Welding Consumables

Table M6.21 has been amended as follows.

Table M6.21 Grades and Marks

For mild steel	For high tensile steel			For steel for low temperature service	
*KSW*1 *KSW*2 *KSW*3	*KSW*51, *KSW*52, *KSW*53, *KSW*54,	*KSW*52*Y*40 *KSW*53*Y*40 *KSW*54*Y*40 *KSW*55*Y*40	*KSW*63*Y*47	*KSWL*1, *KSWL*2, *KSWL*3	*KSWL*91 *KSWL*92

6.4.4 General Provisions for Tests

Table M6.23 has been amended as follows.

Table M6.23 Grades of Steel Used for Test Assembly

Grade of welding consumable	Grade of steel used for test assembly(1)(2)
*KSW*1	*KA*
*KSW*2	*KA*, *KB* or *KD*
*KSW*3	*KA*, *KB*, *KD* or *KE*
*KSW*51	*KA*32 or *KA*36
*KSW*52	*KA*32, *KA*36, *KD*32 or *KD*36
*KSW*53	*KA*32, *KA*36, *KD*32, *KD*36, *KE*32 or *KE*36
*KSW*54	*KA*32, *KA*36, *KD*32, *KD*36, *KE*32, *KE*36, *KF*32 or *KF*36
*KSW*52*Y*40	*KA*40 or *KD*40
*KSW*53*Y*40	*KA*40, *KD*40 or *KE*40
*KSW*54*Y*40, *KSW*54*Y*40	*KA*40, *KD*40, *KE*40 or *KF*40
*KSW*63*Y*47	*KE*47
*KSWL*1	*KE* or *KL*24*A*
*KSWL*2	*KE*, *KL*24*A*, *KL*24*B*, *KL*27 or *KL*33
*KSWL*3	*KL*27, *KL*33 or *KL*37
*KSWL*91	*KL*9*N*53 or *KL*9*N*60
*KSWL*92	*KL*9*N*53 or *KL*9*N*60

Notes:

(1) Notwithstanding the requirements in this Table, mild or high tensile steels may be used for deposited metal test assembly. In this case, appropriate buttering is to be carried out for *KSWL*91 and *KSWL*92.

(2) The tensile strength of high tensile steels *KA*32, *KD*32, *KE*32 and *KF*32 used in the test assemble is to be greater than 490 N/mm^2.

6.4.6 Deposited Metal Tensile Test

Table M6.24 has been amended as follows.

Table M6.24 Tensile Test Requirements for Deposited Metal

Grade of welding consumable	Tensile Strength (N/mm^2)	Yield point (N/mm^2)	Elongation (%)
*KSW*1	400～560	305 min.	22 min.
*KSW*2			
*KSW*3			
*KSW*51	490～660	375 min.	
*KSW*52			
*KSW*53			
*KSW*54			
*KSW*52*Y*40	510～690	400 min.	
*KSW*53*Y*40			
*KSW*54*Y*40			
*KSW*55*Y*40			
*KSW*63*Y*47	570～720	460 min.	19 min.
*KSWL*1	400～560	305 min.	22 min.
*KSWL*2	440～610	345 min.	
*KSWL*3	490～660	375 min.	21 min.
*KSWL*91	590 min.	375(1) min.	25 min.
*KSWL*92	660 min.	410(1) min.	

Note:
(1) 0.2% proof stress

6.4.7 Deposited Metal Impact Test

Table M6.25 has been amended as follows.

Table M6.25 Impact Test Requirements for Deposited Metal

Grade of welding consumable	Testing temperature (℃)	Minimum mean absorbed energy (*J*)
*KSW*1	20	47
*KSW*2	0	
*KSW*3	-20	
*KSW*51	20	
*KSW*52	0	
*KSW*53	-20	
*KSW*54	-40	
*KSW*52*Y*40	0	
*KSW*53*Y*40	-20	
*KSW*54*Y*40	-40	
*KSW*55*Y*40	-60	
*KSW*63*Y*47	-20	53
*KSWL*1	-40	34
*KSWL*2	-60	
*KSWL*3	-60	
*KSWL*91	-196	27
*KSWL*92	-196	

6.4.8 Butt Weld Tensile Test

Table M6.26 has been amended as follows.

Table M6.26 Tensile Test Requirements for Butt Weld

Grade of welding consumable	Tensile Strength (N/mm^2)
*KSW*1, *KSW*2, *KSW*3	400 min.
*KSW*51, *KSW*52, *KSW*53, *KSW*54	490 min.
*KSW*52*Y*40, *KSW*53*Y*40, *KSW*54*Y*40, *KSW*55*Y*40	510 min.
*KSW*63*Y*47	570 min.
*KSWL*1	400 min.
*KSWL*2	440 min.
*KSWL*3	490 min.
*KSWL*91	630 min.
*KSWL*92	670 min.

6.4.10 Butt Weld Impact Test

Table M6.27 has been amended as follows.

Table M6.27 Impact Test Requirements for Butt Weld

Grade of welding consumable	Testing temperature (℃)	Minimum mean absorbed energy (*J*)	
		Flat, Horizontal, Overhead	Vertical upward, Vertical downward
*KSW*1	20	47	34
*KSW*2	0		
*KSW*3	-20		
*KSW*51	20		
*KSW*52	0		
*KSW*53	-20		
*KSW*54	-40		
*KSW*52*Y*40	0		39
*KSW*53*Y*40	-20		
*KSW*54*Y*40	-40		
*KSW*55*Y*40	-60		
*KSW*63*Y*47	-20	53	
*KSWL*1	-40	27	27
*KSWL*2	-60		
*KSWL*3	-60		
*KSWL*91	-196		
*KSWL*92	-196		

6.5 Electro-slag and Electro-gas Welding Consumables

6.5.2 Grades and Marks of Welding Consumables

Table M6.29 has been amended as follows.

Table M6.29 Grades and Marks

For mild steel	For high tensile steel		
*KEW*1	*KEW*51	*KEW*52*Y*40	*KEW*63*Y*47
*KEW*2	*KEW*52	*KEW*53*Y*40	
*KEW*3	*KEW*53	*KEW*54*Y*40	
	*KEW*54	*KEW*55*Y*40	

6.5.4 General Provisions for Tests

Table M6.31 has been amended as follows.

Table M6.31 Grades of Steel Used for Test Assembly

Grade of welding consumable	Grade of steel used for test assembly(1)
*KEW*1	*KA*
*KEW*2	*KA*, *KB* or *KD*
*KEW*3	*KA*, *KB*, *KD* or *KE*
*KEW*51	*KA*32 or *KA*36
*KEW*52	*KA*32, *KA*36, *KD*32 or *KD*36
*KEW*53	*KA*32, *KA*36, *KD*32, *KD*36, *KE*32 or *KE*36
*KEW*54	*KA*32, *KA*36, *KD*32, *KD*36, *KE*32, *KE*36, *KF*32 or *KF*36
*KEW*52*Y*40	*KA*40 or *KD*40
*KEW*53*Y*40	*KA*40, *KD*40 or *KE*40
*KEW*54*Y*40, *KEW*55*Y*40	*KA*40, *KD*40, *KE*40 or *KF*40
*KEW*63*Y*47	*KE*47

Note:
(Omitted)

6.5.6 Tensile Test

Table M6.32 has been amended as follows.

Table M6.32 Tensile Test Requirement

Grade of welding consumable	Tensile Strength (N/mm^2)
*KEW*1 *KEW*2 *KEW*3	400 min.
*KEW*51 *KEW*52 *KEW*53 *KEW*54	490 min.
*KEW*52*Y*40 *KEW*53*Y*40 *KEW*54*Y*40 *KEW*55*Y*40	510 min.
*KEW*63*Y*47	570 min.

Table M6.33 has been amended as follows.

Table M6.33 Longitudinal Tensile Test Requirement

Grade of welding consumable	Tensile Strength (N/mm^2)	Yield point (N/mm^2)	Elongation (%)
*KEW*1 *KEW*2 *KEW*3	400～560	305 min.	22 min.
*KEW*51 *KEW*52 *KEW*53 *KEW*54	490～660	375 min.	
*KEW*52*Y*40 *KEW*53*Y*40 *KEW*54*Y*40 *KEW*55*Y*40	510～690	400 min.	
*KEW*63*Y*47	570～720	460 min.	19 min.

6.5.8 Impact Test

Table M6.34 has been amended as follows.

Table M6.34 Impact Test Requirement

Grade of welding consumable	Testing temperature (℃)	Minimum mean absorbed energy (*J*)
*KEW*1	20	34
*KEW*2	0	
*KEW*3	-20	
*KEW*51	20	
*KEW*52	0	
*KEW*53	-20	
*KEW*54	-40	
*KEW*52*Y*40	0	39
*KEW*53*Y*40	-20	
*KEW*54*Y*40	-40	
*KEW*55*Y*40	-60	
*KEW*63*Y*47	-20	53

6.6 One Side Automatic Welding Consumables for Mild Steels, High Tensile Steels and Steels for Low Temperature Service

6.6.2 Grades and Marks of Welding Consumables

Table M6.37 has been amended as follows.

Table M6.37 Kinds of Test for One-side Automatic Welding Consumable

Grade of welding consumable	Welding process	Kinds of test[5]	Test assembly			Kind and number of test specimens taken from test assembly
			Number	Dimension	Thickness[1][8] (*mm*)	
*KAW*1 *KAW*2 *KAW*3 *KAW*51 *KAW*52 *KAW*53	One-run technique	Butt weld test	1	**Fig. M6.14**	12～15	Tensile test specimen : 2 Longitudinal tensile test specimen : 1
			1		20～25	Face bend test specimen : 1 Root bend test specimen : 1 Impact test specimen : 6[4] Macro-etching test specimen : 1
*KAW*54 *KAW*52*Y*40 *KAW*53*Y*40 *KAW*54*Y*40 *KAW*55*Y*40 *KAW*63*Y*47	Multi-run technique		1		12～15[2] 20～25[3]	Tensile test specimen : 2 Longitudinal tensile test specimen : 1
			1		20～25[2]	Face bend test specimen : 1
					30～35[3]	Root bend test specimen : 1 Impact test specimen : 6[4] Macro-etching test specimen : 1
*KAWL*1 *KAWL*2 *KAWL*3 *KAWL*91 *KAWL*92	One-run and Multi-run technique		1		12～15[6]	Tensile test specimen : 2 Longitudinal tensile test specimen : 1 Face bend test specimen : 1
			1		20～25[2][7]	Root bend test specimen : 1
					30～35[3][7]	Impact test specimen : 6[4] Macro-etching test specimen : 1

Notes:

(1) Where thickness is restricted by welding process, thickness of test assemblies may be changed upon approval of the Society. In this case, the maximum thickness of test assemblies restrictions is to be taken as the maximum applicable thickness, and is to be certified.
(2) Thickness of test assemblies corresponding to single electrodes.
(3) Thickness of test assemblies corresponding to multiple electrodes.
(4) Where thickness of test assemblies ranges between 12～15 *mm*, the test specimens are to be 1 set of 3 impact test specimens given in **Fig. M 6.15(b)**.
(5) The hydrogen test may be carried out at the request of the manufacturer.
(6) Thickness of test assembly for one-run technique.
(7) Thickness of test assembly for multi-run technique.
(8) Thicknesses of *KE*47 steel used as test specimens may be reduced to the thicknesses in the table by machining before welding.

6.6.4 General Provisions for Tests

Table M6.38 has been amended as follows.

Table M6.38 Grades of Steel Used for Test Assembly

Grade of welding consumable	Grade of steel used for test assembly(1)
*KAW*1	*KA*
*KAW*2	*KA*, *KB* or *KD*
*KAW*3	*KA*, *KB*, *KD* or *KE*
*KAW*51	*KA*32 or *KA*36
*KAW*52	*KA*32, *KA*36, *KD*32 or *KD*36
*KAW*53	*KA*32, *KA*36, *KD*32, *KD*36, *KE*32 or *KE*36
*KAW*54	*KA*32, *KA*36, *KD*32, *KD*36, *KE*32, *KE*36, *KF*32 or *KF*36
*KAW*52*Y*40	*KA*40 or *KD*40
*KAW*53*Y*40	*KA*40, *KD*40 or *KE*40
*KAW*54*Y*40, *KAW*55*Y*40	*KA*40, *KD*40, *KE*40 or *KF*40
*KAW*63*Y*47	*KE*47
*KAWL*1	*KE* or *KL*24*A*
*KAWL*2	*KE*, *KL*24*A*, *KL*24*B*, *KL*27 or *KL*33
*KAWL*3	*KL*27, *KL*33 or *KL*37
*KAWL*91	*KL*9*N*53 or *KL*9*N*60
*KAWL*92	*KL*9*N*53 or *KL*9*N*60

Note:

(1) The tensile strength of high tensile steels *KA*32, *KD*32, *KE*32 and *KF*32 used in the test assemble is to be greater than 490 N/mm^2.

6.6.11 Annual Inspections

Table M6.39 has been amended as follows.

Table M6.39 Kinds of Test at Annual Inspection

Grade of welding consumable	Welding process	Kinds of test	Test assembly			Kind and number of test specimens taken from test assembly
			Number	Dimension	Thickness[3] (*mm*)	
*KAW*1 *KAW*2 *KAW*3 *KAW*51 *KAW*52	One-run technique	Butt weld[2] test	1	**Fig. M6.14**	20	Tensile test specimen : 1 Longitudinal tensile test specimen : 1 Face bend test specimen : 1 Root bend test specimen : 1 Impact test specimen : 3[1]
*KAW*53 *KAW*54 *KAW*52*Y*40 *KAW*53*Y*40 *KAW*54*Y*40 *KAW*55*Y*40	Multi-run technique		1		20～25	Tensile test specimen : 1 Longitudinal tensile test specimen : 1 Face bend test specimen : 1 Root bend test specimen : 1 Impact test specimen : 3[1]
*KAW*63*Y*47 *KAWL*1 *KAWL*2 *KAWL*3 *KAWL*91 *KAWL*92	One-run and Multi-run technique		1		20～25	Tensile test specimen : 1 Longitudinal tensile test specimen : 1 Face bend test specimen : 1 Root bend test specimen : 1 Impact test specimen : 3[1]

Notes:

(1) The positions of notch and selection of impact test specimens are to be as given in **Fig. M6.15(b)**.

(2) The butt weld tests for one-run and multi-run technique are to be carried out by one-run technique.

(3) Thicknesses of *KE*47 steel used as test specimens may be reduced to the thicknesses in the table by machining before welding.

6.7 Welding Consumables for Stainless Steel

6.7.4 General Provisions for Tests

Table M6.42 has been amended as follows.

Table M6.42 Kinds of Test of Welding Consumables for Stainless Steel (continued)

Kind of welding consumables		Kind of test	Test assembly					Kind and number of test specimens taken from test assembly
			Welding position	Dia. of electrode or wire[(1)] (*mm*)	No.	Dimension	Thickness (*mm*)	
Consumables for sub-merged arc welding	Multi-run technique	Deposited metal test	Flat	1.2~4.0	1	**Fig. M6.16**	19~25	Tensile test specimen : 1
		Butt weld test	Flat	1.2~4.0	1	**Fig. M6.18(a)**	19	Tensile test specimen : 1 Face bend test specimen : 1 Root bend test specimen : 1
	Two-run technique	Butt weld test	Flat	1.2~2.4	1	**Fig. M6.18(b)**	12	Tensile test specimen : 1 Face bend test specimen : 1 Root bend test specimen : 1
			Flat	4.0	1		19	Tensile test specimen : 1 Longitudinal tensile test specimen : 1 Face bend test specimen : 1 Root bend test specimen : 1
	Multi-run and Two-run technique	Deposited metal test	Flat	1.2~4.0	1	**Fig. M6.16**	19~25	Tensile test specimen : 1
		Butt weld test (Multi-run)	Flat	1.2~4.0	1	**Fig. M6.18(a)**	19	Tensile test specimen : 1 Face bend test specimen : 1 Root bend test specimen : 1
		Butt weld test (Two-run)	Flat	1.2~2.4	1	**Fig. M6.18(b)**	12	Tensile test specimen : 1 Face bend test specimen : 1 Root bend test specimen : 1
			Flat	4.0	1		19	Tensile test specimen : 1 Face bend test specimen : 1 Root bend test specimen : 1

Note:

(1) Where approval is granted by the Society, the diameter of electrodes or wires may be changed.

6.9 Welding Consumables for High Strength Rolled Steels for Offshore Structures

6.9.2 Grades and Marks of Welding Consumables

Table M6.58 has been amended as follows.

Table M6.58 Kind and Grade

High Strength Rolled Steels for Offshore Structures		
Electrode for manual arc welding	Welding consumables for Semi-automatic welding	Welding consumables for automatic welding
*KMW*2*Y*42	*KSW*2*Y*42	*KAW*2*Y*42
*KMW*2*Y*46	*KSW*2*Y*46	*KAW*2*Y*46
*KMW*2*Y*50	*KSW*2*Y*50	*KAW*2*Y*50
*KMW*2*Y*55	*KSW*2*Y*55	*KAW*2*Y*55
*KMW*2*Y*62	*KSW*2*Y*62	*KAW*2*Y*62
*KMW*2*Y*69	*KSW*2*Y*69	*KAW*2*Y*69
*KMW*2*Y*89	*KSW*2*Y*89	*KAW*2*Y*89
*KMW*2*Y*96	*KSW*2*Y*96	*KAW*2*Y*96
*KMW*3*Y*42	*KSW*3*Y*42	*KAW*3*Y*42
*KMW*3*Y*46	*KSW*3*Y*46	*KAW*3*Y*46
*KMW*3*Y*50	*KSW*3*Y*50	*KAW*3*Y*50
*KMW*3*Y*55	*KSW*3*Y*55	*KAW*3*Y*55
*KMW*3*Y*62	*KSW*3*Y*62	*KAW*3*Y*62
*KMW*3*Y*69	*KSW*3*Y*69	*KAW*3*Y*69
*KMW*3*Y*89	*KSW*3*Y*89	*KAW*3*Y*89
*KMW*3*Y*96	*KSW*3*Y*96	*KAW*3*Y*96
*KMW*4*Y*42	*KSW*4*Y*42	*KAW*4*W*42
*KMW*4*Y*46	*KSW*4*Y*46	*KAW*4*Y*46
*KMW*4*Y*50	*KSW*4*Y*50	*KAW*4*Y*50
*KMW*4*Y*55	*KSW*4*Y*55	*KAW*4*Y*55
*KMW*4*Y*62	*KSW*4*Y*62	*KAW*4*Y*62
*KMW*4*Y*69	*KSW*4*Y*69	*KAW*4*Y*69
*KMW*4*Y*89	*KSW*4*Y*89	*KAW*4*Y*89
*KMW*4*Y*96	*KSW*4*Y*96	*KAW*4*Y*96
*KMW*5*Y*42	*KSW*5*Y*42	*KAW*5*Y*42
*KMW*5*Y*46	*KSW*5*Y*46	*KAW*5*Y*46
*KMW*5*Y*50	*KSW*5*Y*50	*KAW*5*Y*50
*KMW*5*Y*55	*KSW*5*Y*55	*KAW*5*Y*55
*KMW*5*Y*62	*KSW*5*Y*62	*KAW*5*Y*62
*KMW*5*Y*69	*KSW*5*Y*69	*KAW*5*Y*69

Paragraph 6.9.4 has been amended as follows.

6.9.4 General Provisions for Tests

1 Kinds of test, number, thickness, and dimensions of test assembles, diameters of electrodes or wires used for welding and welding positions, together with kinds and number of test specimens taken from each test assembly for welding consumables are to be in accordance with the requirements specified given in **6.2.4**, **6.3.4** or **6.4.4**. However, **Note(4)** of **TableM6.2** and **Note(3)** of **Table M6.22** are not to be required. Provisions for automatic welding consumables are to be the requirements specified multi-run technique.

2 In addition to the test specified in **-1** above, the hydrogen test specified in **6.9.11** is to be carried out during the approval test, notwithstanding **Note(6)** of **TableM6.2**, **Note(2)** of **TableM6.3**, **Note(8)** of **TableM6.15** and **Note(6)** of **TableM6.22**.

~~2~~**3** The grades of steels used for tests are to be those given in **Table M6.59** in corresponding to the grades of welding consumables, or those which considered equivalent by the Society.

Table M6.59 has been amended as follows.

Table M6.59 Grades of Steel for Test Assembly

Grades of welding consumables	Grade of steel for test assembly(1) (2)
*KMW*2*Y*42 ～ ~~69~~96 *KSW*2*Y*42 ～ ~~69~~96 *KAW*2*Y*42 ～ ~~69~~96	*KA*420～*KA*~~690~~960
*KMW*3*Y*42 ～ ~~69~~96 *KSW*3*Y*42 ～ ~~69~~96 *KAW*3*Y*42 ～ ~~69~~96	*KA*420～*KA*~~690~~960 or *KD*420～*KD*~~690~~960
*KMW*4*Y*42 ～ ~~69~~96 *KSW*4*Y*42 ～ ~~69~~96 *KAW*4*Y*42 ～ ~~69~~96	*KA*420～*KA*~~690~~960, *KD*420～*KD*~~690~~960 or *KE*420～*KE*~~690~~960
*KMW*5*Y*42 ～ 69 *KSW*5*Y*42 ～ 69 *KAW*5*Y*42 ～ 69	*KA*420～*KA*690, *KD*420～*KD*690, *KE*420～*KE*690 or *KF*420～*KF*690

Notes:

(1) Notwithstanding the requirements in this table, mild or high tensile steels may be used for deposited metal test assembly. In this case, appropriate buttering is to be carried out.

(2) For butt weld test assemblies, a grade of steel having the same strength as the welding consumable is to be used.

6.9.6 Deposited Metal Tensile Test

Table M6.60 has been amended as follows.

Table M6.60 Test Requirements for Deposited Metal

Grades of welding consumables	Tensile test			Impact test	
	Tensile strength (N/mm^2)~~(1)~~	Yield point or proof stress (N/mm^2)	Elongation (%)	Test temperature (℃)	Minimum mean absorbed energy(J)
*KMW*2*Y*42,*KSW*2*Y*42,*KAW*2*Y*42	~~530~~520～680	420 min.	20 min.	0	47
*KMW*3*Y*42,*KSW*3*Y*42,*KAW*3*Y*42				-20	
*KMW*4*Y*42,*KSW*4*Y*42,*KAW*4*Y*42				-40	
*KMW*5*Y*42,*KSW*5*Y*42,*KAW*5*Y*42				-60	
*KMW*2*Y*46,*KSW*2*Y*46,*KAW*2*Y*46	~~570~~540～720	460 min.		0	
*KMW*3*Y*46,*KSW*3*Y*46,*KAW*3*Y*46				-20	
*KMW*4*Y*46,*KSW*4*Y*46,*KAW*4*Y*46				-40	
*KMW*5*Y*46,*KSW*5*Y*46,*KAW*5*Y*46				-60	
*KMW*2*Y*50,*KSW*2*Y*50,*KAW*2*Y*50	~~610~~590～770	500 min.	18 min.	0	50
*KMW*3*Y*50,*KSW*3*Y*50,*KAW*3*Y*50				-20	
*KMW*4*Y*50,*KSW*4*Y*50,*KAW*4*Y*50				-40	
*KMW*5*Y*50,*KSW*5*Y*50,*KAW*5*Y*50				-60	
*KMW*2*Y*55,*KSW*2*Y*55,*KAW*2*Y*55	~~670~~640～~~830~~820	550 min.		0	55
*KMW*3*Y*55,*KSW*3*Y*55,*KAW*3*Y*55				-20	
*KMW*4*Y*55,*KSW*4*Y*55,*KAW*4*Y*55				-40	
*KMW*5*Y*55,*KSW*5*Y*55,*KAW*5*Y*55				-60	
*KMW*2*Y*62,*KSW*2*Y*62,*KAW*2*Y*62	~~720~~700～890	620 min.		0	62
*KMW*3*Y*62,*KSW*3*Y*62,*KAW*3*Y*62				-20	
*KMW*4*Y*62,*KSW*4*Y*62,*KAW*4*Y*62				-40	
*KMW*5*Y*62,*KSW*5*Y*62,*KAW*5*Y*62				-60	
*KMW*2*Y*69,*KSW*2*Y*69,*KAW*2*Y*69	770～940	690 min.	17 min.	0	69
*KMW*3*Y*69,*KSW*3*Y*69,*KAW*3*Y*69				-20	
*KMW*4*Y*69,*KSW*4*Y*69,*KAW*4*Y*69				-40	
*KMW*5*Y*69,*KSW*5*Y*69,*KAW*5*Y*69				-60	
*KMW*2*Y*89,*KSW*2*Y*89,*KAW*2*Y*89	940～1100	890 min.	14 min.	0	69
*KMW*3*Y*89,*KSW*3*Y*89,*KAW*3*Y*89				-20	
*KMW*4*Y*89,*KSW*4*Y*89,*KAW*4*Y*89				-40	
*KMW*2*Y*96,*KSW*2*Y*96,*KAW*2*Y*96	980～1150	960 min.	13 min.	0	69
*KMW*3*Y*96,*KSW*3*Y*96,*KAW*3*Y*96				-20	
*KMW*4*Y*96,*KSW*4*Y*96,*KAW*4*Y*96				-40	

~~Note:~~

~~(1) Tensile strength specified in the table may be altered where deemed appropriate by the Society.~~

6.9.8 Butt Weld Tensile Test

Table M6.61 has been amended as follows.

Table M6.61 Tensile Strength Requirements for Butt Weld

Grade of welding consumables	Tensile strength (N/mm^2)
*KMW*2*Y*42,*KSW*2*Y*42,*KAW*2*Y*42 *KMW*3*Y*42,*KSW*3*Y*42,*KAW*3*Y*42 *KMW*4*Y*42,*KSW*4*Y*42,*KAW*4*Y*42 *KMW*5*Y*42,*KSW*5*Y*42,*KAW*5*Y*42	~~530~~520 min.
*KMW*2*Y*46,*KSW*2*Y*46,*KAW*2*Y*46 *KMW*3*Y*46,*KSW*3*Y*46,*KAW*3*Y*46 *KMW*4*Y*46,*KSW*4*Y*46,*KAW*4*Y*46 *KMW*5*Y*46,*KSW*5*Y*46,*KAW*5*Y*46	~~570~~540 min.
*KMW*2*Y*50,*KSW*2*Y*50,*KAW*2*Y*50 *KMW*3*Y*50,*KSW*3*Y*50,*KAW*3*Y*50 *KMW*4*Y*50,*KSW*4*Y*50,*KAW*4*Y*50 *KMW*5*Y*50,*KSW*5*Y*50,*KAW*5*Y*50	~~610~~590 min.
*KMW*2*Y*55,*KSW*2*Y*55,*KAW*2*Y*55 *KMW*3*Y*55,*KSW*3*Y*55*KAW*3*Y*55 *KMW*4*Y*55,*KSW*4*Y*55,*KAW*4*Y*55 *KMW*5*Y*55,*KSW*5*Y*5,*KAW*5*Y*55	~~670~~640 min.
*KMW*2*Y*62,*KSW*2*Y*62,*KAW*2*Y*62 *KMW*3*Y*62,*KSW*3*Y*62,*KAW*3*Y*62 *KMW*4*Y*62,*KSW*4*Y*62,*KAW*4*Y*62 *KMW*5*Y*62,*KSW*5*Y*62,*KAW*5*Y*62	~~720~~700 min.
*KMW*2*Y*69,*KSW*2*Y*69,*KAW*2*Y*69 *KMW*3*Y*69,*KSW*3*Y*69,*KAW*3*Y*69 *KMW*4*Y*69,*KSW*4*Y*69,*KAW*4*Y*69 *KMW*5*Y*69,*KSW*5*Y*69,*KAW*5*Y*69	770 min.
*KMW*2*Y*89,*KSW*2*Y*89,*KAW*2*Y*89 *KMW*3*Y*89,*KSW*3*Y*89,*KAW*3*Y*89 *KMW*4*Y*89,*KSW*4*Y*89,*KAW*4*Y*89	940 min.
*KMW*2*Y*96,*KSW*2*Y*96,*KAW*2*Y*96 *KMW*3*Y*96,*KSW*3*Y*96,*KAW*3*Y*96 *KMW*4*Y*96,*KSW*4*Y*96,*KAW*4*Y*96	980 min.

6.9.9 Butt Weld Bend Test

Table M6.62 has been amended as follows.

Table M6.62 Butt Weld Bend Test for the Bend Radius

Grade of welding consumable	Radius of plunger (*mm*)
*KMW*2*Y*42～50, *KSW*2*Y*42～50, *KAW*2*Y*42～50 *KMW*3*Y*42～50, *KSW*3*Y*42～50, *KAW*3*Y*42～50 *KMW*4*Y*42～50, *KSW*4*Y*42～50, *KAW*4*Y*42～50 *KMW*5*Y*42～50, *KSW*5*Y*42～50, *KAW*5*Y*42～50	2.0*t*
*KMW*2*Y*55～69, *KSW*2*Y*55～69, *KAW*2*Y*55～69 *KMW*3*Y*55～69, *KSW*3*Y*55～69, *KAW*3*Y*55～69 *KMW*4*Y*55～69, *KSW*4*Y*55～69, *KAW*4*Y*55～69 *KMW*5*Y*55～69, *KSW*5*Y*55～69, *KAW*5*Y*55～69	2.5*t*
*KMW*2*Y*89, *KSW*2*Y*89, *KAW*2*Y*89 *KMW*3*Y*89, *KSW*3*Y*89, *KAW*3*Y*89 *KMW*4*Y*89, *KSW*4*Y*89, *KAW*4*Y*89	3.0*t*
*KMW*2*Y*96, *KSW*2*Y*96, *KAW*2*Y*96 *KMW*3*Y*96, *KSW*3*Y*96, *KAW*3*Y*96 *KMW*4*Y*96, *KSW*4*Y*96, *KAW*4*Y*96	3.5*t*

Note:
t : thickness of bend test specimens (*mm*).

6.9.11 Hydrogen Test

Table M6.63 has been amended as follows.

Table M6.63 Requirements for Hydrogen Contents

Grade of welding consumables	Suffixes	Requirements for Hydrogen Contents (cm^3/g)		
		Glycerine method	Mercury method	Gas chromatographic method
*KMW*2*Y*42～50 *KMW*3*Y*42～50 *KMW*4*Y*42～50 *KMW*5*Y*42～50	*H*10	0.05 max.	0.10 max.	0.10 max.
*KSW*2*Y*42～50 *KSW*3*Y*42～50 *KSW*4*Y*42～50 *KSW*5*Y*42～50				
*KAW*2*Y*42～50 *KAW*3*Y*42～50 *KAW*4*Y*42～50 *KAW*5*Y*42～50				
*KMW*2*Y*55～69 *KMW*3*Y*55～69 *KMW*4*Y*55～69 *KMW*5*Y*55～69	*H*5	-	0.05 max.	0.05 max.
*KSW*2*Y*55～69 *KSW*3*Y*55～69 *KSW*4*Y*55～69 *KSW*5*Y*55～69				
*KAW*2*Y*55～69 *KAW*3*Y*55～69 *KAW*4*Y*55～69 *KAW*5*Y*55～69				
*KMW*2*Y*89, 96 *KMW*3*Y*89, 96 *KMW*4*Y*89, 96	*H*5	-	0.05 max.	0.05 max.
*KSW*2*Y*89, 96 *KSW*3*Y*89, 96 *KSW*4*Y*89, 96				
*KAW*2*Y*89, 96 *KAW*3*Y*89, 96 *KAW*4*Y*89, 96				

Paragraph 6.9.15 has been amended as follows.

6.9.15 Annual Inspections

1 Annual inspections are to comply with the requirements specified in **6.2.15**, **6.3.15** or **6.4.15** according to the grade of the welding consumables. However, in general, annual inspections for automatic welding consumables are to comply with the requirements specified for multi-run technique.

2 A hydrogen test is to be carried out in addition to the test specified in **-1** above for the welding consumables whose grade symbols end in *Y*69, *Y*89 or *Y*96.

EFFECTIVE DATE AND APPLICATION (Amendment 1-2)

1. The effective date of the amendments is 1 July 2019.

2. Notwithstanding the amendments to the Rules, the current requirements apply to welding consumables for which the application for approval is submitted to the Society before the effective date.

Amendment 1-3

Chapter 3 TEST SPECIMENS AND MECHANICAL TESTING PROCEDURES

3.2 Test Specimens

3.2.2 Tensile Test Specimens

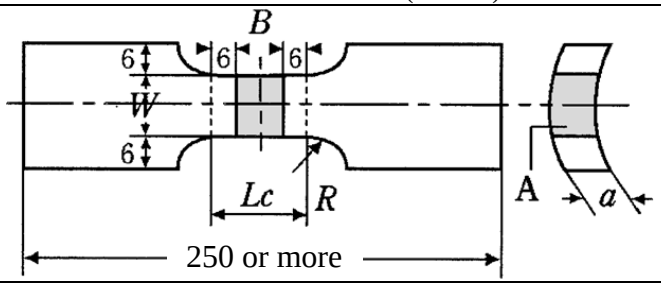
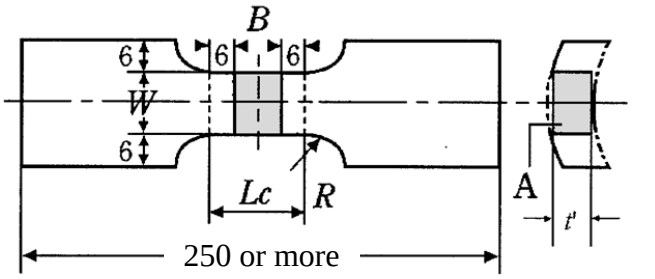
1 Tensile test specimens are to be of size and dimensions given **Table M3.1**, and the both ends of the test specimen may be machined to such a shape as to fit the holder of the testing machine.

2 The upper and lower surfaces of weld are to be filed, ground or machined flush with the surface of plate.

3 Reinforcements and back straps are to be machined flush with base metal.

Table M3.1 has been amended as follows.

Table M3.1 Size and Dimension of Tensile Test Specimens (*mm*)

kind	Size of specimens		Dimensions(1)	Intended for
(Omitted)				
2*C*	Butt weld tensile test specimen		*a* = *t* W = 6 (*D* < 50) *W* = 20 (*D* ≥ 50) $L_c = B + 12$ *R* ≥ 50 The sectional area of *A* shall be considered to be *W*×*a*	Butt weld test for pipe: *t* < 9
2*D*			*a* = *t*'(2) W = 6 (*D* < 50) *W* = 20 (*D* ≥ 50) $L_c = B + 12$ *R* ≥ 50 The sectional area of *A* shall be finished to be rectangular. However, the machining allowance shall be minimum.	Butt weld test for pipe: *t* ≥ 9

Notes:

(1) The following designations are used.
d : diameter, *a* : thickness, *W* : width, L_0 : gauge length, L_c : parallel part length
R : transition radius, *B* : breadth of weld, *t* : thickness of test assembly
t' : thickness of hobbed test assembly, *D* : outside diameter of the pipe.

(2) When the thickness of the test piece is so large that it exceeds the capacity of the testing machine, the test piece may be divided to be tested.

EFFECTIVE DATE AND APPLICATION (Amendment 1-3)

1. The effective date of the amendments is 14 December 2019.

2. Notwithstanding the amendments to the Rules, the current requirements apply to welding procedures for which the application for approval is submitted to the Society before the effective date.

3. Notwithstanding the provision of preceding **2.**, the amendments to the Rules may apply to welding procedures for which the application for approval is submitted to the Society before the effective date upon request by the applicant.

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

Part M Welding

GUIDANCE

2019 AMENDMENT NO.1

Notice No.26 14 June 2019

Resolved by Technical Committee on 30 January 2019

Notice No.26 14 June 2019
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 M WELDING

Amendment 1-1

M4 WELDING PROCEDURE AND RELATED SPECIFICATIONS

M4.1 General

Paragraph M4.1.4 has been amended as follows.

M4.1.4 Range of Approval

1 (Omitted)

2 With respect to the provisions of **4.1.4-1(1)** and **-2(1)**, **Part M of the Rules**, fillet weld joints, T-joints with full penetration and T-joints with partial penetration included in the approval of butt welding are to be in accordance with ~~**Table M4.1.4-2** and **Table M5.10**~~ the followings.

(1) For plates, **Table M4.1.4-2** and **Table M5.10, Part M of the Rules**

(2) For pipes, **Table M4.1.4-3** and **Table M5.11, Part M of the Rules**

3 The wording "deemed appropriate by the Society" specified in **4.1.4-~~2~~3, Part M of the Rules** means the following **(1)** to **(3)**.

((1) to (3) are omitted.)

4 For the wording "deemed appropriate by the Society" specified in **4.1.4-~~4~~5, Part M of the Rules**, the approval of welding procedure and related specifications of rolled stainless steel, aluminium alloys and rolled steels for low temperature service are to comply with the requirements specified in the following **(1)** to **(3)**, provided that the applied welding condition is the same.

(1) Rolled Stainless Steel

For rolled stainless steel, **4.1.4-1** and **-~~2~~3**, **Part M of the Rules** (excluding the requirements of large heat input welding) is to be applied. However, the kind of base metal is to be the same as test assembly. Where the provisory requirement specified in **3.5.5-1**, **Part K of the Rules** is applied, the steel with the specified minimum proof stress less than that of the tested steels may be included. In addition, the heat input, interpass temperature and post-weld heat treatment for *KSUS*329*J*1, *KSUS*329*J*3*L*, *KSUS*329*J*4*L*, *KSUS*323*L*, *KSUS*821*L*1, *K*329*J*1*TP*, *K*329*J*3*LTP* and *K*329*J*4*LTP* are to be in accordance with the following **(a)** to **(c)**.

((a) to (c) are omitted.)

(2) Aluminium Alloys

The requirements specified in the following **(a)** thorough **(h)** are to be applied.

(a) Type of welded joints

Type of welded joints is to be as specified in **Table M4.1.4-~~3~~4**. Where the welding procedures of butt welded joints are approved, the fillet welded joints corresponding to the welding position are to be included.

(b) Thickness

Range of thickness is to be as specified in **Table M4.1.4-~~4~~5**.

(c) Throat thickness of fillet welds
Throat thickness of fillet welds is to be as specified in **Table M4.1.4-~~5~~6**.
(d) Kind of aluminium alloys
Kind of aluminium alloys is to be as specified in **Table M4.1.4-~~6~~7**.
((e) to (h) are omitted.)

(3) Rolled Steels for Low Temperature Service
4.1.4-1 and **-~~2~~3, Part M of the Rules** are to be applied. However, thickness and the kind of base metal are to be in accordance with the following **(a)** and **(b)**:
(a) (Omitted)
(b) Kind of base metal
The kind of base metal is, in principle, to be as specified in **Table M4.1.4-~~7~~8**.

Title of Table M4.1.4-2 has been amended as follows.

Table M4.1.4-2 Correspondence of Fillet, T-joints with Full Penetration and T-joints with Partial Penetration Welding Positions to Butt Welding Positions for Plates

Table M4.1.4-3 to Table M4.1.4-7 have been renumbered to Table M4.1.4-4 to Table M4.1.4-8, and Table M4.1.4-3 has been added as follows.

Table M4.1.4-3 Correspondence of Fillet and T-joints with Full Penetration Welding Positions to Butt Welding Positions for Pipes

Butt welding position (welding position during tests)	Fillet and T-joints with full penetration welding positions deemed to be included in butt welding positions
Flat (*PA*)	Flat (*PA*)
	Horizontal vertical (*PB*)
Horizontal (*PC*)	Horizontal vertical (*PB*)
Tube position for welding upwards (*PH*)	Tube position for welding upwards (*PH*)
Tube position for welding downwards (*PJ*)	Tube position for welding downwards (*PJ*)

Table M4.1.4-~~3~~4 Type of Welded Joint
(Table is omitted.)

Table M4.1.4-~~4~~5 Thickness
(Table and notes are omitted.)

Table M4.1.4-~~5~~6 Throat Thickness of Fillet Welds
(Table is omitted.)

Table M4.1.4-~~6~~7 Kind of Aluminium Alloys
(Table and notes are omitted.)

Table M4.1.4-~~7~~8 Range of approval for Rolled Steels for Low Temperature Service
(Table and notes are omitted.)

M4.2 Tests for Butt Welded Joints

Paragraph M4.2.3 has been added as follows.

M4.2.3 Test Assemblies

In cases where it is difficult to collect a specified number of test specimens from a single test assembly due to tube diameter, the test specimens may be collected from the minimum number of required test assemblies.

M4.2.7 Impact Tests

Sub-paragraph -1 has been amended as follows.

1 With respect to **Table4.~~7~~9 Notes (1), Part M of the Rules**, the wording "impact test requirements deemed appropriate by the Society" refers to the following~~s~~.
((1) and (2) are omitted.)

EFFECTIVE DATE AND APPLICATION (Amendment 1-1)

1. The effective date of the amendments is 14 June 2019.
2. Notwithstanding the amendments to the Guidance, the current requirements apply to welding procedures for which the application for approval is submitted to the Society before the effective date.

Amendment 1-2

M2 WELDING WORKS

M2.4 Welding Process

Paragraph M2.4.1 has been amended as follows.

M2.4.1 Selection of Welding Consumables

1 With respect to the provisions of **2.4.1**, **Part M of the Rules**, semi-automatic welding consumables may be used in automatic welding work.

2 "It is deemed to be appropriate by the Society" specified in **2.4.1(2)(c)**, **Part M of the Rules** is, in principle, to be as provided below:

(1) The steel materials are to be in accordance with the followings:
   (a) The steel materials are to be *KA*32, *KD*32, *KA*36 or *KD*36 of *TMCP* not exceeding 25 *mm* in thickness.
   (b) The carbon equivalent (C_{eq}) of steel materials is to be calculated in accordance with **Note (3)** of **Table M2.4.3-1** and to be not more than 0.36%.

(2) The welding method is to be one pass horizontal fillet welding either by manual welding or gravity welding, and to have been approved by the Society in accordance with the requirements in **M4.3.1**.

(3) Approval is to have been obtained ~~form~~from the Society for electrodes as being the non-low hydrogen electrodes for high tensile steel in accordance with the requirements in **M6.2.1**.

(4) Notwithstanding the requirement in preceding **(3)**, low hydrogen electrodes are to be used for repair welding.

3 "Welding consumables different from those given in **Table M2.1** may be selected" specified in **2.4.1-1(3)**, **Part M of the Rules**, means cases where the standard value for the strength of the welding metal is lower than the standard value for the strength of base metal.

~~3~~4 Backing flux used for submerged arc one side automatic welding is not included in the backing specified in **2.4.1-2**, **Part M of the Rules**

~~4~~5 The wording "measures deemed appropriate by the Society" stipulated in **Note (4)** of **Table M2.1, Part M of the Rules** means applying corrosion protection in accordance with **25.2.3(1), Part C of the Rules** or **22.4.3(1), Part CS of the Rules** to welded parts.

M5 WELDERS AND THEIR QUALIFICATION TESTS

M5.2 Qualifications

M5.2.2 Range of Qualification

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

2 The wording “in cases where deemed appropriately by the Society” in **5.2.2-6, Part M of the Rules** refers to in the following **(1)** and **(2)**, in addition to **Table M5.2.2-1**:

(1) Welders who are qualified for welding positions of *PA*, *PE* and *PF*/*PG* for the butt welding of plates may perform the butt welding of tubes whose fixed outside diameters exceed 300 *mm* as *PH*/*PJ* in case where the essential variables relating to welding process, type of welded joint, base metal, and detail of welded joint are the same or are included in the acquired qualifications for the overlapping range of qualification for base metal thickness involved in each qualification.

(2) Welders who are qualified for welding positions of ~~*PA*~~*PB*, ~~*PE*~~*PD* and *PF*/*PG* for the fillet welding of plates may perform out the fillet welding for tubes fixed as *PH*/*PJ* in cases where the essential variables relating to welding process, type of welded joint, base metal, and detail of welded joint are the same or are included in the acquired qualifications, for the overlapping range of qualification for base metal thickness involved in each qualification.

EFFECTIVE DATE AND APPLICATION (Amendment 1-2)

1. The effective date of the amendments is 1 July 2019.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to welding consumables for which the application for approval is submitted to the Society before the effective date.