RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

RULES

Part M Welding

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 M WELDING

Amendment 2-1

Chapter 6 WELDING CONSUMABLES

6.7 Welding Consumables for Stainless Steel

6.7.4 General Provisions for Tests

Table M6.43 has been amended as follows.

Table M6.43 Grades of Steel for Test Assembly

Grade of welding consumable	Grade of steel for test assembly
*KD*308, *KY*308, *KW*308, *KU*308	*KSUS*304, *KSUS*304*L*
*KD*308*L*, *KY*308*L*, *KW*308*L*, *KU*308*L*	
*KD*308*N2*, *KY*308*N2*, *KW*308*N2*	*KSUS*304*N2*
*KD*309, *KY*309, *KW*309, *KU*309	*KSUS*309*S*
*KD*309*L*, *KY*309*L*, *KW*309*L*, *KU*309*L*	
*KD*309*Mo*, *KY*309*Mo*, *KW*309*Mo*, *KU*309*Mo*	
*KD*309*MoL*, *KW*309*MoL*	
*KD*310, *KY*310, *KW*310, *KU*310	*KSUS*310*S*
*KY*310*S*	
*KD*310*Mo*	
*KD*316, *KY*316, *KW*316, *KU*316	*KSUS*316, *KSUS*316*L*
*KD*316*L*, *KY*316*L*, *KW*316*L*, *KU*316*L*	
*KD*317, *KY*317, *KW*317, *KU*317	*KSUS*317, *KSUS*317*L*
*KD*317*L*, *KY*317*L*, *KW*317*L*, *KU*317*L*	
*KY*321	*KSUS*321
*KD*329*J*1	*KSUS*329*J*1
*KD*329*J*4*L*, *KY*329*J*4*L*, *KW*329*J*4*L*	*KSUS*329*J*4*L*
*KD*2209, *KY*2209, *KW*2209	*KSUS*323*L*, *KSUS*329*J*3*L*, *KSUS*821*L*1
*KD*347, *KY*347, *KW*347, *KU*347	*KSUS*321, *KSUS*347

Note:

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

6.7.8 Butt Weld Tensile Test

Table M6.49 has been amended as follows.

Table M6.49 Tensile Test Requirements for Butt Weld

Electrode for manual arc welding	*TIG* and *MIG* welding consumable	Flux wire for semi-automatic welding	Submerged arc welding consumable	Tensile strength (N/mm^2)
*KD*308	*KY*308	*KW*308	*KU*308	520 min. (1)
*KD*308*L*	*KY*308*L*	*KW*308*L*	*KU*308*L*	520 min. (1)
*KD*308*N2*	*KY*308*N2*	*KW*308*N2*	–	690 min.
*KD*309	*KY*309	*KW*309	*KU*309	520 min.
*KD*309*L*	*KY*309*L*	*KW*309*L*	*KU*309*L*	520 min.
*KD*309*Mo*	*KY*309*Mo*	*KW*309*Mo*	*KU*309*Mo*	520 min.
*KD*309*MoL*	–	*KW*309*MoL*	–	520 min.
*KD*310	*KY*310	*KW*310	*KU*310	520 min.
–	*KY*310*S*	–	–	520 min.
*KD*310*Mo*	–	–	–	520 min.
*KD*316	*KY*316	*KW*316	*KU*316	520 min. (1)
*KD*316*L*	*KY*316*L*	*KW*316*L*	*KU*316*L*	520 min. (1)
*KD*317	*KY*317	*KW*317	*KU*317	520 min. (1)
*KD*317*L*	*KY*317*L*	*KW*317*L*	*KU*317*L*	520 min. (1)
–	*KY*321	–	–	520 min.
*KD*329*J*1	–	–	–	590 min.
*KD*329*J*4*L*	*KY*329*J*4*L*	*KW*329*J*4*L*	–	620 min.
*KD*2209	*KY*2209	*KW*2209	–	620 min. (2)
*KD*347	*KY*347	*KW*347	*KU*347	520 min.

Notes:

(1) Where the test assembly is made of *KSU*304*L*, *KSU*316*L* and *KSU*317*L*, the tensile strength is not to be less than 480 N/mm^2.

(2) Where the test assembly is made of *KSU*323*L* and *KSU*821*L*1, tensile strength is not to be less than 600 N/mm^2.

EFFECTIVE DATE AND APPLICATION (Amendment 2-1)

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

Amendment 2-2

Chapter 4 WELDING PROCEDURE AND RELATED SPECIFICATIONS

4.1 General

4.1.3 Execution of Tests*

Sub-paragraphs -1 and -5 have been amended as follows.

1 For the approval of welding procedure and related specifications, the tests specified in **4.2**~~**, 4.3 or 4.4**~~ to **4.5** are to be carried out based on the representing conditions, such as the edge preparation, welding parameter, etc., described in the welding procedure specification, with satisfactory results. However, for high strength rolled steels for offshore structures, the tests are to be carried out for every kind of heat treatment.
(-2 to -4 are omitted.)
5 For qualification tests for stainless clad steels, the requirements specified in **4.2**~~**, 4.3** and **4.4**~~ to **4.5** are to be complied with. However the impact test may be dispensed with where other welding procedure qualification on the stainless clad steel base metal has been approved under the same welding condition.
(-6 is omitted.)

4.1.4 Range of Approval*

Sub-paragraphs -1(1) and (6) have been amended as follows.

1 The scope of approval of the welding procedure and related specifications of rolled steels for hull and high strength rolled steels for offshore structures are in accordance with the following **(1)** through **(6)**, on the condition that other welding conditions are same. However, the range of approval differing from the requirements specified in this Chapter may be accepted that it is deemed appropriate by the Society.

(1) Kind of weld joints
Kind of weld joints is in accordance with in **Table M4.1**. ~~Where the welding procedures for butt welding are approval, the kinds of weld joints include the fillet weld joints and the T-joints with full penetration, corresponding to the welding position applied for the butt weld joint.~~

((2) to (5) are omitted.)

(6) Welding position
(a) Welding position is in accordance with in **Table M5.10**. The welding position of T-joints with partial penetration and T-joints with full penetration are to be the same welding position as 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 vertical position with travel in the downward direction which will always require separate tests and only are acceptable for that position.

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~~
~~Butt Welding~~	~~One side~~	~~With backing~~	~~A~~	~~A, C~~
		~~Without backing~~	~~B~~	~~A, B, C, D~~
	~~Both side~~	~~With gouging~~	~~C~~	~~C~~
		~~Without gouging~~	~~D~~	~~C, D~~
~~Fillet Welding~~			~~E~~	~~E~~

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

Note of Table M4.2 has been amended as follows.

Table M4.2 Approved Range of Thickness[1], [8]

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

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** or equivalent materials by a manual, semi-automatic welding or automatic welding method, etc.

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** or equivalent materials welded by a manual, semi-automatic or automatic welding method, etc.

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** or equivalent materials welded by a manual, semi-automatic or automatic welding method, etc.

Section 4.5 has been added as follows.

4.5 Tests for T-joints with Partial Penetration

4.5.1 Application

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

4.5.2 Kinds of Test

T-joints with partial penetration are to be subjected to finished inspection, macro-structure inspection, fracture test, hardness test and non-destructive inspection. Additional tests may be required if found necessary by the Society.

4.5.3 Test Assemblies and Welding

1 Test assemblies are to be prepared with the same or equivalent material used in the actual work.

2 The dimensions and type of test assemblies are to be as indicated in **Fig. M4.10**.

3 Test assemblies are to be welded in the general conditions specified in welding procedure specifications.

4 The tack welds of test assemblies are to be the same procedure as the actual work.

4.5.4 Finished Inspection

Welded surface is to be regular and uniform and is to be free from injurious defects, such as cracks, undercuts, overlaps, etc.

4.5.5 Macro-structure Inspection

1 Macro specimens are to be taken from the position indicated in **Fig. M4.10**.

2 In macro etched specimens showing the transverse section of welding, weld joints are to be free from excessive difference between upper and lower fillet lengths, cracks and other injurious defects.

3 Macro examination is to include about 10 *mm* unaffected base metal.

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**.

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

4.5.7 Fracture Tests

1 Two test specimens are to be taken from the remaining test assembly after the macro-structure specimens have been taken.

2 Test specimens are to be broken by pressing as shown in **Fig. M4.12**, and be without cracks, poor penetrations, blow holes and injurious defects in the fractured surface. However, in cases where , the sum of lengths having blow holes (include poor penetrations), except at both ends of the specimen, is not greater than 10% of the total welded length, the test may be regarded as satisfactory.

4.5.8 Non-destructive Inspection

1 Surface inspections by magnetic particle examination or liquid penetrant examination are to be carried for whole length of the welding. The result of non-destructive inspection is to show that there are no crack and other injurious defects.

2 In case any post-weld heat treatment is required or specified, non-destructive inspection is to be performed after heat treatment.

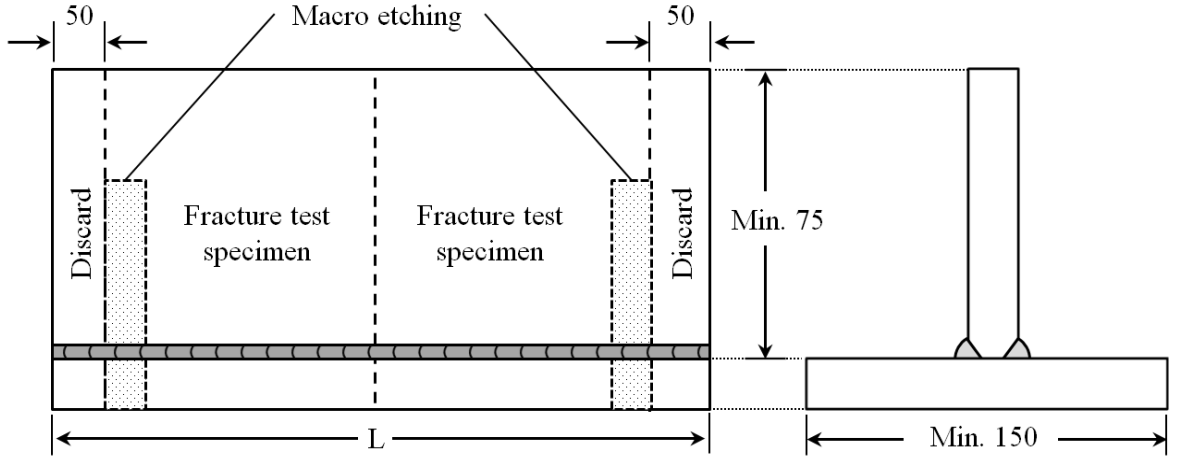
3 High strength rolled steels for offshore structures is to be delayed for minimum of 48 hours, unless heat treatment has been carried out.

4.5.9 Retests

1 Where finished inspection, macro-structure inspection, fracture test or non-destructive inspection fails, the new test specimens welded under the same welding conditions, are to be subject to retest, and all of these test specimens are to pass the test items specified.

2 Where the hardness test fails, the retest may be correspondingly applied to the requirement in **4.2.11-4**.

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



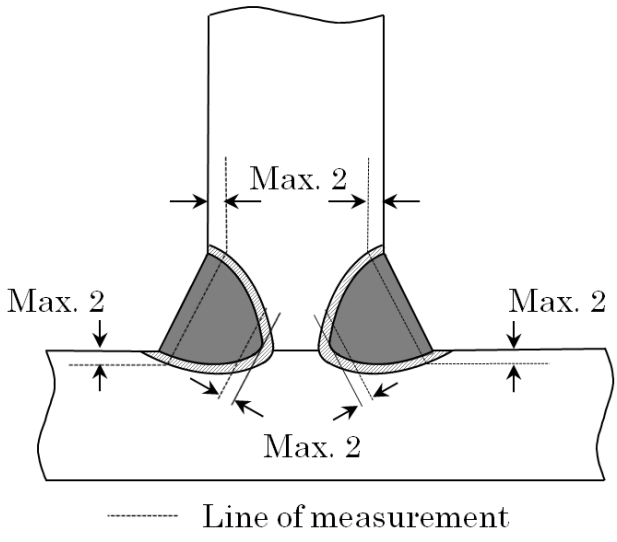
Notes:

(1) The length of test assemblies, *L* is not less than 350 *mm* for manual welding and semi-automatic welding (including gravity welding) and not less than 1,000 *mm* for automatic welding.

(2) Hardness test may be carried out on any section of test assemblies, except for discarded sections.

(3) Fracture test specimens are, as far as possible, to be taken in equal lengths in the direction of welding direction.

Fig. M4.11 Hardness Test (Unit: *mm*)



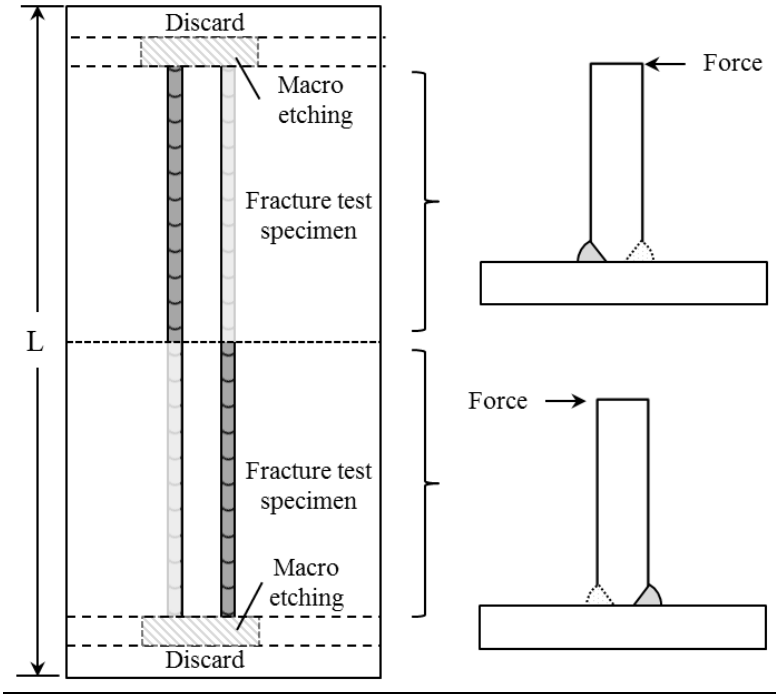
Notes:

(1) For each row of indentations there is to be a minimum of 3 individual indentations in the weld metal, the heat affected zones (both side) and the base metal (both sides).

(2) Measuring intervals are to be 1 *mm* on the basis of the bond.

(3) Test force is to be 98.07 *N*.

Fig. M4.12 Fracture Test (Unit: *mm*)



Note:
(1) Welding is to be removed from the side where force is applied.

EFFECTIVE DATE AND APPLICATION (Amendment 2-2)

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

2. Notwithstanding the amendments to the Rules, the current requirements apply to welding procedure 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 is submitted to the Society before the effective date upon request of the applicant.

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

Part M Welding

GUIDANCE

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 M WELDING

Amendment 2-1

M2 WELDING WORKS

M2.1 General

Paragraph M2.1.1 has been amended as follows.

M2.1.1 Application

1 In **2.1.1-3, Part M of the Rules**, application of welding consumables used for rolled stainless steel and aluminium alloys is to comply with the requirements specified in **-2** and **-3** as follows.

2 Rolled Stainless Steel

(1) The welding consumables corresponding to the kind of the steel materials ~~is~~ are, in principle, to be selected in accordance with **Table M2.1.1-1**. Other considerations for selecting welding consumables may be acceptable in cases where technical documents clarifying the suitability of the selection are submitted and deemed to be appropriate by the Society.

(2) For welded joints of steels of which the minimum proof stress is specified to greater value in accordance with **3.5.5-1, Part K of the Rules**, the welding consumables of which the specified minimum proof stress is equivalent to or greater than the steels are to be used.

3 Aluminium Alloys

(1) The selection of welding consumables for the welding joints of the aluminium alloys is to be as specified in **Table M2.1.1-2**. However, for the welding joints of 6000 series alloys, *RA/WA*, *RB/WB* or *RC/WC* may be used.

(2) The selection of welding consumables for welding joints to different aluminium alloys is to comply with the followings.

(a) For the welding joints of 5000 series alloys, any welding consumables corresponding to the kind of alloys specified in **Table M2.1.1-2** may be used.

(b) For welding joints of 6000 series alloys, *RA/WA*, *RB/WB* or *RC/WC* in lieu of *RD/WD* may be used.

(c) For welding joints of 5000 series alloys and 6000 series alloys, the welding consumables corresponding to 5000 series alloys specified in **Table M2.1.1-2** may be used.

Table M2.1.1-1 has been amended as follows.

Table M2.1.1-1 Application of Welding Consumables (Rolled Stainless Steel)

Kind and grade of base plates	Grade of applicable welding consumables			
*KSUS*304	*KD*308	*KY*308	*KW*308	*KU*308
	*KD*308*L*(1)	*KY*308*L*(1)	*KW*308*L*(1)	*KU*308*L*(1)
*KSUS*304*L*	*KD*308*L*	*KY*308*L*	*KW*308*L*	*KU*308*L*
*KSUS*304*N1*	*KD*308*N*2	*KY*308*N*2	*KW*308*N*2	-
*KSUS*304*N2*	*KD*308*N*2	*KY*308*N*2	*KW*308*N*2	-
*KSUS*304*LN*	*KD*308*L*(1)	*KY*308*L*(1)	*KW*308*L*(1)	*KU*308*L*(1)
*KSUS*309*S*	*KD*309	*KY*309	*KW*309	*KU*309
	*KD*309*L*(1)	*KY*309*L*(1)	*KW*309*L*(1)	*KU*309*L*(1)
*KSUS*310*S*	*KD*310	*KY*310	*KW*310	*KU*310
	-	*KY*310*S*	-	-
*KSUS*316	*KD*316	*KY*316	*KW*316	*KU*316
	*KD*316*L*(1)	*KY*316*L*(1)	*KW*316*L*(1)	*KU*316*L*(1)
*KSUS*316*L*	*KD*316*L*	*KY*316*L*	*KW*316*L*	*KU*316*L*
*KSUS*316*N*	*KD*316	*KY*316	*KW*316	*KU*316
*KSUS*316*LN*	*KD*316*L*(1)	*KY*316*L*(1)	*KW*316*L*(1)	*KU*316*L*(1)
*KSUS*317	*KD*317	*KY*317	*KW*317	*KU*317
	*KD*317*L*(1)	*KY*317*L*(1)	*KW*317*L*(1)	*KU*317*L*(1)
*KSUS*317*L*	*KD*317*L*	*KY*317*L*	*KW*317*L*	*KU*317*L*
*KSUS*317*LN*	*KD*317*L*(1)	*KY*317*L*(1)	*KW*317*L*(1)	*KU*317*L*(1)
*KSUS*321	-	*KY*321	-	-
	*KD*347	*KY*347	*KW*347	*KU*347
*KSUS*323*L*	*KD*2209	*KY*2209	*KW*2209	-
*KSUS*329*J*1	*KD*329*J*1	-	-	-
*KSUS*329*J*3*L*	*KD*2209	*KY*2209	*KW*2209	-
*KSUS*329*J*4*L*	*KD*329*J*4*L*	*KY*329*J*4*L*	*KW*329*J*4*L*	-
*KSUS*347	*KD*347	*KY*347	*KW*347	*KU*347
*KSUS*821*L*1	*KD*2209	*KY*2209	*KW*2209	-

Note:

(1) The specified minimum proof stress and tensile strength of the applicable welding consumables are equivalent to or greater than those of the base plate steels are to be used.

EFFECTIVE DATE AND APPLICATION (Amendment 2-1)

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

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

Amendment 2-2

M4 WELDING PROCEDURE AND RELATED SPECIFICATIONS

M4.1 General

M4.1.4 Range of Approval

Sub-paragraph -2 has been amended as follows.

2 With respect to the provisions of **4.1.4-1(1)**, **Part M of the Rules**, fillet weld joints ~~and~~, 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**.

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

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

Position of butt welding	Fillet ~~and~~, T-joints with full penetration and T-joints with partial penetration welding positions deemed to be included in butt welding positions
Flat (*PA*)	Flat (*PA*)
	Horizontal-vertical (*PB*)
Horizontal (*PC*)	Horizontal (*PC*)
	Horizontal-vertical (*PB*)
Vertical upward (*PF*)	Vertical upward (*PF*)
Vertical downward (*PG*)	Vertical downward (*PG*)
Overhead (*PE*)	Horizontal overhead (*PD*)
	Overhead (*PE*)

EFFECTIVE DATE AND APPLICATION (Amendment 2-2)

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

2. Notwithstanding the amendments to the Guidance, the current requirements apply to welding procedure 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 Guidance may apply to welding procedures for which the application is submitted to the Society before the effective date upon request of the applicant.