Welding for Machinery Installations

Amended Guidance

Guidance for the Survey and Construction of Steel Ships Parts D, and M

Reason for Amendment

The requirements of welding for machinery installations are specified in Chapter 11, Part D of the Rules for the Survey and Construction of Steel Ships and the approval for welding procedures and related specifications for welding work on boilers and Group I and II pressure vessels is required by them.

However, the handling of the impact tests, hardness tests, creep tests and high temperature tensile tests carried out during approval tests of welding procedures as well as the selection criteria of applicable welding consumables for welding work on boilers and Group I and II pressure vessels are partially unclear.

Therefore, as a part of comprehensive review of the NK Rules, relevant requirements are amended to make the above-mentioned handling and criteria clearer.

Outline of Amendment

The main contents of this amendment are as follows:

(1) For Chapter D11, Part D of the Guidance for the Survey and Construction of Steel Ships, the following clarification is made with respect to the approval tests for welding procedures and related specifications for machinery installations.
   (a) Specifies the toughness of welded joints is to be equal to or greater than that of the base materials for impact tests.
   (b) Specifies the Vickers hardness as a standard for hardness tests.
   (c) Clarifies the reference standards for creep tests and high temperature tensile tests.

(2) For Chapter M2, Part M of the Guidance for the Survey and Construction of Steel Ships, adds selection criteria for applicable welding consumables used for welding work on boilers and the pressure vessels as Table M2.1.1-4.

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

Part D MACHINERY INSTALLATIONS

D11 WELDING FOR MACHINERY INSTALLATIONS

D11.2 Welding Procedure and Related Specifications

Paragraph D11.2.2 has been amended as follows.

D11.2.2 Execution of Tests

1 Approval tests for welding procedures and related specifications that fall under **11.2.2(1), Part D of the Rules** are to comply with the following requirements. For items not specified in the following requirements, **4.1.3** and **4.2** to **4.6, Part M of the Rules** are to be applied correspondingly. In cases where it is difficult to meet the above requirements, approval tests are to be as deemed appropriate by the Society.

(1) Selection of welding consumables
In general, a welding consumable for which the requirements related to strength (i.e. yield point or proof stress and tensile strength) of deposited weld metal is higher than strength of base metals and which resemble to base metals in the chemical composition is to be selected.

(2) Tests for butt welded joints
(a) The kinds of tests, the areas subjected to tests and the number of specimens is to be in accordance with the requirements specified in **Table D11.2.2-1**.
(b) The ~~testing temperatures during impact tests and the~~ values of minimum mean absorbed energy are to comply with the requirements of base metals. In addition, testing temperatures are to be lower than the testing temperatures required for base metals.
(c) The Vickers hardness measured by hardness tests is, as a standard, to comply with the values specified in **Table D11.2.2-2** depending on the requirements related to the yield point or proof stress of base metals.

(3) Tests for fillet weld joints, T-joints with full penetration and T-joints with partial penetration
(a) For the number of specimens for hardness tests, the requirements specified in **Table D11.2.2-1** are to be applied correspondingly.
(b) The Vickers hardness measured by hardness tests is to be in accordance with **(2)(c)**.

2 Approval tests for welding procedures and related specifications that fall under **11.2.2(2), Part D of the Rules** are to be comply with the following requirements. ~~For the approval tests for welding procedures and related specifications applied to the welding work for materials used at high temperatures, the Society may require a creep test or a high temperature tensile test where deemed necessary.~~ For items not specified in the following requirements, **4.1.3** and **4.2** to **4.6, Part M of the Rules** are to be applied correspondingly.

(1) Test assemblies
Test assemblies are to be of the same or equivalent material used in the actual welding work. Additionally, the thickness of the test assemblies is, in principle, to be equal to the maximum thickness of the materials to be used in the actual welding work.

(2) Tests for butt welded joints
(a) The kinds of tests, areas subjected to tests and the number of specimens is to be in accordance with the requirements specified in **Table D11.2.2-3**.
(b) Test specimens are to be collected in accordance with **Fig. D11.2.2-1**.
(c) Minimum mean absorbed energy values for impact tests are to be in accordance with **-1**

(2)(b).

(d) The Vickers hardness measured by hardness tests is to be in accordance with **-1 (2)(c)**.

(e) Notwithstanding **(a)** above, in principle, creep tests or high temperature tensile tests are to be added as a reference in cases where deemed necessary by the Society for the welding work of components used at temperatures higher than 1/2 of the melting points (absolute temperature) of base metals or the welding consumables, whichever is lower. Creep tests are to be performed in accordance with *ISO* 204, *JIS Z* 2271 or equivalent standards, and high temperature tensile tests are to be performed in accordance with *ISO* 6892-2, *JIS Z* 0567 or equivalent standards.

(3) Tests for fillet weld joints

The kinds of tests to be conducted are finished inspections, macro-structure inspections, hardness tests and fracture tests.

3 (Omitted)

Part M WELDING

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, ~~aluminium alloys, stainless steel pipes, steel tubes for boilers and heat exchangers, steel pipes for pressure piping, headers and steel pipes for low temperature service~~ etc. is to comply with the requirements specified in **-2** to ~~**-4**~~**5** as follows.

2 Rolled Stainless Steel

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

3 Aluminium Alloys

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

4 Stainless steel pipes, steel tubes for boilers and heat exchangers, steel pipes for pressure piping, headers and steel pipes for low temperature service

The welding consumables corresponding to the kind of steel pipes (of tubes) or headers are, in principle, to be selected in accordance with **Table M2.1.1-1** or **Table M2.1.1-3**. 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.

5 Rolled steels for boilers and pressure vessels

The welding consumables corresponding to the kind of steel are, in principle, to be selected in accordance with **Table M2.1.1-4**. 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.

Table M2.1.1-1 Application of Welding Consumables
(Rolled Stainless Steel and Stainless Steel Pipes)
(Table and Note are omitted.)

Table M2.1.1-2 Application of Welding Consumables (Aluminium Alloys)
(Table and Note are omitted.)

Table M2.1.1-3 has been amended as follows.

Table M2.1.1-3 Application of Welding Consumables
(Steel tubes for boilers and heat exchangers, steel pipes for pressure piping, headers and steel pipes for low temperature service)

Kind of base pipe (or tube)	Grade of base pipe (or tube)	Grade of applicable welding consumables (1)
Steel tubes for boilers and heat exchangers, steel pipes for pressure piping, headers	*KSTB*33, *KSTB*35, *KSTPG*38, *KSTS*38, *KSTPT*38	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
	*KSTB*42, *KSTPG*42, *KSTS*42, *KSTPT*42, *KBH*-1	51, 52, 53, 54, 52*Y*40, 53*Y*40, 54*Y*40, 55*Y*40, *L*2, *L*3, 2*Y*42, 3*Y*42, 4*Y*42, 5*Y*42
	*KSTS*49, *KSTPT*49, *KBH*-2	51, 52, 53, 54, 52*Y*40, 53*Y*40, 54*Y*40, 55*Y*40, *L*3, 2*Y*42, 3*Y*42, 4*Y*42, 5*Y*42
Steel pipes for low temperature service	*KLPA*	*L*1, *L*2, *L*3, 54, 54*Y*40, 55*Y*40
	KLPB, *KLPC*	*L*2, *L*3
	*KLP*9	*L*91, *L*92

Note:

(1) The symbols for the welding consumables listed above indicate materials which are specified in **Table M6.1**, **Table M6.12**, **Table M6.21**, **Table M6.29** or **Table M6.58** that have the same mark at the end. (For example, "3" indicates *KMW*3, *KAW*3, *KSW*3 and *KEW*3; "*L3*" indicates *KMWL3*, *KAWL*3 and *KSWL3*; and "3*Y42*" indicates *KMW*3*Y*42, *KAW*3*Y*42 and *KSW*3*Y*42.)

Table M2.1.1-4 has been added as follows.

Table M2.1.1-4 Application of Welding Consumables
(Rolled steels for boilers and pressure vessels)

Kind of base plate	Grade of base plate	Grade of applicable welding consumables (1)
Rolled steel for boilers	*KP*42	51, 52, 53, 54, 52*Y*40, 53*Y*40, 54*Y*40, 55*Y*40, *L*2, *L*3, 2*Y*42, 3*Y*42, 4*Y*42, 5*Y*42
	*KP*46, *KPA*46, *KP*49, *KPA*49	51, 52, 53, 54, 52*Y*40, 53*Y*40, 54*Y*40, 55*Y*40, *L*3, 2*Y*42, 3*Y*42, 4*Y*42, 5*Y*42
Rolled steel for pressure vessels	*KPV*24(2)	2, 3, 52, 53, 54, 52*Y*40, 53*Y*40, 54*Y*40, 55*Y*40, 2*Y*42, 3*Y*42, 4*Y*42, 5*Y*42
	*KPV*32(3)	52, 53, 54, 52*Y*40, 53*Y*40, 54*Y*40, 55*Y*40, 2*Y*42, 3*Y*42, 4*Y*42, 5*Y*42
	*KPV*36	63*Y*47, 2*Y*42, 3*Y*42, 4*Y*42, 5*Y*42, 2*Y*46, 3*Y*46, 4*Y*46, 5*Y*46, 3*Y*50, 4*Y*50, 5*Y*50
	*KPV*42, *KPV*46	63*Y*47, 3*Y*50, 4*Y*50, 5*Y*50, 3*Y*55, 4*Y*55, 5*Y*55
	*KPV*50	3*Y*55, 4*Y*55, 5*Y*55, 3*Y*62, 4*Y*62, 5*Y*62

Notes:

(1) The symbols for the welding consumables listed above indicate materials which are specified in **Table M6.1**, **Table M6.12**, **Table M6.21**, **Table M6.29** or **Table M6.58** that have the same mark at the end. (For example, "3" indicates *KMW*3, *KAW*3, *KSW*3 and *KEW*3; "*L3*" indicates *KMWL3*, *KAWL*3 and *KSWL3*; and "3*Y42*" indicates *KMW*3*Y*42, *KAW*3*Y*42 and *KSW*3*Y*42.)

(2) The symbols for the welding consumables listed above as "2, 3, 52, 53, 54, 52*Y*40, 53*Y*40, 54*Y*40, 55*Y*40" are applicable only for *KMW* and *KSW*.

(3) The symbols for the welding consumables listed above as "52, 53, 54, 52*Y*40, 53*Y*40, 54*Y*40, 55*Y*40" are applicable only for *KMW* and *KSW*.