Approval Tests of Welding Procedures and Related Specifications for 9 % Nickel Steels

Object of Amendment

Rules for the Survey and Construction of Steel Ships Part M

Reason for Amendment

Requirements for the approval testing of welding procedures and related specifications for welded joints of 9 % nickel steel in Chapter 4 of Part M of the Rules for the Survey and Construction of Steel Ships specify a standard value for tensile tests based on the strength of the weld metal, taking into account that such joints are undermatched (i.e. the strength of the weld metal is lower than the strength of the base metal).

Although current requirements specify a constant value as the evaluation criterion for such tests, weld metal strength is often used as the standard value in actual tank design. Since welding quality has improved over the years due to advances in welding technology improvement, it was decided to specify the specified values for tensile tests according to the type of welding consumable used.

Accordingly, relevant requirements for standard values of tensile tests carried out during the approval testing of welding procedures and related specifications are amended.

At the same time, based on requests from relevant industry members, some of the requirements for the approval testing of steel pipe welding procedures and related specifications are clarified.

Outline of Amendment

(1) Specify standard values in accordance with the welding consumable used in tensile tests of 9 % nickel steel joints.
(2) Clarify conditions under which positions of rotating pipes may be omitted with respect to the scope of approval of welding positions in the approval testing of welding procedures for pipes.

Effective Date and Application

(1) 4.1.4-2, Chapter 4, Part M of the Rules for the Survey and Construction of Steel Ships
Effective date of this draft amendment is the date of establishment.
(2) Table M4.7, Chapter 4, Part M of the Rules for the Survey and Construction of Steel Ships
This draft amendment applies to tests for which the application is submitted to the Society on or after the date of establishment.

ID: DH24-02

Amended-Original Requirements Comparison Table
(Approval Tests of Welding Procedures and Related Specifications for 9 % Nickel Steels)

Amended	Original	Remarks
RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS **Part M WELDING** **Chapter 4 WELDING PROCEDURE AND RELATED SPECIFICATIONS** **4.1 General** **4.1.4 Range of Approval*** **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 **(8)** 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**. Set-on, Set-in and Set-through may be accepted regardless of the kind of pipe assembly used in the test except in the case of butt-welded joints. (2) Thickness The range of the thickness is to be in accordance with in **Table M4.2**. (3) Outside diameter	**RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS** **Part M WELDING** **Chapter 4 WELDING PROCEDURE AND RELATED SPECIFICATIONS** **4.1 General** **4.1.4 Range of Approval*** **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 **(8)** 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**. Set-on, Set-in and Set-through may be accepted regardless of the kind of pipe assembly used in the test except in the case of butt-welded joints. (2) Thickness The range of the thickness is to be in accordance with in **Table M4.2**. (3) Outside diameter	

Amended-Original Requirements Comparison Table
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Amended	Original	Remarks
(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) Angles of pipe (or tube) fittings The angles of pipe (or tube) fittings are not to be less than the angle of test assemblies or 60 degrees, whichever smaller, but is to be not more than 90 degrees. "Angles of pipe (or tubes) fittings" means the angle in "α" degrees between the centrelines of pipes (or tubes), or between pipes (or tubes) and plates on transverse sections as shown in **Fig. M4.13**. (5) Leg length of fillet welding The range of the leg length of fillet welding is to be in accordance with in **Table M4.3**. (6) 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. (7) Kind of welding consumable The welding consumable is to be selected according	(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) Angles of pipe (or tube) fittings The angles of pipe (or tube) fittings are not to be less than the angle of test assemblies or 60 degrees, whichever smaller, but is to be not more than 90 degrees. "Angles of pipe (or tubes) fittings" means the angle in "α" degrees between the centrelines of pipes (or tubes), or between pipes (or tubes) and plates on transverse sections as shown in **Fig. M4.13**. (5) Leg length of fillet welding The range of the leg length of fillet welding is to be in accordance with in **Table M4.3**. (6) 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. (7) Kind of welding consumable The welding consumable is to be selected according	

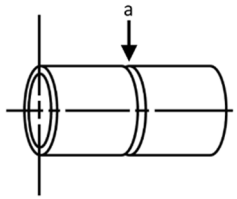
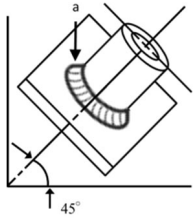
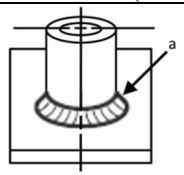
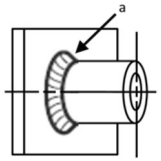
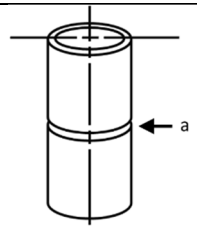
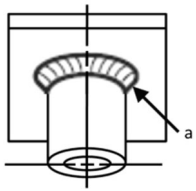
Amended-Original Requirements Comparison Table
(Approval Tests of Welding Procedures and Related Specifications for 9 % Nickel Steels)

Amended	Original	Remarks
to grade (including all suffixes) not brand, except for the large heat inputs specified in **Note (5) of Table M4.2**. (8) Welding position (a) The welding position is to be in accordance with **Table M5.11**. The welding position of T-joints with partial penetration and 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. With respect to the welding positions for rotating and fixed pipes (tubes), when the tests required for fixed pipes (tubes) are performed for *PB*, *PC* or *PD* respectively, the tests required for rotating pipes (tubes) may also be considered to have been performed respectively as shown in **Table M5.11**.	to grade (including all suffixes) not brand, except for the large heat inputs specified in **Note (5) of Table M4.2**. (8) Welding position (a) The welding position is to be in accordance with **Table M5.11**. The welding position of T-joints with partial penetration and 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. With respect to the welding positions for rotating and fixed pipes (tubes), when the tests required for fixed pipes (tubes) are performed, the tests required for rotating pipes (tubes) may be also be considered to have been performed as shown in **Table M5.11**.	Clarify that the test for rotating pipe is omitted respectively according to the welding position PB (horizontal vertical), PC (horizontal) and PD (horizontal overhead) of fixed pipe for which a test was carried out.

Amended-Original Requirements Comparison Table
(Approval Tests of Welding Procedures and Related Specifications for 9 % Nickel Steels)

Amended	Original	Remarks

Table M5.11 Symbols for Welding Positions for Tubes

Welding position	Symbol	Tube	
		Butt welding	Fillet welding
Flat	*PA*	 (tube rotating)	 (tube rotating)
Horizontal vertical	*PB*	—	 (tube rotating or fixed)  (tube rotating)
Horizontal	*PC*	 (tube rotating or fixed)	—
Horizontal overhead	*PD*	—	 (tube rotating or fixed)

Amended-Original Requirements Comparison Table
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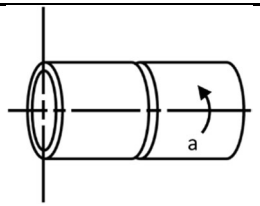
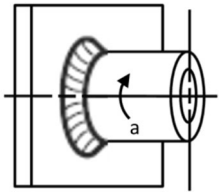
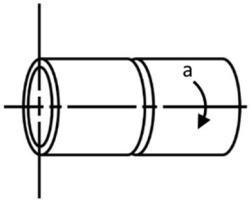
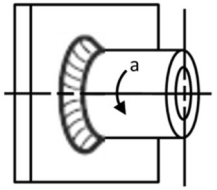
Amended	Original	Remarks

Tube position for welding upwards	*PH*	 (tube fixed)	 (tube fixed)
Tube position for welding downwards	*PJ*	 (tube fixed)	 (tube fixed)

Note:
(1) The symbol "a" in this table indicates the following:
PA, *PB*, *PC*, *PD*, *PE*: welding position
PF, *PG*: weld progression or direction

EFFECTIVE DATE AND APPLICATION

1. The effective date of the amendments is [the date of establishment].

Amended-Original Requirements Comparison Table
(Approval Tests of Welding Procedures and Related Specifications for 9 % Nickel Steels)

Amended

4.2 Tests for Butt Welded Joints

4.2.5 Tensile Tests*

Table M4.7 Tensile Test Requirements for Butt Welded Joint

Kind of test assembly	Grade of test assembly		Tensile test	
			Tensile strength (N/mm^2)	0.2 % proof stress (N/mm^2)
Rolled steels for low temperature service	*KL9N*53, *KL9N*60	*L*91 (7)	590 min. (1)	375 min.
			630 min. (2)	
		*L*92 (7)	660 min. (1)	410 min. (1)
			670 min. (2)	—
Steel pipes for low temperature service	*KLP*9	*L*91 (7)	630 min.	—
		*L*92 (7)	670 min. (2)	—
Aluminium alloys (3)	5086*P*-*H*112 (4)		240 min.	—
	5086*P*-*H*116			
	5083*P*-*H*116		275 min.	—
	5083*P*-*H*321			
	5383*P*-*H*116		290 min.	—
	5383*P*-*H*321			
	5456*P*-*H*116 (6)			—
	5456*P*-*H*321 (6)			
	5059*P*-*H*116		330 min.	—
	5059*P*-*H*321			
	5086*S*-*H*111		240 min.	—
	5383*S*-*H*112		290 min.	—
	6061*P*-*T*6		170 min.	—
	6005*AS*-*T*5 (5) ,6005*AS*-*T*6 (5)			
	6061*S*-*T*6 (5)			

Original

4.2 Tests for Butt Welded Joints

4.2.5 Tensile Tests*

Table M4.7 Tensile Test Requirements for Butt Welded Joint

Kind of test assembly	Grade of test assembly	Tensile test	
		Tensile strength (N/mm^2)	0.2% proof stress(N/mm^2)
Rolled steels for low temperature service	*KL9N*53, *KL9N*60	590 min. (1)	315 min.
		630 min. (2)	—
Steel pipes for low temperature service	*KLP*9	630 min.	—
Aluminium alloys (3)	5086*P*-*H*112 (4)	240 min.	—
	5086*P*-*H*116		
	5083*P*-*H*116	275 min.	—
	5083*P*-*H*321		
	5383*P*-*H*116	290 min.	—
	5383*P*-*H*321		
	5456*P*-*H*116 (6)		—
	5456*P*-*H*321 (6)		
	5059*P*-*H*116	330 min.	—
	5059*P*-*H*321		
	5086*S*-*H*111	240 min.	—
	5383*S*-*H*112	290 min.	—
	6061*P*-*T*6	170 min.	—
	6005*AS*-*T*5 (5) , 6005*AS*-*T*6 (5)		
	6061*S*-*T*6 (5)		

Remarks

For under-matching welding joints, specified standard values are revised in accordance with the mechanical properties of used welding consumables.
The values are consistent with those for the mechanical property of welding consumables and tensile test requirements for welding joints specified in Chapter 6, Part M of the Rules.

Amended-Original Requirements Comparison Table
(Approval Tests of Welding Procedures and Related Specifications for 9 % Nickel Steels)

Amended	Original	Remarks
6082*S*-*T*5 (5) ,6082*S*-*T*6 (5)	6082*S*-*T*5 (5) , 6082*S*-*T*6 (5)	
Notes: (1) For test specimens in longitudinal direction (2) For test specimen in transverse direction (3) Grades of aluminium alloys have indication grade showing the temper condition. (4) For test assembly thickness not more than 12.5 *mm* (5) See **Notes (13)** of **Table M4.6**. (6) When the thickness is 40 *mm* or less. (7) The symbols for the welding consumables listed above indicate the materials specified in **Table M6.1**, **Table M6.12** and **Table M6.21**, and have same mark at the end. (For example, "*L*91" indicates *KMWL*91, *KAWL*91 and *KSWL*91)	Notes: (1) For test specimens in longitudinal direction (2) For test specimen in transverse direction (3) Grades of aluminium alloys have indication grade showing the temper condition. (4) For test assembly thickness not more than 12.5 *mm* (5) See **Notes (13)** of **Table M4.6**. (6) When the thickness is 40 *mm* or less.	
EFFECTIVE DATE AND APPLICATION **1.** The effective date of the amendments is [the date of establishment]. **2.** Notwithstanding the amendments to the Rules, the current requirements apply to test for which the application for survey is submitted to the Society before the effective date.		