

# Rolled Steels for Low Temperature Service

## Amended Rules and Guidance

Rules for the Survey and Construction of Steel Ships Parts K, and M  
Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use

## Reason for Amendment

Part K of the Rules and the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use specify requirements for rolled steels for low temperature service that are used for tanks and tank perimeter structures on ships using low-flashpoint fuels or ships carrying liquefied gases in bulk. The maximum applicable plate thickness of rolled steels for low temperature service in Part K is limited to 40 *mm* based on the actual results of using such steels at the time when the requirements were originally specified; in recent years, however, there have been some cases of rolled steels for low temperature service exceeding 40 *mm* being used in response to continued increases in ship size. In such cases, the Society has been approving such steel on a case-by-case basis.

Part N of the Rules, which incorporates the IGC Code, and Part GF of the Rules, which incorporates the IGF Code, also specify requirements for rolled steels for low temperature service, but these requirements limit maximum applicable plate thickness to 50 *mm*.

Accordingly, relevant requirements in Part K and the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use are amended to change the maximum applicable plate thickness of rolled steels for low temperature service from 40 *mm* to 50 *mm* in reference to corresponding requirements for such steels in Part N and Part GF.

In addition, since the wording of requirements for approval tests for welding practices for rolled steels for low temperature service and other materials specified in Part M differed from similar requirements in Part N, the wording in Part M is amended to be consistent to that in Part N.

## Outline of Amendment

The main details of the amendment are as follows:

- (1) Chapter 3, Part K of the Rules for the Survey and Construction of Steel Ships and Chapter 1, Part 1 of the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use  
Maximum applicable plate thickness of rolled steels for low temperature service is extended to 50 *mm*; in addition a minimum elongation for U1 test specimens exceeding 40 *mm* and up to 50 *mm* is added to relevant requirement in Part K.
- (2) Chapter 4, Part M of the Rules for the Survey and Construction of Steel Ships  
For the welding procedure tests for rolled steels for low temperature service and steel pipes for low temperature service, the wording of some of the requirements regarding the positions of notches in impact test specimens is amended.

“Rules for the survey and construction of steel ships” has been partly amended as follows:

## **Part K        MATERIALS**

### **Chapter 3    ROLLED STEELS**

#### **3.4        Rolled Steels for Low Temperature Service**

##### **3.4.1        Application**

Sub-paragraphs -1 and -2 have been amended as follows.

**1**        The requirements are to apply to the rolled steels not exceeding ~~40~~50 *mm* in thickness intended for tanks and ship’s hull structures adjacent to tanks of liquefied gas carriers or ships using low-flashpoint fuels, and other parts such as hull structures of refrigerated cargo carrier which are exposed to low temperature (hereinafter referred to as “steels” in **3.4**).

**2**        Any requirement regarding the steels over ~~40~~50 *mm* in thickness is left to the discretion of the Society.

### 3.4.5 Mechanical Properties

- 1 The mechanical properties of steels are to comply with the requirements given in **Table K3.15**.
- 2 Where deemed necessary by the Society, other tests on notch toughness may be required.
- 3 For steels to which the requirement in **17.12, Part N** is applicable, the specified value of the maximum yield point or proof stress may be set after obtaining verification by the Society.

Table K3.15 Heat Treatment and Mechanical Properties

Grade	Heat treatment	Tensile test			Impact test <sup>(4)(5)</sup>		
		Yield point or proof stress ( <i>N/mm</i> <sup>2</sup> )	Tensile strength ( <i>N/mm</i> <sup>2</sup> )	Elongation <sup>(3)</sup> ( $L = 5.65 \times \sqrt{A}$ ) (%)	Testing temperature (°C)	Minimum mean absorbed energy( <i>J</i> )	
						<i>L</i>	<i>T</i>
<i>KL24A</i>	Normalized, quenched and tempered or <i>TMCP</i> <sup>(1)</sup>	235 min.	400~510	20 min.	-40	41 min.	27 min.
<i>KL24B</i>					-50		
<i>KL27</i>		-60					
<i>KL33</i>		265 min.	420~540	19 min.	-70		
<i>KL37</i>		325 min.	440~560		-95		
<i>KL2N30</i>	Normalized, normalized and tempered, quenched and tempered or <i>TMCP</i> <sup>(2)</sup>	295 min.	420~570	-110			
<i>KL3N32</i>		315 min.	440~590	-196			
<i>KL5N43</i>		420 min.	540~690	-196			
<i>KL9N53</i>	Double normalized and tempered, quenched and tempered or <i>TMCP</i> <sup>(2)</sup>	520 min.	690~830	18 min.	-196		
<i>KL9N60</i>		590 min.		-196			

Notes:

- (1) Controlled rolling may be used as the heat treatment procedure in cases where deemed appropriate by the Society.
- (2) If it is deemed appropriate by the Society, the intermediate heat treatment (the intermediate heat treatment is an operation of cooling from a dual phase composed of austenite and ferrite intended for improving toughness which is carried out prior to tempering) may be applied.
- (3) The specified value for *U1* test specimen other than those of proportional-size type is to be in compliance with the requirements given in **Table K3.16**.
- (4) *L* (or *T*) indicates that the longitudinal axis of the test specimen is arranged parallel (or transverse) to the final direction of rolling.
- (5) When the absorbed energy of two or more test specimens among a set of test specimens is less in value than the specified minimum mean absorbed energy or when the absorbed energy of a single test specimen is less in value than 70% of the specified minimum average absorbed energy, the test is considered to be failed.

Table K3.16 has been amended as follows.

Table K3.16 Minimum Elongation for *U1* Specimen (%)

Grade	Thickness <i>t</i> (mm)									
	$t \leq 5$	$5 < t \leq 10$	$10 < t \leq 15$	$15 < t \leq 20$	$20 < t \leq 25$	$25 < t \leq 30$	$30 < t \leq 35$	$35 < t \leq 40$	<u><math>40 &lt; t \leq 45</math></u>	<u><math>45 &lt; t \leq 50</math></u>
<i>KL24A</i> , <i>KL24B</i> , <i>KL27</i>	13	14	15	16	17	18	18	19	<u>19</u>	<u>20</u>
<i>KL33</i>	12	13	14	15	16	17	18	19	<u>19</u>	<u>20</u>
<i>KL37</i>	11	12	13	14	15	16	17	18	<u>18</u>	<u>19</u>
<i>KL2N30</i> , <i>KL3N32</i> , <i>KL5N43</i>	12	13	14	15	16	17	17	18	<u>18</u>	<u>19</u>
<i>KL9N53</i> , <i>KL9N60</i>	10	11	12	13	14	15	16	17	<u>17</u>	<u>18</u>

# Part M WELDING

## Chapter 4 WELDING PROCEDURE AND RELATED SPECIFICATIONS

### 4.2 Tests for Butt Welded Joints

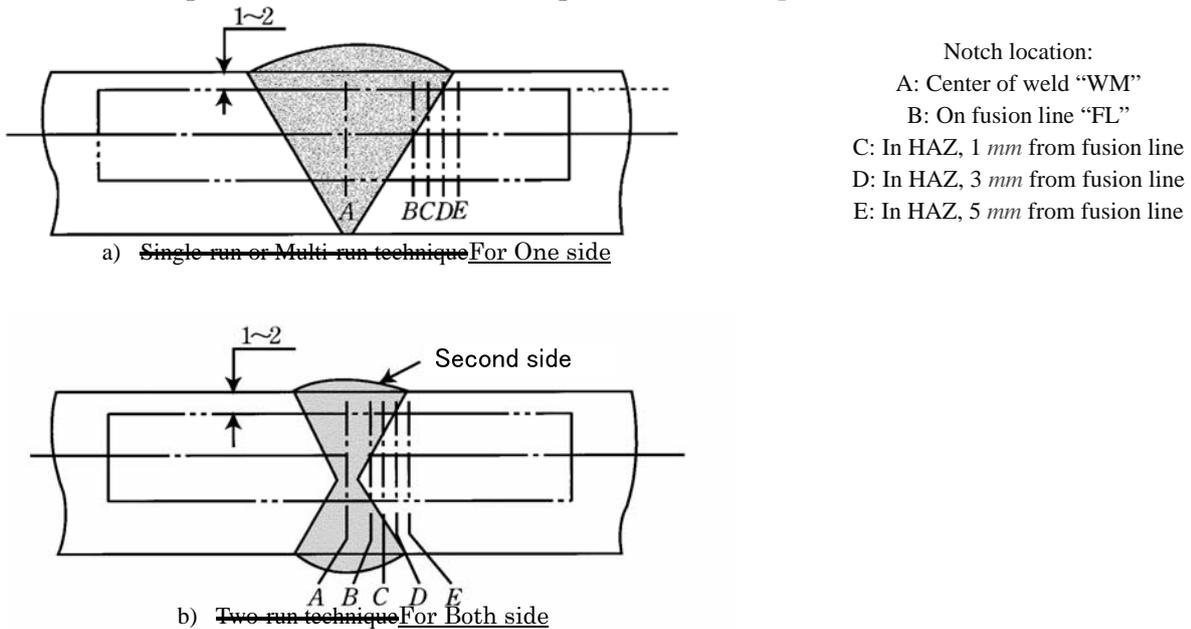
#### 4.2.7 Impact Tests\*

1 Impact test specimens are to be *U4* specimens shown in **Table K2.5** and to be taken from the position shown in **Fig. M4.2** to **Fig. M4.4**. Where *U4* impact test specimens cannot be taken because of the convenience of material, the requirements in sub-paragraphs **2.2.4-4** and **2.3.2-2** in **Part K of the Rules** is to be applied.

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 M4.6** 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 to -7 are omitted.)

Fig. M4.4 has been amended as follows.

Fig. M4.4 Positions of Notch for Impact Test Specimens for Rolled Steel for Low Temperature Service and Steel Pipes for Low Temperature Service (Unit: *mm*)



“Guidance for the approval and type approval of materials and equipment for marine use” has been partly amended as follows:

## **Part 1 METALLIC MATERIALS**

### **Chapter 1 APPROVAL OF MANUFACTURING PROCESS OF ROLLED STEELS**

#### **1.4 Approval Test**

##### **1.4.2 Selection of Test Samples**

Sub-paragraph -3 has been amended as follows.

**3** Where the maximum manufacturing thickness of rolled steels for hull, rolled steels for low temperature service and high strength rolled steels for offshore structures is more than 50 *mm*, ~~40 *mm*~~ and ~~50 *mm*~~ respectively, and in the case of first approval of at least one item of deoxidation practice, grain refining and micro-alloying elements, heat treatment, steel making process and steel casting process, Society may request an additional test samples of which thickness is indicated with a ● mark in **Table 1.1-1** or other proper thickness, in addition to the test samples in accordance with -2.

Table 1.1-1 has been amended as follows.

Table 1.1-1 Standard Thickness and Dimensions of Test Samples

Material symbol		Deoxidation, grain refining, etc.	Thickness <sup>(1)</sup> (mm)									
			0	10	20	30	40	50	60	70		
Rolled steels for hull	KA	Any method except rimmed			●		●					
	KB	Any method except rimmed			●		●					
	KD	Killed and fine grain treated			●		●					
	KE	Killed and fine grain treated			●		●					
	KA32	KA36	Killed and fine grain treated	without Nb and/or V		12.5	●		●			
				with Nb and/or V			●		●			
	KD32	KD36		without Nb and/or V			●		●			
				with Nb and/or V			●		●			
	KE32	KE36	Killed and fine grain treated			●		●				
	KA40	Killed and fine grain treated				●		●				
	KD40				●		●					
	KE40				●		●					
	KF32				●		●					
KF36				●		●						
KF40				●		●						
KE47				●		●						
KL24A	Aluminium treated killed and fine grain treated				●		●					
KL24B				●		●						
KL27				●		●						
KL33				●		●						
KL37				●		●						
KL2N30				●		●						
KL3N32				●		●						
KL5N43				●		●						
KL9N53				●		●						
KL9N60				●		●						
High strength rolled steels for offshore structure	KA420, KD420	Killed and fine grain treated			●		●					
	KE420, KF420				●		●					
	KA460, KD460				●		●					
	KE460, KF460				●		●					
	KA500, KD500				●		●					
	KE500, KF500				●		●					
	KA550, KD550				●		●					
	KE550, KF550				●		●					
	KA620, KD620				●		●					
	KE620, KF620				●		●					
	KA690, KD690				●		●					
KE690, KF690			●		●							
KA890, KD890			●		●							
KE890			●		●							
KA960, KD960			●		●							
KE960			●		●							

Notes:

- (1) The colored portion (■ and ■) show the range or thickness for which normalizing of quenching and tempering treatment have been specified for steel plates respectively, while the uncolored portion shows the as-rolled condition. However, quenching and tempering is included for KE40, KF32, KF36 and KF40, KL24A, KL24B, KL27, KL33 and KL37, and normalizing and tempering, and quenching and tempering is included for KL2N30, KL3N32 and KL5N43, and KL9N53 is to be double normalized and tempered, and quenching and tempering.
- (2) See 1.4.2-3.