Chemical Composition of Grade KD steel

Amended Rules

Rules for the Survey and Construction of Steel Ships Part K

Reason for Amendment

Requirements for the chemical composition of normal strength steel specified in Chapter 3, Part K of the Rule are specified based on IACS Unified Requirement (UR) W11.

In cases where Grade D steel thickness exceeds 25 mm, UR W11 specifies that killed and fine grain treatment by aluminum is required in principle as well as the minimum aluminum content values required for such steel. The NK Rules, however, are unclear with respect to which thicknesses are subject to the requirements for minimum aluminum content.

Thus, relevant requirements were accordingly amended for clarification.

Outline of Amendment

Amended Table K3.1, Part K of the Rules to clarify that the minimum aluminium content values in UR W11 apply to Grade KD rolled steels for hulls with thicknesses exceeding 25 mm.

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

Part K MATERIALS

Chapter 3 ROLLED STEELS

3.1 Rolled Steels for Hull

3.1.2 Kinds

Table K3.1 has been amended as follows.

Table K3.1 Grades, Deoxidation Practice and Chemical Composition of Steels

Kind	Grade	Deoxidation practice	Chemical composition (%)(1)														Carbon equivalent (%)
			C	*Si*	*Mn*	*P*	*S*(14)	*Cu*	*Cr*	*Ni*	*Mo*	*Al*(8)	*Nb*	*V*	*Ti*	*N*	
Mild Steels	*KA*	Any method except rimmed	0.21 max. (4)(5)	0.50 max.	2.5×C min.(4)	0.035 max.	0.035 max.	—	—	—	—	—	—	—	—	—	—
	KB		0.21 max. (4)	0.35 max.	0.80 min. (4)(6)												
	KD	Killed(2) or Killed and fine grain treated			0.60 min.(4)							0.015 min. (2)(3)(11)					
	KE	Killed and fine grain treated	0.18 max. (4)		0.70 min.(4)							0.015 min.(11)					
High Tensile Steels	*KA*32 *KD*32 *KE*32 *KA*36 *KD*36 *KE*36 *KA*40 *KD*40 *KE*40	Killed and fine grain treated	0.18 max.	0.50 max.	0.90~ 1.60 (7)	0.035 max.	0.035 max.	0.35 max.	0.20 max.	0.40 max.	0.08 max.	0.015 min. (9)	0.02 ~ 0.05 (9)(10)	0.05~ 0.10 (9)(10)	0.02 max. (10)	—	(13)
	*KF*32 *KF*36 *KF*40		0.16 max.			0.025 max.	0.025 max.			0.80 max.						0.009 max. (12)	

Notes:

(1) Where additions of any other element have been made as part of the steel making practice, the content is to be indicated on the test certificate.

(2) For steels up to 25 *mm* in thickness, killed steel may be accepted and the specified minimum content of aluminium is not needed to be applied.

(3) For steels over 25 *mm* in thickness, aluminium treatment is to be used as a killed and fine grain treatment.

(4) The value of $C + Mn/6$ is not to exceed 0.40%.

(5) For steels sections, maximum carbon content may be increased to 0.23%.

(6) When an impact test is conducted or when steels contain *Si* not less than 0.10%, the minimum manganese content may be reduced to 0.60%.
(7) For steels up to 12.5 *mm* in thickness, the minimum manganese content may be reduced to 0.70%.
(8) Aluminium content is to be represented by the acid soluble aluminium content, but may be determined the total aluminium content. In such a case, the total aluminium content is not to be less than 0.020%.
(9) The steel is to contain aluminium, niobium, vanadium or other suitable grain refining elements, either singly or in any combination. When used singly, the steel is to contain the specified minimum content of the grain refining element. When used in combination, the specified minimum content of each grain refining element is not applicable.
(10) The total niobium, vanadium and titanium content is not to exceed 0.12%.
(11) Upon the approval by the Society, grain refining elements other than aluminium may be used.
(12) The maximum content of nitrogen may be increased to 0.012% if aluminium is present.
(13) Carbon equivalent is to be recorded on test certificate. When any grade of higher strength steel is supplied in *TMCP* condition, the carbon equivalent is to comply with the requirements of **Table K3.2**.
(14) For steels complying with the requirements specified in **3.11** the maximum content of sulphur is to be 0.008% determined by the ladle analysis.