



CCS Rule Change Notice For:
Rules for Ships Using Natural Gas Fuels
2021

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Beijing

CHAPTER 3 MATERIALS AND PIPE DESIGN

Section 3 MATERIALS

3.3.1 Metallic materials

The existing table 3.3.1.1 (1) is revised as follows:

Table 3.3.1.1 (1)

PLATES, PIPES (SEAMLESS AND WELDED) ^{1, 2} , SECTIONS AND FORGINGS FOR FUEL TANKS AND PROCESS PRESSURE VESSELS FOR DESIGN TEMPERATURES NOT LOWER THAN 0 °C		
CHEMICAL COMPOSITION AND HEAT TREATMEN		
Carbon-manganese steel		
Fully killed fine grain steel		
Small additions of alloying elements by agreement with CCS		
Composition limits to be approved by CCS		
Normalized, or quenched and tempered ⁴		
TENSILE AND TOUGHNESS (IMPACT) TEST REGULATIONS		
Sampling frequency		
Plates	Each 'piece' to be tested	
Sections and forgings	Each "batch" to be tested.	
Mechanical properties		
Tensile properties	Specified minimum yield stress not to exceed 410 N/mm ^{2 5}	
Toughness (Charpy V-notch test)		
Plates	Transverse test pieces. Minimum average energy value (KV) 27J	
Sections and forgings	Longitudinal test pieces. Minimum average energy (KV) 41J	
Test temperature	Thickness t (mm)	Test temperature (°C)
	t≤20	0
	20<t≤40 ³	-20

Notes:

1. For seamless pipes and fittings normal practice applies. The use of longitudinally and spirally welded pipes is to be specially approved by CCS.
2. Charpy V-notch impact tests are not required for pipes.
3. This Table is generally applicable for material thicknesses up to 40 mm. Proposals for greater thicknesses are to be approved by CCS.
4. A controlled rolling procedure or thermo-mechanical controlled processing (TMCP) may be used as an alternative.
5. Materials with specified minimum yield stress exceeding 410 N/mm² may be approved by CCS. For these materials, particular attention is to be given to the hardness of the welded and heat affected zones.

Note: ① For welded pressure pipes and materials for fuel tanks and process pressure vessels, the chemical compositions and mechanical properties are to complying with the requirements of Chapter 3 and Chapter 4 of CCS Rules for Materials and Welding.

② For the material of 40mm < thickness ≤ 50mm, charpy V-notch impact test shall be carried out according to the following requirements:

<u>CHARPY V-NOTCH IMPACT TEST REQUIREMENTS</u>		
<u>TEST TEMPERATURE</u>	<u>Thickness t (mm)</u>	<u>Test temperature (°C)</u>
	$40 < t \leq 50^1$	-20^2
	$40 < t \leq 50^1$	-30^3
Notes: <u>1. A further set of impact test at mid thickness for products with $t > 40\text{mm}$ is required except rolled steels specified in section 2 and 3, Chapter 3, Part 1 of CCS Rules for Materials and Welding.</u> <u>2. Applies to type C independent tanks and process pressure vessels. In addition, post-weld stress relief heat treatment shall be performed. Exemption to post-weld stress relief heat treatment based on alternative approach (e.g. Engineering Critical Assessment) shall be approved by the Classification Society or shall be to recognized standards.</u> <u>3. Applies to cargo tank or fuel tank other than type C.</u>		

The existing table 3.3.1.1 (2) is revised as follows:

Table 3.3.1.1 (2)

PLATES, SECTIONS AND FORGINGS FOR FUEL TANKS, SECONDARY BARRIERS AND PROCESS PRESSURE VESSELS FOR DESIGN TEMPERATURES BELOW 0 °C AND DOWN TO 55 °C Maximum thickness 25 mm					
CHEMICAL COMPOSITION AND HEAT TREATMEN					
Carbon-manganese steel					
Fully killed, aluminium treated fine grain steel					
Chemical composition (ladle analysis)					
C	Mn	Si	S	P	
≤0.16% ³	0.7~1.60%	0.1~0.50%	≤0.025%	≤0.025%	
Optional additions: Alloys and grain refining elements may be generally in accordance with the following					
Ni	Cr	Mo	Cu	Nb	V
≤0.8%	≤0.25%	≤0.08%	≤0.35%	≤0.05%	≤0.1%
Al content total 0.020% min. (Acid soluble 0.015% min.)					
Normalized, or quenched and tempered ⁴					
TENSILE AND TOUGHNESS (IMPACT) TEST REGULATIONS					
Sampling frequency					
Plates		Each 'piece' to be tested			
Sections and forgings		Each "batch" to be tested.			
Mechanical properties					
Tensile properties		Specified minimum yield stress not to exceed 410 N/mm ^{2 5}			
Toughness (Charpy V-notch test)					
Plates		Transverse test pieces. Minimum average energy value (KV) 27J			
Sections and forgings		Longitudinal test pieces. Minimum average energy (KV) 41J			
Test temperature		5 °C below the design temperature or -20 °C whichever is lower			

Notes:

1. The Charpy V-notch and chemistry regulations for forgings may be specially considered by CCS.
2. For material thickness of more than 25 mm, Charpy V-notch tests are to be conducted as follows:

Material thickness (mm)	Test temperature (°C)
$25 < t \leq 30$	10 °C below design temperature or -20 °C whichever is lower
$30 < t \leq 35$	15 °C below design temperature or -20 °C whichever is lower
$35 < t \leq 40$	20 °C below design temperature
$40 < t$	Temperature approved by CCS <u>(See note ①)</u>

The impact energy value is to be in accordance with the table for the applicable type of test specimen. Materials for tanks and parts of tanks which are completely thermally stress relieved after welding may be tested at a temperature 5 °C below design temperature or -20 °C whichever is lower.

For thermally stress relieved reinforcements and other fittings, the test temperature is to be the same as that required for the adjacent tank-shell thickness.

3. By special agreement with CCS, the carbon content may be increased to 0.18% maximum provided the design temperature is not lower than -40 °C

4. A controlled rolling procedure or thermo-mechanical controlled processing (TMCP) may be used as an alternative

5. Materials with specified minimum yield stress exceeding 410 N/mm² may be approved by CCS. For these materials, particular attention is to be given to the hardness of the welded and heat affected zones.

For materials exceeding 25 mm in thickness for which the test temperature is -60 °C or lower, the application of specially treated steels or steels in accordance with Table 3.3.1.1 (3) of this Chapter may be necessary.

Note: ① For fuel tanks with $-55^{\circ}\text{C} \leq \text{design temperature} < 0^{\circ}\text{C}$, charpy v-notch impact test for materials with thickness $\leq 50\text{mm} < 40\text{mm}$ shall be carried out according to the following requirements:

CHARPY V-NOTCH IMPACT TEST REQUIREMENTS		
TEST TEMPERATURE	Thickness t (mm)	Test temperature (°C)
	$40 < t \leq 50^1$	<u>5 °C below design temperature or – 20 °C, whichever is lower²</u>
	$40 < t < 45^1$	<u>25 °C below design temperature²</u>
	$45 < t \leq 50^1$	<u>30 °C below design temperature³</u>
Notes: <u>1. A further set of impact test at mid thickness for products with $t > 40\text{mm}$ is required except rolled steels specified in section 2 and 3, Chapter 3, Part 1 of CCS Rules for Materials and Welding.</u> <u>2. Applies to type C independent tanks and process pressure vessels. Post-weld stress relief heat treatment shall be performed when the design temperature is below 0°C to -10°C. Post-weld heat treatment should be performed when the design temperature is below -10°C to -55°C. If alternative methods (eg. Engineering Critical Assessment) are used for post-weld stress relief heat treatment/post-weld heat treatment, they shall be approved by CCS or shall be to recognized standards.</u> <u>3. Applies to cargo tank or fuel tank other than type C.</u>		

The existing table 3.3.1.1 (3) is revised as follows:

Table 3.3.1.1 (3)

PLATES, SECTIONS AND FORGINGS¹ FOR FUEL TANKS, SECONDARY BARRIERS AND PROCESS PRESSURE VESSELS FOR DESIGN TEMPERATURES BELOW MINUS 55 °C AND DOWN TO MINUS 165 °C² Maximum thickness 25 mm		
Minimum design temp.(°C)	Chemical composition ⁵ and heat treatment	Impact test temp. (°C)
-60	1.5% nickel steel – normalized or normalized and tempered or quenched and tempered or TMCP see note ⁶	-65
-65	2.25% nickel steel – normalized or normalized and tempered or quenched and tempered or TMCP see note ^{6,7}	-70
-90	3.5% nickel steel – normalized or normalized and tempered or quenched and tempered or TMCP see note ^{6,7}	-95
-105	5% nickel steel – normalized or normalized and tempered or quenched and tempered ^{6,7} and ⁸	-110
-165	9% nickel steel – double normalized and tempered or quenched and tempered ⁶	-196
-165	Austenitic steels, such as types 304, 304L, 316, 316L, 321 and 347 solution treated ⁹	-196
-165	Aluminium alloys; such as type 5083 annealed	Not required
-165	Austenitic Fe-Ni alloy (36% nickel) Heat treatment as agreed	Not required
TENSILE AND TOUGHNESS (IMPACT) TEST REGULATIONS		

Sampling frequency	
Plates	Each 'piece' to be tested
Sections and forgings	Each "batch" to be tested.
Toughness (Charpy V-notch test)	
Plates	Transverse test pieces. Minimum average energy value (KV) 27J
Sections and forgings	Longitudinal test pieces. Minimum average energy (KV) 41J

Notes:

1. The impact test required for forgings used in critical applications is to be subject to special consideration by CCS.
2. The regulations for design temperatures below -165°C are to be specially agreed with CCS.
3. For materials 1.5% Ni, 2.25% Ni, 3.5% Ni and 5% Ni, with thicknesses greater than 25 mm, the impact tests are to be conducted as follows:

Material thickness (mm)	Test temperature ($^{\circ}\text{C}$)
$25 < t \leq 30$	10 $^{\circ}\text{C}$ below design temperature
$30 < t \leq 35$	15 $^{\circ}\text{C}$ below design temperature
$35 < t \leq 40$	20 $^{\circ}\text{C}$ below design temperature

The energy value is to be in accordance with the table for the applicable type of test specimen. For material thickness of more than 40 mm, the Charpy V-notch values are to be specially considered (see note ①).

4. For 9% Ni steels, austenitic stainless steels and aluminium alloys, thickness greater than 25 mm may be used.
5. The composition limits are to be in accordance with Recognized Standards.
6. Thermo-mechanical controlled processing (TMCP) nickel steels will be subject to acceptance by CCS.
7. A lower minimum design temperature for quenched and tempered steels may be specially agreed with CCS.
8. A specially heat treated 5% nickel steel, for example triple heat treated 5% nickel steel, may be used down to -165°C , provided that the impact tests are carried out at -196°C .
9. The impact test may be omitted subject to agreement with CCS.

Note: ① For the material of $40\text{mm} < \text{thickness} \leq 50\text{mm}$, charpy V-notch impact test shall be carried out according to the following requirements:

CHARPY V-NOTCH IMPACT TEST REQUIREMENTS	
<u>Thickness t (mm)</u>	<u>Test temperature ($^{\circ}\text{C}$)</u>
<u>$40 < t \leq 45 \text{ mm}^1$</u>	<u>25 $^{\circ}\text{C}$ below design temperature</u>
<u>$45 < t \leq 50 \text{ mm}^1$</u>	<u>30 $^{\circ}\text{C}$ below design temperature</u>
<u>Note</u> <u>1. A further set of impact test at mid thickness for products with $t > 40\text{mm}$ is required except rolled steels specified in section 2 and 3, Chapter 3, Part 1 of CCS Rules for Materials and Welding.</u>	

Note: The requirements of above revised paragraph in table 3.3.1.1 (1) ~ 3.3.1.1 (3) are to be implemented from 1 July 2022.

CHAPTER 4 FULE CONTAINMENT SYSTEMS

Section 5 PRESSURE RELIEF SYSTEMS

The existing paragraph 4.5.1.1 is revised as follows:

4.5.1.1 All fuel storage tanks are to be provided with a pressure relief system appropriate to the design of the fuel containment system and the fuel being carried. Fuel storage hold spaces, interbarrier spaces, tank connection spaces ~~and tank cofferdams~~, which may be subject to pressures beyond their design capabilities, are also to be provided with a suitable pressure relief system.

Note: The requirements of above revised paragraph are to be implemented from 1 January 2024.

CHAPTER 13 MANUFACTURE, WORKMANSHIP AND TESTING

Section 3 WELDING OF METALLIC MATERIALS AND NON-DESTRUCTIVE TESTING FOR THE FUEL CONTAINMENT SYSTEM

The existing paragraph 13.3.3.5(1) is revised as follows:

(1) tensile tests: cross-weld tensile strength is not to be less than the specified minimum tensile strength for the appropriate parent materials. For materials such as aluminium alloys, reference is to be made to 4.2.10.1(1) of the Rules with regard to the regulations for weld metal strength of under-matched welds (where the weld metal has a lower tensile strength than the parent metal). In every case, the position of fracture is to be recorded for information;

For longitudinal tensile tests, the yield stress of the deposited weld metal is not to be less than the specified minimum yield stress or minimum yield stress considered in design of the parent metal.

Note: The requirements of above revised paragraph are to be implemented from 1 January 2024.

Section 7 TESTING REQUIREMENTS

The existing paragraph 13.7.3.8 is revised as follows:

13.7.3.8 The closing time of the valve referred to in 5.3.1.8 and 12.2.1.2(2) (i.e. time from shutdown signal initiation to complete valve closure) is not to be greater than:

$$\frac{3600U}{BR} \quad (\text{second})$$

where, U —ullage volume at operating signal level, in m^3 ;

BR —maximum bunkering rate agreed between ship and shore facility (m^3/h) ;or
5 seconds, whichever is the least.

The bunkering rate is to be adjusted to limit surge pressure on valve closure to an acceptable level, taking into account the bunkering hose or arm, the ship and the shore piping systems, where relevant.