RUSSIAN MARITIME REGISTER OF SHIPS

HEAD OFFICE

CIRCULAR LETTER **No. 314-53-**.1013c dated 17.05 .2017

Re:

amendments to Part XIII "Materials" of the Rules for the Classification and Construction of Sea-Going Ships, 2017, ND No. 2-020101-095-E

Item of technical supervision:

hull structural steel

Implementation	01.07.2017
Valid: till	-
Validity period extended till	.
Cancels / amends / supplements Circular letter No.	- dated -
Number of pages:	1+8
Appendices:	amendments to Part XIII "Materials" of the Rules for the Classification and Construction of Sea-Going Ships, 2017, ND No. 2-020101-095-E
Director General	K.G. Palnikov
Amends	Rules for the Classification and Construction of Sea-Going Ships, 2017, ND No. 2-020101-095-E.

We hereby inform that in connection with coming into force on 01.07.2017 of the new revision of IACS UR W16 (Rev.3 Mar 2016) "High Strength Steels for Welded Structures", Part XIII "Materials" of the Rules for the Classification and Construction of Sea-Going Ships, 2017, ND No. 2-020101-095-E shall be amended as specified in the Appendix to the Circular Letter.

These amended requirements apply on ships contracted for construction on or after 1 July 2017.

Original UR W16 (Rev.3 Mar 2016) in English is posted on the RS website in the Section "External Normative Documents", and on the IACS official website www.iacs.org.uk.

The above amendments will be introduced to the Rules for the Classification and Construction of Sea-Going Ships, 2017, ND No. 2-020101-095-E at the re-publication thereof.

It is necessary to do the following:

1. Familiarize surveyors of the RS Branch Offices as well as interested organizations and persons in the area of the RS Branch Offices' activity with the content of the Circular Letter.

2. Apply the provisions introduced by the Circular Letter during the review and approval of the technical documentation for ships.

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Appendix to Circular Letter

No. 314-53-..... dated 2017

RULES FOR THE CLASSIFICATION AND CONSTRUCTION OF SEA-GOING SHIPS, 2017, ND No. 2-020101-095-E

PART XIII. MATERIALS

Chapter 3.13. HIGH STRENGTH STEEL FOR WELDED STRUCTURES shall be amended to read:

"3.13 HIGH STRENGTH STEEL FOR WELDED STRUCTURES

3.13.1 General.

The present requirements apply to hot-rolled, fine-grain, weldable high strength steels subject to the survey by the Register during manufacture and intended for use in Sea-Going Ships and in MODU/FOP.

Proceeding from the minimum yield stress guaranteed the steel is subdivided into eight strength levels: 420, 460, 500, 550, 620, 690, 890 and 960 MPa. For each yield strength level grades A, D, E and F are specified, based on the impact test temperature, except for yield strength level of 890 and 960 MPa for which grade F is not applicable.

The requirements for the hot-rolled products with thickness of 15 mm or less designed for operation at design temperatures below — 30 °C are specified in 3.5.2.6.
High strength steel is manufactured at works recognized according to 1.3.1.2.

The attention of the users shall be drawn to the fact that when fatigue loading is present, the effective fatigue strength of a welded joint of high strength steel may not be greater than that of a welded joint in normal strength steels.

Before subjecting steels produced by thermomechanical rolling to further heating for forming or stress relieving, or using high heat-input welding, special consideration shall be given to the possibility of a consequent reduction in mechanical properties

3.13.2 Steel making process.

Vacuum degassing shall be used for any of the following:

All steels with enhanced through-thickness properties, and

All steels of grade PC690, PC890 and PC960.

The steel shall be fully killed, fine grain treated and shall have fine grain structure. The fine grain practice is to be as detailed in the approved manufacturing specification.

A fine grain structure has an equivalent index ≥ 6 determined by micrographic examination in accordance with ISO 643 or alternative national or international test method agreed with the Register.

The steels shall contain nitrogen binding elements as detailed in the manufacturing specification. Also refer to Table 3.13.3.1.

3.13.3 Chemical composition.

3.13.3.1 The chemical composition of steel shall be determined by the manufacturer from each cast or ladle in an adequately equipped laboratory. The method of sampling is to follow that carried out for the initial approval testsThe chemical composition of steel shall be in accordance with specification approved by the Register and the limiting values given in Table 3.13.3.1.

Table 3.13.3.1

Chemical composition of high strength steels

Delivery condition [1]	N/NR		TM		QT	
Steel grade	PCA420N/NR PCD420N/NR PCA460N/NR PCD460N/NR	PCE420N/NR PCE460N/NR	PCA420TM PCD420TM PCA460TM PCD460TM PCA500TM PCD500TM PCA550TM PCD550TM PCA620TM PCD620TM PCA690TM PCD690TM PCA890TM	PCE420TM PCF420TM PCE460TM PCF460TM PCE500TM PCF500TM PCE550TM PCF550TM PCE620TM PCF620TM PCE690TM PCF690TM PCD890TM PCE890TM	PCA420QT PCD420QT PCA460QT PCD460QT PCA500QT PCD500QT PCA550QT PCD550QT PCA620QT PCD620QT PCA690QT PCD690QT PCA890QT PCA960QT	PCE420QT PCF420QT PCE460QT PCF460QT PCE500QT PCF500QT PCE550QT PCF550QT PCE620QT PCF620QT PCE690QT PCF690QT PCD890QT PCE890QT PCD960QT PCE960QT
Chemical Composition, % [2]						
C_{max}	0,20	0,18	0,16	0,14	0,18	
Mn	1,0~1,70				1,70	
Si_{max}	0,60				0,80	
P_{max} [3]	0,030	0,025	0,025	0,020	0,025	0,020
S_{max} [3]	0,025	0,020	0,025	0,010	0,015	0,010
Al_{total} min [4]	0,02				0,018	
Nb_{max} [5]	0,05				0,06	
V_{max} [5]	0,20		0,12		0,12	
Ti_{max} [5]	0,05				0,05	
Ni_{max} [6]	0,80		2,00		2,00	
Cu_{max}	0,55				0,50	
Cr_{max} [5]	0,30		0,50		1,50	
Mo_{max} [5]	0,10		0,50		0,70	

N_{max}	0,025			0,015	
Oxygen ppm_{max} [7]	-	-	50	-	30

[1]Refer to 3.13.4 for definition of delivery conditions.
[2]The chemical composition is to be determined by ladle analysis and shall meet the approved manufacturing specification at the time of approval.
[3]For sections the P and S content can be 0.005% higher than the value specified in the table.
[4]The total aluminium to nitrogen ratio shall be a minimum of 2:1. When other nitrogen binding elements are used, the minimum Al value and Al/N ratio do not apply.
[5]Total Nb+V+Ti ≤ 0.26% and Mo+Cr ≤ 0.65%, not applicable for QT steels.
[6]Higher Ni content may be approved at the discretion of the Register.
[7]The requirement on maximum Oxygen content is only applicable to PCD890; PCE890; PCD960 and PCE960.

3.13.3.2 Elements used for alloying, nitrogen binding, and fine grain treatment, and as well as the residual elements shall be as detailed in the manufacturing specification., e.g. when boron is deliberately added for enhancement of hardenability of the steels, the maximum content of the boron content shall not be higher than 0,005 %.

3.13.3.3 The carbon equivalent value shall be calculated from the ladle analysis. Maximum values are specified in Table 3.13.3.3. Calculation formulas are given below:

for all steel grades the following formula of IIW may be used:

$$Ceq = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15} (\%) \quad (3.13.3.3\text{-}1)$$

for steel grades H460 and higher, CET may be used instead of Ceq at the discretion of the manufacturer, and is to be calculated according to the following formula:

$$CET = C + \frac{(Mn + Mo)}{10} + \frac{(Cr + Cu)}{20} + \frac{Ni}{40} (\%) \quad (3.13.3.3\text{-}2)$$

Note.The CET is included in the standard EN 1011-2:2001 used as one of the parameters for preheating temperature determination which is necessary for avoiding cold cracking.

for TM and QT steels with carbon content not more than 0,12%, the cold cracking susceptibility Pcm for evaluating weldability may be used instead of carbon equivalent of Ceq or CET at manufacturer's discretion and is to be calculated using the following formula:

$$Pcm = C + \frac{Si}{30} + \frac{Mn}{20} + \frac{Cu}{20} + \frac{Ni}{60} + \frac{Cr}{20} + \frac{Mo}{15} + \frac{V}{10} + 5B (\%) \quad (3.13.3.3\text{-}3)$$

Table 3.13.3.3

Maximum Ceq, CET and Pcm values

Steel grade and delivery condition	Carbon Equivalent (%)							
	Ceq						CET	Pcm
	Plates			Section	Bars	Tubulars	all	all
	t≤50 mm	50<t≤100 mm	100<t ≤250 mm	t≤50 mm	t≤250 or d≤250 mm	t≤65 mm	all	all
PC420N/NR	0,46	0,48	0,52	0,47	0,53	0,47	-	-
PC420TM	0,43	0,45	0,47	0,44	-	-	-	-
PC420QT	0,45	0,47	0,49	-	-	0,46	-	-
PC460N/NR	0,50	0,52	0,54	0,51	0,55	0,51	0,25	-
PC460TM	0,45	0,47	0,48	0,46	-	-	0,30	0,23
PC460QT	0,47	0,48	0,50	-	-	0,48	0,32	0,24
PC500TM	0,46	0,48	0,50	-	-	-	0,32	0,24
PC500QT	0,48	0,50	0,54	-	-	0,50	0,34	0,25
PC550TM	0,48	0,50	0,54	-	-	-	0,34	0,25
PC550QT	0,56	0,60	0,64	-	-	0,56	0,36	0,28
PC620TM	0,50	0,52	-	-	-	-	0,34	0,26
PC620QT	0,56	0,60	0,64	-	-	0,58	0,38	0,30
PC690TM	0,56	-	-	-	-	-	0,36	0,30
PC690QT	0,64	0,66	0,70	-	-	0,68	0,40	0,33
PC890TM	0,60	-	-	-	-	-	0,38	0,28
PC890QT	0,68	0,75	-	-	-	-	0,40	-
PC960QT	0,75	-	-	-	-	-	0,40	-

3.13.4 Condition of supply.

3.13.4.1 Steel shall be delivered in accordance with the processes approved by the Register. These processes include:

Normalized (N)/Normalized rolled (NR);
Thermo-mechanical controlled rolled (TM)/with Accelerated cooling (TM+AcC)/with direct quenching followed by tempering (TM+DQ), or
Quenched and Tempered condition (QT).

The definition of these delivery conditions are specified in 3.2.1.4.
Direct quenching after hot-rolling followed by tempering is considered equivalent to conventional quenching and tempering.

3.13.5 Rolling reduction ratio.

3.13.5.1 The rolling reduction ratio of slab, billet, bloom or ingot should not be less than 3:1 unless agreed at the time of approval.

3.13.6 Thickness limits for approval.

3.13.6.1 The maximum thickness of slab, billet or bloom from the continuous casting process shall be at the manufacturer's discretion.

3.13.6.2 Maximum thickness of plates, sections, bars and tubulars over which a specific delivery condition is applicable are shown in Table 3.13.6.2.

Table 3.13.6.2

Maximum thickness limits

Delivery condition	Maximum thickness (mm)			
	Plates	Sections	Bars	Tubulars
N	250[1]	50	250	65
NR	150	[2]		
TM	150	50	-	-
QT	150[1]	50	-	50

[1] Approval for N steels with thickness larger than 250 mm and QT steels with thickness larger than 150 mm is subject to the special consideration of the Register.
[2] The maximum thickness limits of sections, bars and tubulars produced by NR process route are less than those manufactured by N route, and shall be at the discretion of Register.

3.13.7 Mechanical properties.

For the purpose of tensile and impact testing, the mechanical properties of steel shall be in accordance with Tables 3.13.7-1 and 3.13.7-2.

Where rolled products of other shapes (sections, construction pipes, etc.) are tested, the elongation required for longitudinal specimens shall exceed that stated in Tables 3.13.7-1 and 3.13.7-2 by 2 %.

Table 3.13.7-1

Mechanical properties for extra high strength steel

Mechanical properties / Steel grade & delivery condition		Yield strength R_{eH}[1] min (MPa)			Tensile strength Rm (MPa)		Minimum percentage elongation after fracture (%) $L_0=5.65\sqrt{S_0}$[3]		Impact energy, average min, (J)		
		Nominal thickness (mm)[2]			Nominal thickness (mm)[2]						
		3 <t ≤ 50	50 <t≤ 100	100 <t≤ 250	3 < t ≤ 100	100 < t ≤ 250	T	L[4]	Test temp (°C)	T	L
PC420N/NR PC420TM PC420QT	A D E F	420	390	365	520-680	470-650	19	21	0 -20 -40 -60	28	42
PC460N/NR PC460TM PC460QT	A D E F	460	430	390	540-720	500-710	17	19	0 -20 -40 -60	31	46
PC500TM PC500QT	A D E F	500	480	440	590-770	540-720	17	19	0 -20 -40 -60	33	50
PC550TM PC550QT	A D E F	550	530	490	640-820	590-770	16	18	0 -20 -40 -60	37	55
PC620TM PC620QT	A D E F	620	580	560	700-890	650-830	15	17	0 -20 -40 -60	41	62
PC690TM PC690QT	A D E F	690	650	630	770-940	710-900	14	16	0 -20 -40 -60	46	69
PC890TM PC890QT	A D E	890	830	-	940-1100	-	11	13	0 -20 -40	46	69
PC960QT	A D E	960	-	-	980-1150	-	10	12	0 -20 -40	46	69

[1] For tensile test either the upper yield stress (R_{eH}) or where R_{eH} cannot be determined, the 0,2 percent proof stress (Rp0.2) is to be determined and the material is considered to comply with the requirement if either value meets or exceeds the specified minimum value of yield strength.

[2] For plates and sections for applications, such as racks in offshore platforms etc., where the design requires that tensile properties are maintained through the thickness, a decrease in the minimum specified tensile properties is not permitted with an increase in the thickness.

[3] For full thickness flat test specimens with a width of 25 mm and a gauge length of 200 mm the elongation shall comply with the minimum values shown in Table 3.13.7.2.

[4] In the case that the tensile specimen is parallel to the final rolling direction, the test result shall comply with the requirement of elongation for longitudinal (L) direction.

Table 3.13.7-2

Elongation Minimum Values for a Width of 25 mm and a 200 mm Gauge Length[1]

Strength level	Thickness (mm)						
	≤ 10	> 10 ≤ 15	> 15 ≤ 20	> 20 ≤ 25	> 25 ≤ 40	> 40 ≤ 50	> 50 ≤ 70
420	11	13	14	15	16	17	18
460	11	12	13	14	15	16	17
500	10	11	12	13	14	15	16
550	10	11	12	13	14	15	16
620	9	11	12	12	13	14	15
690	9[2]	10[2]	11[2]	11	12	13	14

[1]The tabulated elongation minimum values are the requirements for testing specimen in transverse direction. PC890 and PC960 specimens and specimens which are not included in this table shall be proportional specimens with a gauge length of $L_0=5.65\sqrt{S_0}$.

[2] For PC690 plates with thickness ≤ 20 mm, round specimen in accordance with 2.1 may be used instead of the flat tensile specimen. The minimum elongation for testing specimen in transverse direction is 14 %.

3.13.8 Sampling and testing

Test specimens and test procedures for mechanical properties are in accordance with 2.2 and 3.1.

3.13.8.1 Tensile test.

Test specimens shall be cut with their longitudinal axes transverse to the final direction of rolling, except in the case of sections, bars, tubulars and rolled flats with a finished width of 600 mm or less, where the tensile specimens may be taken in the longitudinal direction.

3.13.8.1.1 Full thickness flat tensile specimens are to be prepared. The specimens are to be prepared in such a manner as to maintain the rolling scale at least at one side. When the capacity of the test machine is exceeded by the use of a full thickness specimen, sub-sized flat tensile specimens representing either the full thickness or half of the product thickness retaining one rolled surface are to be used. Alternatively, machined round test specimens may be used. The specimens are to be located at a position lying at a distance of (t/4) from the surface and additionally at (t/2) for thickness above 100 mm or as near as possible to these positions.

3.13.8.1.2 The results of the tests are to comply with the appropriate requirements of Table 4. In the case of product forms other than plates and wide flats where longitudinal tests are agreed, the elongation values are to be 2 percentage units above those transverse requirements as listed in Table 3.13.7-1.

The specimens shall be dimensioned and tests shall be conducted in compliance with the requirements of 2.2. Where test results are unsatisfactory, retesting shall be conducted in compliance with the requirements of 1.3.4.2.

3.13.8.2 Impact test

3.13.8.2.1 Unless otherwise agreed with the Register, the impact testing of steel plates and wide flats more than 600 mm in width shall be effected on specimens prepared in accordance with 2.2.3.1-2, the longitudinal axis of which is perpendicular to the direction of rolling (transverse specimens). Where rolled products of another cross-sectional shape are concerned the impact testing shall be effected on longitudinal specimens.

3.13.8.2.2 Sub-surface test specimens will be taken in such a way that one side is not further away than 2 mm from a rolled surface, however, for material with a thickness in excess of 50 mm, impact tests shall be taken at the quarter thickness (t/4) location and mid-thickness (t/2).

3.13.8.2.3 Impact test for a nominal thickness less than 6 mm are normally not required

3.13.9 Scope of testing.

Each plate (rolled length) shall undergo tensile and impact testing after heat treatment.

For rolled products quenched and tempered in continuous furnaces, the scope of testing, including the number of specimens and the direction of their cutting out, is determined on the basis of specification approved by the Register.

Out of each test sample, at least one tensile specimen and three impact test specimens shall be prepared.

If required by the Register, tensile testing shall be made on specimens with their longitudinal axes perpendicular to the plate surface and the reduction in cross-sectional area shall be determined.

3.13.10 Inspection.

Rolled products shall be in accordance with all the requirements of 3.2.7 taking the provisions below into consideration.

When surface defects are eliminated by grinding, the thickness of the rolled products at the ground spot shall not exceed permitted tolerances. When required by the Rules, the rolled products shall undergo the ultrasonic testing in conformity with standards approved by the Register.

3.13.11 Marking and documentation.

Identification, marking and issued documentation shall be in accordance with the requirements of 3.2.9.".