GUIDANCE CHANGE NOTICE No.1 April 2022

Part 1 Seagoing Ships

Volume W

GUIDANCE FOR THE APPROVAL AND TYPE APPROVAL OF MATERIALS AND EQUIPMENT FOR MARINE USE

2022

Biro Klasifikasi Indonesia

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Foreword

This Guidance Change Notices (GCN) No. 1 provide amendment and corrigenda to the Guidance for The Approval and Type Approval of Materials and Equipment for Marine Use (Pt.1, Vol.W) 2022 edition along with effective date from which these changes are applicable.

Amendments to the preceding edition are marked by strikethrough, red color, and expanded text. These new additions and amendments are to be read in conjunction with the requirements given in the 2022 Edition of the Guidance.

The summary of current amendments for each section including the implementation date are indicated in *Table 1 - Amendments Incorporates in This Notice*.

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Any quires or comments concerning these Guidance are welcomed through communication with BKI Head Office.

Guidance Changes Notice No. 1 – April 2022

Table 1 – Amendments Incorporates in This Notice

These amendments will come into force as indicated in the table below.

Paragraph	Title/Subject	Status/Remark
Section 2 – Approval for Manufacturing Process *The amendments are effective from 1 July 2022*		
A.	General	
A.9.6	(See paragraph)	To add a new requirement for periodically surveillance certificate.
B.	Rolled Steels	
B.I.	Normal and Higher Strength Steels	
Table 2.1	Approval Test Items for Rolled Steels	To add requirements for High manganese austenitic steel plates and to add requirements for fatigue test
Table 2.2	Test Items and Selection of Test Specimens	Adding requirements for fatigue test and providing redaction correction
Table 2.3	Weldability test Items, test methods and acceptance criteria	References correction and corrigenda
B.VIII	High Manganese Austenitic Steels	To add new requirements for High Manganese Austenitic Steels according to IACS Rec. 169.
Table 2.6A	Weldability test Items, test methods and acceptance criteria	To add new provisions of weldability test according to IACS Rec. 169.
Table 2.6B	Mechanical properties for butt weld tests	To add new provisions of mechanical properties for butt weld tests according to IACS Rec. 169.
Section 3 - Type Approval *The amendments are effective from 1 July 2022*		
I.	Crankcase Explosion Relief valves	
I.4	Recognized standards	To add new information of recognized standards according to IACS UR M66
U.	Cable Laying	
Table 3.33	Type tests for cable trays/ protective casings made of plastics materials	To add revise information of recognized standards according to IACS Rec. 73

Section 2 Approval for Manufacturing Process

A. General

9. Validity and renewal of approval certificate

9.6 Periodical surveillance is carried out to the approved manufacturing works. In the periodical surveillance, it is confirmed by BKI that the approved quality system, etc. of the manufacturing works are maintained satisfactorily. Periodical surveillance is to be carried out after 2 years but not 3 years passing from the initial or the renewal approval date.

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B. Rolled Steels

I. Normal and Higher Strength Steels

3. Approval tests

3.2 Approval test and acceptance criteria

3.2.1 Approval tests are to be carried out in the presence of the Surveyor at the manufacturing plant and approval test items are to be as given in Table 2.1.

3.2.2 Test methods and acceptance criteria are to be as given in Table 2.2. However, where accordance with these requirements are difficult, decisions are left to the discretion of BKI.

Table 2.1 Approval Test Items for Rolled Steels

Kinds	Grade	Base metal test													Brittle fracture test		Weldability test						Other Test					
		a	b	c	d	e	f	g	h	i	j	k	l	m	~~m~~ n	~~n~~ o	~~o~~ p	~~p~~ q	~~q~~ r	~~r~~ s	~~s~~ t	u	~~t~~ v	~~u~~ w	~~v~~ x	~~w~~ y	~~x~~ z
Rolled steel for hull	KI-A, KI-B	○	○	○		○		○			○																	
	KI-D	○	○	○		○		○			○	○																
	KI-E	○	○	○		○		○			○	○				○	○	○	○	○								
	KI-A32, KI-A36, KI-A40, KI-D32, KI-D36, KI-D40	○	○	○		○		○			○	○					○	○	○	○								
	KI-E32, KI-E36, KI-E40, KI-F32, KI-F36, KI-F40	○	○	○		○		○			○	○				○	○	○	○	○								
YP47 steels	KI-E47	○	○	○		○		○			○	○			○[7]	○	○	○	○	○	○							
Brittle Crack Arrest Steels	KI-E36, KI-E40	○	○	○		○		○			○	○				○	○	○	○	○								○
	KI-E47	○	○	○		○		○			○	○			○[7]	○	○	○	○	○	○							○
High strength steels for welded structure	Refer to Rules for Materials (Pt.1, Vol.V) Sec.4.D	○	○	○		○		○	○		○	○			○	○	○	○	○	○	○							
Rolled steels for low temp. service	Refer to Rules for Materials (Pt.1, Vol.V) Sec.4.F	○	○	○		○		○	○		○	○			○	○	○	○	○	○								
Rolled steel for boilers	Refer to Rules for Materials (Pt.1, Vol.V) Sec.4.E	○	○	○		○		○	○		○								○				○	○				
Rolled steel for pressure vessels	Refer to Rules for Materials (Pt.1, Vol.V) Sec.4.E	○	○	○		○		○	○		○	○				○			○									
Round bars for chain	KI-K1, KI-K2, KI-K3	○	○	○		○		○	○		○								○									
	KI-R3, KI-R3S, KI-R4, KI-R4S, KI-R5		- [6]																									
Round steels bar for boiler	Refer to Rules for Materials (Pt.1, Vol.V) Sec.9.C	○	○	○		○		○	○		○																	
Rolled and forged steel carbon bars	Refer to Rules for Materials (Pt.1, Vol.V) Sec.6	○	○	○		○		○	○		○																	
Rolled and forged low allow steel bars	Refer to Rules for Materials (Pt.1, Vol.V) Sec.6	○	○	○		○		○	○		○																	
Rolled stainless steels	Refer to Rules for Materials (Pt.1, Vol.V) Sec.4.G	○	○	○		○		○	○		○														○			
Stainless steel clad plates	Refer to Rules for Materials (Pt.1, Vol.V) Sec.4.H	○	○	○	○	○	○	○	○	○	○														○	○		
High manganese austenitic steel plates	Refer to Rules for Materials (Pt.1, Vol.V) Sec.4.M	○	○	○		○		○			○	○		○	○	○	○	○	○	○		○				○			

Table 2.1 Approval Test Items for Rolled Steels *(continued)*

Notes

1. *Where thermo-mechanical controlled processing (TMCP) is performed, tensile test after stress relieving is required in addition to those tests given in table.*
2. *For steel materials with consideration against through thickness properties as specified in Rules for Materials (Pt.1, Vol.V), the tensile test of through thickness direction, microscopic examination for non-metallic inclusions, ultrasonic test are required in addition to those tests given in table.*
3. *For steels other than steel plates, the strain ageing Charpy impact test, NRL drop weight test and CTOD test are not required, unless otherwise specified. However, where cast piece from the continuous casting method is used, the macrostructure of the cast piece and sulphur print test may be required.*
4. *The CTOD test, high temperature tension test and creep test as specified in the Table are performed for the purpose of evaluating low temperature toughness and high temperature characteristics, and these tests may be omitted in case appropriate records prepared by the manufacturer are available or in case BKI deems the test unnecessary.*
5. *Additional tests such as large scale brittle fracture tests (Double Tension test, ESSO test, Deep Notch test, etc.) or other tests may be required when deemed necessary by BKI.*
6. *The approval test items of round bar for offshore chains and accessories are to be in accordance with J.III.*
7. *Instead of CTOD test, deep notch test may be carried out.*
8. *Base metal test is to include corrosion test (general corrosion test, intergranular corrosion test and stress corrosion cracking test). Weldability test is to include micro structure, bend test and corrosion test (general corrosion test, intergranular corrosion test and stress corrosion cracking test).*
9. *Kind of test:*

(a) Chemical analysis	*(b) Sulphur test*	*(c) Micro structure*	*(d) Macro structure*
(e) Ferrite grain size	*(f) Hardness Test*	*(g) Tensile test*	*(h) Bend test*
(i) Shearing strength test	*(j) Charpy impact test*	*(k) Strain charpy impact test*	*(l) Hydrogen embrittlement test*
(m) Fatigue test	*(~~m~~ n) CTOD test*	*(~~n~~ o) NRL drop weight test*	*(~~o~~ p) Weldment tensile test*
(~~p~~ q) Weldment impact test	*(~~q~~ r) Max. Hardness test*	*(~~r~~ s) Macro structure*	*(~~s~~ t) Hydrogen crack test*
(u) Fatigue test	*(~~t~~ v) High temp. Tensile test*	*(~~u~~ w) Creep test*	*(~~v~~ x) Corrosion test*
(~~w~~ y) Ultrasonic test.	*(~~x~~ z) Brittle crack arrest tests*		

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Table 2.2 Test Items and Selection of Test Specimens

Approval test items		Position of the sample (0)	Direction of the test specimens	Approval Testing method	Acceptance criteria
Base metal test	Chemical analysis	T (Top)	-	ASTM A568 or equivalent method. Ladle analysis and production analysis (from the tensile test specimens) are to be performed for C, Si, Mn, P, S and other elements as deemed necessary.	The chemical composition by ladle analysis is to comply with the requirements in Rules for Material (Pt.1, Vol.V) Sec. 4.C Excess difference in the chemical compositions between melt analysis and product analysis is not to be accepted.
	Sulphur print	T	T (Transverse)	ASTM E1180-03 or equivalent method. Length is to be greater than 600 mm (cross section in the case of cast piece)	Segregation, etc., deemed to have negative effect are not to be present
	Microscopic exam. for non-metallic inclusion	T	T	ISO 4967 or equivalent method.	The result ~~Acceptance criteria~~ is to be reported for ~~the~~ reference.
	Macro structure	T	T	ISO 4967 or equivalent method.	
	Micro structure	T	-	Microscopic photographs (approx.100x) of base metal, joining part and cladding metal are to be taken	
	Ferrite grain size	T		ASTM E112 or equivalent method. Magnification of microscopic photographs are to be as a rule 100x.(2)	

Table 2.2 Test Items and Selection of Test Specimens *(continued)*

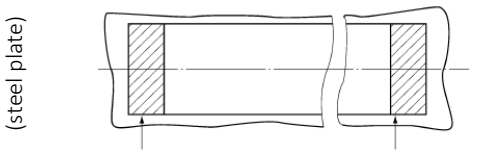
Approval test items		Position of the sample (0)	Direction of the test specimens	Approval Testing method	Acceptance criteria
Base metal test	Hardness test	T	-	In accordance with Rules for Materials (Pt.1, Vol.V). Hardness distribution in the thickness direction is to be measured in the case of stainless clad steel.	To meet the requirements in Rules for Materials (Pt.1, Vol.V). Sec. 6.G, to be as appropriate by BKI.
	Tensile test	T	T(3)	In accordance with Rules for Materials (Pt.1, Vol.V). (4) (5)	To meet the requirements in Rules for Materials (Pt.1, Vol.V). Sec. 4 ~~6.G.~~
		B (Bottom)	T(3)		
	Tensile test of through thickness direction	T	Thickness direction	In accordance with Rules for Materials (Pt.1, Vol.V).	To meet the requirements in Rules for Materials (Pt.1, Vol.V) Sec. 4.
		B			
	Tensile test (stress relieved) (6)	T	T(3)	Tensile test after stress relieving at 600℃ (2 min/mm with minimum 1 hour holding)	The result ~~Acceptance criteria~~ is to be reported for ~~the~~ reference.
		B	T(3)		
	Bend test	B	T	In accordance with Rules for Materials (Pt.1, Vol.V). However, in case of not being prescribed in the Rules , bend test is to be in accordance with recognized national or international standard which BKI considers appropriate.	Defects etc., deemed to have negative effect are not to be present
	V-notch Charpy impact test	T	P (Parallel)	Using R4 test specimen, the transition temperature curve of the absorbed energy and fracture surface ratio is to be determined by testing three pieces at each temperature. (8) (9) (also the lateral expansion to be reported.) Furthermore, the test temperature is to include the temperature as specified in Rules for Materials (Pt.1, Vol.V) and its interval is to be 10~20°C (10) V-notch Charpy impact test specimens for stainless clad steels are to be taken from the base material.	To meet the requirements in Rules for Materials (Pt.1, Vol.V) Sec. 4. Others are the reference.
			T(7)		
		B	P		
	Strain ageing V-notch charpy impact test	T	P	Same as V-notch Charpy impact test. However The test specimens which have been maintained for one hour at 250°C after strain of 5 % have been applied is, as a rule, to be used. (8) (9) (11)	The result ~~Acceptance criteria~~ is to be reported for ~~the~~ reference.
	Fatigue Test	T	T	S-N fatigue test is to be In accordance with ASTM E466:2015 or other equivalent method. The test temperature is room temperature.	The S-N curve should be established and the result should be equal or better than the FAT125-curve in International Institute of Welding (IIW).
		T	-	Fatigue crack growth rate test is to be In accordance with ASTM E647:2015 or other equivalent method. The test temperature is room temperature.	The result is to be reported for reference
Brittle fractu-re test	CTOD test	T	P	BS 7448 or equivalent. To be consulted with BKI the dimension of test specimen, test condition, etc., when newly performing tests at the time of approval.	The result ~~Acceptance criteria~~ is to be reported for ~~the~~ reference.
	NRL drop weight test	T	P(7)	ASTM E 208 or equivalent method. The NDTT (Non-Ductility transition temperature) is to be determined and photographs of the tested specimens are to be taken and enclosed with the test report.	The result ~~Acceptance criteria~~ is to be reported for ~~the~~ reference However no fracture to be occurred at the impact test temperature specified in the Rules for Materials (Pt.1, Vol.V) Sec. 4.

Table 2.2 Test Items and Selection of Test Specimens *(continued)*

Approval test items		Position of the sample	Direction of the test specimens	Approval Testing method	Acceptance criteria
Weld-ability test	Weldment tensile test	T	T (to the welding direction)	in accordance with the test method described in B.I.3.3	in accordance with the test method described in B.I.3.3
	Weldment impact test	T			
	Maximum hardness test	T	-		
	Macro structure	T	-		
	Fatigue Test	T	T	S-N fatigue test is to be In accordance with ASTM E466:2015 or other equivalent method. The test temperature is room temperature.	The S-N curve should be established and the result should be equal or better than the FAT90-curve in IIW.
		T	-	Fatigue crack growth rate test is to be In accordance with ASTM E647:2015 or other equivalent method. The test temperature is room temperature.	The result is to be reported for reference
High temp. Charac teristic s tests	High temp. Tensile test	T	P	ASTM A 572 (High temp. tensile test), To be consulted with BKI on the dimension of test specimen, test condition etc., when newly performing tests at the time of Approval.	The result ~~Acceptance criteria~~ is to be reported for ~~the~~ reference.
Corrosi on resista nce test	Corrosion test	T	-	Corrosion resistance accordance with Rules for Material (Pt.1, Vol.V) Annex 3 or equivalent method.	The result ~~Acceptance criteria~~ is to be reported for ~~the~~ reference.
				For high manganese austenitic steel, general corrosion test shall be carried out in accordance with ASTM NACE/ASTM G31-21 or equivalent method. Intergranular corrosion test shall follow ASTM A262 or equivalent method and stress corrosion cracking test shall be lined with ASTM G36 and ASTM G123 or equivalent method.	The result is to be reported for reference.
Non-destru ctive test	Ultrasonic test	T	-	NDT accordance with Rules for Material (Pt.1, Vol.V) Sec. 3. or equivalent method.	Acceptance criteria is the reference.

Notes

(0) The followings can be shown the example of the poison (Top and Bottom) where the test samples are detached



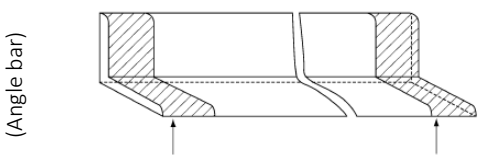


Table 2.2 Test Items and Selection of Test Specimens *(continued)*

(1) For rolled steels for hull, the content of the following elements is to be checked: *C, Mn, Si, P, S, Ni, Cr, Mo, Al, N, Nb, V, Cu, As, Sn, Ti* and, for steel manufactured from electric or open-hearth furnace, *Sb* and *B*.

(2) For thick products in general at least three examinations are to be made at surface, one quarter and mid-thickness of the product.

(3) Longitudinal direction for sections and plates having width less than 600 mm.

(4) In case of tensile test specimens of bar steels taken from steels over 40 mm in thickness, test specimens are to be taken at the middle of thickness and in accordance with the requirements of Rules for Materials (Pt.1, Vol.V).

(5) For plates made from hot rolled strip one additional tensile specimen is to be taken from the middle of the strip constituting the coil.

(6) Only for TMCP steels, or when deemed necessary by BKI.

(7) Not required for sections and plates having width less than 600 mm.

(8) For plates made from hot rolled strip one additional set of impact specimens is to be taken from the middle of the strip constituting the coil.

(9) For plates having thickness higher than 40 mm one additional set of impact specimens is to be taken with the axis located at mid-thickness.

(10) Impact test temperature of hull steels are as bellows:

Grade	Direction	Test temperature (˚C)			
KI-A, KI-B, KI- KI-A 32, KI-KI-A 36, KI- KI-A 40	Longitudinal	+20	0	-20	-
KI-D, KI- KI-D 32, KI-D 36, KI-D 40		0	-20	-40	-
E, KI-E 32, KI-E 36, KI-E 40		0	-20	-40	-60
KI-F 32, KI-F 36, KI-F 40		-20	-40	-60	-80
KI-A, KI-B, KI-A 32, KI-A 36, KI-A 40	Transverse	+20	0	-20	-
KI-D, KI-D 32, KI-D 36, KI-D 40		0	-20	-40	-
E, KI-E 32, KI-E 36, KI-E 40		-20	-40	-60	-
KI-F 32, KI-F 36, KI-F 40		-40	-60	-80	-

(11) Strain ageing charpy impact test temperature of hull steels are as bellows:

Grades	Test temperature (˚C)		
KI-A 32, KI-A 36, KI-A 40	+20	0	-20
KI-D, KI-D 32, KI-D 36, KI-D 40	0	-20	-40
E, KI-E 32, KI-E 36, KI-E 40	-20	-40	-60
KI-F 32, KI-F 36, KI-F 40	-40	-60	-80

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Table 2.3 Weldability test Items, test methods and acceptance criteria

Test items	Direction of the test specimens	Test method	Acceptance Criteria
Tensile test	T (Transverse)	Rules for Welding (Pt.1, Vol.VI) Sec. 11 ~~Materials (Pt.1, Vol.V)~~.	To meet the requirements of the Rules for Materials (Pt.1, Vol.V). Sec. 4 ~~6.G~~
Charpy V-notch Impact test	T	A set of 3 Charpy V-notch impact specimens transverse to the weld with the notch located at the fusion line and at a distance 2, 5 and minimum 20 mm from the fusion line. The fusion boundary is to be identified by etching the specimens with a suitable reagent.	To meet the requirements in Rules for Materials (Pt.1, Vol.V). Sec. 4.B. Table 4.7
Maximum hardness tests	-	Hardness tests ~~Hu~~ *HV* 5 across the weldment. The indentations are to be made along a 1 mm transverse line beneath the plate surface on both the face side and the root side of the weld as follows: Fusion line HAZ: at each 0,7 mm from fusion line into unaffected base material (6 to 7 minimum measurements for each HAZ)	The maximum hardness value should not be higher than 350 ~~Hu~~ *HV*
Macro structure tests	T	A sketch of the weld joint depicting groove dimensions, number of passes, hardness indentations should be attached to the test report together with photo-macrographs of the weld cross section.	To be free from crack, incomplete penetration, lack of fusion, other harmful defects

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VIII. High Manganese Austenitic Steels

1. Application

The requirements in this sub-section apply to tests and inspection for the approval of manufacturing process of high manganese austenitic steels as specified in Rules for Materials (Pt.1, Vol.V) Sec. 4.M.

2. Documents to be submitted

The following reference documents in addition to those specified in A.2 and B.I.2 are to be submitted to BKI.

1) Type of products delivery condition, range of thickness and aim material properties as follows:
   A) Range of chemical composition, aim analyses and associated control limits, including grain refining, micro alloying and residual elements; if the range of chemical composition depends on thickness and delivery condition, the different ranges are to be specified, as appropriate.
   B) Production statistics of the chemical composition and mechanical properties (R_{eH}, R_m, A% and CVN). The statistics are intended to demonstrate the capability to manufacture the steel products in accordance with the requirements.

3) Reheating and rolling
   A) Description of the rolling process
   B) Control standard for typical rolling parameters used for the different thickness and steel(temperature and thickness at the beginning and at the end of the passes, interval between passes, reduction ratio, temperature range and cooling speed of accelerated cooling, if any) and relevant method of control
   C) Calibration of the control equipment
4) Heat treatment
   A) Description of the heat treatment applied
   B) Control standard of the heat treatment used for the different thickness and steel(including the temperature, holding time, cooling rate, etc.) and the relevant method of cooling
5) Where any part of the manufacturing process is assigned to other companies or other manufacturing plants, additional information required by BKI should be included.
6) Approval already granted by other Classification Societies and documentation of approval tests performed.
7) Technical documents demonstrating that the percent of the ductile fracture surface at 196°C is 100% by fractography (SEM).

3. Approval tests

3.1 Extent of the approval test

The extent of the test program is specified in B.I; it may be modified based on the preliminary information submitted by the manufacturer.

In particular, a reduction of the indicated number of casts, steel plate thickness to be tested or complete suppression of the approval tests may be accepted by BKI taking into account:

1) Approval already granted by other Classification Societies and documentation of approval tests performed
2) Steel to be approved and where available the long term statistical results of chemical and mechanical properties

An increase of the number of casts and thickness to be tested may be required in the case of newly developed types of steels or manufacturing processes.

In case of multi-source slabs or changing of slab manufacturer, the rolled steel manufacturer is required to obtain the approval of the manufacturing process of rolled steels using the slabs from each slab manufacturer and to conduct approval tests in accordance with B.I. A reduction or complete suppression of the approval tests may be considered by BKI taking into account previous approval as follows:

1) The rolled steel manufacturer has already been approved for the rolling process and heat treatment using approved other semi-finished products characterized by the same thickness, steel grade, grain refining and micro-alloying elements, steel making and casting process;
2) The semi-finished products have been approved for the complete manufacturing process with the same conditions (steelmaking, casting, rolling and heat treatment) for the same steel types.

3.2 Approval test program

Where the number of test differs from those shown in B.I, the program shall be confirmed by BKI before the tests are carried out.

3.3 Approval survey

The approval tests may be carried out in the presence of the surveyor at the manufacturer's plant and the execution of the plant inspection in operation may be required by the surveyor during the visit for the approval.

If the testing facilities are not available at the works, the tests are to be carried out at recognized laboratories.

3.4 Selection of the test product

For each manufacturing process(e.g. steel making, casting, rolling and condition of supply), one test product with the maximum thickness to be approved is in general to be selected. In addition, for initial approval, BKI requires selection of two test plate of average thickness.

3.5 Position of the test samples and specimens

The test samples are to be taken from the plate corresponding to the top of the ingot, unless otherwise agreed.

In the case of continuous castings, test samples are to be taken from the plates corresponding to the head and/or the end of the whole casting.

The location of the test sample in width of the product shall be in compliance with Rules for Materials (Pt.1, Vol.V) Fig. 4.1.

The position of the samples to be taken in the length of the rolled product, "piece"(top and/or bottom of the piece) and the direction of the test specimens with respect to the final direction of rolling of the material are indicated in Table 2.2.

3.6 Tests on base material

3.6.1 Type of tests

The tests to be carried out are indicated in the Table 2.1. BKI may require the additional tests to verify the relevant characteristics of high manganese austenitic steels compared with those of the conventional materials applied to cryogenic service.

3.6.2 Test specimens and testing procedure

The test specimens and testing procedures are to be, as a rule, in accordance with the requirements given in Table 2,2, the following applies:

1) Tensile test
   - Tensile tests are to be carried out at room temperature and -165°C.
   - Result of tensile tests at -165°C should be reported for reference.
   - Tensile tests should be carried out with specimen of full thickness.
2) Impact test on non-aged specimens
   - The Charpy V-notch impact test temperature should include -196°C at least.
   - In addition to the determination of the energy value, the lateral expansion and the percentage crystallinity are also to be reported. The percentage of the ductile fracture surface at -196°C should be 100% by fractography (SEM).

– Additionally at each location, Charpy V-notch impact tests are to be carried out with appropriate temperature intervals(-196°C, -165°C, -100°C and -65°C) to verify the properties of toughness at each temperature for reference.

3) Impact test on strain aged specimens
   – The Charpy V-notch impact test temperature should include -196°C at least.
4) Drop weight test
   – Two specimens for drop weight test are to be taken from the surface of one test sample.
   – The test temperature is -196°C.
5) Micro examination
   – All micrographs are to be taken at ×100 magnification and where austenite grain size exceeds ASTM E112-2013 index 10 or equivalent, additionally at ×500 magnification.
   – The austenite grain size should be measured and the non-metallic inclusions are to be examined.
   – The micrographs are to be representative of the full thickness.
6) CTOD test
   – One set of three CTOD specimens is required for each test.
   – CTOD minimum value should be in accordance with design specification for testing at room and cryogenic temperatures as per design conditions. As a guidance, a minimum CTOD value of 0.2mm is often required.

3.6.3 Other tests

Additional test such as large scale brittle fracture tests(Double tension test, ESSO test, Deep notch test, etc.) or other tests may be required in the case of newly developed type of steel, when deemed necessary by BKI.

3.7 Weldability Test

3.7.1 General

Weldability tests are required for plates and are to be carried out on samples of the thickest plate.

3.7.2 Preparation and welding of the test assemblies

.1 In general, the following test assembles are to be prepared.

– One butt weld test assembly welded with a heat input 15kJ/cm ±10%.
– One butt weld test assembly welded with a heat input 30kJ/cm ±10%.
– Where steel is required to be approved for heat input levels higher than 30kJ/cm, the maximum heat input to be approved should be used for the test assembly in agreement with BKI.

.2 The butt weld test assemblies are to be prepared with the weld seam longitudinal to the plate rolling direction, so that impact specimens will result in the transverse direction. The bevel preparation should be preferably single or double V groove or double bevel upon the test assembly thickness. The welding procedure should be as far as possible in accordance with the normal welding practice used at the yards for the type of steel in question.

.3 The welding parameters including welding process, consumables designation and diameter, preheating temperature, interpass temperature, heat input, number of passes, etc. are to be reported. The maximum approved heat input level may be specified on the approval certificate.

3.7.3 Type of tests

The tests to be carried out are indicated in the following Table 2.1. Test methods and acceptance criteria are to be as given in Table 2.6A. BKI may require the additional tests to verify the relevant characteristics of high manganese austenitic steels compared with those of the conventional materials applied to cryogenic service.

Table 2.6A Weldability test Items, test methods and acceptance criteria

Test items	Position of the sample	Direction of the test specimens	Test method and procedure	Acceptance criteria
Tensile test	Top	T (Transverse to the weld)	Two tensile test specimens are to be taken from one test assembly according to Rules for Welding (Pt.1, Vol.VI) Sec. 11. Tensile tests are to be carried out at room temperature and -165°C. Tensile tests should be carried out with specimen of full thickness.	Result of the tests at room temperature shall meet Table 2.6B and at -165°C shall be reported for reference.
Charpy V-notch Impact test	Top	T	A set of 3 Charpy V-notch impact specimens with the notch located at the weld metal (WM), fusion line (FL), and at a distance 1, 3 and 5 mm from the fusion line. The fusion boundary is to be identified by etching the specimens with a suitable reagent. The test are to be carried out at temperatures -196°C, -165°C, -100°C, 0°C.	Result of the tests at temperature -196 °C shall meet Table 2.6B and at other temperature shall be reported for reference.
Hardness tests	Top	-	Hardness tests *HV* 10 across the weldment. The indentations are to be made along a 1-2 mm transverse line beneath the plate surface on both the face side and the root side of the weld as follows: • Fusion line • HAZ: at each 0,7 mm from fusion line into unaffected base material (6 to 7 minimum measurements for each HAZ) A sketch of the weld joint depicting groove dimensions, number of passes, hardness indentations shall be attached to the test report together with photo-macrographs of the weld cross section.	The result is to be reported for reference.
Micro structure examination	Top	-	The micrographs are to be representative of the full thickness. Three examinations are to be made at surface, one quarter and mid-thickness of the product. All micrographs are to be taken at ×100 magnification and where austenite grain size exceeds ASTM E112-2013 index 10 or equivalent, additionally at × 500 magnification. The austenite grain size shall be measured and the non-metallic inclusions are to be examined.	The result including metallurgical phases is to be reported for reference.
Macro structure examination	Top	-	One macroscopic photograph shall be representative of transverse section of the welded joint	To be free from crack, incomplete penetration, lack of fusion, other harmful defects

Table 2.6A Weldability test Items, test methods and acceptance criteria *(continued)*

Test items	Position of the sample	Direction of the test specimens	Test method and procedure	Acceptance criteria
Bending Test	Top	L	Atest specimens are to be taken from the test assembly and bent on a mandrel with diameter of four times thickness specimen thickness. Bending angle is to be at least 180°. Test specimens are to comply with the requirements of ISO 5173.	The test specimens shall not reveal any fracture.
CTOD	Top	T	CTOD test for three specimens for each condition shall be carried out in accordance with ISO 15653:2018, ASTM E1820:2020, or equivalent method, at a position of coarse grained heat affected zone (CGHAZ). Additional set of CTOD tests with notch positions such as FL+1, FL+3, FL+5 may be required.	CTOD minimum value shall be in accordance with design specification for testing at room and cryogenic temperatures as per design conditions. As a guidance, a minimum CTOD value of 0,2 mm is often required.
Fatigue Test	Top	T	S-N fatigue test is to be In accordance with ASTM E466:2015 or other equivalent method. The test temperature is room temperature.	The S-N curve should be established and the result should be equal or better than the FAT90-curve in IIW.
	Top	-	Fatigue crack growth rate test is to be In accordance with ASTM E647:2015 or other equivalent method. Notch in test specimen should be parallel with welding seam. The test temperature is room temperature.	The result is to be reported for reference
Corrosion Test	Top	-	• General corrosion test shall comply with ASTM G31-21 or equivalent method. • Intergranular corrosion test shall comply with ASTM A262 or equivalent method.	The result is to be reported for reference.
		T	• Stress corrosion cracking test shall comply with ASTM G36 or equivalent method, and the test specimen shall comply with ASTM G58: 2015 or equivalent.	

Table 2.6B Mechanical properties for butt weld tests

Tensile Strength (N/mm2)	Elongation % at 5.65 $\sqrt{S_0}$	Charpy Impact Energy, Average	
		Test Temp (°C)	Average Energy (J)
≥660	≥22.0	-196	≥27

4. Results

All the results, which are in any case to comply with the requirements, are evaluated for the approval.

The manufacturer shall submit all the results of the test together with manufacturing records relevant to steel making, casting, rolling and heat treatment of the test products.

---------- *end* ----------

Section 3 Type Approval

I. Crankcase Explosion Relief Valves

4. Recognized standards

- ISO 16852:2016 – Flame arresters - Performance requirements, test methods and limits for use
- ISO 12100:2010 – Safety of machinery - General principles for design - Risk assessment and risk reduction
- VDI 3673-1:2002 – Pressure Venting of Dust Explosions
- IMO MSC/Circ.677 as amended by MSC/Circ.1009 and MSC.1/Circ.1324

(IACS UR M66)

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U. Cable Laying

3. Type tests

3.3 Non-metallic cable trays/protective casings

The type tests for cable trays/protective casings made of plastics materials are, according to the purpose and kind, to be carried out in accordance with the requirements given in Table 3.33.

Table 3.33 Type tests for cable trays/ protective casings made of plastics materials

Test item	Approval test method and acceptance criteria
Impact Resistance Test	The test should be performed according to ~~IEC 60082-2~~ IEC 60068-75:2014 using the pendulum hammer. (a) The test should be carried out on samples of cable tray lengths or cable ladder lengths of 250 mm ± 5 mm long. Samples of ladder should consist of two side-members with one rung positioned centrally. Samples of mesh trays should be prepared in such a way that there will be a wire in the centre. (b) Before the test, plastics components should be aged at a temperature of 90°C ± 2°C for 240 h continuously. (c) The samples should be mounted on wooden fibreboard of thickness 20 mm ± 2 mm. (d) The samples to be tested should be placed in a refrigerator, the temperature within which is maintained at the declared temperature below with a tolerance of ±2°C. -25°C to 90°C for outdoor use + 5°C to 90°C for indoor use. Consideration will be given to the use of plastics cable trays/protective casings in the cold environment where the ambient temperature is below -25°C provided the mechanical properties of the plastics can be maintained for the intended purpose and the installation location. In this particular instance, the cold bend and cold impact properties of the material should also be considered.

Table 3.33 Type tests for cable trays/ protective casings made of plastics materials *(continued)*

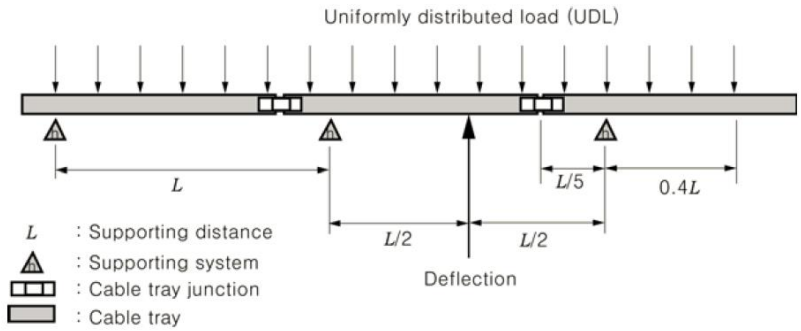
<table>
<tr><th colspan="2">Test item</th><th>Approval test method and acceptance criteria</th></tr>
<tr><td colspan="2">Impact Resistance Test</td><td>(e) After 2 h, the samples should, in turn, be removed from the refrigerator and immediately placed in the test apparatus.
(f) At 10 s ± 1 s after removal of each sample from the refrigerator the hammer should be allowed to fall with impact energy, mass of the hammer and fall height as bellows:
<table><tr><th>Approximate energy(J)</th><th>Mass of hammer (kg)</th><th>Fall height(mm)</th></tr><tr><td>10</td><td>5.0</td><td>200 ± 2</td></tr></table>
(g) The impact should be applied to the base, or the rung, in the first sample, to one of the side members in the second sample, and to the other side member in the third sample. In each case, the impact should be applied to the centre of the face being tested.
(h) After the test, the samples should show no signs of disintegration and/or deformation that will impair the safety.</td></tr>
<tr><td rowspan="3">Safe Working Load (SWL) Test</td><td>Application</td><td>Tests should be carried out for the smallest and largest sizes of cable trays lengths or cable ladder lengths, having the same material, joint and topological shape.</td></tr>
<tr><td>Test temperature</td><td>Cable trays/protective casings and joints should be tested at the declared temperatures according to (d) of impact resistance test above. Alternatively, tests can be carried out:
(a) at any temperature within the declared range if documentation is available which states that the relevant structural properties of the materials as used within the system do not differ by more than 5% of the average between the maximum and minimum property values, or,
(b) only at maximum temperature within the range, if documentation is available, which states that the relevant structural properties of the materials, as used within the system decrease when the temperature is increasing, or
(c) at maximum and minimum temperature only.</td></tr>
<tr><td>Test loads</td><td>All loads should be uniformly distributed (UDL) over the length and width of the samples as shown in Fig 3.12. The loads should be applied in such a way that a UDL is ensured even in the case of extreme deformation of the samples.
 

Fig 3.12 UDL applying method (IEC 61537:2006)</td></tr>
</table>

Table 3.33 Type tests for cable trays/ protective casings made of plastics materials *(continued)*

Test item		Approval test method and acceptance criteria
Safe Working Load (SWL) Test	Load test	(a) To allow for settlement of the samples, a pre-load of 10% of the test load unless otherwise specified, should be applied and held for at least 5 min, after which the measurement apparatus should be calibrated to zero. (b) The load should then be gradually increased evenly longitudinally and transversely up to the test load continuously or when a continuous increase is impractical, the load may be increased by increments. These increments should not exceed about a quarter of the safe working load. The load increments should be distributed through the load plates longitudinally and transversely as evenly as is practical. (c) After loading, the deflection should be measured at the points specified to give a practical mid-span deflection. (refer to Fig 3.12) The samples should be left, and the deflections measured every 5 minutes until the difference between two consecutive sets of readings is less than 2 % with regard to the first set of the two consecutive sets of readings. The first set of readings measured at this point is the set of deflections measured at the test load. (d) The maximum deflection should not exceed L/100 where L is the distance between the supports. (refer to Fig 3.12) (e) When subject to the test load the samples, their joints and internal fixing devices, should show no damage or crack visible to normal view or corrected vision without magnification
	Breaking test	(a) The load should then be increased to 1,7 times the test load. (b) The samples should be left, and the deflections measured every 5 min until the difference between two consecutive sets of readings is less than 2 % with regard to the first set of the two consecutive sets of readings. (refer to Fig 3.5) (c) The samples should sustain the increased loading without collapsing. Buckling and deformation of the samples is permissible at this loading.
Flame Retardant Test		The cable trays/protective casings should be at least flame retardant. They should be tested in accordance with Table 3.43 of Y.4. of this Guidance.
Smoke and Toxicity Test		The cable tray/protective casings should be tested in accordance with Y.4.4 of this Guidance, or any international or national standard.
Resistivity Test		(a) Cable trays/protective casings passing through a hazardous area should be electrically conductive. The cable tray/protective casings should be tested in accordance with ~~IEC 60093~~ IEC 626313-1:2016 and IEC 62631-3-2:2015. (b) The volume resistivity level of the cable trays/protective casings and fittings should be below 10^5 ohm meter [Ωm] and the surface resistivity should be below 10^6 ohm [Ω]. The resistance to earth from any point in these appliances should not exceed 10^6 ohm [Ω].