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An American National Standard

Standard Guide for Steel Hull Construction Tolerances [Metric][1]

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1. Scope

1.1 This guide outlines permissible deviations and distortions in new construction of steel hulls, in accordance with good fit criteria and strength requirements.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Terminology

2.1 *Definitions:*

2.1.1 *standard range*—level of construction accuracy that is normally expected to be achieved using conventional shipbuilding practice.

2.1.2 *tolerance limits*—construction tolerance range within which no corrective action need be taken.

3. Application

3.1 Table 1, appearing as Fig. 1, Fig. 2, Fig. 3, Fig. 4, and Fig. 5, is to be used as a guide in determining permissible deviations, distortions, unfairness, and construction inaccuracies in principal strength members in new construction of steel hulls. The principal strength members include longitudinal strength members within the 0.4 length amidships, as well as other structurally critical hull members. This guide is intended for use with ordinary strength steels.

4. Corrective Action

4.1 Construction inaccuracies falling outside the standard range but within the tolerance limits require no corrective action with respect to the element in question. However, if such inaccuracies are encountered frequently it may indicate that process controls should be reviewed and possibly tightened.

4.2 Construction inaccuracies falling outside the tolerance limits in principal strength members may cause problems in service or may lead to excessive costs at subsequent stages of construction, and may require corrective action. Deviations exceeding the tolerance limits may be considered on a case by case basis, depending on location and extent of the deviation, and the intended service and criticality of the affected element.

4.3 Standard corrective action will be indicated in this guide where appropriate. In other cases appropriate corrective actions may depend on circumstances. (See also Fig. 6 and Fig. 7.)

5. Keywords

5.1 construction tolerances; fit criteria; hull construction; steel hull; strength requirements; tolerance limits

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Legend:

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B Fabrication and Forming
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  - B-1.2 Height of longitudinal
  - B-1.3 Angle between flange and web
  - B-1.4 Straightness in the plane of the flange
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- B-2 *Flanged Bracket:*
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- B-3 *Built-Up Sections:*
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- B-4 *Plates:*
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C Alignment and Fitting
- C-1 *Fitting Accuracy:*
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  - C-1.3 Gap between beam and frame
  - C-1.4 Lap joint
  - C-1.5 Alignment of butt joint
- C-2 *Openings or entrances:*
  - C-2.1 Steel door opening (watertight)

D Distortion and fairness
- D-1 *Fairness:*
  - D-1.1 General fairness of plating
  - D-1.1.1 Fig. 1
  - D-1.1.2 Fig. 2
- D-2 *Distortion of Hull Form:*
  - D-2.1 Flatness of Keel
- D-3 *Miscellaneous:*
  - D-3.1 Permissible distortion of beams, frames, girders and stiffeners
  - D-3.2 Permissible warping
  - D-3.3 Distortion of H pillar between decks
  - D-3.4 Distortion of tripping bracket and small stiffener bracket without faceplate

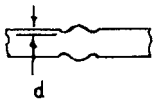
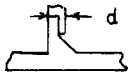
A. Welding		
A-1 Shape of Bead	Tolerance Limits, mm (in.)	Corrective Action
A-1.1 Undercut (butt weld) 	d = 0.8 (1/32) NOTE—Continuous undercut in thin members (≤12.5 mm (½ in.)) may require special consideration to assure adequate net section.	Repair using small electrode to fill in undercut.
A-1.2 Undercut (fillet weld) 	d = 0.8 (1/32) NOTE—Continuous undercut in thin members (≤12.5 mm (½ in.)) may require special consideration to assure adequate net section.	Repair using small electrode to fill in undercut.

FIG. 1 Hull Construction Tolerances

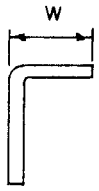
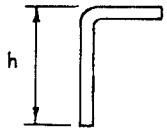
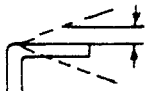
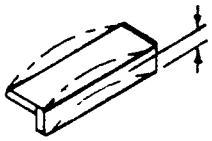
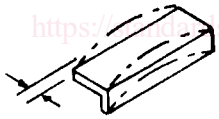
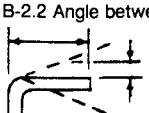
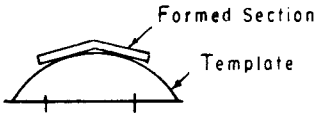
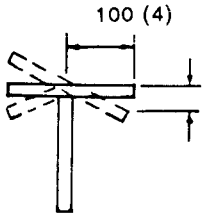
B. Fabrication and Forming			
B-1 Flanged Plate Longitudinal	Standard Range, mm (in.)	Tolerance Limits, mm (in.)	Corrective Action
B-1.1 Breadth of flange 	±3 (⅛)	+6 (¼) −5 (3⁄16)	Trim to correct width. or Build up with weld, not to exceed thickness/2.
B-1.2 Height of longitudinal 	±3 (⅛)	+6 (¼) −5 (3⁄16)	
B-1.3 Angle between flange and web  Compare with template to determine deviation over 100 (4) breadth of flange.	±3 (⅛) (3/100)	±5 (3⁄16) (5/100)	
B-1.4  Sweep in 10 (400) of length.	±10 (⅜)	±25 (1)	
B-1.5 Straightness in the plane of the web (strong plane)  Camber in 10 (400) of length.	±10 (⅜)	±25 (1)	
B-2 Flanged bracket			
B-2.1 Breadth of flange 	±3 (⅛)	+6 (¼) −5 (3⁄16)	Trim to correct size. or Build up with weld, not to exceed thickness/2
B-2.2 Angle between flange and web  Compare with template to determine deviation over 100 (4) breadth of flange.	±3 (⅛) (3/100)	±5 (3⁄16) (5/100)	
B-3 Built-Up Sections			
B-3.1 Frame and longitudinals			
B-3.1.1. Deviation from design curvature compared with template or check line per 10 m (400 in.) length.	±10 (⅜)	±25 (1)	

FIG. 2 Hull Construction Tolerances *Continued*

B. Fabrication and Forming—*Continued*			
B-1 Flanged Plate Longitudinal	Standard Range, mm (in.)	Tolerance Limits, mm (in.)	Corrective Action
B-3.1.2. Gap between template and formed section.	3 (1/8)	5 (3/16)	
			
B-3.1.3. Angular deviation or distortion of face plate, per 4 width (100).	±3 (1/8)	±5 (3/16)	
			

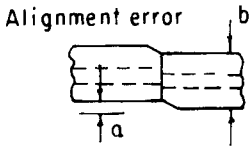
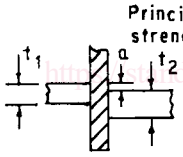
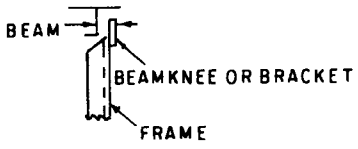
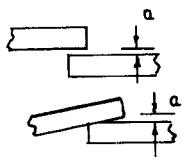
C. Alignment and Fitting			
C-1 Fitting Accuracy	Standard Range, mm (in.)	Tolerance Limits, mm (in.)	Corrective Action
C-1.1 Flange in tee longitudinals		$a \le 0.04b$ max 8 (5/16)	Refit if tolerance limit is exceeded.
 Vertical alignment of flanges and alignment of webs must meet standard for butt joints. (C-1.5)			Plate to be released for distance of 50*a*.
C-1.2 Alignment of intercostal joint		$a \le 1/3\ t_1$	Refit if *a* exceeds tolerance limit.
 a = OFFSET t = THICKNESS $t_1 \le t_2$ Other strength members			Plate to be released for distance of 50*a*.
		$a \le 1/2t_1$	Refit if *a* exceeds tolerance limit.
C-1.3. Gap between beam and frame	3 (1/8)	5 (3/16)	*a* > 5 (3/16), disconnect either frame or beam for length of 50(*a*) and reweld. (Gaps less than 5 (3/16) are to be pulled together before welding.)
 a = gap before forcing to fit.			
C-1.4. Lap	2 (1/16)	3 (1/8)	1. 3 (1/8) ≤ *a* ≤ 5 (3/16) Increase weld lag length by amount *a*. 2. *a* > 5 (3/16) refit.
			

FIG. 3 Hull Construction Tolerances *Continued*