INTERNATIONAL STANDARD

ISO
13795

Ships and marine technology — Ship's mooring and towing fittings — Welded steel bollards for sea-going vessels

Navires et technologie maritime — Corps-morts et ferrures de remorquage de navires — Bittes d'amarrage en acier soudées pour navires de haute mer

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Foreword

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ISO 13795 was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 4, *Outfitting and deck machinery*.

Introduction

A bollard is a type of ship's mooring and towing fitting installed on board to belay the mooring and towing rope.

Ships and marine technology — Ship's mooring and towing fittings — Welded steel bollards for sea-going vessels

1 Scope

This International Standard specifies the design, size and technical requirements for welded steel bollards suitable for installation on sea-going vessels to meet normal mooring and towing requirements.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IMO Circular MSC/Circ.1175, *Guidance on shipboard towing and mooring equipment*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
safe working load
SWL
maximum load in kN on the rope that should normally be applied in service conditions

3.2
TOW
maximum load on the rope applied to a bollard subjected to tug boat pull by using an eye splice at the end of the towing rope to connect to the bollard

4 Classification

4.1 Type

Depending on the construction, welded steel bollards shall be classified as the following two types:

— Type A – with compact base plate;

— Type B – with wide base plate.

4.2 Nominal sizes

The nominal sizes, D_n, of bollards are denoted by reference to the outside diameter of the post, in millimetres, in terms of the nearest number drawn from a basic series of preferred numbers. For the bollards having the same post diameter, the nominal size is followed by an alphabetical character for the different SWL.

The nominal sizes are: 150, 200, 250A, 250B, 300A, 300B, 350A, 350B, 400A, 400B, 450A, 450B, 500A, 500B, 550A, 550B and 600.

5 Dimensions

Bollards have dimensions and particulars in accordance with Tables 1 and 2, and Figures 1 and 2.

6   Materials

The materials of the following components shall be used for manufacturing the bollards:

— Plates: weldable steel plates having a yield point of not less than 235 N/mm^2.

— Post tubes: weldable steel plates having a yield point of not less than 235 N/mm^2 or equivalent steel tubes.

7   Construction

7.1   The posts of the bollards shall be constructed from steel tubes or formed from plate.

7.2   The fins shall be installed to keep the ropes as low as possible so as to reduce the loads to the bollard posts from the mooring/towing ropes.

7.3   The eye plate for tying the stopping-off rope or chain shall be provided.

8   Manufacturing and inspection

8.1   All surfaces of the bollards including welding shall be free from any visible flaws or imperfections.

8.2   All surfaces in contact with the ropes shall be free from surface roughness or irregularities likely to cause damage to the ropes by abrasion.

8.3   The bollards shall be coated externally with an anti-corrosion protective finish.

8.4   A low-friction surface coating is not recommended so as to increase the holding force of the mooring ropes under figure-of-eight belay.

9   Marking

9.1 The safe working load (SWL) intended for the use of the bollards shall be noted in the towing and mooring plan available on board for the guidance of the shipmaster as specified in MSC/Circ.1175.

9.2 The actual SWL on board shall be determined by considering the under deck reinforcement, and it shall be marked on the towing and mooring plan. The actual SWL shall not be over the SWL indicated in this International Standard.

9.3 The bollards shall be clearly marked with their SWL by weld bead or equivalent. The SWL shall be expressed in tonnes (letter 't') and be placed so that it is not obscured during operation of the fitting.

9.4   In case the bollard is used both for mooring and towing, the marking shall be provided as below:

Both SWLs for mooring and towing purposes shall be marked.

EXAMPLE 1   SWL XXX t

EXAMPLE 2   TOW XXX t
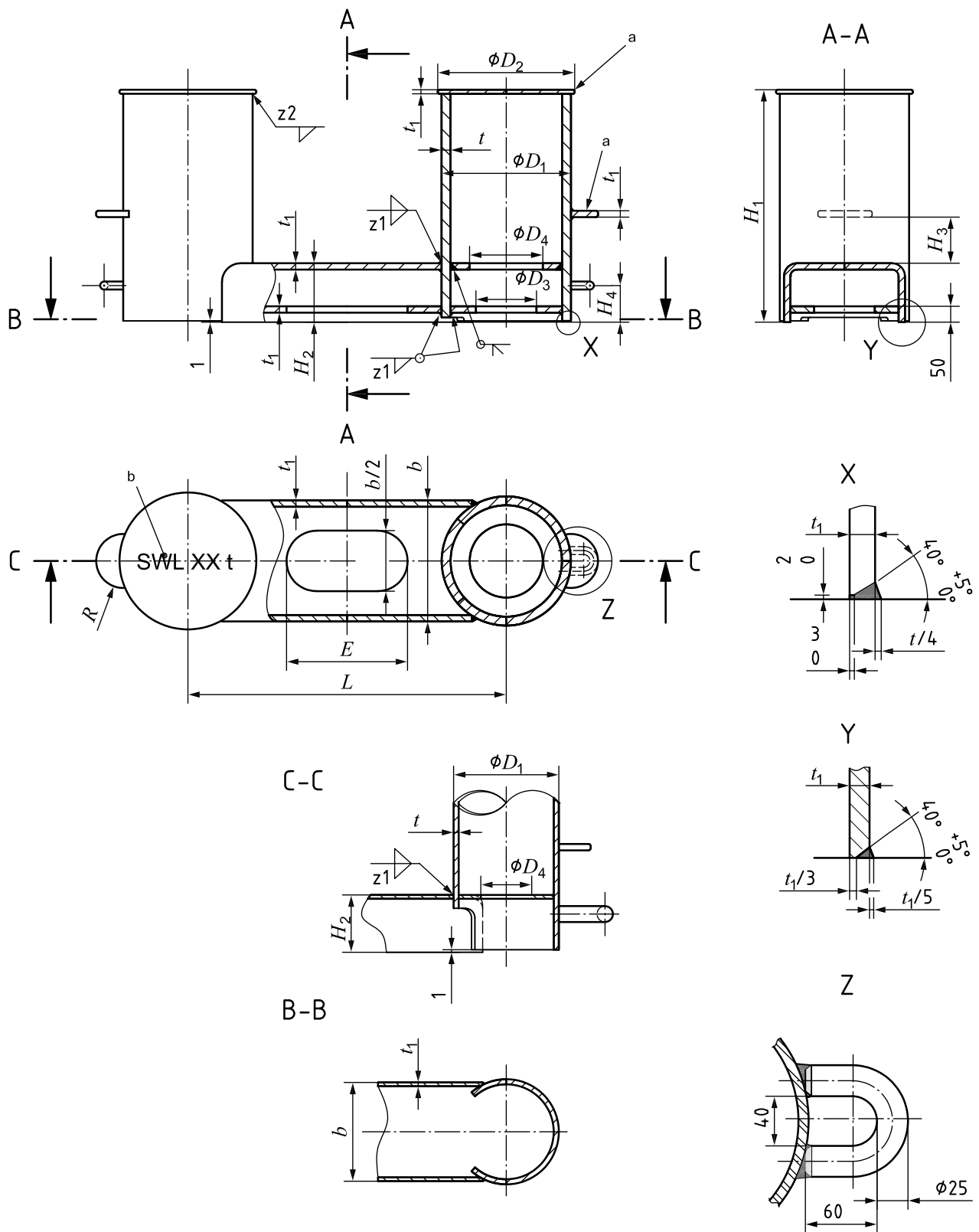
Dimensions in millimetres

Key

a   Edges smooth grinding.

b   SWL marking.

Figure 1 — Type A (for nominal sizes 150, 200, 250A and 250B)

Table 1 — Dimensions and SWL for Type A bollards

Dimensions in millimetres

Nominal size D_n	D_1	D_2	D_3	D_4	H_1	H_2	H_3	H_4	b	L	E	t	t_1	t_2	R
150	165,2	185	-	80	330	90	70	60	155	400	-	8,0	6	6	40
200	216,3	240	-	130	395	115	70	60	205	500	-	8,0	6	6	50
250A	267,4	290	-	160	505	135	90	75	250	630	-	12,0	9	8	60
250B	267,4	290	-	160	505	135	90	75	250	630	-	10,0	8	7	60
300A	318,5	340	150	185	600	150	110	85	290	800	300	21,5	16	9	70
300B	318,5	340	150	185	600	150	110	85	290	800	300	12,0	9	9	70
350A	355,6	380	170	200	685	175	130	105	340	890	350	26,0	19	11	80
350B	355,6	380	170	220	685	175	130	105	340	890	350	14,0	10	9	80
400A	406,4	430	190	230	730	185	145	115	380	1 000	380	28,0	20	13	85
400B	406,4	430	190	250	730	185	145	115	380	1 000	380	15,0	11	11	85
450A	457,2	480	210	265	770	195	160	120	425	1 100	410	29,0	21	14	90
450B	457,2	480	210	285	770	195	160	120	425	1 100	410	14,5	11	11	90
500A	508,0	530	235	295	830	230	200	150	480	1 250	460	32,0	23	16	100
500B	508,0	530	235	320	830	230	200	150	480	1 250	460	14,5	11	11	100
550A	558,8	580	255	330	900	270	200	180	520	1 380	540	31,0	22	16	110
550B	558,8	580	255	350	900	270	200	180	520	1 380	540	21,0	16	11	110
600	609,4	630	280	365	950	300	200	200	560	1 550	600	33,0	23	16	120

Table 1 (*continued*)

| Nominal size D_n	Welding leg length[a]		SWL[b]						Calculated weight[c] (kg)
			For mooring purposes (Figure-of-eight belay)				For towing purposes (Eye splice)		
	z_1	z_2	One-rope use		Two-rope use				
			(kN)	(t)	(kN)	(t)	(kN)	(t)	
150	3,5	3,5	54	5,5	49	5,0	383	10	29
200	3,5	3,5	82	8,4	65	6,7	579	13	46
250A	5,5	4	156	16	134	14	1 315	27	107
250B	5,5	4	127	13	108	11	215	22	91
300A	10,5	4	332	34	306	31	3 365	62	281
300B	10,5	4	186	19	161	16	352	36	166
350A	12,5	5	443	45	418	43	5 062	85	431
350B	7	4	244	25	216	22	2 855	50	241
400A	12,5	6	594	61	521	53	6 632	106	570
400B	8	5	326	33	269	27	3 816	67	322
450A	12	7	753	77	612	62	8 201	124	712
450B	8	7	382	39	292	30	4 483	78	379
500A	12,5	8	992	101	757	77	10 928	154	960
500B	8	5	457	47	326	33	5 474	93	465
550A	11,5	8	1 131	115	812	83	12 635	165	1 123
550B	11,5	5	781	80	541	55	9 280	159	787
600	11,5	8	1 401	143	948	97	15 539	193	1 391

[a]   Welding with chamfering is available based on the same welding volume/strength.

[b]   The SWL is the maximum applicable rope tension.

The SWLs shown in this table are for reference only. These are based on the loadings as mentioned in Annex A.

[c]   The calculated weight is for reference only.

Dimensions in millimetres

Key
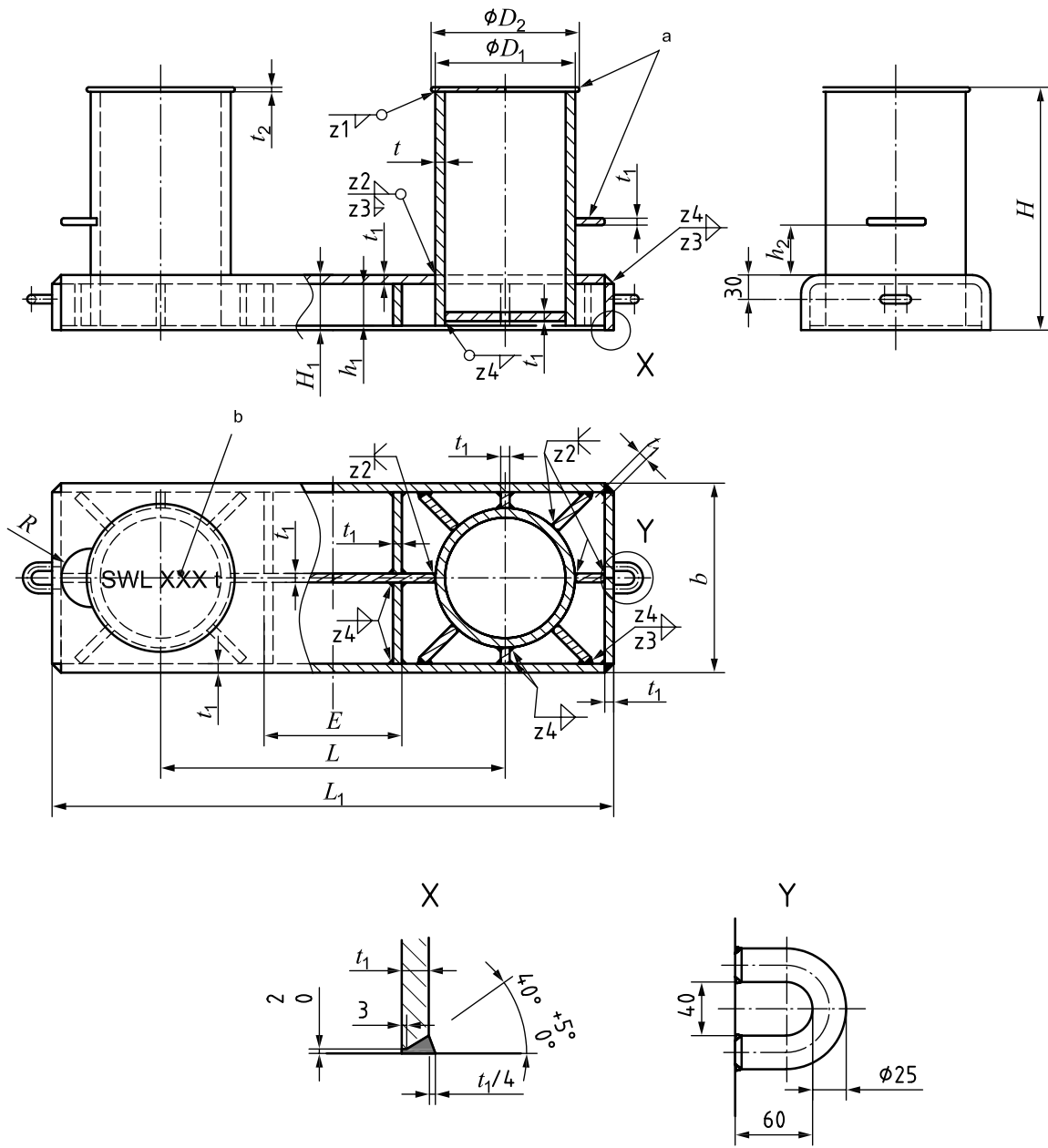
a   Edges smooth grinding.

b   SWL marking.

Figure 2 — Type B

Table 2 — Dimensions and SWL of Type B bollards

Dimensions in millimetres

Nominal size D_n	D_1	D_2	H_1	H_2	h_1	h_2	b	L	L_1	E	t	t_1	t_2	R
150	165,2	185	320	80	62	70	225	400	670	145	8,0	8	6	40
200	216,3	240	365	85	67	70	290	500	860	160	8,0	8	6	50
250A	267,4	290	470	100	79	90	360	630	1 065	215	12,0	11	8	60
250B	267,4	290	470	100	79	90	360	630	1 065	215	10,0	8	7	60
300A	318,5	340	575	125	95	110	430	800	1 300	325	21,5	20	9	70
300B	318,5	340	575	125	95	110	430	800	1 300	325	12,0	9	9	70
350A	355,6	380	655	145	108	130	480	890	1 475	360	26,0	23.5	11	80
350B	355,6	380	655	145	119	130	480	890	1 475	360	14,0	13	9	80
400A	406,4	430	705	160	121	145	550	1 000	1 630	400	28,0	26	13	85
400B	406,4	430	705	160	133	145	550	1 000	1 630	400	15,0	13,5	11	85
450A	457,2	480	745	170	131	160	620	1 100	1 810	430	29,0	26	14	90
450B	457,2	480	745	170	144	160	620	1 100	1 810	430	14,5	13	11	90
500A	508,0	530	790	190	146	200	690	1 250	2 040	500	32,0	29	16	100
500B	508,0	530	790	190	162	200	690	1 250	2 040	500	14,5	13	11	100
550A	558,8	580	840	210	167	200	750	1 380	2 240	560	31,0	28	16	110
550B	558,8	580	840	210	176	200	750	1 380	2 240	560	21,0	19	11	110
600	609,4	630	875	225	182	200	820	1 550	2 490	660	33,0	28	16	120

Nominal size D_n	Welding leg length[a]				SWL[b]						Calculated weight[c]
					For mooring purposes (Figure-of-eight belay)				For towing purposes		
	z_1	z_2	z_3	z_4	One-rope use		Two-rope use		(Eye splice)		(kg)
					(kN)	(t)	(kN)	(t)	(kN)	(t)	
150	3	3	6	4	54	5,5	49	5,0	540	10	45
200	3	3	6	4	82	8,4	65	6,7	795	13	68
250A	4	4,5	8	6	156	16	134	14	1 736	27	150
250B	3	3,5	6	4	127	13	108	11	216	22	119
300A	4	8	12	10	332	34	306	31	4 365	62	383
300B	4	5	8	6	186	19	161	16	353	36	203
350A	5	10	14	12	443	45	418	43	6 543	85	582
350B	4	5,5	8	6	244	25	216	22	3 757	50	333
400A	6	11	16	13	594	61	521	53	8 819	106	793
400B	5	5,5	8	7	326	33	269	27	4 983	67	441
450A	7	11	16	13	753	77	612	62	10 820	124	979
450B	7	5,5	8	7	382	39	292	30	5 837	78	517
500A	8	12	17	15	992	101	757	77	14 470	154	1 321
500B	5	5,5	8	7	457	47	326	33	7 102	93	631
550A	8	11	17	14	1 131	115	812	83	16 628	165	1 530

[a]   Welding with chamfering is available based on the same welding volume/strength.

[b]   The SWL is the maximum applicable rope tension.

The SWLs shown in this table are for reference only. These are based on the loadings as mentioned in Annex A.

[c]   The calculated weight is for reference only.

Table 2 *(continued)*

Nominal size D_n	D_1	D_2	H_1	H_2	h_1	h_2	b	L	L_1	E	t	t_1	t_2	R
550B	5	8	12	10	781	80		541	55	11 949	159		1 059	
600	8	11	17	14	1 401	143		948	97	20 042	193		1 850	

a   Welding with chamfering is available based on the same welding volume/strength.

b   The SWL is the maximum applicable rope tension.

The SWLs shown in this table are for reference only. These are based on the loadings as mentioned in Annex A.

c   The calculated weight is for reference only.

Annex A
(informative)

Basis for strength assessment of welded steel bollards

A.1 General

The strength of the bollards was evaluated by finite element model analysis and simple beam theory calculation, and determined based on the following design criteria.

A.2 Loading

A.2.1 The bollards are to be designed to withstand the loads imposed by the mooring and/or towing ropes.

When using two ropes on a bollard, the maximum applicable load on each rope is to be limited as described under the SWL column "Two-rope use" in Tables 1 and 2. The ropes are to be belayed as low as possible to reduce the bending stress on the posts.

NOTE   In normal mooring practice, only one mooring rope is fitted per bollard.

A.2.2   The load P imposed by a rope belayed in figure-of-eight fashion around the bollard produces a resultant load of $2P$.

A.2.3   When two ropes are used, it is possible to impose $4P$ as a shear load at the lowest part of the post.

A.2.4   The bollards are to be designed to withstand the following load cases.

A.2.4.1   Case 1 — Bending loads by mooring rope

It is to be designed to withstand the bending force produced by P imposed at position $H\,4/5$ above the base plate.

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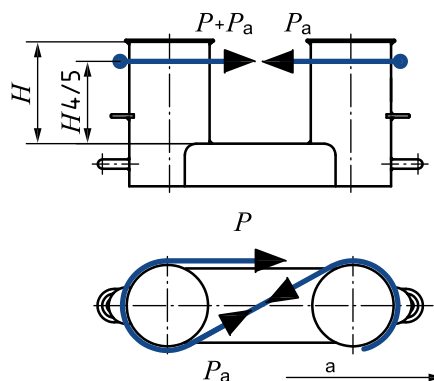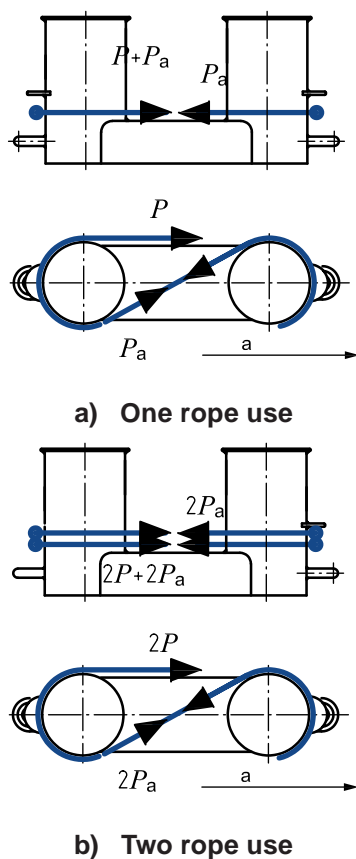
P mooring force

P_a reaction force produced by P

a   Ship side.

Figure A.1 — Bending loads by mooring rope

A.2.4.2 Case 2 — Shearing loads by mooring rope(s)

When two ropes are used, it is to be designed to withstand the shearing force produced by $4P$ imposed by two mooring ropes at the lowest part of post.

$P+P_a$ P_a

P

P_a a

a) One rope use

$2P_a$

$2P+2P_a$

$2P$

$2P_a$ a

b) Two rope use
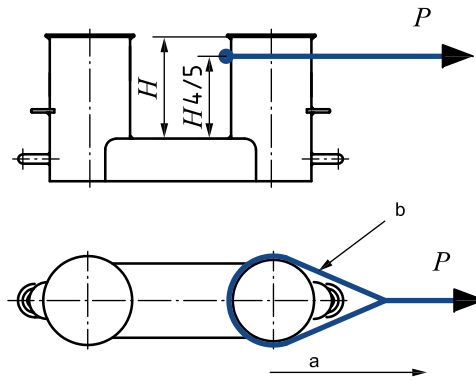
Key

P mooring force

P_a reaction force produced by P

a   Ship side.

Figure A.2 — Shearing loads by mooring rope(s)

A.2.4.3 Case 3 — Bending loads by towing rope

Key

P towing force

a   Ship side.

b   Eye splice.

Figure A.3 — Bending loads by towing rope

A.3   Load and stress criteria

Under the SWL, the following stress criteria were adopted:

— The bending stress is limited to 85 % of the yield stress of the material.

— The shear stress is limited to 60 % of the yield stress of the material.

A.4   Dimensional allowances, wear-down allowances and corrosion additions

A.4.1   Dimensional allowances

The minimum limit of tolerance is used for tube or steel plates for the posts and base plates as follows:

— D minus 1 %;

— t minus 3 %.

A.4.2   Wear-down allowances

For the strength calculation, the wear-down of 2 mm is to be deducted from the gross thickness, where rope is rubbing the surface.

A.4.3   Corrosion additions

The corrosion margin was already included in the safety factor and 2 mm wear-down allowance.

A.5   Bending radius

As a general rule, for wire ropes, a minimum bending ratio of 12 is recommended, and for synthetic ropes, the manufacturer's guidelines of acceptable minimum bending radius are to be consulted for each specific application.

Bibliography

[1]   ISO 2408, *Steel wire ropes for general purposes — Minimum requirements*

[2]   IACS UR A2, *Shipboard fittings and supporting hull structures associated with towing and mooring on conventional vessels*

[3]   OCIMF, *Mooring Equipment Guidelines (MEG3)*

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