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Ships and marine technology — Ship's mooring and towing fittings — Steel rollers

Navires et technologie maritime — Corps-morts et ferrures de remorquage de navires — Rouleaux en acier

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Contents

Page

Foreword

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ISO 13755 was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 4, *Outfitting and deck machinery*.

Introduction

The steel roller is a type of ship's mooring fitting installed on board to lead the mooring rope from the ship's inboard to outboard as shipside roller fairleads and to change the direction of ropes as pedestal fairleads.

Ships and marine technology — Ship's mooring and towing fittings — Steel rollers

1 Scope

This International Standard specifies the design, size and technical requirements for steel rollers installed to lead the mooring rope of a ship.

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.

ISO 13767, *Ships and marine technology — Ship's mooring and towing fittings — Shipside roller fairleads*

ISO 13776, *Ships and marine technology — Ship's mooring and towing fittings — Pedestal fairleads*

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.

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

4 Classification

4.1 Type

Depending on the construction, steel rollers shall be classified as the following three types:

— type A: made of steel casting without upper dust cover;

— type B: made of steel casting with upper dust cover;

— type C: made of steel plate with dust cover.

4.2 Nominal sizes

The nominal sizes, D_n, of steel rollers are denoted by reference to the outside diameter of the roller in millimetres from a basic series of preferred numbers.

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

5 Dimensions

Steel rollers have dimensions and particulars in accordance with Tables 1, 2, 3 and 4, and Figures 1, 2, 3, 4, 5, 6, 7 and 8.

6 Materials

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

— Roller: steel casting having a yield point of not less than 205 N/mm^2 or steel plates having a yield point of not less than 235 N/mm^2.

— Axle: weldable steel casting having a yield point of not less than 350 N/mm^2 or equivalent.

— Bush: brass, bronze or equivalent.

7 Construction

7.1 The rollers of the steel rollers (Type C) shall be constructed from steel tubes or formed from plate.

7.2 The foundation of the steel rollers shall be determined by the manufacturer in accordance with ISO 13767 and ISO 13776. The foundation and welding connections shall be guaranteed reliable transmission of the maximum loading of the steel rollers to hull construction without any plastic deformation or cracks.

8 Manufacturing and inspection

8.1 All surfaces of the steel rollers, 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 steel rollers shall be coated externally with an anti-corrosion protective finish.

8.4 All rotating parts are to be provided with greasing.

9 Marking

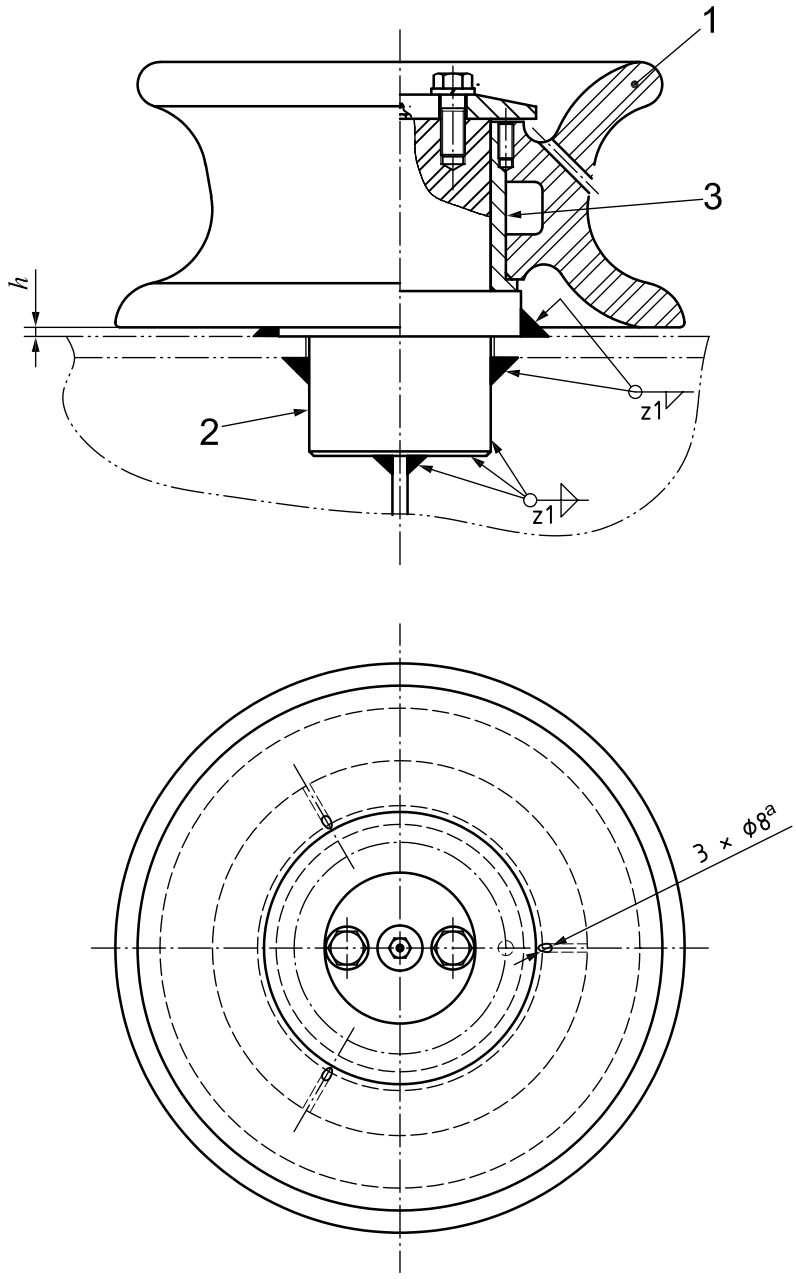
9.1 The safe working load (SWL) for the intended use for the steel rollers shall be noted in the towing and mooring plan available on board for the guidance of the shipmaster as specified in MSC/Circ.1175.

9.2 The actual SWL on board shall be determined by considering the foundation and 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.

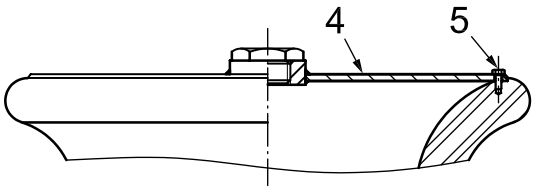
9.3 The steel rollers shall be clearly marked on their seat or foundation with their SWL by weld bead or equivalent. The SWL shall be expressed in tonnes (letter ‘t’) and be placed so that it is not obscured during operation of the fitting.

EXAMPLE SWL XXX t

Dimensions in millimetres



a) Type A



b) Type B

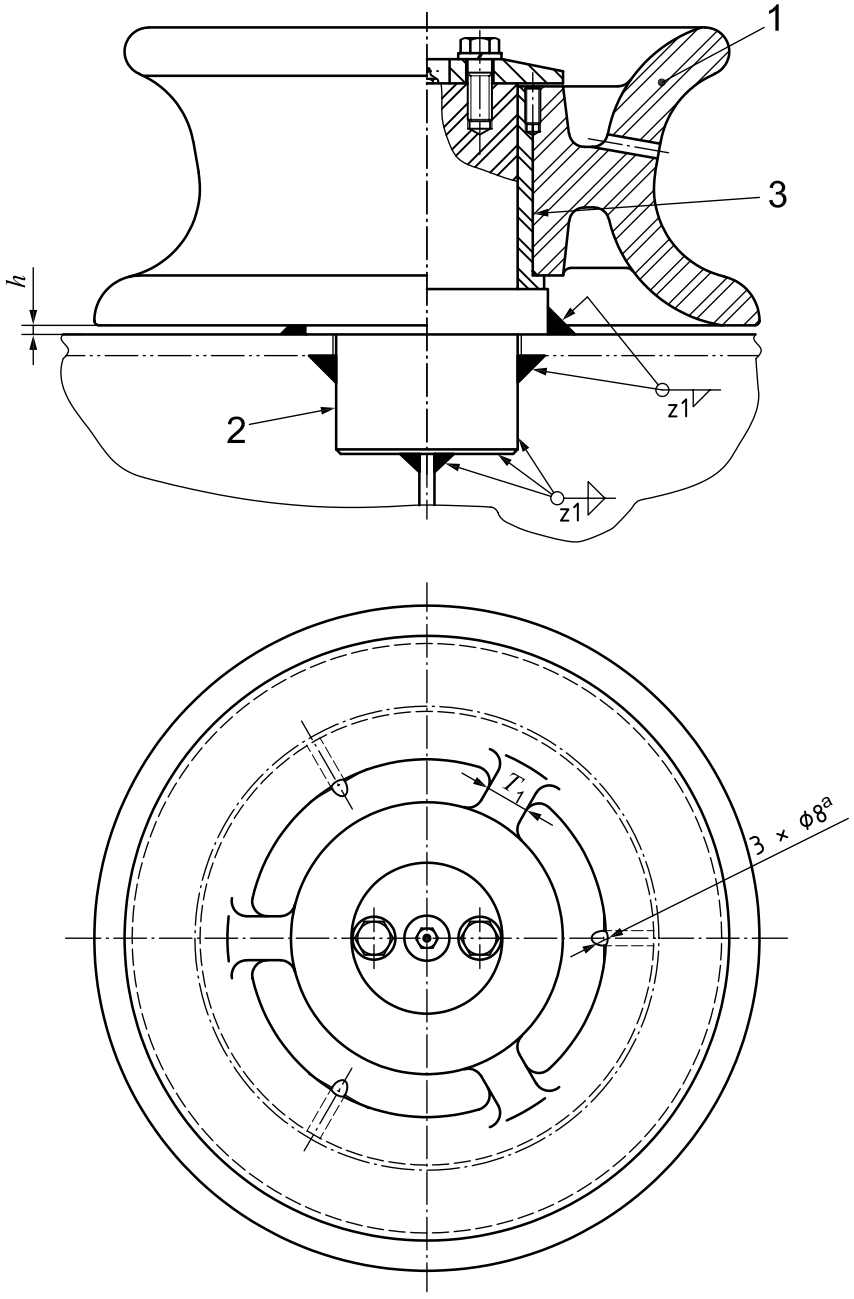
Key

1 roller
2 axle
3 bush
4 dust cover to apply on type B only
5 N-M6 bolt

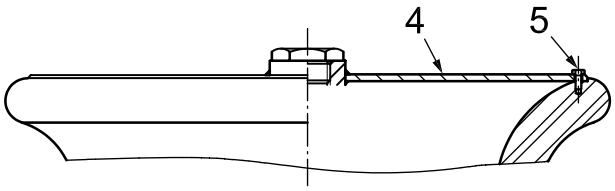
[a] Drain hole.

Figure 1 — Assembly of steel rollers for nominal sizes 150, 200 and 250 (type A and type B)

Dimensions in millimetres



a) Type A



b) Type B

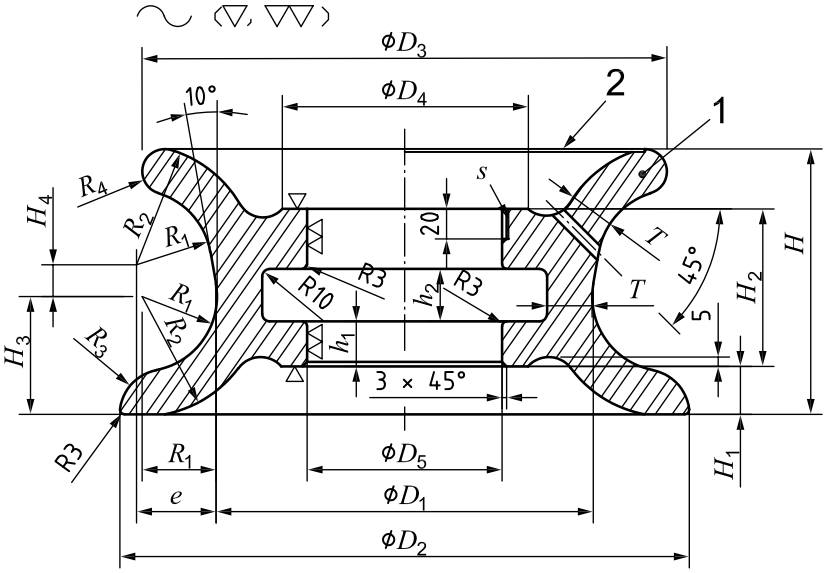
Key

1 roller
2 axle
3 bush
4 dust cover to apply on type B only
5 N-M6 bolt

[a] Drain hole.

Figure 2 — Assembly of steel rollers for nominal sizes 300 and above (type A and type B)

Dimensions in millimetres

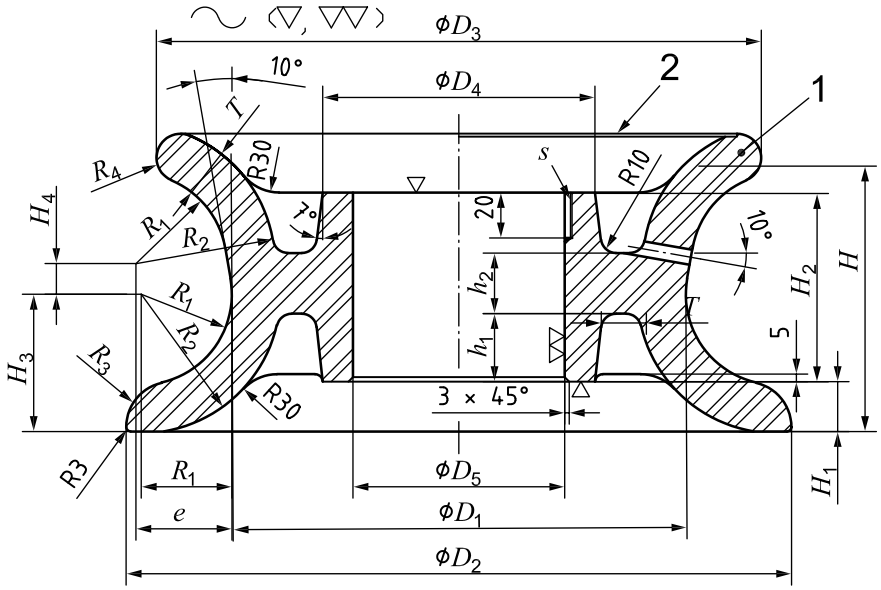


Key

1 roller
2 dust cover to apply on type B only

Figure 3 — Detail of steel rollers for nominal sizes 150, 200 and 250 (type A and type B)

Dimensions in millimetres



Key

1 roller

2 dust cover to apply on type B only

Figure 4 — Detail of steel rollers for nominal sizes 300 and above (type A and type B)

Table 1 — Dimensions and SWL of steel rollers for type A and type B

Dimensions in millimetres

Nominal size D_n	D_1	D_2 +2/0	D_3 +2/0	D_4	D_5 H7	R_1	R_2	R_3	R_4	H	H_1	H_2	H_3	H_4	e
150	150	230	216	110	90	30	52	15	11	137	25	84	44,7	43,38	37,7
200	200	300	280	145	115	40	66	20	13	157	30	99	59,2	35,46	46,3
250	250	370	340	165	135	50	80	25	15	177	32	105	73,5	28,33	55,0
300	300	430	400	190	150	55	87	30	16	197	33	125	82,6	32,62	60,8
350	350	490	460	210	167	55	89	30	17	217	33	140	83,7	49,06	63,7
400	400	560	520	225	177	63	99	30	18	237	43	150	91,8	52,0	72,2
450	450	620	590	245	190	63	101	30	19	257	43	162	92,5	67,07	74,8
500	500	680	660	260	205	63	103	30	20	277	43	180	93,0	82,94	77,6

Nominal size D_n	h	h_1	h_2	Set screw s	T	T_1	N	Welding leg length z_1	SWL[b] $\theta = 90°$[a] (kN)	SWL[b] $\theta = 90°$[a] (t)	SWL[b] $\theta = 0°$ (kN)	SWL[b] $\theta = 0°$ (t)	Calculated weight[c] (kg/set) Type A	Calculated weight[c] (kg/set) Type B
150	5	35	25	M6	22	-	6	8	265	27	186	19	23	24
200	5	38	35	M6	26	-	6	10	441	45	314	32	42	43
250	6	40	35	M8	30	-	6	11	579	59	412	42	77	80

[a] θ is the relative angle of ropes on the steel roller (refer to Annex A).

[b] The SWL is the maximum applicable rope tension based on 90° ($\theta = 90°$) and 180° ($\theta = 0°$) deflection of rope direction by steel roller.

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

The "SWL" may be adjusted depending on the actual loading conditions, and the actual marking shall be as agreed between the user and the manufacturer.

[c] The calculated weight is for reference only.

Table 1 *(continued)*

Nominal size D_n	D_1	D_2 +2/0	D_3 +2/0	D_4	D_5 H7	R_1	R_2	R_3	R_4	H	H_1	H_2	H_3	H_4	e
300	7	45	40	M8	32	29	8	12	726	74	510	52	109	112	
350	7	50	45	M8	34	29	8	15	1 040	106	736	75	154	160	
400	7	53	49	M8	36	30	12	17	1 246	127	883	90	207	215	
450	7	57	53	M8	38	32	12	20	1 599	163	1 128	115	275	286	
500	7	65	60	M8	40	34	12	23	1 942	198	1 373	140	360	374	

[a] θ is the relative angle of ropes on the steel roller (refer to Annex A).

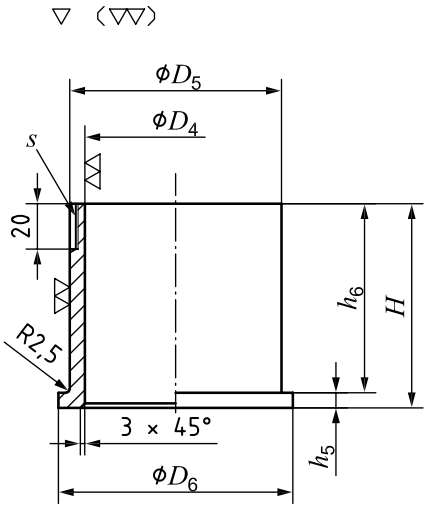
[b] The SWL is the maximum applicable rope tension based on 90° ($\theta = 90°$) and 180° ($\theta = 0°$) deflection of rope direction by steel roller.

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

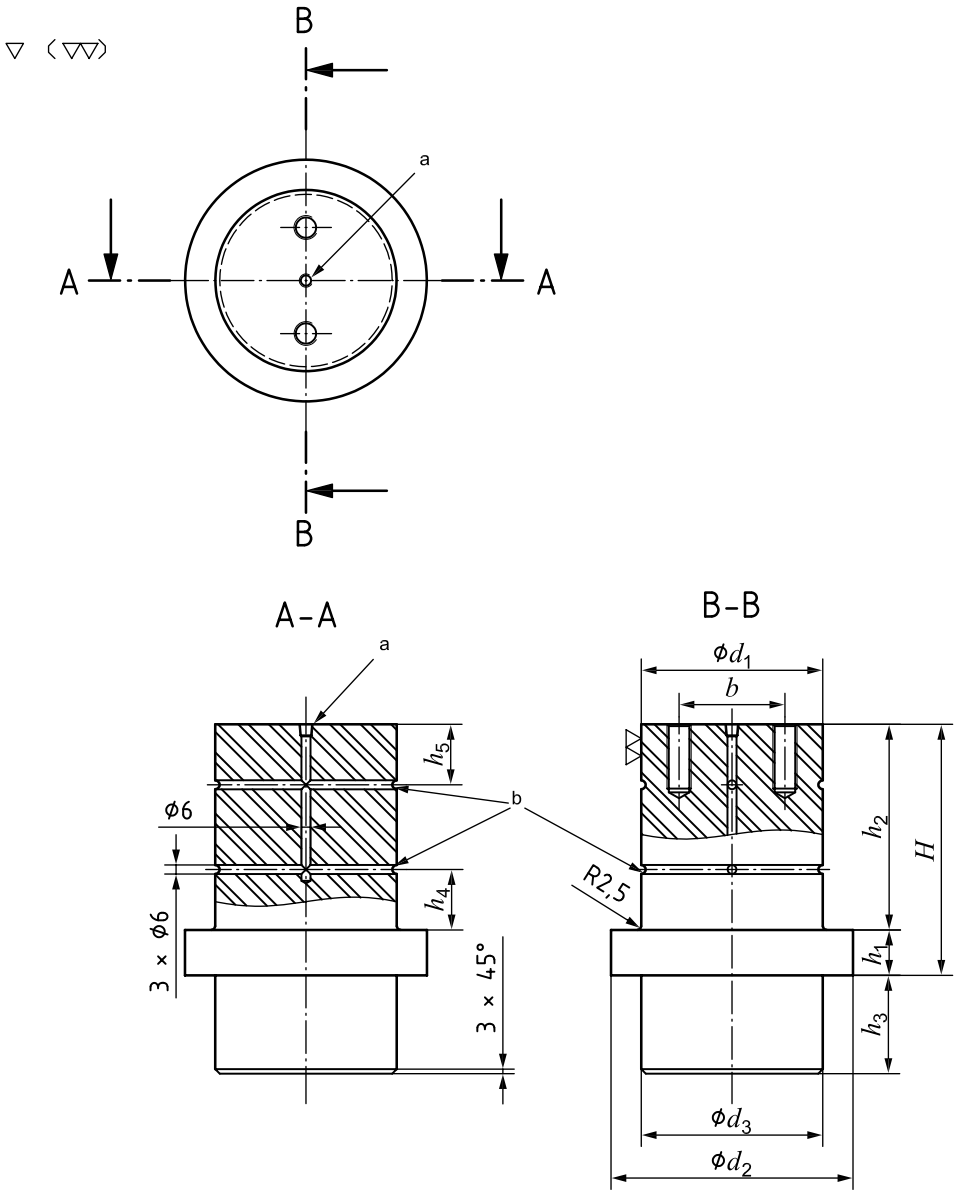
The "SWL" may be adjusted depending on the actual loading conditions, and the actual marking shall be as agreed between the user and the manufacturer.

[c] The calculated weight is for reference only.

Dimensions in millimetres



a) Bush



b) Axle

a Thread for grease nipple.

b Grease way.

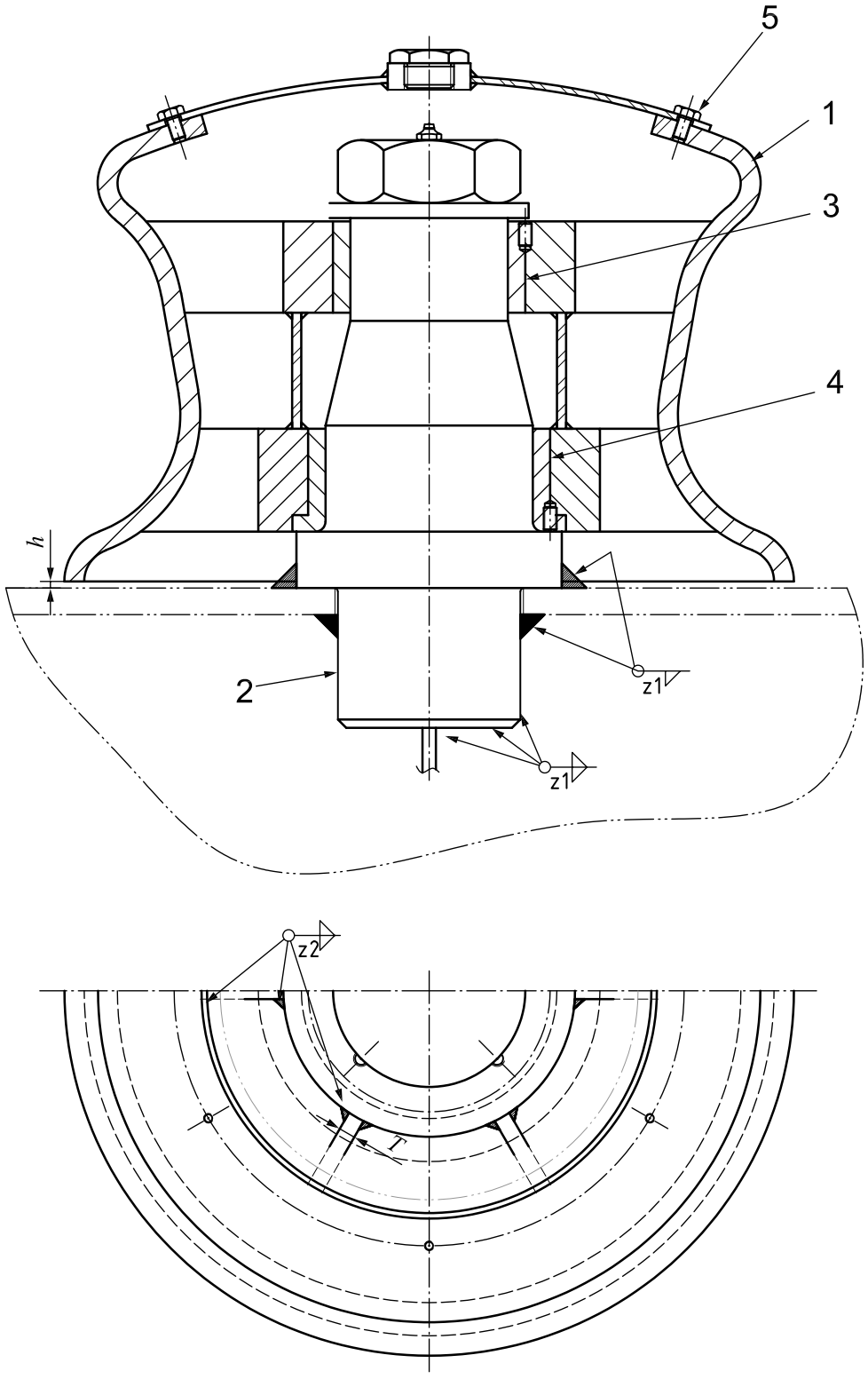
Figure 5 — Detail of axle and bush for steel rollers (type A and type B)

Table 2 — Dimensions of axle and bush for steel rollers (type A and type B)

Dimensions in millimetres

Nominal size D_n	Axle											Bush						
	d_1 f6	d_2	d_3	H	h_1	h_2	h_3	h_4	h_5	b	m x d	D_4 H7	D_5 m6	D_6	H	h_5	h_6	s
150	71	105	71	115	22	93	100	25	7	50	M10 × 20	71	90	105	92,5	8	84,5	M6
200	93	135	93	135	27	108		27	7	55		93	115	135	107,5	8	99,5	
250	113	155	113	144	30	114	125	28	9	65	M16 × 30	113	135	155	113,5	8	105,5	M8
300	128	175	128	166		136		30	12	75		128	150	175	135,5	10	125,5	
350	145	190	145	181		151		35	13	85	M20 × 40	145	167	190	150,5	10	140,5	
400	154	200	154	201	40	161	150	37	14	90		154	177	200	160,5	10	150,5	
450	167	220	167	213		173		40	15	105	M24 × 50	167	190	220	172,5	10	162,5	
500	178	235	178	232		191		45	16	110		178	205	235	190,5	10	180,5	

Dimensions in millimetres



Key

1 roller
2 axle
3 upper bush
4 lower bush
5 N-M6 bolt

Figure 6 — Assembly of steel rollers for type C

Dimensions in millimetres

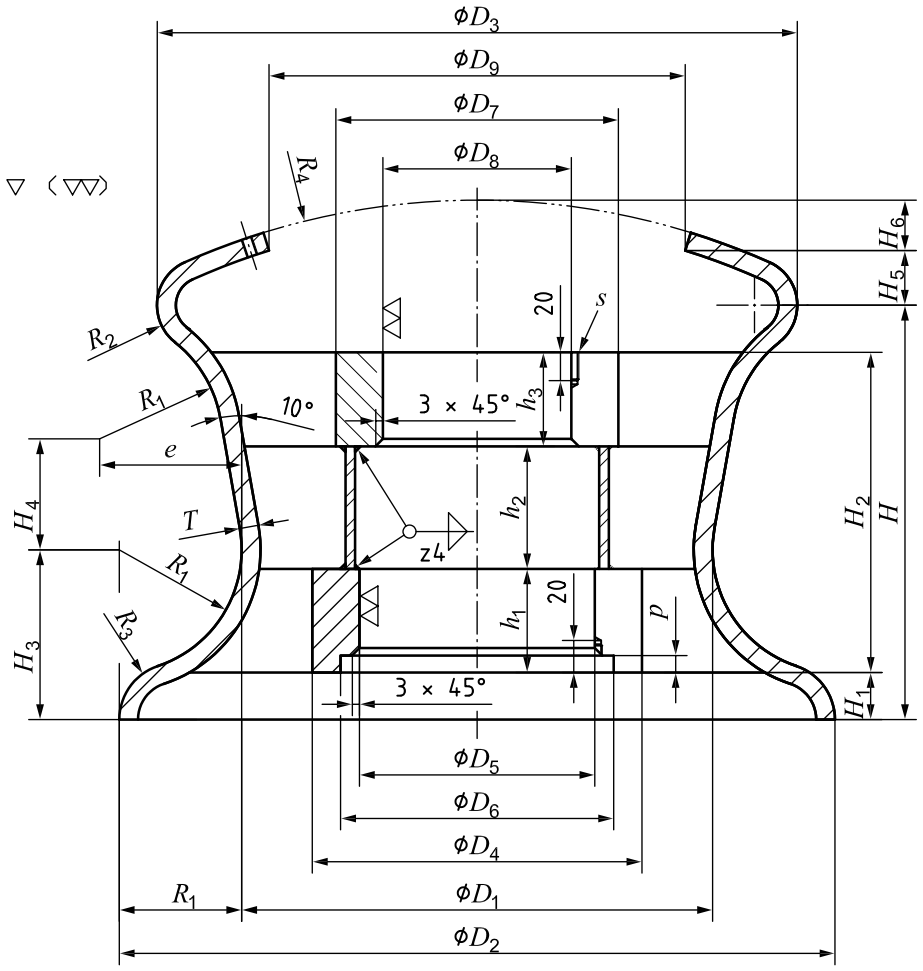


Figure 7 — Detail of steel rollers for type C

Table 3 — Dimensions and SWL of steel rollers for type C

Dimensions in millimetres

Nominal size D_n	D_1	D_2 +2/0	D_3 +2/0	D_4	D_5 H7	D_6	D_7	D_8 H7	D_9	R_1	R_2	R_3	R_4	H	H_1
150	150	230	220	121	95	110	121	69	140	40	17	20	214	150	16
200	200	300	280	162	118	140	144	86	190	50	21	25	279	185	21
250	250	370	340	186	136	160	162	97	250	60	25	30	327	220	25
300	300	430	400	209	149	180	175	114	300	65	28	32	446	240	30
350	350	490	455	236	172	195	198	130	350	70	30	35	537	260	35
400	400	560	520	254	184	207	215	145	400	80	40	40	680	280	40
450	450	620	580	269	199	225	230	160	450	85	45	42	797	292	45
500	500	680	640	293	217	240	254	178	500	90	50	45	885	305	50
Nominal size D_n	H_2	H_3	h_4	H_5	(H_6)	e	h	h_1	h_2	h_3	p	**Set screw** s	T	T_1	N
150	115	56,6	44,92	18,0	22,4	47,9	5	35	45	35	7	M6	10	10	6
200	140	70,7	56,27	22,8	27,3	59,9	5	45	55	40	8	M6	10	10	6
250	170	84,9	67,89	26,4	35,7	72,0	6	55	65	50	9	M8	10	10	6
300	187	91,6	74,25	26,3	38,8	78,1	7	62	70	55	10	M8	12	12	8
350	203	99,0	82,6	23,8	46,3	84,6	7	68	75	60	11	M8	16	16	8
400	220	113,1	71,3	29,0	50,0	92,6	7	75	80	65	11	M8	19	19	12
450	238	119,9	67,31	33,8	52,3	96,9	7	87	81	70	11	M8	19	19	12
500	251	127,3	63,7	36,9	58,0	101,2	7	87	89	75	12	M8	21	21	12

Table 3 (*continued*)

Dimensions in millimetres

Nominal size D_n	Welding leg length		SWL[b]				Calculated weight[c] (kg/set)
			$\theta = 90°$[a]		$\theta = 0°$		
	z_1	z_2	(kN)	(t)	(kN)	(t)	Type C
150	8	7	265	27	186	19	21
200	10	8	441	45	314	32	37
250	11	8	579	59	412	42	56
300	12	10	726	74	510	52	86
350	15	10	1 040	106	736	75	127
400	17	12	1 246	127	883	90	174
450	20	12	1 599	163	1 128	115	215
500	23	14	1 942	198	1 373	140	253

[a] θ is the relative angle of ropes on the steel roller (refer to Annex A).

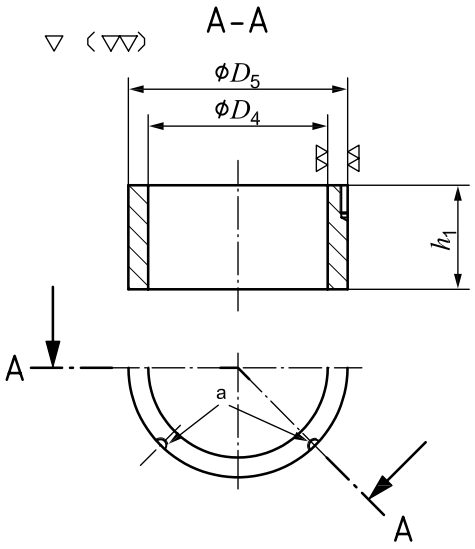
[b] The SWL is the maximum applicable rope tension based on 90° ($\theta = 90°$) and 180° ($\theta = 0°$) deflection of rope direction by steel roller.

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

The "SWL" may be adjusted depending on the actual loading conditions, and the actual marking shall be as agreed between the user and the manufacturer.

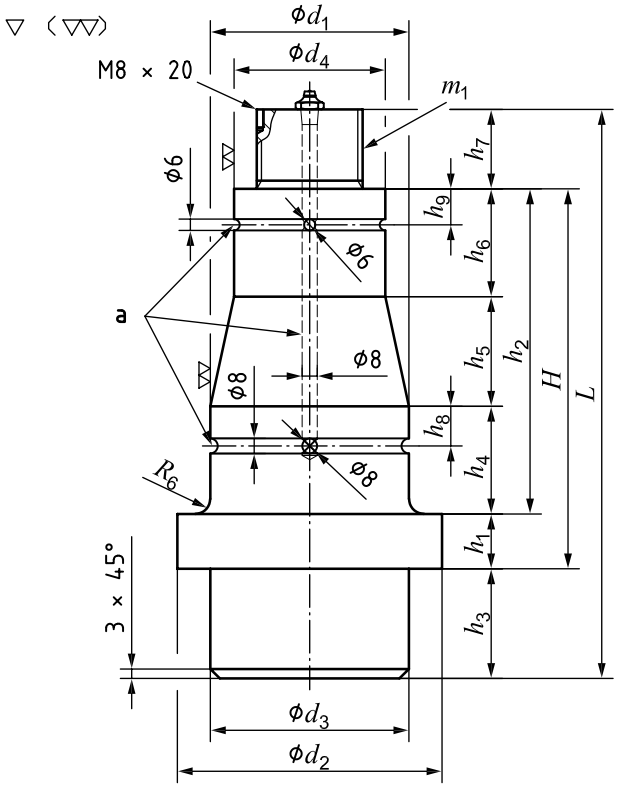
[c] The calculated weight is for reference only.

Dimensions in millimetres



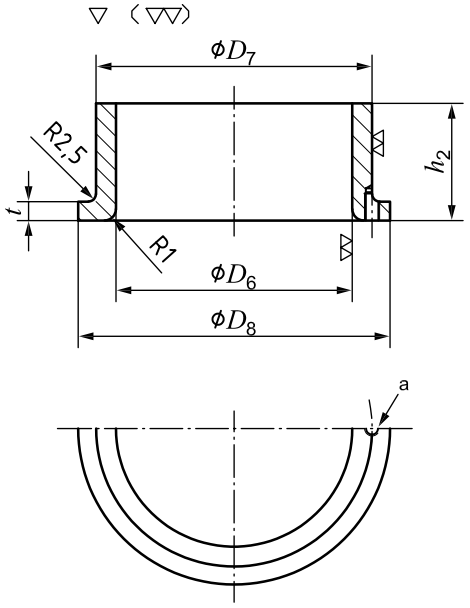
a) Upper bush

a 4-set screw.



b) Axle

a Grease way.



c) Lower bush

a $m \times s$ set screw.

Figure 8 — Detail of axle and bush for type C

Table 4 — Dimensions of axle and bush for type C

Dimensions in millimetres

Nominal size D_n	Axle																
	d_1 f6	d_2	d_3	d_4 f6	H	h_1	h_2	h_3	h_4	h_5	h_6	h_7	h_8	h_9	L	R_6	m_1
150	81	105	81	55	138	21	117	100	37	41	39	30	17	14	268	5	M39
200	102	135	102	70	168	26	142	100	47	51	44	39	19	15	307	7	M52
250	119	155	119	80	203	31	172	100	57	58	57	42	21	19	345	8	M56
300	130	175	130	95	226	37	189	125	64	63	62	47	23	20	398	8	M64
350	152	190	152	110	247	42	205	125	70	67	68	50	25	22	422	9	M68
400	164	200	164	125	270	47	223	150	78	74	71	56	28	25	476	10	M76
450	179	220	179	140	293	52	241	150	91	74	76	56	30	28	499	10	M76
500	195	235	195	156	311	57	254	150	91	82	81	58	30	28	519	11	M80

Nominal size D_n	Bush									
	D_4 H7	D_5 m6	D_6 H7	D_7 m6	D_8	h_1	h_2	t	R_1	m x s
150	55	69	81	95	108	35	35	7	6	M6x20
200	70	86	102	118	138	40	45	8	8	
250	80	97	119	136	158	50	55	9	9	M8x20
300	95	114	130	149	178	55	62	10	9	
350	110	130	152	172	193	60	68	11	10	
400	125	145	164	184	205	65	75	11	11	
450	140	160	179	199	223	70	87	11	11	
500	156	178	195	217	238	75	87	12	12	

Annex A
(informative)

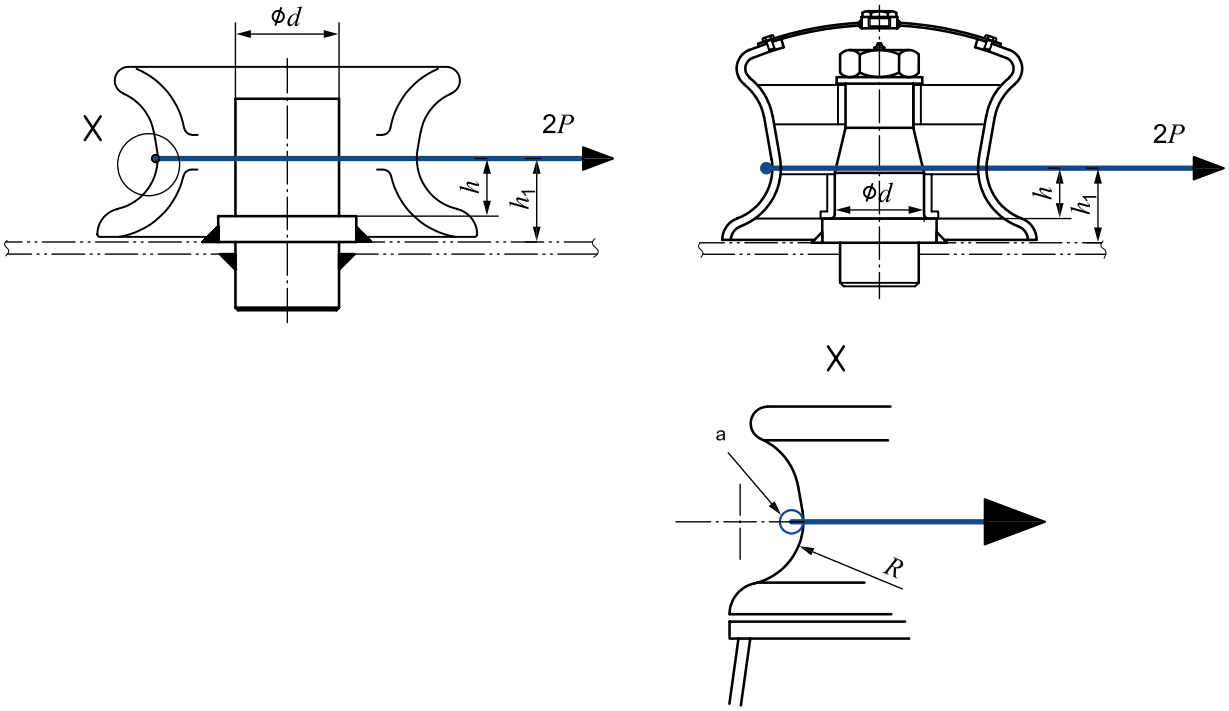
Basis for strength assessment of steel rollers

A.1 General

The strength of the steel rollers was evaluated by simple beam theory calculation and determined based on the following design criteria.

A.2 Loading

The steel rollers are to be designed to withstand the following load cases.



Key

P mooring force and towing force at the conical part of the throat

a Conical part of throat.

NOTE The loads were considered with a rope deflected 180° through the steel roller as shown in this figure.

Figure A.1 — Loading on steel roller

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.

— The combined stress is limited to 100 % of the yield stress of the material.

A.4 Wear-down allowances and corrosion additions

The wear-down margin and corrosion margin were already included in the safety factor.

Bibliography

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

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

[3] ISO 4990, *Steel castings — General technical delivery requirements*

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