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Ships and marine technology — Ship's mooring and towing fittings — Universal fairleads without upper roller

Navires et technologie maritime — Corps-morts et ferrures de remorquage de navires — Chaumards universels sans rouleau supérieur

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Foreword

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ISO 13742 was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 4, *Outfitting and deck machinery*.

Introduction

The universal fairlead is a type of ship's mooring fitting installed on board to lead the mooring rope from the ship's inboard to outboard.

A universal fairlead without upper roller is used for vessels in which the mooring deck level is higher than quay side.

Ships and marine technology — Ship's mooring and towing fittings — Universal fairleads without upper roller

1 Scope

This International Standard specifies the design, size and technical requirements for universal fairleads without upper roller(s) 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.

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

4 Classification

4.1 Type

Depending on the construction, universal fairleads shall be classified as the following four types:

— type 3R: with one rope-passing opening;

— type 4RL: with one rope-passing opening with additional guide roller on left side;

— type 4RR: with one rope-passing opening with additional guide roller on right side;

— type 5R: with two rope-passing openings.

4.2 Nominal sizes

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

The nominal sizes are:

140, 160, 180, 200, 250, 300A, 300B, 400A, 400B and 400C.

5 Dimensions

Universal fairleads have dimensions and particulars in accordance with Tables 1, 2, 3 and 4, and Figures 1, 2, 3, 4 and 5.

6 Materials

The materials of the following components are to be used for manufacturing the universal fairleads:

— Frame and other plates: weldable steel plates having a yield point of not less than 235 N/mm^2 except frame with rope guide for nominal size 400A, 400B and 400C shall be made of weldable steel plates having a yield point of not less than 315 N/mm^2.

— Roller: weldable steel plates having a yield point of not less than 235 N/mm^2 except rollers for nominal size 400A, 400B and 400C shall be made of weldable steel plates having a yield point of not less than 315 N/mm^2, or equivalent steel tubes.

— Axle: carbon steel having a yield point of not less than 345 N/mm^2.

— Bush: brass or bronze or equivalent.

7 Construction

7.1 The rollers of the universal fairleads shall be constructed from steel tubes or formed from plate.

7.2 The foundation of the universal fairleads shall be determined by the manufacturer. The foundation and welding connections to the hull shall be guaranteed reliable transmission of the maximum loading of the universal fairleads to hull construction without any plastic deformation or cracks.

8 Manufacturing and inspection

8.1 All surfaces of the universal fairleads 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 universal fairleads are to be coated externally with an anti-corrosion protective finish.

8.4 All rotating parts shall be provided with greasing.

9 Marking

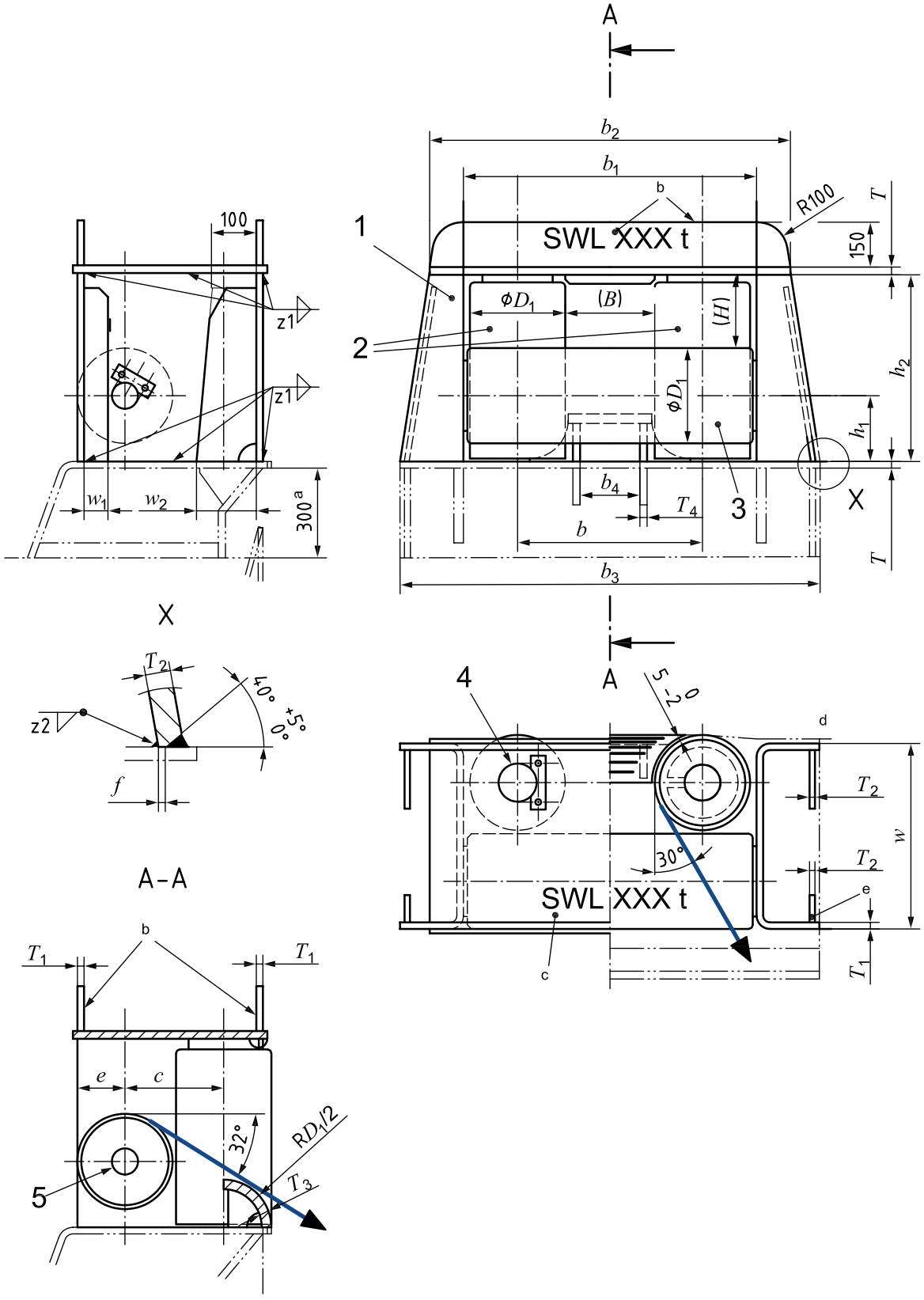
9.1 The safe working load (SWL) intended for the use of the universal fairleads shall be noted in the towing and mooring plan available on board for the guidance of the shipmaster as specified in MSC/Circ.1175.

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 universal fairleads shall be clearly marked with its 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



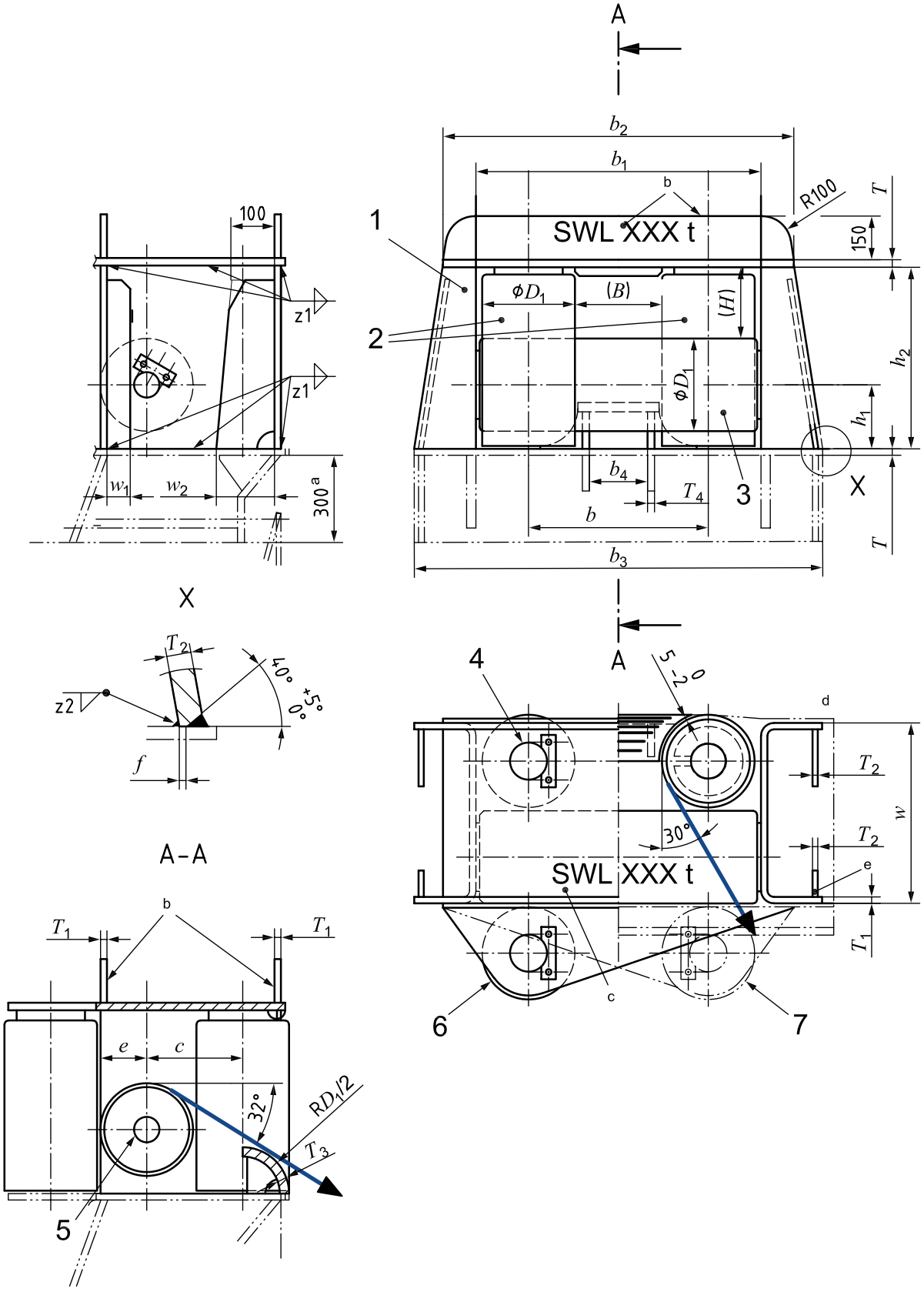
Key

1 frame with rope guide
2 vertical rollers with housing and washers
3 lower horizontal roller with washers
4 vertical axles with stopper
5 lower horizontal axle with stoppers

a Height of seat shall be determined in accordance with the hull construction design.
b For nominal size 250 and above.
c For nominal size 140 to 200 only.
d Side shell.
e For nominal size 300 and above.

Figure 1 — Assembly of type 3R universal fairleads

Dimensions in millimetres



Key

1 frame with rope guide
2 vertical rollers with housing and washers
3 lower horizontal roller with washers
4 vertical axles with stopper
5 lower horizontal axle with stoppers
6 for type 4RL
7 for type 4RR

[a] Height of seat shall be determined in accordance with the hull construction design.
[b] For nominal size 250 and above.
[c] For nominal size 140 to 200 only.
[d] Side shell.
[e] For nominal size 300 and above.

NOTE Details are not shown in this figure. Refer to Figure 1.

Figure 2 — Assembly of type 4RL and 4RR universal fairleads

Table 1 — Dimensions and SWL of type 3R, 4RL and 4RR universal fairleads

Dimensions in millimetres

Nominal size D_n	$B \times H$	D_1	h_1	h_2	b	b_1	b_2	b_3	b_4	w	c
140	195 × 150	139,8	130	350	335	515	656	780	140	260	150
160	200 × 150	165,2	145	378	365	570	730	870	140	310	175
180	200 × 150	190,7	155	400	391	620	800	950	140	360	200
200	200 × 150	216,3	170	428	416	675	896	1 060	140	410	225
250	250 × 200	267,4	195	530	517	825	1 046	1 220	180	520	280
300A	300 × 250	318,5	220	630	618	980	1 206	1 420	200	620	330
300B	300 × 250	318,5	220	630	618	980	1 206	1 420	200	620	330
400A	350 × 250	406,4	265	720	756	1 210	1 450	1 680	200	795	420
400B	350 × 250	406,4	265	720	756	1 210	1 450	1 680	200	795	420
400C	350 × 250	406,4	265	720	756	1 210	1 450	1 680	200	795	420

Table 1 (*continued*)

Dimensions in millimetres

Nominal size D_n	e	w_1	w_2	T	T_1	T_2	T_3	T_4	f	Welding leg length[a,b]		SWL[c]		Calculated weight[d] (kg)	
										z_1	z_2	(kN)	(t)	3R	4R
140	70	-	-	12	8	10	12	12	3	6	4	137	14	101	126
160	83	-	-	14	8	10	14	14	3	6	4	196	20	140	176
180	95	-	-	16	8	12	16	16	3	6	4	245	25	181	226
200	108	-	-	18	10	12	18	18	3	7	4	314	32	246	305
250	133	-	150	22	14	14	20	20	4	10	5	510	52	585	731
300A	159	80	150	24	16	16	24	22	6	11	7	687	70	780	945
300B	159	80	150	26	18	18	24	22	6	13	7	736	75	852	1 029
400A	203	100	150	26	18	18	32	28	6	13	7	981	100	1 245	1 506
400B	203	100	150	28	18	20	32	28	6	13	7	1 256	128	1 353	1 648
400C	203	100	150	30	20	22	32	28	7	14	8	1 373	140	1 464	1 780

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

[b] Welding otherwise mentioned in the figures above and in this table: minimum leg length is to be 1/2 of thinner plate thickness.

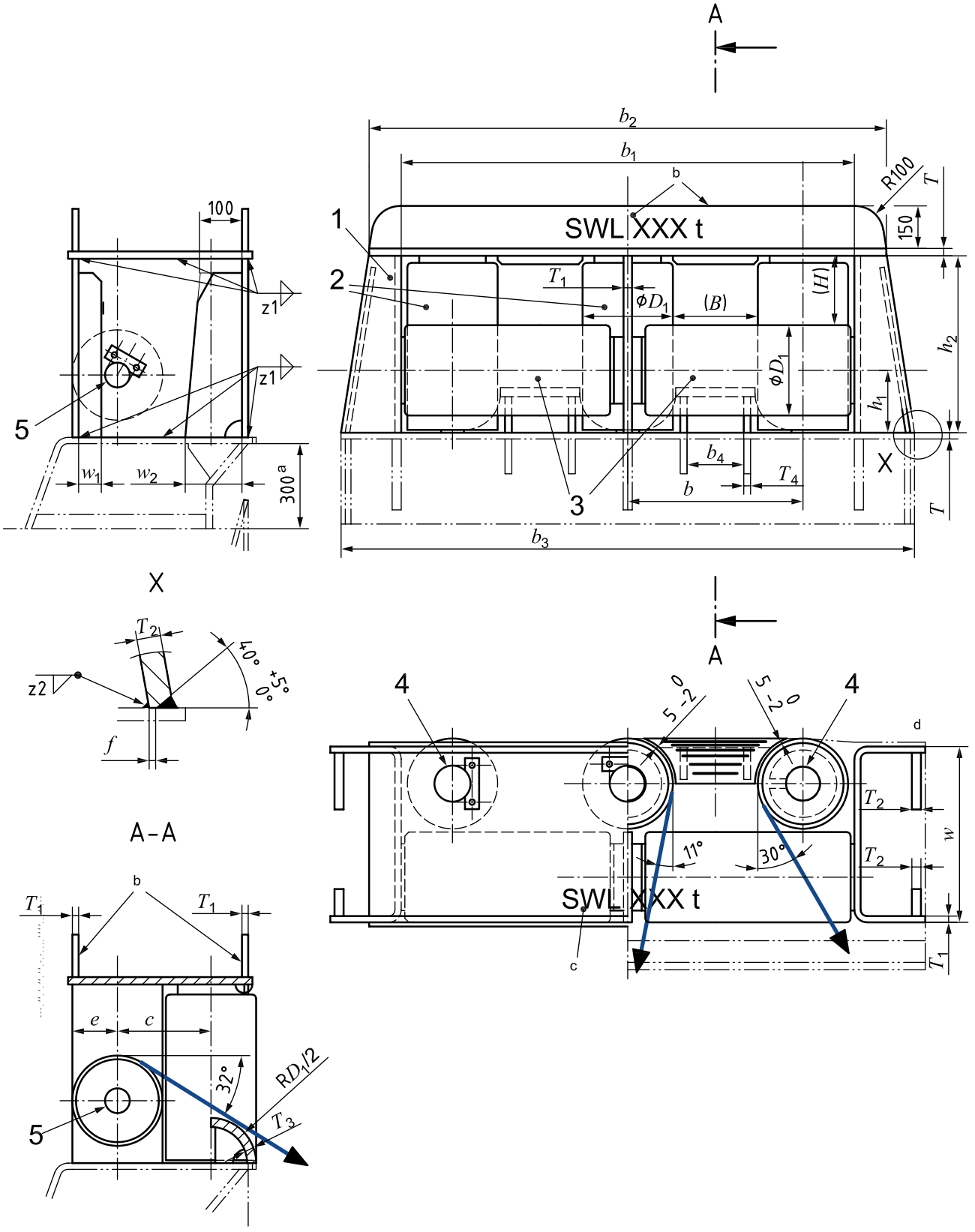
[c] The SWL is the maximum applicable rope tension.

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

The "SWL" may be adjusted depending on the actual loading conditions, and the actual marking is to be per the agreement between the user and the manufacturer.

[d] The calculated weight is for reference excluding foundation.

Dimensions in millimetres



Key

1 frame with rope guide
2 vertical rollers with housing and washers
3 lower horizontal roller with housing and washers
4 vertical axles with stopper
5 lower horizontal axle with stoppers

a Height of seat shall be determined in accordance with the hull construction design.
b For nominal size 250 and above.
c For nominal size 140 to 200 only.
d Side shell.

Figure 3 — Assembly of type 5R universal fairleads

Table 2 — Dimensions and SWL of type 5R universal fairleads

Dimensions in millimetres

Nominal size D_n	$B \times H$	D_1	h_1	h_2	b	b_1	b_2	b_3	b_4	w	c
140	195 × 150	139,8	130	350	335	850	1 000	1 140	140	260	150
160	200 × 150	165,2	145	378	365	935	1 100	1 260	140	310	175
180	200 × 150	190,7	155	400	391	1 011	1 200	1 360	140	360	200
200	200 × 150	216,3	170	428	416	1 091	1 320	1 480	140	410	225
250	250 × 200	267,4	195	530	517	1 342	1 580	1 740	180	520	280
300A	300 × 250	318,5	220	630	618	1 598	1 840	2 100	200	620	330
300B	300 × 250	318,5	220	630	618	1 598	1 840	2 100	200	620	330
400A	350 × 250	406,4	265	720	756	1 966	2 250	2 500	200	795	420
400B	350 × 250	406,4	265	720	756	1 966	2 250	2 500	200	795	420
400C	350 × 250	406,4	265	720	756	1 966	2 250	2 500	200	795	420

Table 2 (*continued*)

Dimensions in millimetres

Nominal size D_n	e	w_1	w_2	T	T_1	T_2	T_3	T_4	f	Welding leg length[a,b]		SWL[c]		Calculated weight[d]
										z_1	z_2	(kN)	(t)	(kg)
140	70	30	50	12	12	12	12	12	6	9	7	137	14	177
160	83	40	50	14	14	16	14	14	6	10	7	196	20	253
180	95	40	50	16	16	18	16	16	6	11	7	245	25	333
200	108	50	50	18	18	20	18	18	6	13	7	314	32	442
250	133	65	150	22	22	24	20	20	8	15	9	510	52	1 015
300A	159	80	150	24	24	26	24	22	8	17	9	687	70	1 348
300B	159	80	150	26	26	28	24	22	8	18	9	736	75	1 453
400A	203	100	150	26	26	32	32	28	10	18	10	981	100	2 146
400B	203	100	150	28	28	40	32	28	10	20	10	1 256	128	2 382
400C	203	100	150	30	30	42	32	28	10	21	10	1 373	140	2 551

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

[b] Welding otherwise mentioned in the figures above and in this table: minimum leg length is to be 1/2 of thinner plate thickness.

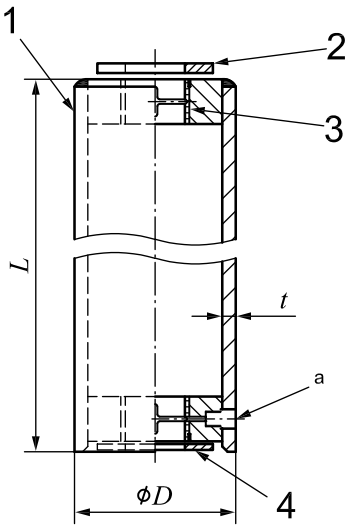
[c] The SWL is the maximum applicable rope tension.

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

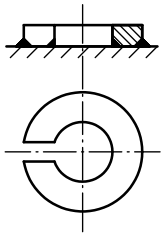
The "SWL" may be adjusted depending on the actual loading conditions, and the actual marking shall be agreed between the user and the manufacturer.

[d] The calculated weight is for reference excluding foundation.

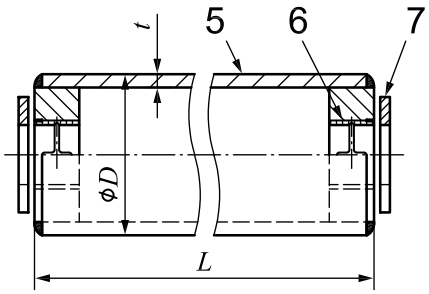
Dimensions in millimetres



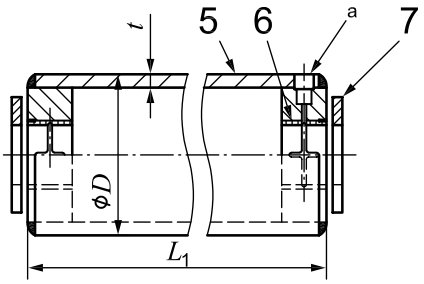
a) Vertical roller



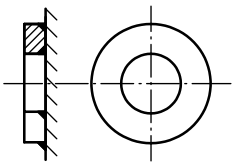
b) Lower support for vertical roller



c) Horizontal roller



d) Type 5R horizontal roller



e) Support for type 5R horizontal roller

Key

1 vertical roller
2 upper washer for vertical roller
3 bushes for vertical roller
4 lower washer for vertical roller
5 horizontal roller
6 bushes for horizontal rollers
7 washers for horizontal rollers

[a] Grease nipple shall be sunken to avoid rope damage.

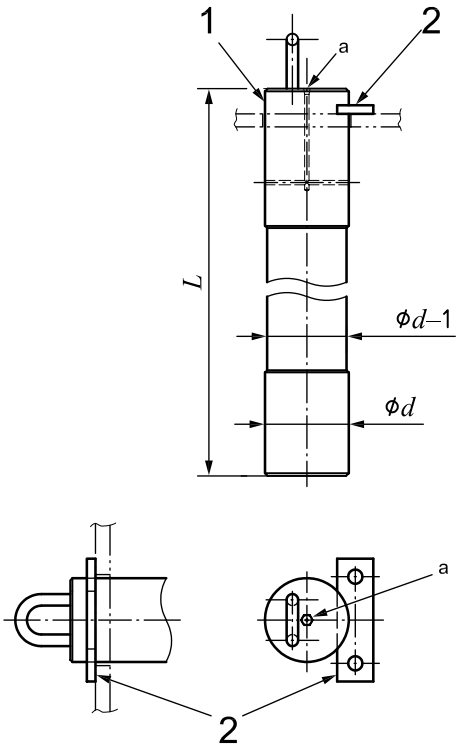
Figure 4 — Assembly of rollers

Table 3 — Dimensions of rollers

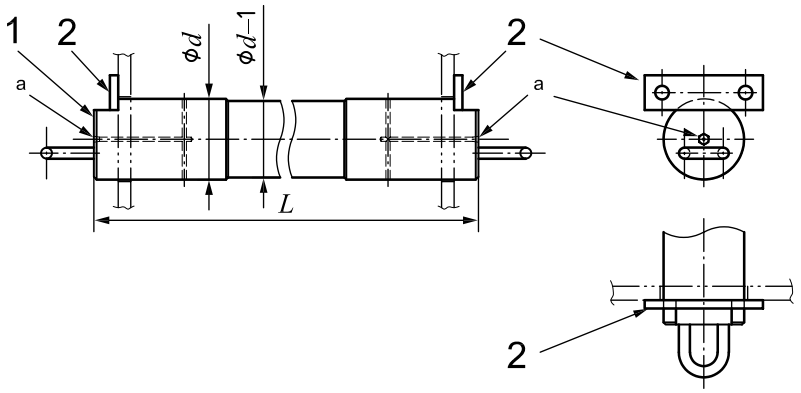
Dimensions in millimetres

Nominal size D_n	Vertical roller			Lower horizontal roller			
	D	t	L	D	t	L	L_1
140	139,8	8	315	139,8	8	499	383
160	165,2	8	343	165,2	8	554	422
180	190,7	8	365	190,7	8	600	453
200	216,3	8	393	216,3	8	655	490
250	267,4	10	495	267,4	10	799	602
300A	318,5	10	590	318,5	10	954	725
300B	318,5	11	590	318,5	11	954	724
400A	406,4	10	680	406,4	10	1 184	908
400B	406,4	11	680	406,4	11	1 184	907
400C	406,4	12	680	406,4	12	1 184	906

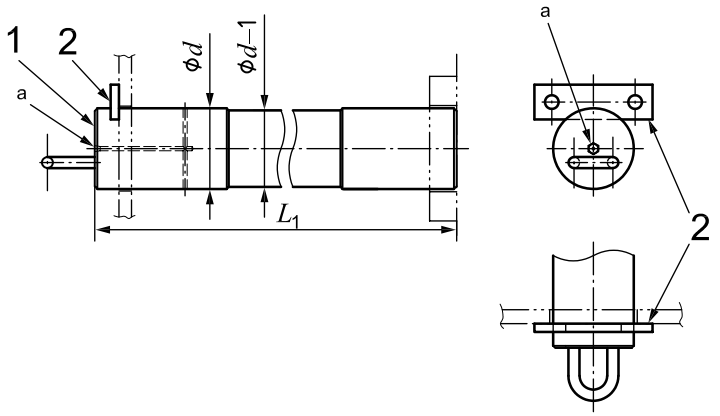
Dimensions in millimetres



a) Vertical axle



b) Horizontal axle



c) Type 5R horizontal axle

Key

1 axle

2 key set for axle

[a] Grease nipple.

Figure 5 — Assembly of axles

Table 4 — Dimensions of axles

Dimensions in millimetres

Nominal size	Vertical axle		Lower horizontal axle		
D_n	d	L	d	L	d
140	65	387	43	551	456
160	76	417	49	610	499
180	82	444	55	666	541
200	91	474	61	725	582
250	111	580	78	889	710
300A	128	689	89	1 048	846
300B	131	691	92	1 052	847
400A	153	781	106	1 282	1 031
400B	166	783	115	1 282	1 032
400C	171	785	119	1 286	1 033

Annex A
(informative)

Basis for strength assessment of universal fairleads

A.1 General

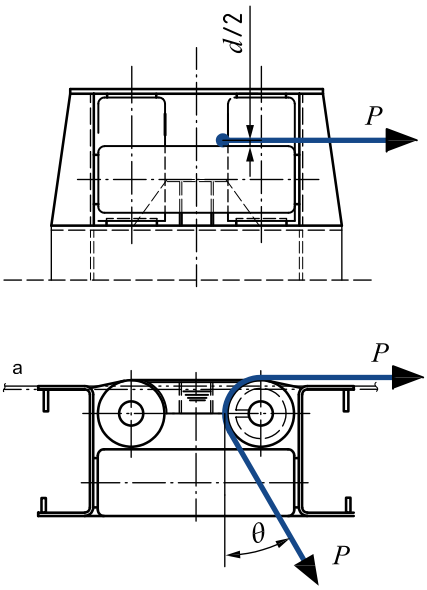
The strength of the universal fairleads was evaluated by finite element model analysis for frames and rope guide plates, and simple beam theory calculation for rollers and axles, and determined based on the following design criteria.

A.2 Loading

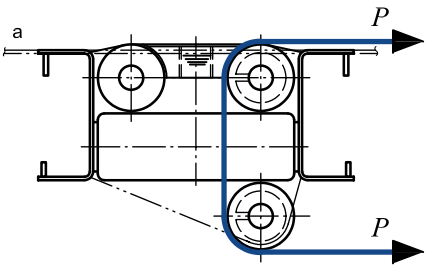
The universal fairleads are to be designed to withstand the horizontal and vertical load cases.

Horizontal and vertical loadings were considered individually, but both loadings were not considered simultaneously.

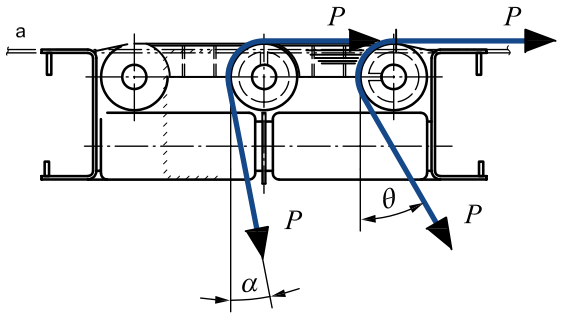
A.2.1 Case 1 — Horizontal loading



a) Type 3R



b) Type 4R



c) Type 5R

Key

P mooring force

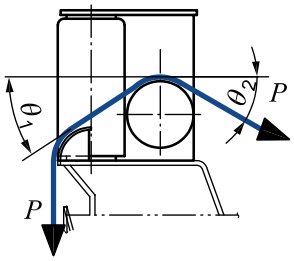
d diameter of mooring rope (wire rope base) as in Table A.1

a Ship side.

NOTE The loads were considered with rope deflected $\theta = 30°$ and $\alpha = 11°$ through the universal fairlead as shown in this figure.

Figure A.1 — Horizontal loading

A.3 Case 2 — Vertical loading



Key

P mooring force

NOTE The loads were considered with rope deflected to down side $\theta_1 = 90°$ and $\theta_2 = 30°$ through the universal fairlead respectively as shown in this figure.

Figure A.2 — Vertical loading

A.2.3 Single load was considered for type 3R, 4RL and 4RR, and simultaneous loadings were considered for type 5R universal fairleads.

A.2.4 For the consideration of load point from the mooring ropes, the wire ropes in Table A.1 were adopted.

Table A.1 — Diameter of applied wire ropes for load consideration

Dimensions in millimetres

Nominal size D_n	Wire rope diameter d
140	14,0
160	16,5
180	19,0
200	21,6
250	27,0
300A	32,0
300B	34,0
400A	40,0
400B	44,0
400C	44,0

A.4 Load and stress criteria

Under the SWL, the following stress criteria were adopted:

For finite element model analysis of frames and rope guide plates, the combined stress is limited to 85 % of the yield stress of the material.

For simple beam theory calculation of rollers and axles:

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.5 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] OCIMF, *Mooring Equipment Guidelines (MEG3)*

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

ICS 47.020.50

Price based on 17 pages