INTERNATIONAL STANDARD

ISO 13742

Second edition
2020-08

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

Reference number
ISO 13742:2020(E)

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Published in Switzerland

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO 13742:2012), which has been technically revised.

The main changes compared to the previous edition are as follows:

— technical guidelines have been added in 7.3 and 7.4;

— the definition of SWL (3.1) has been reworded;

— the object lines and key numbers in Figures 1, 2, 3 and 4 have been amended;

— the values of "t" for the lower horizontal roller in Table 5 (former Table 3) have been amended;

— the thickness of the bushes and washers have been added in Table 5 (former Table 3);

— the numbering of A.2.2, A.3 and A.4 have been corrected;

— the dimension line (θ_1) in Figure A.2 has been amended;

— the descriptions in Clause A.3 have been amended;

— technical information on FEM and strength calculation have been added in A.3.2 and A.3.3.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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 document specifies the types, nominal sizes, dimensions and materials, as well as construction, manufacturing and marking requirements, for universal fairleads without upper roller(s) installed to lead the mooring rope of a ship.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
safe working load
SWL
safe load limit (maximum permissible load) of the fittings used for mooring and towing

4 Classification

4.1 Type

Depending on the construction, universal fairleads shall be classified as belonging to one of the following four types:

a) Type 3R: with one rope-passing opening;

b) Type 4RL: with one rope-passing opening with an additional guide roller on the left side;

c) Type 4RR: with one rope-passing opening with an additional guide roller on the right side;

d) 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 code, i.e. 3R, 4RL, 4RR or 5R, is followed by the nominal size for the different SWLs.

The nominal sizes are:

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

5 Dimensions

Universal fairleads shall have dimensions and particulars in accordance with Tables 1, 2, 3, 4, 5 and 6, and Figures 1, 2, 3, 4 and 5.

6 Materials

The following materials shall be used for manufacturing the components of universal fairleads.

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

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

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

d) 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 guarantee a reliable transmission of the maximum loading of the universal fairleads to the hull construction without any plastic deformation or cracks.

7.3 The selection of ship's mooring fittings and mooring lines should take into account the diameter, D, of surfaces of mooring fittings that are in contact with the mooring line diameter, d, (D/d ratio) to reduce or mitigate bend ross of strength.

7.4 The tensile strength of mooring rope may be reduced depending on bend radius (D/d ratio) through the mooring fittings, in accordance with the rope manufacturer's guidelines.

8 Manufacturing and inspection

8.1 All surfaces of the universal fairleads, including welded surfaces, 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 shall be coated externally with an anti-corrosion protective finish.

8.4 All rotating parts shall be greased.

9 Marking

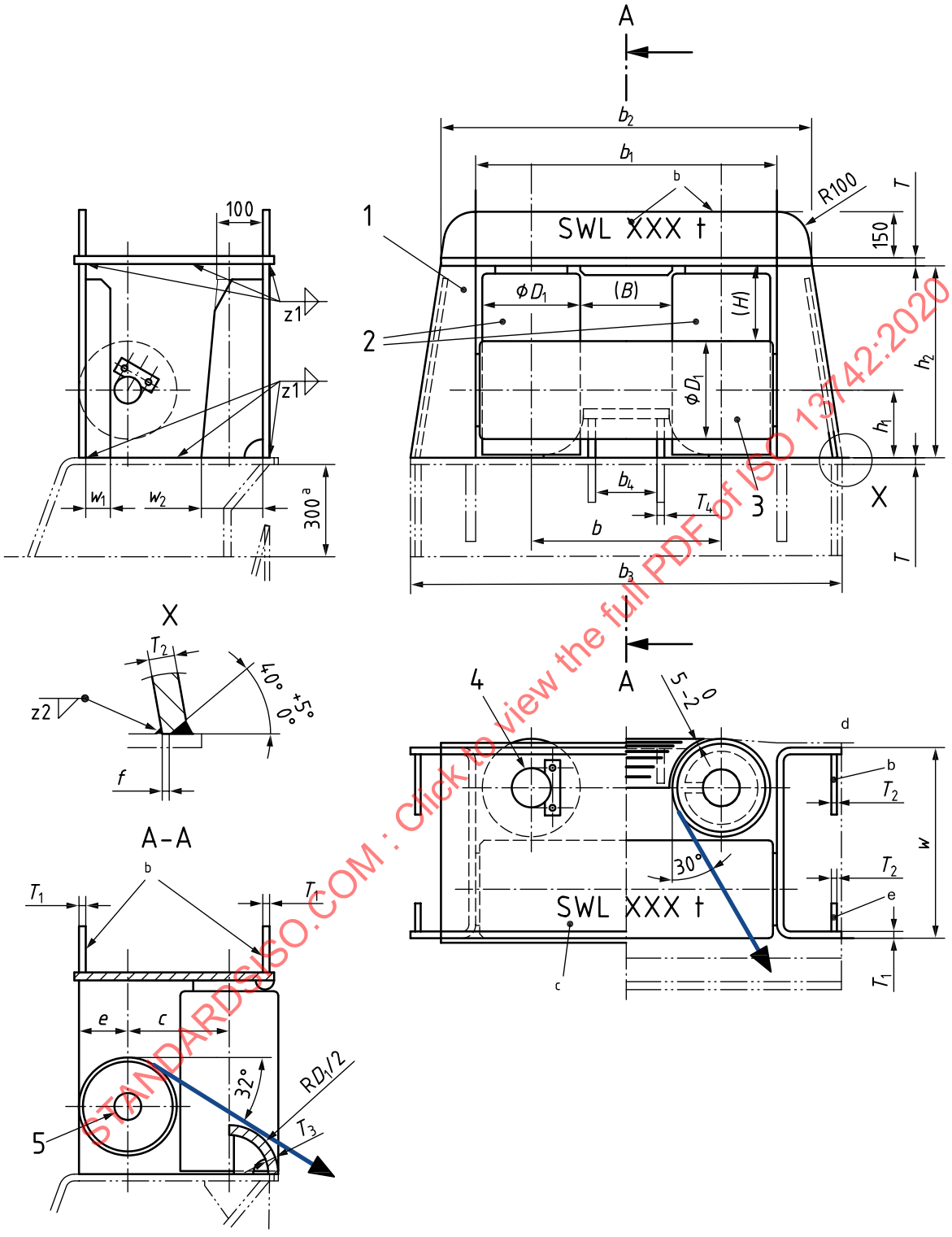
9.1 The safe working load (SWL) for the intended use of the universal fairleads shall be noted in the towing and mooring plan available on board for the guidance of the shipmaster as specified in IMO circular MSC/Circ.1175.

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 document.

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

EXAMPLE SWL XXX t

Dimensions in millimetres



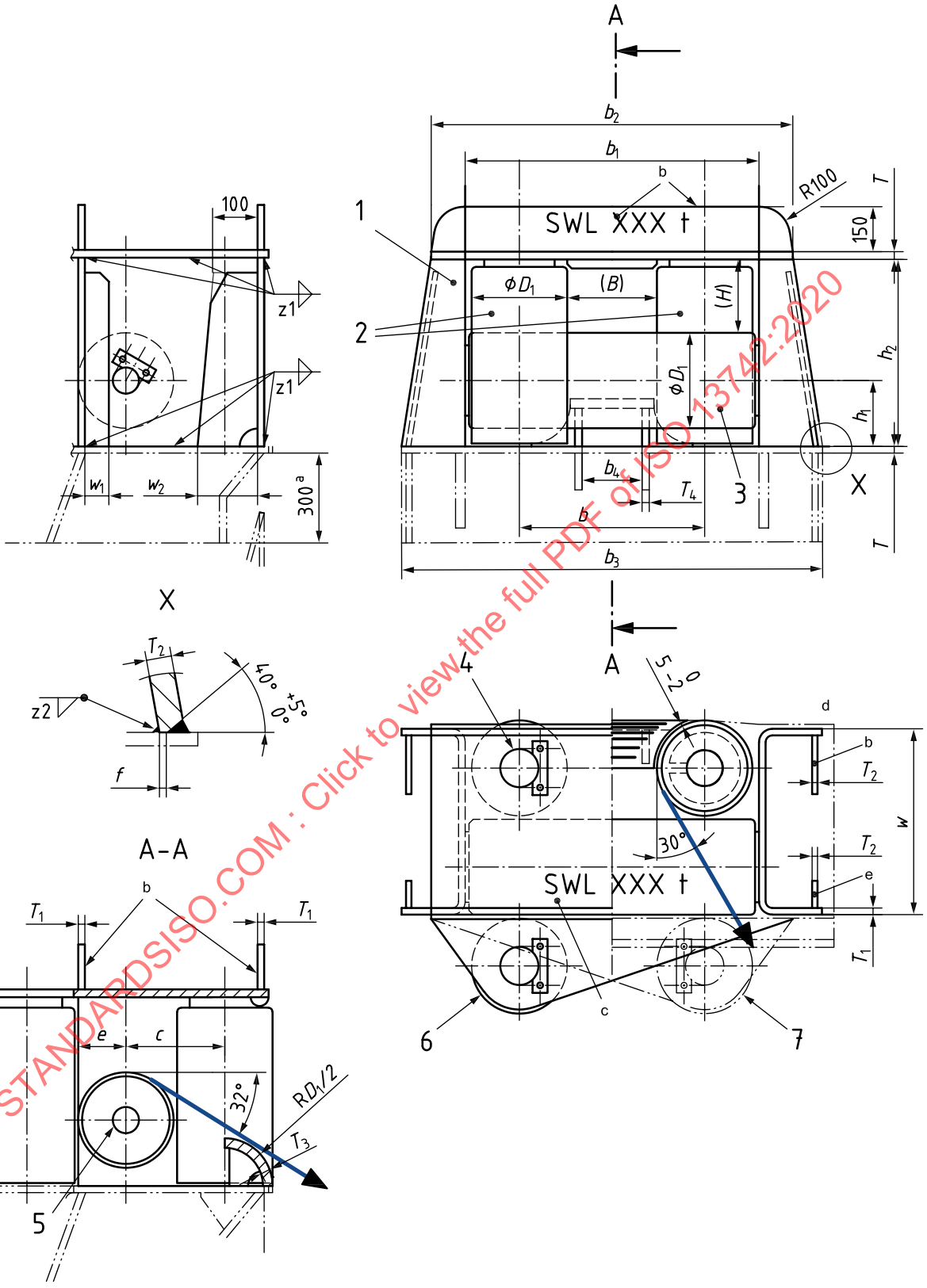
Key

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 between 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 between 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 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 2 — Dimensions *(continued)* and SWL of type 3R, 4RL and 4RR universal fairleads

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	113	143
160	83	—	—	14	8	10	14	14	3	6	4	196	20	163	207
180	95	—	—	16	8	12	16	16	3	6	4	245	25	215	272
200	108	—	—	18	10	12	18	18	3	7	4	314	32	296	373
250	133	—	150	22	14	14	20	20	4	10	5	510	52	678	858
300A	159	80	150	24	16	16	24	22	6	11	7	687	70	951	1 174
300B	159	80	150	26	18	18	24	22	6	13	7	736	75	1 029	1 268
400A	203	100	150	26	18	18	32	28	6	13	7	981	100	1 472	1 802
400B	203	100	150	28	18	20	32	28	6	13	7	1 256	128	1 615	1 997
400C	203	100	150	30	20	22	32	28	7	14	8	1 373	140	1 736	2 145

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

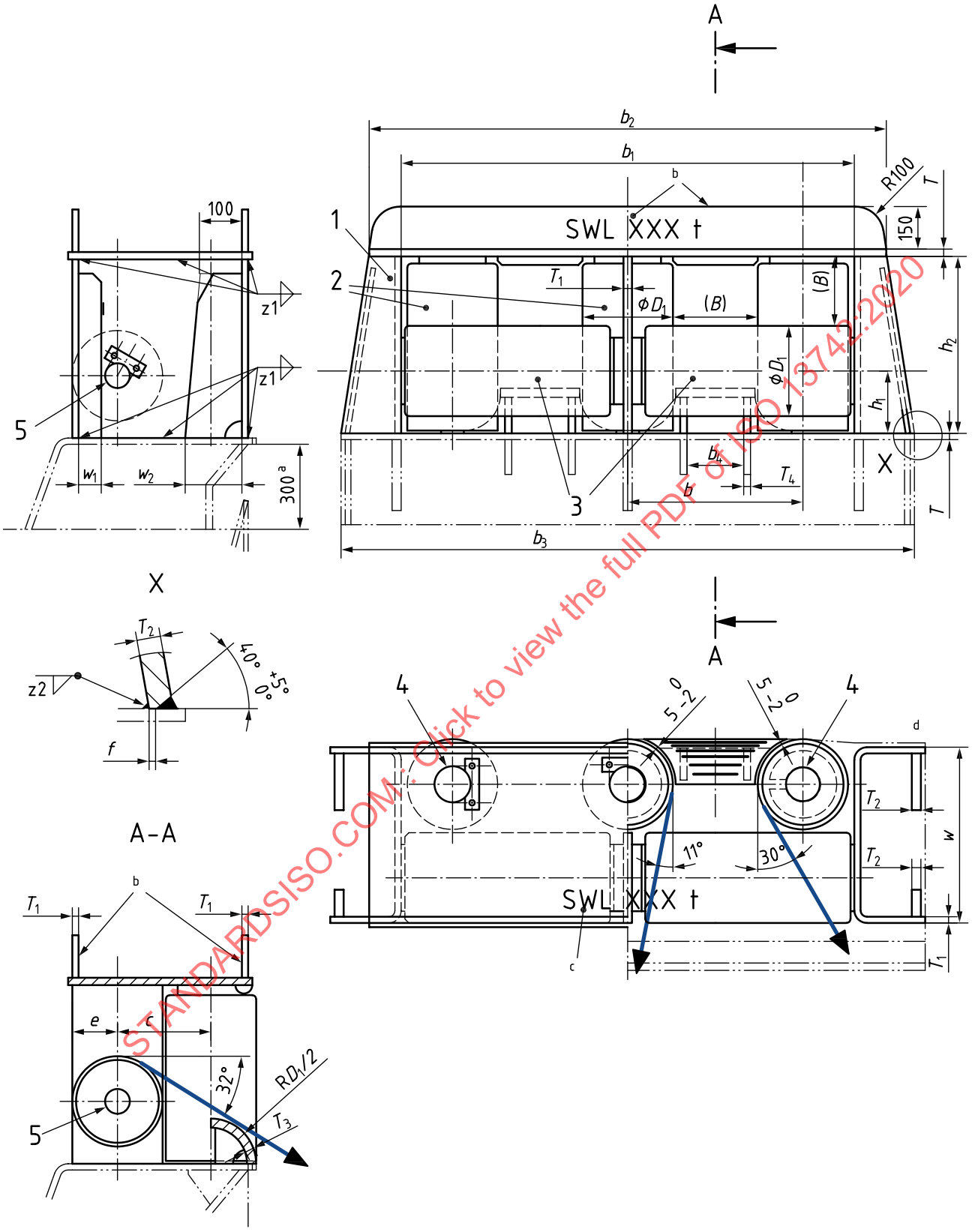
[b] Welding otherwise than mentioned in the Figures above and in this table: minimum leg length shall be 1/2 of thinner plate thickness.

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

The "SWL" which is marked on the fitting may be adjusted depending on the actual loading conditions of mooring rope under the agreement between the user and the manufacturer.

[d] The calculated weight (mass) 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 between 140 to 200 only.

[d] Side shell.

Figure 3 — Assembly of type 5R universal fairleads

Table 3 — Dimensions 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 4 — Dimensions *(continued)* and SWL of type 5R universal fairleads

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	195
160	83	40	50	14	14	16	14	14	6	10	7	196	20	285
180	95	40	50	16	16	18	16	16	6	11	7	245	25	384
200	108	50	50	18	18	20	18	18	6	13	7	314	32	516
250	133	65	150	22	22	24	20	20	8	15	9	510	52	1 155
300A	159	80	150	24	24	26	24	22	8	17	9	687	70	1 605
300B	159	80	150	26	26	28	24	22	8	18	9	736	75	1 720
400A	203	100	150	26	26	32	32	28	10	18	10	981	100	2 490
400B	203	100	150	28	28	40	32	28	10	20	10	1 256	128	2 777
400C	203	100	150	30	30	42	32	28	10	21	10	1 373	140	2 962

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

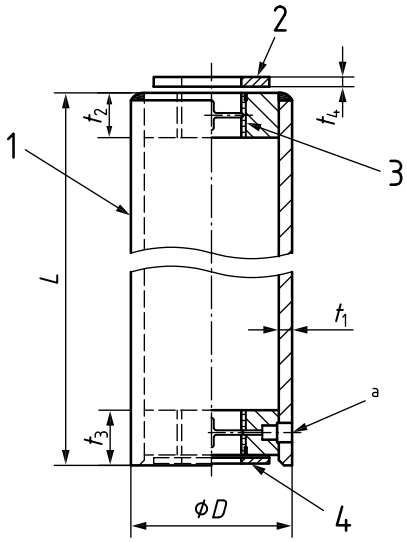
[b] Welding otherwise than mentioned in the Figures above and in this table: minimum leg length is to be 1/2 of thinner plate thickness.

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

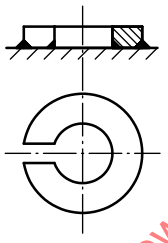
The "SWL" which is marked on the fitting may be adjusted depending on the actual loading conditions of mooring rope under the agreement between the user and the manufacturer.

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

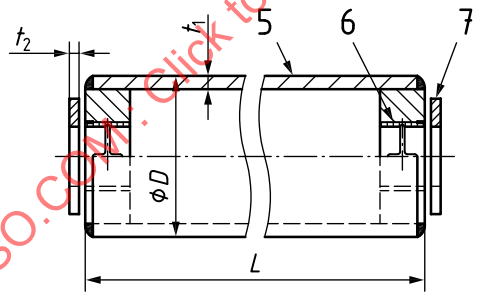
Dimensions in millimetres



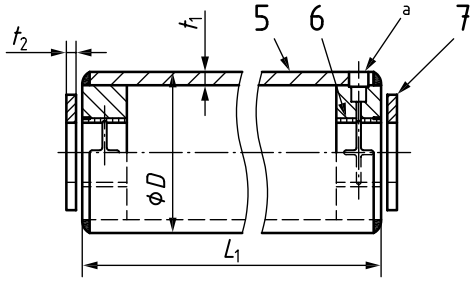
a) Vertical roller



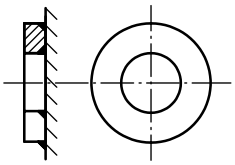
b) Lower support for vertical roller



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.

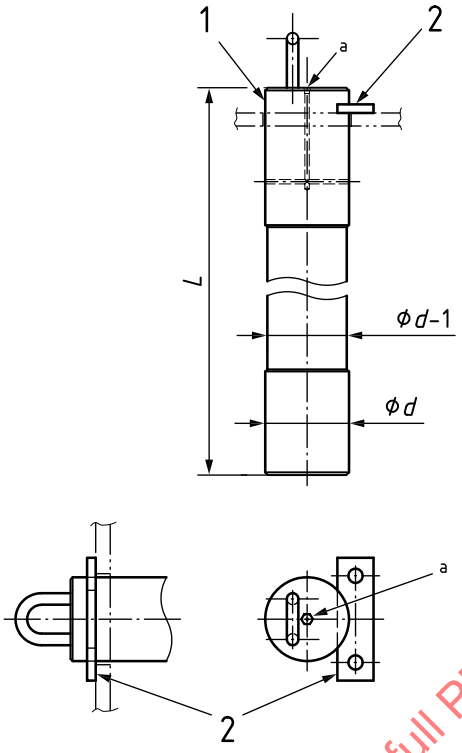
Figure 4 — Assembly of rollers

Table 5 — Dimensions of rollers

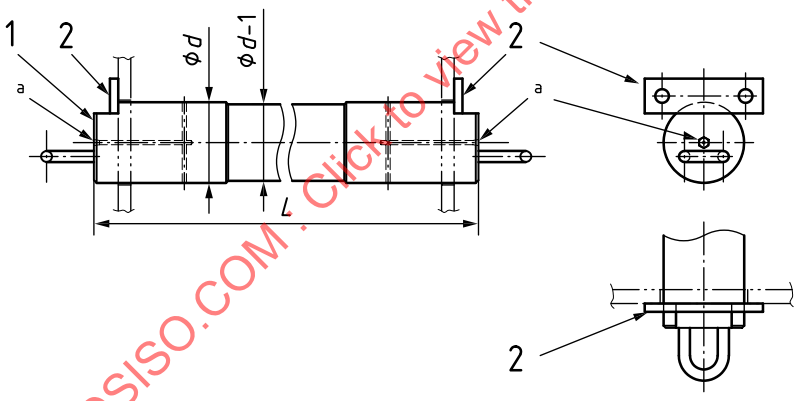
Dimensions in millimetres

Nominal size D_n	Vertical roller						Lower horizontal roller				
	D	t_1	t_2	t_3	t_4	L	D	t_1	t_2	L	L_1
140	139,8	13	40	61	27	315	139,8	10	6	499	383
160	165,2	15	50	73	27	343	165,2	11	6	554	422
180	190,7	16	55	82	27	365	190,7	12	8	600	453
200	216,3	18	60	89	27	393	216,3	12	8	655	490
250	267,4	22	75	110	27	495	267,4	15	10	799	602
300A	318,5	24	90	129	32	590	318,5	18	10	954	725
300B	318,5	26	90	129	32	590	318,5	19	10	954	724
400A	406,4	21	120	159	32	680	406,4	18	10	1 184	908
400B	406,4	25	120	159	32	680	406,4	19	10	1 184	907
400C	406,4	27	120	159	32	680	406,4	20	10	1 184	906

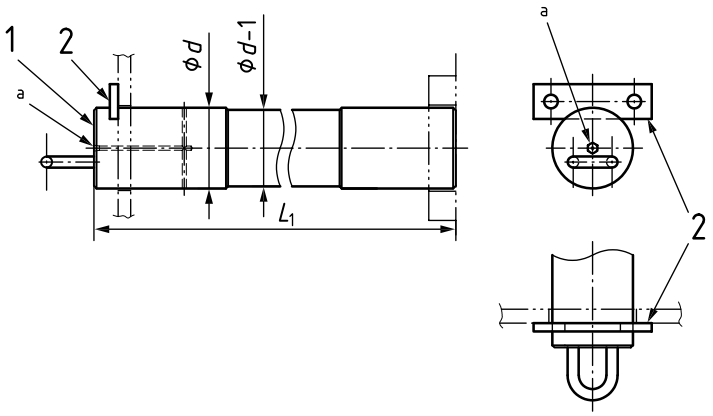
Dimensions in millimetres



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 6 — Dimensions of axles

Dimensions in millimetres

Nominal size D_n	Vertical axle		Lower horizontal axle		
	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
(normative)

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, axles and rope guide plates, and simple beam theory for rollers, and determined based on the following design criteria.

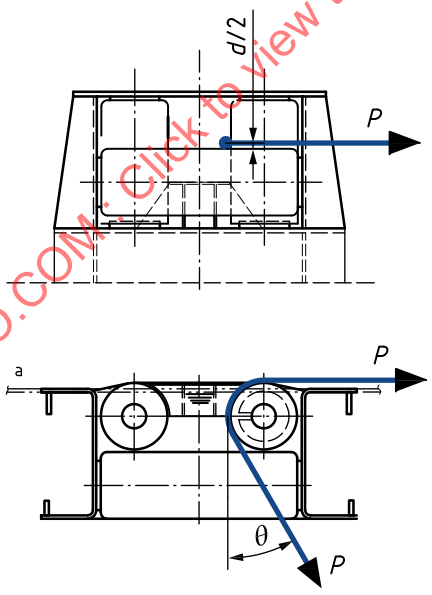
A.2 Loading

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

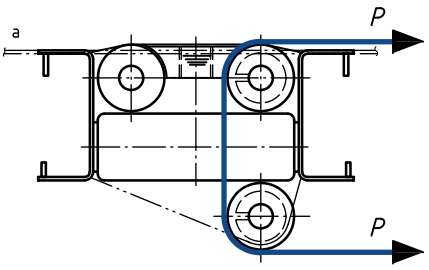
Horizontal and vertical loadings were considered individually, but both loadings were not considered simultaneously.

A.2.1 Case 1 — Horizontal loading

See Figure A.1.



a) Type 3R



b) Type 4R