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Ships and marine technology — Loose gear of lifting appliances on ships — Pulleys

Navires et technologie maritime — Accessoires mobiles des appareils de levage sur les navires — Poulies

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Foreword

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The committee responsible for this document is ISO/TC 8, *Ships and marine technology*, Subcommittee SC 4, *Outfitting and deck machinery*.

Ships and marine technology — Loose gear of lifting appliances on ships — Pulleys

1 Scope

This International Standard specifies the structural types, basic parameters, technical requirements, test methods, inspection rules, marking, storage, and transportation of sheaves, loose gear of lifting appliances on ships.

This International Standard is applicable to hot-rolled sheaves of lifting appliances on ships.

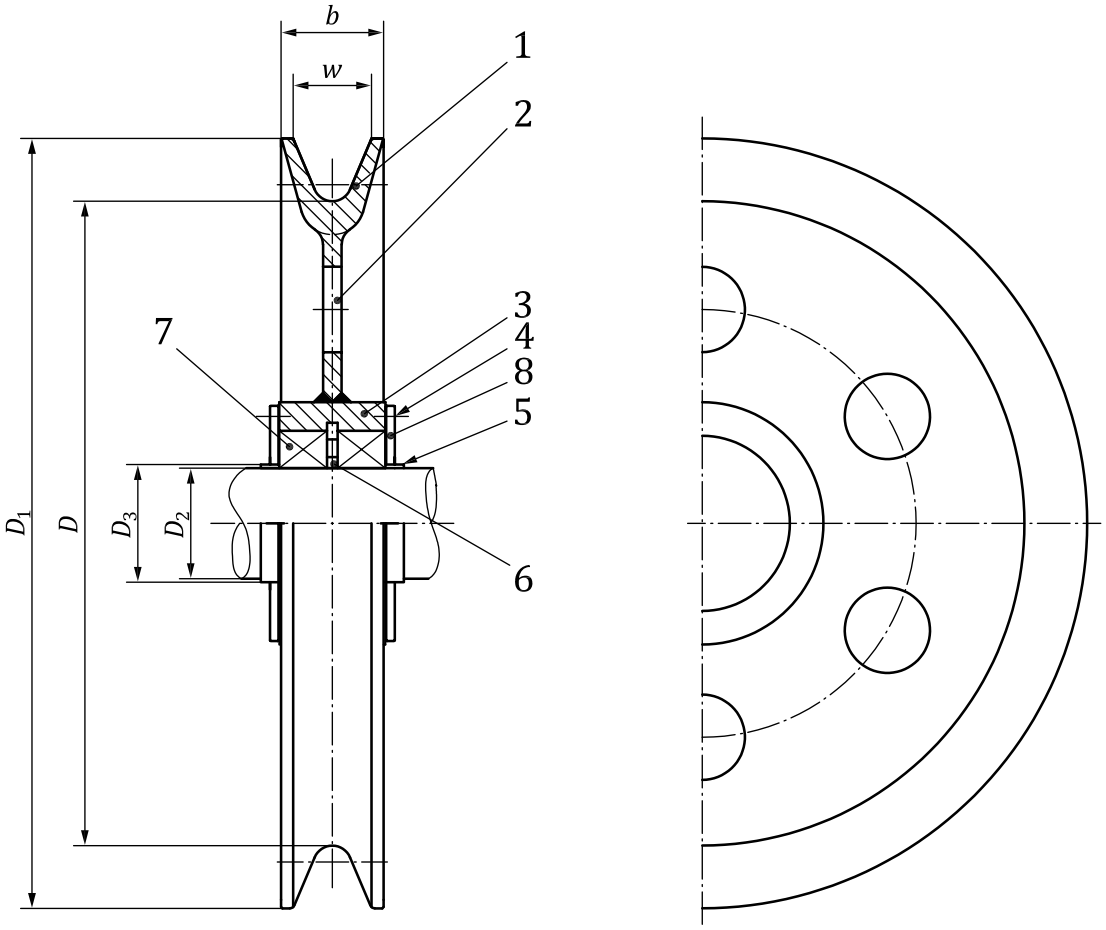
2 Normative references

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

ISO 16855, *Ships and Marine Technology — Loose gear of lifting appliances on ships — General requirements*

3 Sheave components

For the components and basic dimensions of hot-rolled sheaves, see Figure 1.



Key

1 rim
2 plate
3 hub
4 bolt
5 spacer
6 spacer sleeve
7 bearing
8 dust washer (optional)

Figure 1 — Sheave components

4 Designation of sheaves

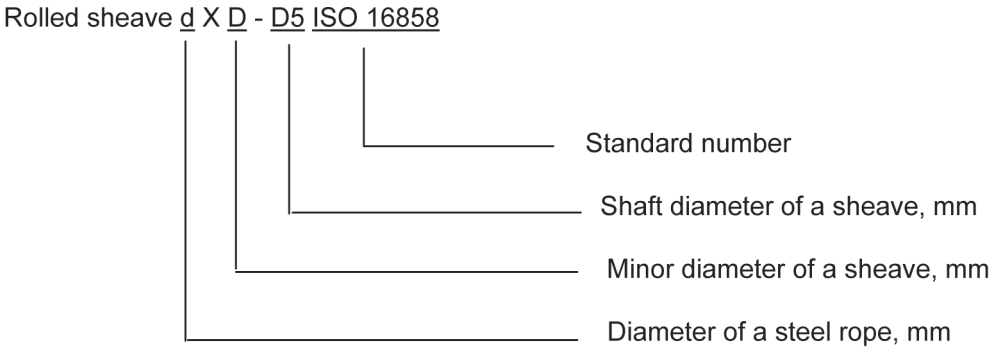


Figure — Example

5 Technical requirements

5.1 Materials

The materials of sheave components shall comply with the provisions in Table 1.

Table 1 — Requirements of component materials

Component name	Materials
Rim, plate, hub	$\sigma s \geq 235$ MPa for common carbon steel
Spacer	$\sigma s \geq 235$ MPa for common carbon steel or $\sigma b \geq 160$ MPa for gray cast-iron
Spacer sleeve	$\sigma s \geq 600$ MPa for quality carbon steel
Bolt	Above grade 8,8 specified in ISO 898
Dust cover	Wool felt

5.2 Ranges

For the ranges of sheaves, see Annex A.

5.3 Process

5.3.1 Rims and web

The rims and web of sheaves shall be manufactured from a single steel piece, with groove produced by hot rolling process.

5.3.2 Welding and weld

5.3.2.1 Welding materials used for sheaves shall match the strength of welded materials, in accordance with International Standards.

5.3.2.2 The rims and hubs of sheaves shall be welded with groove weld, with double groove preferred. The types of weld shall be in accordance with the related provisions of ISO.

5.3.2.3 The appearance shall have no quality defects such as steel pits, splashes, slag, undercuts, and surface cracks after welding.

5.3.2.4 After welding of rims and hubs, and before machining of sheaves, the sheave weld shall be adequately stabilized through thermal or vibratory stress relief, to ensure dimensional stability.

5.3.3 Surface treatment

5.3.3.1 The surface roughness of rope grooves shall not be less than 12,5; their surface hardness shall be HB260 minimum.

5.3.3.2 Machining positions of sheaves and open positions such as spacer sleeves shall be painted with antirust oil to prevent corrosion; non-machining positions shall be painted with antirust paint after the surface removal of rust.

5.4 Assembly requirements

5.4.1 Components can be assembled only after they pass tests.

5.4.2 Rolling bearings shall be cleaned before assembly, with clean, rustless, and burr-free contact surface.

5.4.3 The fit between outer rings of rolling bearings and hubs of sheaves is N7; the fit between inner rings and shafts is n6.

5.4.4 After assembly, sheaves can turn flexibly around the shaft without blocking, when manually moved.

5.5 Accuracy requirements

5.5.1 For the requirements on the limit deviation of outside diameter D_1, see Table 2.

Table 2 — Requirements on limit deviation of outside diameter D_1

Dimension in millimetres

Outside diameter D_1	**Limit deviation** t_1
≤250	−0,5
>250–500	−1,0
>500–1 000	−1,5
>1 000–1 200	−2,0
>1 200–1 500	−2,5
>1 500–1 800	−3,0
>1 800–2 000	−3,5

5.5.2 For the requirements on the limit deviation of groove minor diameter D, see Table 3.

Table 3 — Requirements on limit deviation of groove minor diameter *D*

Dimension in millimetres

Groove minor diameter *D*	Limit deviation t_2
≤250	+2,5
>250–500	+3,0
>500–1 000	+4,0
>1 000–1 200	+5,0
>1 200–1 500	+6,0
>1 500–1 800	+7,0
>1 800–2 000	+8,0

5.5.3 For the requirements on the limit deviation of groove radius *R*, see Table 4.

Table 4 — Requirements on limit deviation of groove radius *R*

Dimension in millimetres

Basic dimensions *R*	Limit deviation t_3
≤15	+1,0
>15–30	+1,5

5.5.4 For the limit deviation of rim width (*W* + 2 m), see Table 5.

Table 5 — Limit deviation of rim width (*W* + 2 m)

Dimension in millimetres

Rim width (*W* + 2 m)	Limit deviation t_4
≤50	+2
≤75	+3
≤108	+4
≤136	+5

5.5.5 The lateral run-out tolerance of grooves (see Figure 2) shall comply with the requirements given in Table 6.

Table 6 — Lateral run-out tolerance of grooves

Dimension in millimetres

Groove minor diameter *D*	Limit deviation t_5
≤250	2,0
>250–500	2,5
>500–1 000	3,0
>1 000–1 200	4,0
>1 200–1 500	5,0
>1 500–1 800	6,0

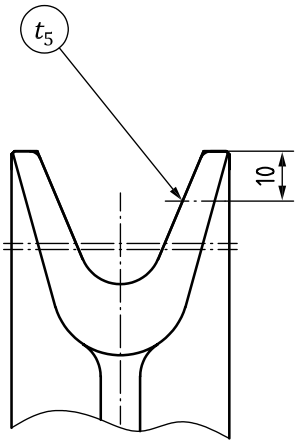


Figure 2 — Lateral run-out tolerance of grooves

5.5.6 Cycle run-out t_6 at the minor diameter D of sheaves shall comply with Formula (1) (see also Figure 3):

$$t_6 \leq \frac{2{,}5}{1\,000} \times D \tag{1}$$

5.5.7 Cylindricity tolerance t_7 at the hub bore D_0 shall comply with Formula (2) (see also Figure 3):

$$t_7 \leq \frac{\text{tolerance zone of } D0}{2} \tag{2}$$

5.5.8 Profile tolerance t_8 of a line within the tolerance zone of groove radius shall comply with Formula (3) (see also Figure 3):

$$t_8 \leq \text{limit deviation } t_3 \text{ of groove radius } R \tag{3}$$

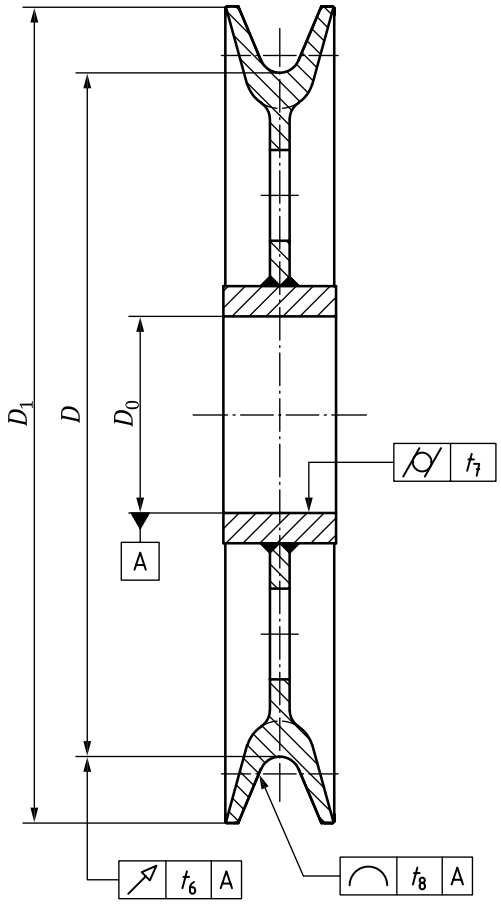


Figure 3 — Cylindricity tolerance t_7 at hub bore D_0

5.6 Special explanations

For other hot-rolled sheaves (different from that in 5.1, 5.2, 5.3, and 5.4 in terms of components, materials, process, assembly requirements, and accuracy requirements), strength shall be calculated during the design and the result shall meet the test requirements of Clause 6, and such sheaves can also be used in lifting appliances on ships, with the special consent of related organizations (such as classification societies) or as agreed on by the supplier and the purchaser.

6 Test requirements

Test requirements should be in accordance with the test requirements for blocks in ISO 16855.

7 Inspection rules

Sheaves shall be inspected and tested by the quality control department of the manufacturer according to the technical requirements and test methods of this International Standard. Inspection shall be made with the items listed in Table 8.

Table 8 — Inspection items of sheaves

No.	Inspection items
1	Limit deviation t_1 of outside diameter D_1
2	Deviation t_2 of groove minor diameter D
3	Limit deviation t_3 of groove radius R
4	Limit deviation t_4 of rim width (W + 2 m)
5	Lateral run-out tolerance t_5 of grooves
6	Cycle run-out t_6 at minor diameter D of sheaves
7	Cylindricity tolerance t_7 of hub bores D_0
8	Profile tolerance t_8 of a line within the tolerance zone of groove radius
9	Surface hardness of grooves
10	Appearance quality of welds
11	Internal quality of welds

8 Package, transportation, and storage

8.1 Package

The package of sheaves shall protect them from damage or corrosion in accordance with International Standards.

8.2 Transportation

Collision that makes sheaves distorted or damaged is strictly prohibited during transportation.

8.3 Storage

Sheaves shall be stored at dry and well-ventilated places, away from acid, alkaline, or other corrosive substances, and protected against erosion of rain, snow, and water, as well as long-time exposure to sunlight.

9 Use, maintenance, and scrapping standards of sheaves

9.1 Upon installation on the appliances, the rotation and wear of sheaves shall be checked before each use, with major check items as follows:

a) wear of rope grooves;

b) presence of loose dust washers;

c) lubrication of sheaves, whether it is required to refill lubricating grease;

d) presence of abnormal sound and irregular run-out of rope grooves during rotation of sheaves.

9.2 Scrapping standard:

a) the dimension of worn rope grooves reaches 20 % of the diameter of ropes;

b) there is distortion or cracks in rims.

Annex A
(informative)

Common hot-rolled sheave ranges

A.1 Range of sheaves

Classifications are made according to the ratio of the pitch diameter D_0 of a sheave (D_0 = minor diameter D of a sheave + diameter d of a steel rope) to the diameter d of a steel rope.

The bigger the ratio of D_0/d, the longer the fatigue life of a steel rope is. For sheaves used in lifting appliances on ships, D/d ratio shall be in accordance with ISO 16855.

Table A.1 — Range of sheaves (D_0/d = 20)

Steel rope diameter d mm	**Basic dimensions** mm							**Recommended bearing model**
	D	D_1	R	f	D_2	D_3	B	
10–14	280	325	7	8	55	63	64	211
					60	69	66	212
					65	75	68	213
					70	80	70	214
>14–19	355	415	10	8	80	90	74	216
					85	96	78	217
					90	102	82	218
					95	108	86	219
>19–23,5	450	521	12	10	95	108	90	219
					100	113	94	220
					110	124	102	222
					120	135	106	224
>23,5–30	560	650	15	10	130	146	106	226
					140	158	110	228
					150	170	116	230
					160	180	122	232
>30–37	710	822	19	12	160	188	128	42232
					170	202	136	42234
					180	212	136	42236
					190	225	142	42238
>37–43	800	926	22	12	160	188	128	42232
					170	202	136	42234
					180	212	136	42236
					190	225	142	42238

Table A.1 *(continued)*

Steel rope diameter d mm	**Basic dimensions** mm							**Recommended bearing model**
	D	D_1	R	f	D_2	D_3	B	
>43–50	900	1 052	26	14	190	225	148	42238
					200	235	154	42240
					220	260	168	42244
					240	278	182	42248
>50–58	1 120	1 292	29	14	190	225	148	42238
					200	235	154	42240
					220	260	168	42244
					240	278	182	42248

Table A.2 — Range of sheaves (D_0/d = 25)

Steel rope diameter d mm	**Basic dimensions** mm							**Recommended bearing model**
	D	D_1	R	f	D_2	D_3	B	
10–14	355	400	7	8	55	63	64	211
					60	69	66	212
					65	75	68	213
					70	80	70	214
>14–19	450	510	10	8	80	90	74	216
					85	96	78	217
					90	102	82	218
					95	108	86	219
>19–23,5	560	631	12	10	95	108	90	219
					100	113	94	220
					110	124	102	222
					120	135	106	224
>23,5–30	710	800	15	10	130	146	106	226
					140	158	110	228
					150	170	116	230
					160	180	122	232
>30–37	900	1 012	19	12	160	188	128	42232
					170	202	136	42234
					180	212	136	42236
					190	225	142	42238
>37–43	1 000	1 126	22	12	160	188	128	42232
					170	202	136	42234
					180	212	136	42236
					190	225	142	42238

Table A.2 *(continued)*

Steel rope diameter d mm	**Basic dimensions** mm							**Recommended bearing model**
	D	D_1	R	f	D_2	D_3	B	
>43–50	1 250	1 402	26	14	190	225	148	42238
					200	235	154	42240
					220	260	168	42244
					240	278	182	42248
>50–58	1 400	1 572	29	14	190	225	148	42238
					200	235	154	42240
					220	260	168	42244
					240	278	182	42248

Table A.3 — Range of sheaves (D_0/d = 28)

Steel rope diameter d mm	**Basic dimensions** mm							**Recommended bearing model**
	D	D_1	R	f	D_2	D_3	B	
10–14	400	445	7	8	55	63	64	211
					60	69	66	212
					65	75	68	213
					70	80	70	214
>14–19	500	560	10	8	80	90	74	216
					85	96	78	217
					90	102	82	218
					95	108	86	219
>19–23,5	630	701	12	10	95	108	90	219
					100	113	94	220
					110	124	102	222
					120	135	106	224
>23,5–30	800	890	15	10	130	146	106	226
					140	158	110	228
					150	170	116	230
					160	180	122	232
>30–37	1 000	1 112	19	12	160	188	128	42232
					170	202	136	42234
					180	212	136	42236
					190	225	142	42238
>37–43	1 120	1 246	22	12	160	188	128	42232
					170	202	136	42234
					180	212	136	42236
					190	225	142	42238

Table A.3 *(continued)*

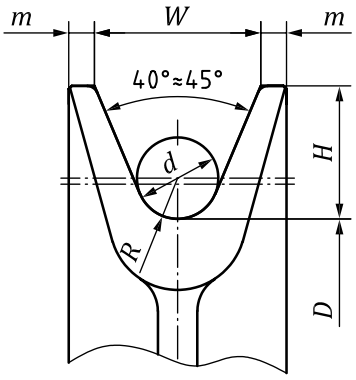
Steel rope diameter d mm	Basic dimensions mm							Recommended bearing model
	D	D_1	R	f	D_2	D_3	B	
>43–50	1 400	1 552	26	14	190	225	148	42238
					200	235	154	42240
					220	260	168	42244
					240	278	182	42248
>50–58	1 600	1 772	29	14	190	225	148	42238
					200	235	154	42240
					220	260	168	42244
					240	278	182	42248

NOTE 1 The dimension of "f" is the width of spacer sleeves.

NOTE 2 Bearings refer to spherical or cylindrical roller bearings.

A.2 Cross section dimensions of rope grooves of sheaves

Main dimensions of cross section of a steel wire rope are recommended in accordance with the provisions specified in Figure A.1 and Table A.4.



Key

W width of a rope groove
m margin width
R radius of a rope groove
H height of a rope groove
d diameter of a steel rope
D diameter of a sheave

Figure A.1 — Cross section of rope groove

Table A.4 — Basic dimensions of cross section of a steel wire rope

Dimension in millimetres

Steel rope diameter *d*	*R*	*H*	*W*	*m*
10–14	7	22,5	26–28	4,5
>14–19	10	30	36–38	6
>19–23,5	12	35,5	43–46	7
>23,5–30	15	45	54–57	8
>30–37	19	56	67–72	10
>37–43	22	63	77–82	11
>43–50	26	76	92–98	12,5
>50–58	29	80	103–110	12,5

Bibliography

[1] ISO 630 (all parts), *Structural steels*

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