INTERNATIONAL STANDARD

ISO 1704

Second edition
1991-11-01

Shipbuilding — Stud-link anchor chains

Construction navale — Chaînes d'ancre à mailles étançonnées

Reference number
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Contents

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 1704 was prepared by Technical Committee ISO/TC 8, *Shipbuilding and marine structures*.

This second edition cancels and replaces the first edition (ISO 1704 : 1973), to which the following changes have been made:

a) the range of sizes has been extended to align with the range covered by the International Association of Classification Societies (IACS);

b) a countersunk head on the shackle bolt is specified as an alternative to the existing flat head;

c) a taper pin is now specified for the shackle in place of the former parallel pin;

d) tolerances on the nominal diameter of the links have been specified more clearly, although remaining largely the same. A larger tolerance has now been proposed for links over 122 mm diameter.

Swivel devices have not been included in this revision, although proposals for this were studied. The diversity of type and individuality of the designs, some of which were patented, militated against standardization, even to a limited extent.

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Shipbuilding — Stud-link anchor chains

1 Scope

This International Standard specifies the shape, proportions, dimensions and tolerances of the component parts of new stud-link anchor chains.[1)]

NOTE — Users of this International Standard should note that, while observing the requirements of the Standard, they should at the same time ensure compliance with such statutory requirements, rules and regulations as may be applicable to the individual ship concerned.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 2093 : 1986, *Electroplated coatings of tin — Specification and test methods.*

ISO 2339 : 1986, *Taper pins, unhardened.*

3 Shape and dimensions

3.1 Shape

The stud-links, shackles and component parts shall be of the shapes and proportions shown in figures 1 to 7. All links and shackles shall be of uniform shape.

3.2 Dimensions

3.2.1 General

The dimensions of stud-links, shackles and component parts shall be in accordance with the values given in tables 1 to 6.

The nominal diameter (d) is a design diameter measured at the crown of a common link. See figure 1 and table 1.

All dimensions, based on the nominal diameters d of the common links, shall be measured after the chain and shackles have been subjected to the statutory proof loads.

3.2.2 Enlarged links

The proportions of the enlarged links are the same as those of the common links.

3.2.3 Common links and enlarged links

The inside radii of common links and enlarged links shall be sufficient to allow each link to bed properly and work freely. See figures 1 and 2.

3.2.4 End links

The inside radii of end links shall be equal to half the inside width and the sides shall be parallel.

3.2.5 Shackle retaining pin

The retaining pin used in "D" type joining shackles and end shackles shall be a taper pin having a taper of not less than 1:50 and not more than 1:16 on the diameter.

The retaining pin used in Kenter type shackles shall be a taper pin having a taper of not less than 1:50 and not more than 1:32 on the diameter.

Nominal sizes and lengths required are given in tables 4, 5 and 6. Other details of the taper pins, e.g. end radius, cone tolerance and surface finish, shall be in accordance with ISO 2339.

Taper pins shall be either of stainless steel or tin-coated. If tin-coated, this shall be either by a hot-dip process or electroplating in accordance with ISO 2093 : 1986, sub-clause 7.1, service condition 4.

1) Studless anchor chains for small vessels are covered by ISO 4565 : 1986, *Small craft — Anchor chains.*

4 Tolerances

4.1 Nominal diameter d of common links

The allowable manufacturing tolerances on the nominal diameter d the common links, measured at the crown, are

$^{0}_{-1}$ mm for $d \leqslant 40$ mm;

$^{0}_{-2}$ mm for 40 mm $< d \leqslant$ 84 mm;

$^{0}_{-3}$ mm for 84 mm $< d \leqslant$ 122 mm;

$^{0}_{-4}$ mm for $d >$ 122 mm.

The cross-sectional area at the crown of the link shall be not less than the area of a circle of the nominal diameter.

The allowable manufacturing tolerance on the nominal diameter measured elsewhere on the link is

$^{0}_{-2,5}$ %.

4.2 Length of five links

The allowable manufacturing tolerance on a length of five links is

$^{+5}_{0}$ %.

4.3 All other dimensions

The allowable manufacturing tolerance is ± 5 %, taking into account the fact that all components of the anchor chain shall be good fits with each other.

5 Range of sizes of links and shackles

The range of nominal diameters d is that specified by the Classification Societies associated in the International Association of Classification Societies (IACS).

6 Designation of size

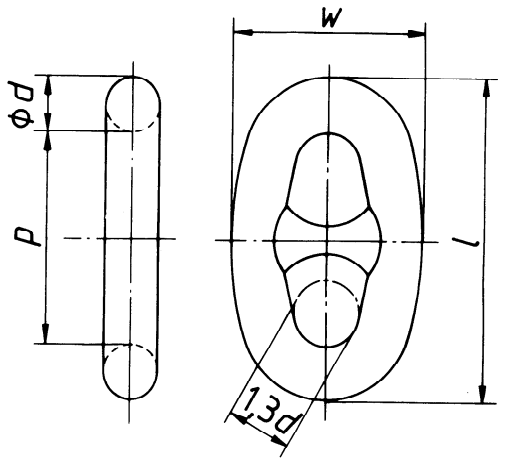
The nominal size of a common link is designated by the nominal diameter d of the link.

The nominal size of other links and shackles is designated by the nominal diameter d of the common link.

The size of a stud-link anchor chain is designated by the nominal size of the common link.

7 Connections

Examples in the use of connecting links, shackles and swivels are shown in figure 7.



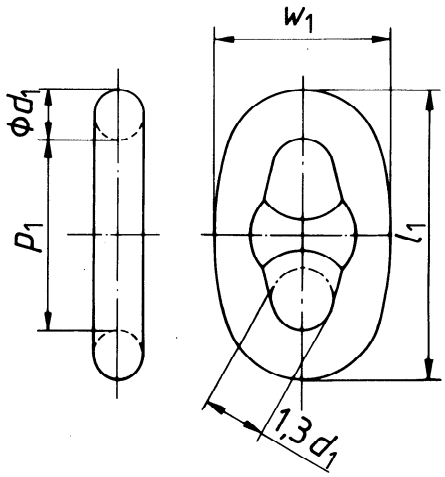
d = nominal diameter of common link
l = $6d$
p = $4d$
w ≈ $3{,}6d$

Figure 1 — Common link

Table 1 — Nominal dimensions of common link

Dimensions in millimetres

d	l	p	w
12,5	75	50	45
14	84	56	50
16	96	64	58
17,5	105	70	63
19	114	76	68
20,5	123	82	74
22	132	88	79
24	144	96	86
26	156	104	94
28	168	112	101
30	180	120	108
32	192	128	115
34	204	136	122
36	216	144	130
38	228	152	137
40	240	160	144
42	252	168	151
44	264	176	158
46	276	184	166
48	288	192	173
50	300	200	180
52	312	208	187
54	324	216	194
56	336	224	202
58	348	232	209
60	360	240	216
62	372	248	223
64	384	256	230
66	396	264	238
68	408	272	245
70	420	280	252
73	438	292	263
76	456	304	274
78	468	312	281
81	486	324	292
84	504	336	302
87	522	348	313
90	540	360	324
92	552	368	331
95	570	380	342
97	582	388	349
100	600	400	360
102	612	408	367
105	630	420	378
107	642	428	385
111	666	444	400
114	684	456	410
117	702	468	421
120	720	480	432
122	732	488	439
124	744	496	446
127	762	508	457
130	780	520	468
132	792	528	475
137	822	548	493
142	852	568	511
147	882	588	529
152	912	608	547
157	942	628	565
162	972	648	583



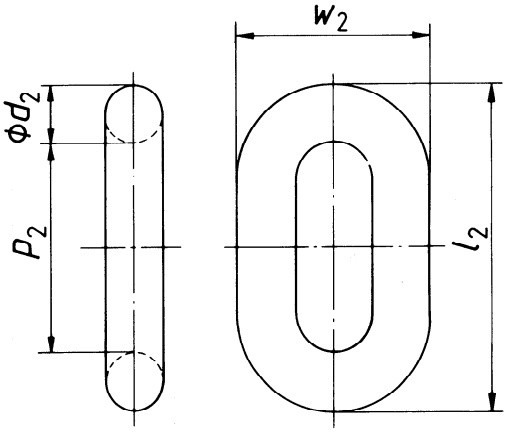
d = nominal diameter of common link
d_1 = diameter of enlarged link $\approx 1{,}1d$
$l_1 = 6d_1$
$p_1 = 4d_1$
$w_1 \approx 3{,}6d_1$

Figure 2 — Enlarged link

Table 2 — Nominal dimensions of enlarged link

Dimensions in millimetres

Nominal size (d common link)	d_1	l_1	p_1	w_1
12,5	14	84	56	50
14	16	96	64	58
16	17,5	105	70	63
17,5	19	114	76	68
19	20,5	123	82	74
20,5	22	132	88	79
22	24	144	96	86
24	26	156	104	94
26	28	168	112	101
28	30	180	120	108
30	34	204	136	122
32	36	216	144	130
34	38	228	152	137
36	40	240	160	144
38	42	252	168	151
40	44	264	176	158
42	46	276	184	166
44	48	288	192	173
46	50	300	200	180
48	54	324	216	194
50	56	336	224	202
52	58	348	232	209
54	60	360	240	216
56	62	372	248	223
58	64	384	256	230
60	66	396	264	238
62	68	408	272	245
64	70	420	280	252
66	73	438	292	263
68	76	456	304	274
70	81	468	312	281
73	81	486	324	292
76	84	504	336	302
78	87	510	340	306
81	90	540	360	324
84	92	552	368	331
87	97	582	388	349
90	100	600	400	360
92	102	612	408	367
95	105	630	420	378
97	107	642	428	385
100	111	666	444	400
102	111	672	448	403
105	114	684	456	410
107	117	702	468	421
111	122	732	488	439
114	124	744	496	446
117	130	780	520	468
120	132	792	528	475
122	137	822	548	493
124	137	822	548	493
127	142	852	568	511
130	142	852	568	511
132	147	882	588	529
137	152	912	608	547
142	157	942	628	565
147	162	972	648	583
152	167	1 002	668	601
157	173	1 038	692	623
162	178	1 068	712	641



d = nominal diameter of common link
d_2 = diameter of end link ≈ 1,2d
l_2 = p_2 + 2d_2 ≈ 6,75d
p_2 ≈ 4,35d
w_2 ≈ 4d

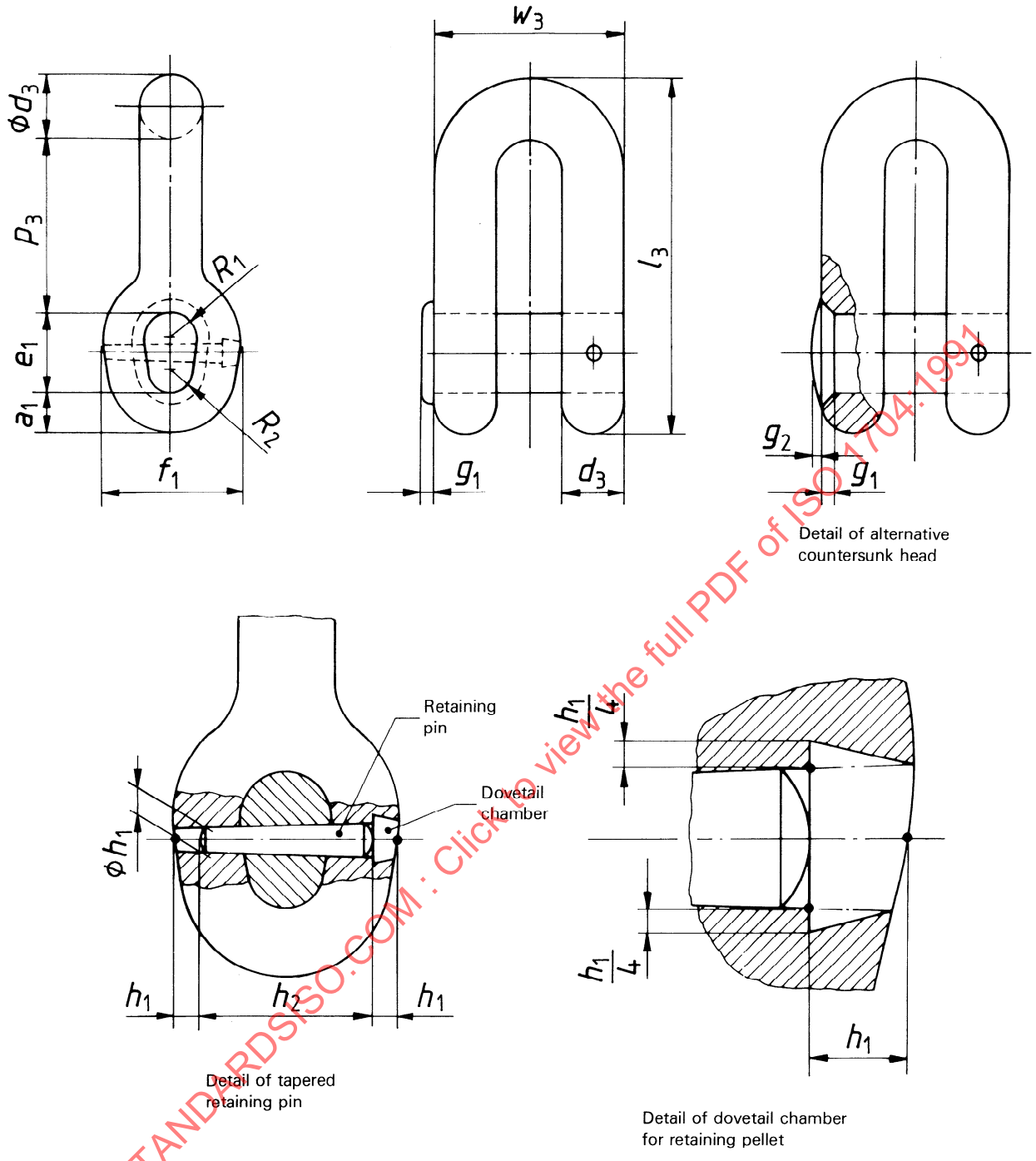
Figure 3 — End link

Table 3 — Nominal dimensions of end link

Dimensions in millimetres

Nominal size (d common link)	d_2	l_2	p_2	w_2
12,5	16	86	54	50
14	17,5	96	61	56
16	19	108	70	64
17,5	20,5	117	76	70
19	22	127	83	76
20,5	24	137	89	82
22	26	148	96	88
24	28	160	104	96
26	32	177	113	104
28	34	190	122	112
30	36	203	131	120
32	38	215	139	128
34	40	228	148	136
36	44	245	157	144
38	46	257	165	152
40	48	270	174	160
42	50	283	183	168
44	52	295	191	176
46	56	312	200	184
48	58	325	209	192
50	60	338	218	200
52	62	350	226	208
54	64	363	235	216
56	68	380	244	224
58	70	392	252	232
60	73	407	261	240
62	73	416	270	248
64	76	430	278	256
66	81	449	287	264
68	81	458	296	272
70	84	473	305	280
73	87	492	318	292

Nominal size (d common link)	d_2	l_2	p_2	w_2
76	92	515	331	304
78	95	529	339	312
81	97	546	352	324
84	100	565	365	336
87	105	588	378	348
90	107	606	392	360
92	111	622	400	368
95	114	643	413	380
97	117	656	422	388
100	120	675	435	400
102	122	688	444	408
105	127	711	457	420
107	130	725	465	428
111	132	747	483	444
114	137	770	496	456
117	142	793	509	468
120	147	816	522	480
122	147	825	531	488
124	152	843	539	496
127	152	856	552	508
130	157	878	566	520
132	162	894	574	528
137	165	926	596	548
142	170	958	618	568
147	180	999	639	588
152	185	1 031	661	608
157	190	1 063	683	628
162	195	1 095	705	648



d = nominal diameter of common link
d_3 = diameter of joining shackle $\approx 1{,}3d$
$l_3 \approx 7{,}1d$
$p_3 = l_3 - (d_3 + a_1 + e_1) \approx 3{,}4d$
$w_3 = 4d$
$a_1 \approx 0{,}8d$
$e_1 \approx 1{,}6d$
$f_1 \approx 2{,}8d$
$g_1 \approx 0{,}2d$
$g_2 \approx 0{,}1d$
h_1 = nominal diameter of taper pin
h_2 = nominal length of taper pin
$R_1 \approx 0{,}6d$
$R_2 \approx 0{,}5d$

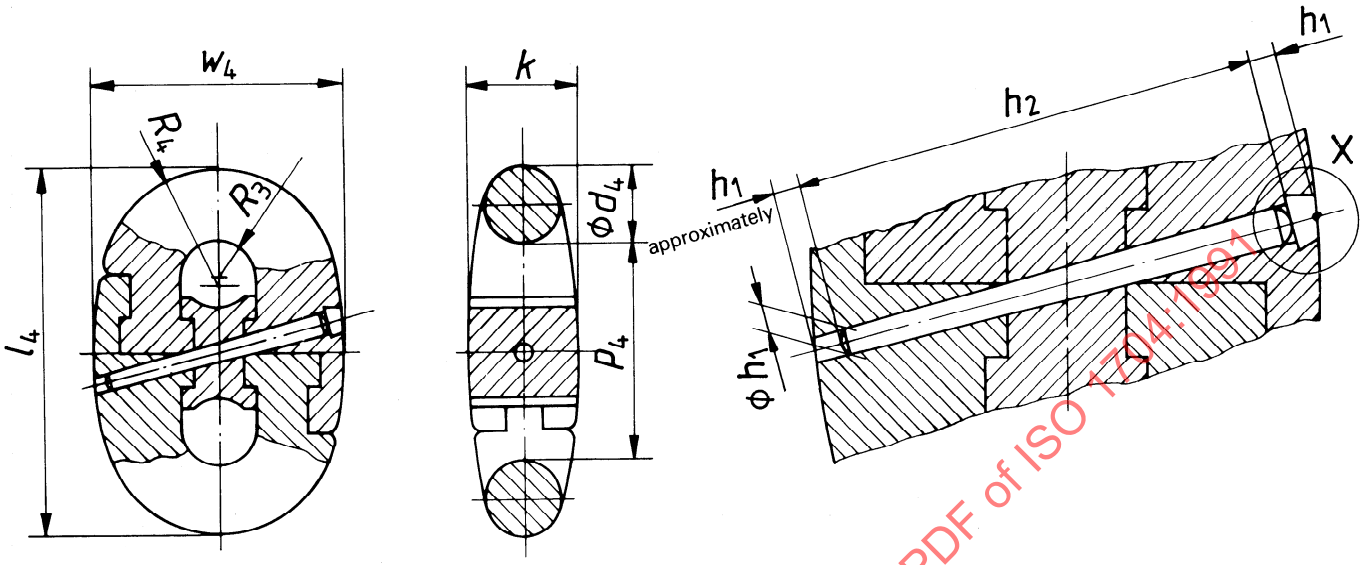
See table 4.
Taper of retaining pin : see 3.2.5.

Figure 4 — "D" type joining shackle

Table 4 — Nominal dimensions of "D" type joining shackle

Dimensions in millimetres

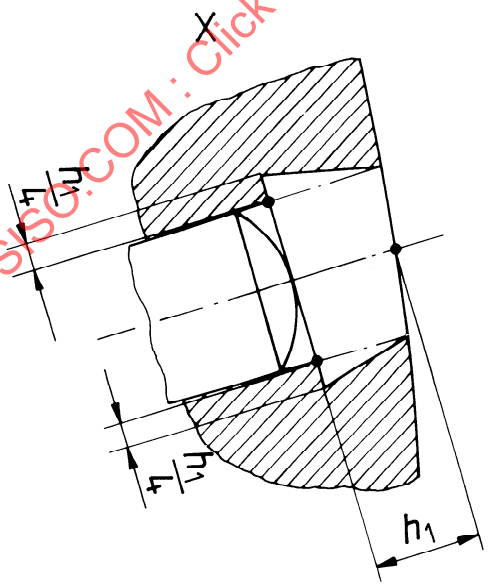
Nominal size (d common link)	d_3	l_3	p_3	w_3	a_1	e_1	f_1	g_1	g_2	h_1	h_2	$2\,R_1$	$2\,R_2$
12,5	16	89	43	50	10	20	35	2,5	1,3	4	25	15	12,5
14	19	99	46	56	11	23	39	3	1,5		28	17	14
16	20,5	114	54,5	64	13	26	45	3	1,5		32	19	16
17,5	23	124	59	70	14	28	49	3,5	1,8		38	21	17,5
19	25	135	65	76	15	30	53	4	2		40	23	19
20,5	27	146	69,5	82	16,5	33	57	4	2		45	25	20,5
22	29	156	74,5	88	17,5	35	61	4,5	2,3		50	27	22
24	31	170	82	96	19	38	67	5	2,5	6	55	29	24
26	34	185	88	104	21	42	73	5	2,5		60	31	26
28	36	199	95,5	112	22,5	45	78	5,5	2,8		65	34	28
30	39	213	102	120	24	48	84	6	3		70	36	30
32	42	227	108,5	128	25,5	51	90	6,5	3,3		80	38	32
34	44	241	116	136	27	54	95	7	3,5		85	41	34
36	47	256	122	144	29	58	101	7	3,5		80	43	36
38	49	271	129	152	31	62	106	7,5	3,8		85	46	38
40	52	284	136	160	32	64	112	8	4		90	48	40
42	55	300	143	168	34	68	118	8,5	4,3	10	100	50	42
44	57	312	150	176	35	70	123	9	4,5		100	53	44
46	60	327	156	184	37	74	129	9	4,5		110	55	46
48	62	341	163,5	192	38,5	77	134	9,5	4,8		110	58	48
50	65	355	170	200	40	80	140	10	5		115	60	50
52	68	369	177	208	41	83	146	10,5	5,3		120	62	52
54	70	383	184	216	43	86	151	11	5,5	12	125	65	54
56	73	398	190	224	45	90	157	11	5,5		130	67	56
58	75	412	198	232	46	93	162	11,5	5,8		140	70	58
60	78	426	204	240	48	96	168	12	6		140	72	60
62	81	440	210	248	50	99	174	12,5	6,3		150	74	62
64	83	454	218	256	51	102	180	13	6,5		150	77	64
66	86	469	224	264	53	106	185	13	6,5		150	79	66
68	88	483	232	272	54	109	190	13,5	6,8		160	82	68
70	91	497	238	280	56	112	196	14	7		160	84	70
73	95	518	248	292	58	117	204	14,5	7,3		170	88	73
76	99	540	258	304	61	122	213	15	7,5		180	91	76
78	101	554	266	312	62	125	218	15,5	7,8	16	190	94	78
81	105	575	275	324	65	130	227	16	8		190	97	81
84	109	596	286	336	67	134	236	17	8,5		200	101	84
87	113	618	296	348	70	139	246	17,5	8,8		200	104	87
90	117	639	306	360	72	144	252	18	9		220	108	90
92	120	653	312	368	74	147	258	18,5	9,3		220	110	92
95	124	675	323	380	76	152	266	19	9,5		220	114	95
97	126	689	330	388	78	155	272	19,5	9,8		240	116	97
100	130	710	340	400	80	160	280	20	10		240	120	100
102	133	724	346	408	82	163	286	20,5	10,3		240	122	102
105	137	746	357	420	84	168	294	21	10,5		260	126	105
107	139	760	364	428	86	171	300	21,5	10,8	20	260	128	107
111	144	788	377	444	89	178	311	22	11		260	133	111
114	148	809	388	456	91	182	319	23	11,5		280	137	114
117	152	831	398	468	94	187	328	23,5	11,8		280	140	117
120	156	852	408	480	96	192	336	24	12		300	144	120
122	159	866	414	488	98	195	342	24,5	12,3		300	146	122
124	161	880	422	496	99	198	347	25	12,5		300	149	124
127	165	902	432	508	102	203	356	25,5	12,8		300	152	127
130	169	923	442	520	104	208	364	26	13		320	156	130
132	172	937	448	528	106	211	370	26,5	13,3		320	158	132
137	178	973	466	548	110	219	384	27,5	13,8	25	320	164	137
142	185	1 008	482	568	114	227	398	28,5	14,3		350	170	142
147	191	1 044	500	588	118	235	412	29,5	14,8		350	176	147
152	198	1 079	516	608	122	243	426	30,5	15,3		350	182	152
157	204	1 115	524	628	126	251	440	31,5	15,8		400	188	157
162	211	1 150	550	648	130	259	454	32,5	16,3		400	194	162



d = nominal diameter of common link
d_4 = diameter of lugless joining shackle = d
l_4 = $6d$
p_4 = $4d$
w_4 ≈ $4{,}2d$

h = nominal diameter of taper pin
h_2 ≈ $3{,}4d$ = length of taper pin
k ≈ $1{,}52d$
R_3 ≈ $0{,}67d$
R_4 ≈ $1{,}83d$

See table 5.
Taper of retaining pin : see 3.2.5.



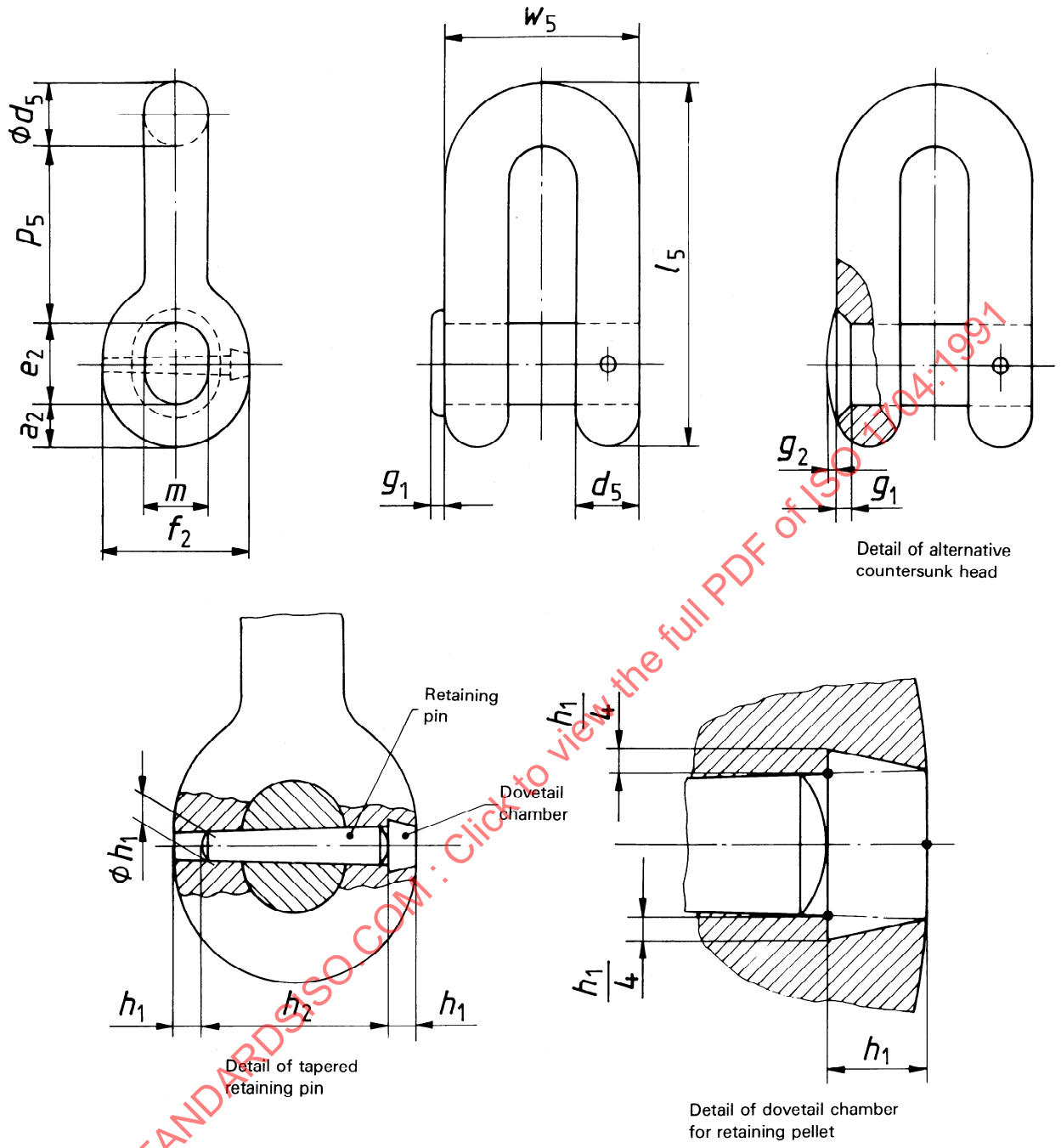
Detail of dovetail chamber for retaining pellet

Figure 5 — Kenter type joining shackle

Table 5 — Nominal dimensions of Kenter type shackle

Dimensions in millimetres

Nominal size (d common link = d_4)	l_4	p_4	w_4	h_1	h_2	k	R_3	R_4
12,5	75	50	53	4	45	19	8,5	23
14	84	56	59		45	21	9,5	26
16	96	64	67		55	24	10.5	29
17,5	105	70	74	6	60	27	12	32
19	114	76	80		65	29	13	35
20,5	123	82	86		70	31	14	38
22	132	88	92		75	33	15	40
24	144	96	101		80	36	16	44
26	156	104	109	10	85	40	17,5	48
28	168	112	118		95	43	19	51
30	180	120	126		100	46	20	55
32	192	128	134		110	49	21,5	59
34	204	136	143		115	52	23	62
36	216	144	151		120	55	24	66
38	228	152	160	12	130	58	25	70
40	240	160	168		140	61	27	73
42	252	168	176		140	64	28	77
44	264	176	185		150	67	29	81
46	276	184	193		160	70	31	84
48	288	192	202	16	160	73	32	88
50	300	200	210		170	76	34	92
52	312	208	218		180	79	35	95
54	324	216	227		180	82	36	99
56	336	224	235		190	85	38	102
58	348	232	244		200	88	39	106
60	360	240	252	20	200	91	40	110
62	372	248	260		220	94	42	113
64	384	256	269		220	97	43	117
66	396	264	277		220	100	44	121
68	408	272	286		220	103	46	124
70	420	280	294		240	106	47	128
73	438	292	307	25	260	111	49	134
76	456	304	319		260	115	51	139
78	468	312	328		260	119	52	143
81	486	324	340		280	123	54	148
84	504	336	353		280	128	57	154
87	522	348	365	30	300	132	58	159
90	540	360	378		300	137	60	165
92	552	368	386		320	140	62	168
95	570	380	399		320	144	64	174
97	582	388	407		340	147	65	178
100	600	400	420		340	152	67	183
102	612	408	428	35	360	155	68	187
105	630	420	441		360	160	70	192
107	642	428	449		360	163	72	196
111	666	444	466		380	169	74	203
114	684	456	479		380	173	76	207
117	702	468	491		400	178	78	214
120	720	480	504	40	400	182	80	220
122	732	488	512		420	185	82	223
124	744	496	521		420	188	83	227
127	762	508	533		440	193	85	232
130	780	520	546		440	198	87	238
132	792	528	554		460	201	88	242
137	822	548	575		460	208	92	251
142	852	568	596	50	480	216	95	260
147	882	588	617		500	223	98	269
152	912	608	638		520	231	102	278
157	942	628	659		540	239	105	287
162	972	648	680		560	246	109	296



d = nominal diameter of common link
d_5 = diameter of end shackle $\approx 1{,}4d$
l_5 $\approx 8{,}7d$
p_5 $= l_5 - (d_5 + a_2 + e_2) \approx 4{,}6d$
w_5 $= 5{,}2d$
a_2 $\approx 0{,}9d$
e_2 $\approx 1{,}8d$
f_2 $\approx 3{,}1d$
g_1 $\approx 0{,}2d$
g_2 $\approx 0{,}1d$
h_1 = nominal diameter of taper pin
h_2 = nominal length of taper pin
m $\approx 1{,}4d$

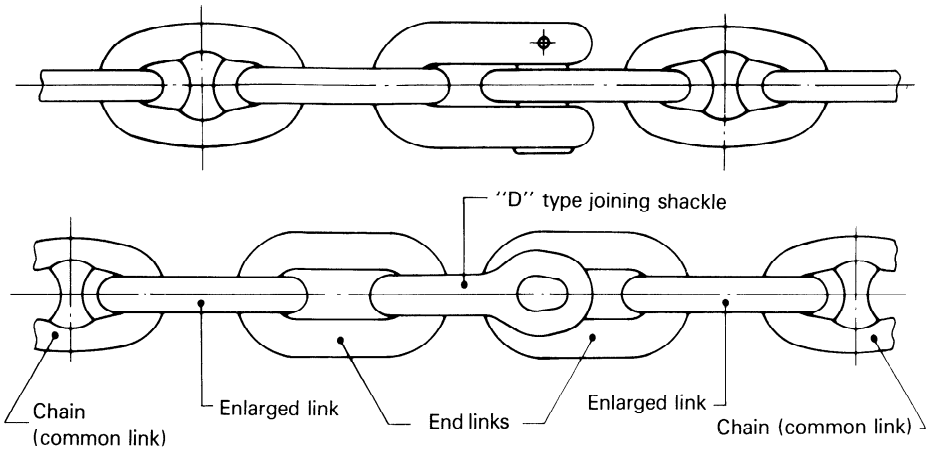
See table 6.
Taper of retaining pin : see 3.2.5.

Figure 6 — End shackle

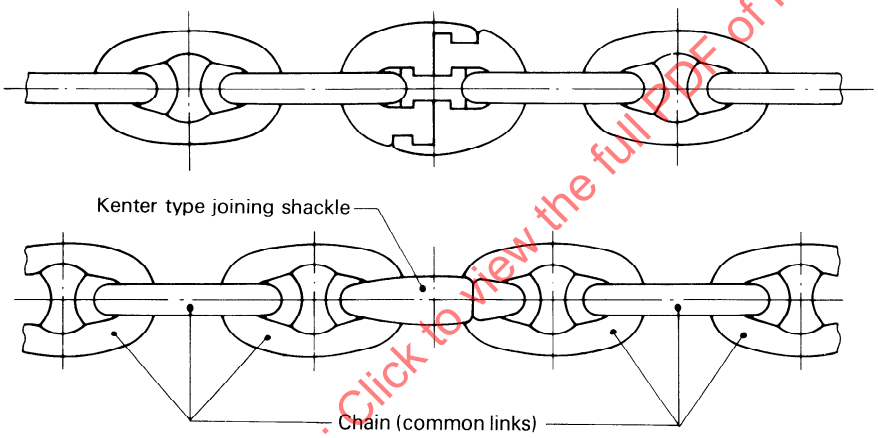
Table 6 — Nominal dimensions of end shackle

Dimensions in millimetres

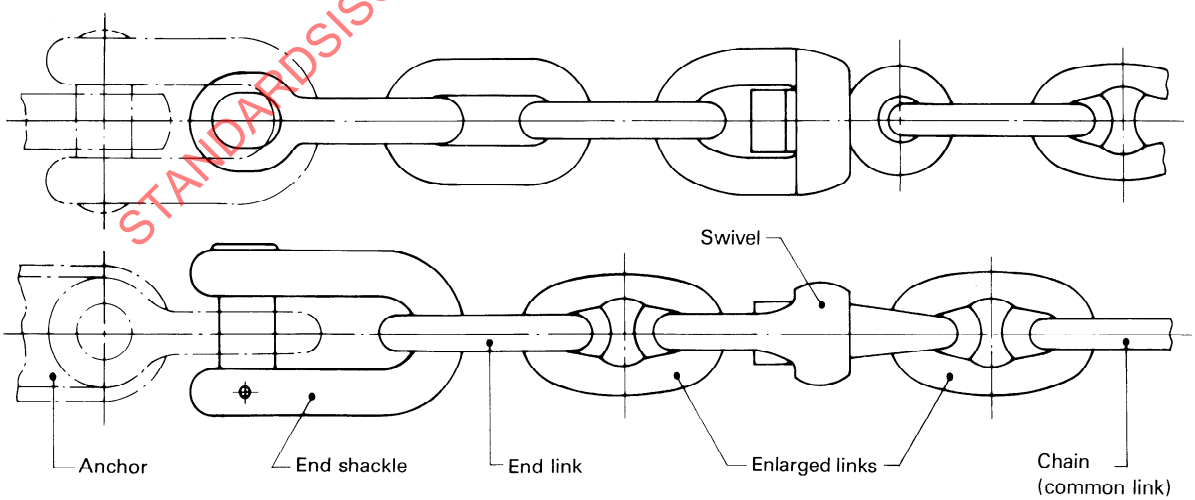
Nominal size (d common link)	d_5	l_5	p_5	w_5	a_2	e_2	f_2	g_1	g_2	h_1	h_2	m
12,5	17,5	109	57,5	65	11	23	39	2,5	1,3	4	28	17,5
14	19,5	122	64,5	73	12,5	25	43	3	1,5		30	19,5
16	22,5	139	73,5	83	14,5	29	50	3	1,5		35	22,5
17,5	24,5	152	81	91	15,5	31	54	3,5	1,8		40	24,5
19	26,5	165	87,5	99	17	34	59	4	2	6	45	26,5
20,5	28,5	178	94	107	18,5	37	64	4	2		45	28,5
22	31	191	101	114	20	39	68	4,5	2,3		50	31
24	34	209	110	125	22	43	74	5	2,5		55	34
26	37	226	120	135	23	46	81	5	2,5		60	37
28	39	244	129	146	25	51	87	5,5	2,8		70	39
30	42	261	138	156	27	54	93	6	3		75	42
32	45	278	147	166	29	57	99	6,5	3,3		80	45
34	48	296	156	176	30	62	105	7	3,5		85	48
36	50	313	166	187	32	65	112	7	3,5		85	50
38	53	331	175	198	34	69	118	7,5	3,8		90	53
40	56	348	184	208	36	72	124	8	4	10	95	56
42	59	365	193	218	38	75	130	8,5	4,3		100	59
44	62	383	202	229	40	79	136	9	4,5		110	62
46	64	400	212	239	41	83	143	9	4,5		115	64
48	67	418	221	250	43	87	149	9,5	4,8		115	67
50	70	435	230	260	45	90	155	10	5		120	70
52	73	452	239	270	47	93	161	10,5	5,3		125	73
54	76	470	248	281	49	97	167	11	5,5	12	130	76
56	78	487	258	291	50	101	174	11	5,5		140	78
58	81	505	267	202	52	105	180	11,5	5,8		140	81
60	84	522	276	312	54	108	186	12	6		150	84
62	87	539	285	322	56	111	192	12,5	6,3		160	87
64	90	557	294	333	58	115	198	13	6,5		150	90
66	92	574	304	343	59	119	205	13	6,5		160	92
68	95	592	313	354	61	123	211	13,5	6,8		160	95
70	98	609	322	364	63	126	217	14	7		170	98
73	102	635	336	380	66	131	226	14,5	7,3		180	102
76	106	661	350	395	68	137	236	15	7,5	16	190	106
78	109	678	359	406	70	140	242	15,5	7,8		190	109
81	113	705	373	421	73	146	251	16	8		200	113
84	118	731	386	437	76	151	260	17	8,5		200	118
87	122	757	400	452	78	157	270	17,5	8,8		220	122
90	126	783	414	468	81	162	279	18	9		220	126
92	129	800	422	478	83	166	285	18,5	9,3		240	129
95	133	827	437	494	86	171	295	19	9,5		240	133
97	136	844	446	504	87	175	301	19,5	9,8		240	136
100	140	870	460	520	90	180	310	20	10		240	140
102	143	887	468	530	92	184	316	20,5	10,3		260	143
105	147	914	483	546	95	189	326	21	10,5		260	147
107	150	931	492	556	96	193	332	21,5	10,8		260	150
111	155	966	511	577	100	200	344	22	11	20	280	155
114	160	992	524	593	103	205	353	23	11,5		280	160
117	164	1 018	538	608	105	211	363	23,5	11,8		300	164
120	168	1 044	552	624	108	216	372	24	12		300	168
122	171	1 061	560	634	110	220	378	24,5	12,3		320	171
124	174	1 079	570	645	112	223	384	25	12,5		320	174
127	178	1 105	584	660	114	229	394	25,5	12,8		320	178
130	182	1 131	598	676	117	234	403	26	13		320	182
132	185	1 148	606	686	119	238	409	26,5	13,3		320	185
137	192	1 192	630	712	123	247	425	27,5	13,8		350	192
142	199	1 235	652	738	128	256	440	28,5	14,3	25	350	199
147	206	1 279	676	764	132	265	456	29,5	14,8		350	206
152	213	1 322	699	790	137	274	471	30,5	15,3		400	213
157	220	1 366	722	816	141	283	487	31,5	15,8		400	220
162	227	1 409	745	842	146	292	502	32,5	16,3		400	227



a) Example of joining chain-strands with "D" type joining shackle



b) Example of joining chain-strands with Kenter type joining shackle



c) Example of connecting chain to anchor

Figure 7 — Examples of use of connecting links, shackles and swivels