RULES

PUBLICATION 99/P

GUIDELINES FOR THE SURVEY OF OFFSHORE MOORING CHAIN CABLE IN USE

January
2021

Publications P (Additional Rule Requirements) issued by Polski Rejestr Statków complete or extend the Rules and are mandatory where applicable.

GDAŃSK

Publication 99/P – Guidelines for the Survey of Offshore Mooring Chain Cable in Use – January 2021, based on IACS recommendation No. 038 is an extension of the requirements contained in *Publication 49/P*. *Publication 99/P* was approved by the PRS Board on 4 December 2020 and enters into force on 1 January 2021.

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PRS/RP, 12/2020

CONTENTS

1 GENERAL

1.1 Appplication

The information herein is intended to provide guidance to PRS Surveyors for inspection of position mooring systems which have been classed by PRS for Mobile Offshore Drilling Units. Temporary mooring equipment is to be surveyed under the PRS *Rules for the Classification and Construction*
of Sea-going Ships, *Part III.*

1.2 Definitions/abbreviations

API – American Petroleum Institute.

NDT (Non-destructive Testing) – NDT methods are described in *Publication 80/P.*

MPI (Magnetic Particle Inspection) – one of NDT methods.

Anchor shackle – shackle linking an anchor to its chain.

End link – studless link usually used at the end of shot, adjacent to a connecting shackle.

Connecting link – link combining two neighbouring shots (e.g. joining-shackle).

ORQ chain (sometimes called Offshore/Rig Quality chain) – Oil Rig Quality chain (of grade developed for off-shore industry). This general grade is being replaced by such grades as Rig Quality 4 or Rig Quality 5 (see Annex: Chains).

2 SURVEY INTERVAL, PURPOSE AND EXTENT

2.1 Annual Surveys

2.1.1 Annual Surveys are to be conducted at approximately twelve (12) month intervals, with the vessel at operational draft, with the position mooring system in use.

2.1.2 The purpose of the Annual Survey is to confirm that the mooring system will continue to carry out its intended purpose until the next annual survey. No disruption of the unit's operation is intended. Ideally, the Annual Survey would be done during a relocation move.

2.1.3 The scope of the Annual Survey is limited to the mooring components adjacent to the winch or windlass. Depending on the mooring component visible from the unit, particular attention should be given to:

a) Chain:
   - wear on the chain shoulders in way of the chain stopper and windlass pockets,
   - support of chain links in the windlass pockets.

b) Wire rope:
   - flattened ropes,
   - broken wires,
   - worn out or corroded ropes.

The surveyor should determine if any problems have been experienced in the previous twelve (12) months period with the mooring system, e.g. breaks, mechanical damage, loose joining shackles, chain or wire jumping.

If the Annual Survey reveals severe damage or neglect to the visible part of chain or cable, a more extensive survey should be performed.

Typical damage warranting a more comprehensive survey could be:

a) chain:
   – reduction in diameter exceeding 4%,
   – missing studs,
   – loose studs in Grade 4 chain,
   – worn out cable lifters (i.e. gypsies) causing damage to the chain:

b) wire rope:
   – obvious flattening or reduction in diameter exceeding 4%,
   – worn cable lifters causing damage to the wire rope,
   – severe wear or corrosion,
   – broken wires.

2.2 Special Periodical Surveys

2.2.1 Special Periodical Surveys are carried out at intervals of approximately five (5) years and will require extensive inspection, usually associated with a sheltered water visit. When considered necessary by PRS, the interval between Special Periodical Surveys may be reduced.

2.2.2 The purpose of the Special Periodical Survey is to ensure that each chain or rope is capable of performing its intended duty until the next Special Periodical Survey, assuming that appropriate care and maintenance is performed on the mooring system during the intervening period.

2.2.3 The Special Periodical Survey shall include:

a) close visual examination of all links of mooring chains, with cleaning as required;
b) enhanced representative NDT sampling:
   – 5% of chains, in general,
   – 20% of chain which has been in way of fairleads over last five (5) years,
   – all connecting links;
c) dimension checks, including length over five (5) links.

2.2.4 Particular attention should be given to:

a) those lengths of chain (or wire rope) which have frequently been in contact with the windlass and fairleads during the unit's operation since the last survey. The Surveyor should ensure that these lengths are rated for use in the way of the windlass and fairlead;
b) the looseness and pin securing arrangements of the joining-shackles;
c) all windlass and fairlead chain pockets for:
   – unusual wear or damage to pockets,
   – rate of wear on pockets, including relative rate of wear between links and pockets,
   – mis-match between links and pockets, and improper support of the links in the pockets.
d) A functional test of the mooring system during anchor-handling operation for:
   – smooth passage of chain links and/or wire rope and joining-shackles over the windlass and fairleads pockets,
   – the absence of chain jumping or other irregularities.

2.2.5 The thickness (diameter) of approximately 1% of all chain links should be measured. The selected links should be approximately uniformly distributed through the working length of the chain. The above percentage may be increased/decreased if the visual examination indicates excessive/minimal deterioration.

2.2.6 All joining-shackles of the Kenter type and bolted type which have been in service for more than four (4) years should be dismantled and an MPI performed on all machined surfaces as per 8.2.

2.3 Special Continuous Surveys

In lieu of a special periodic survey, the Owner may opt for a Continuous Survey, by providing an extra mooring line which may be regularly inspected on shore and exchanged with lines installed on the unit on an annual or other appropriate schedule.

3 ANCHOR INSPECTION

The anchor head, flukes and shank should be examined for damage, including cracks or bending. The anchor shackle pin and crown pin should be examined and renewed if excessively worn or bent. Moveable flukes should be free to rotate between stops on the anchor head.

Bent flukes or shanks should be heated and jacked back in place according to an approved procedure, followed by Magnetic Particle Inspection.

4 ANCHOR SWIVELS

Although swivels are no longer in common use, anchors have been lost due to corrosion of the threads engaging the swivel nut. These threads should be carefully examined and, if significant corrosion is found, the swivel should be removed or replaced.

5 CHAIN INSPECTION CRITERIA

5.1 Chain Types Considered

This section applies only to “offshore or “Rig Quality” chains with studs secured by one of the following means:

a) mechanically locked adjacent to the link’s flash-butt-weld and fillet welded on the other end (IACS R3 chain for example);
b) studs mechanically locked in place on both ends (IACS R4 chain for example).

Other types of chain will require special consideration.

The service environment of offshore mooring chain is more severe than the service environment for conventional ship anchoring chain. Offshore chain is exposed to service loads for a much longer period of time. The long term exposure to cyclical loadings in sea water magnifies the detrimental effect of geometric and metallurgical imperfections on fatigue life. Moreover the increased number of links in offshore chains renders the chain more susceptible to failure from a statistical standpoint.

Due to the effect of "notches", e.g. the stud footprint, higher strength steels, such as that used for IACS R4 chain, have a lower ratio of fatigue strength to static tensile strength than typical lower strength steel such as used for IACS R3 chain.

5.2 Chain Link Diameter Loss due to Abrasion and Corrosion

Diameter measurements should be taken in the curved or bend region of the link and at any area with excessive wear or gouging. Particular attention should be given to the 'shoulder' areas which normally contact the windlass or fairlead pockets.

Links with minimum cross-sectional area less than 90% of the original nominal area should be rejected. If repair is permitted, it should be done by qualified personnel using an approved procedure.

Note:

Weld repair is not permitted on IACS R4, R4S and R5 chain (See paragraph 5.3.1).

A 5% reduction in diameter is equivalent to 10% of the reduction in cross-sectional area to original.

Two diameter measurements should be taken 90 degrees apart and the average compared with original diameter considering with allowable diminution.

5.3 Chain Stud Defects and Repair or Replacement

Studs prevent knots or twist problems during chain handling and support the sides of the links under load to reduce stretching and bending stresses, resulting in longer fatigue life. Links with missing studs should be removed or the studs should be refitted using an approved procedure

5.3.1 Chain Studs Secured by Fillet Welds on one End

The stud is likely to fall out if it is loose or the weld is cracked.

Any axial or lateral movement is unacceptable and the link must be repaired or replaced.

Links with studs fillet welded on the flash-butt-weld end of the stud are unacceptable.

Rejection of links with gaps exceeding 3 mm (1/8 inch) between the stud and the link at the flash-butt-weld end of the stud should be considered. Closing the gap by renewing the fillet weld may be considered, where permitted.

Field repair of cracked welds should be avoided. Welding must be performed by qualified personnel using approved procedures.

Note:

Weld repair is not permitted on IACS R4, R4S and R5 chain.

Chains with studs mechanically locked in place on both ends may only be repaired by an approved mechanical 'squeezing' procedure to reseat the stud.

Fillet welding of studs on both ends is not acceptable nor is welding on the stud end adjacent to the link's flash-butt-weld.

Existing studs with fillet welds on both ends will require special consideration and will be subject to special crack detection efforts. A reduction in mechanical properties in way of the flash-butt-weld will normally be required and approval of the coastal Administration may also be required

5.3.2 Chain Studs Secured by Press Fitting and Mechanical Locking

It is very difficult to quantify excessive looseness of chain studs. The decision to reject or accept a link with a loose stud must depend on the surveyor's judgment of the overall condition of the chain complement.

Axial movement of studs of 1 mm or less is acceptable. Links with axial movement greater than 2 mm must be repaired by 'squeezing' or removed. Acceptance of chain links with axial movements from 1 to 2 mm must be evaluated based on the environmental conditions of the unit's location and expected period of time before the chain is again available for inspection.

Lateral movement of studs up to 4 mm is acceptable.

5.4 Link Repairs

Cracks, gouges and other surface defects (excluding weld cracks) may be removed by grinding provided the resulting reduction in link diameter does not exceed 5% and the cross-sectional area, due to abrasion, wear, and grinding is at least 90% of the original nominal area. Cross-sectional area should be calculated for the lowest average of two diameters taken 90 degrees apart. Links with surface defects which cannot be removed by grinding should be replaced.

5.5 Chain Link Replacement

Defective links should be removed and replaced with joining-shackles, i.e. connecting links, guided by the following good marine practice:

- replacement joining-shackle should comply with IACS W22 or API Spec 2F 6th Edition;
- joining-shackles should pass through fairleads and windlasses in the horizontal plane.

Since joining-shackles have much lower fatigue lives than ordinary chain links as few as possible should be used. On average, joining-shackles should be by 122 m (400 ft) or more apart.

If a large number of links meet the discard criteria and these links are distributed in the whole length, the chain should be replaced with new chain.

6 FAIRLEAD AND WINDLASS INSPECTION – CHAIN SYSTEMS

6.1 Fairleads

Inspection should verify that all fairleads move freely about their respective Z-axes, to the full range of motion required for their proper operation. All bolts, nuts and other hardware used to secure the fairlead shafts should be inspected and replaced, as required.

Fairlead attachment to the hull should be verified and NDT conducted, as necessary.

Note:

There have been cases of closing plates on the fairlead shaft coming loose due to corrosion of the threads of the securing bolts, resulting in serious damage to the fairlead arrangements and the complete jamming of the fairlead and chain.

Consequently, the securing bolts should also be checked to ensure that the bolt material does not corrode preferentially, should the sacrificial anode system fail to function in way of the fairlead.

6.2 Windlasses

Special attention should be given to the holding ability of the windlass. The chain stopper and the resultant load path to the unit's structure should be inspected and its soundness verified.

6.3 Chain Pockets and Chain Support

It is essential that a link resting in a chain pocket makes contact with the fairlead at only the four shoulder areas of the link to avoid critical bending stresses in the link.

Satisfactory chain support is to be verified, and excessive wear in the pockets should be repaired as required, to prevent future damage to the chain.

Chain pockets may be repaired by welding in accordance with the standard procedures supplied by the fairlead/windlass manufacturer. Normally, the hardness of the pockets should be slightly softer than the hardness of the chain link, and procedures must be specific for the chain quality used.

7 FAIRLEADS AND WINCHES INSPECTION – WIRE ROPE SYSTEMS

7.1 Fairleads

See 6.1.

7.2 Winches

Special attention should given to the holding ability of the winch and the satisfactory operation of the pawls, rachets and braking equipment. The soundness of the resultant load path to the unit's structure should be verified.

Proper laying down of the wire on the winch drum should be verified to the satisfaction of the Surveyor, and drums and spooling gear adjustments made, if required.

8 INSPECTION OF JEWELLERY AND MISCELLANEOUS FITTINGS

8.1 General

Anchor shackles, large open links, swivels and connecting links should be visually inspected. Certain areas should be examined by MPI. Areas to be examined should be clearly marked on each item. Links and fittings should be dismantled, as required. Damaged items should be replaced as required by the attending surveyor. Illustrations showing the areas of concern may be found in API RP 2I, (R2015) 3rd Edition, section 2.4.

General guidance on the areas requiring MPI is provided below:
– large open links: the interior contact surfaces of large open links,
– bolted shackles: the inside contact areas and the pins,
– swivels: the swivel pin and threads and mating surface.

8.2 Joining Shackles (Connecting Links)

8.2.1 Experience has shown that an undue number of anchors and chains have been lost due to connecting link failure. Joining-shackles used for higher strength chains, such as ORQ and above, which do not have certificates of equivalent quality should receive special attention.

8.2.2 Magnetic Particle Inspection

All joining-shackles of Kenter or similar design which have been in service for more than four (4) years should be dismantled and MPI carried out. Illustrations showing the areas of concern may be found in API RP 2I (R2015) 3rd edition, section 2.4.

General guidance on the areas requiring MPI is provided below:
– joining shackle links: all machined and ground surfaces of the link and the sides of the curved portions of the link,
– joining shackle stud: machined surfaces only,
– joining shackle pin: 100%

8.2.3 Fatigue strength is considered to be the critical criteria in way of the machined surfaces. On the remaining surface, the profile should be ground smooth and MPI should be carried out upon completion of grinding. In general, the radius of the completed grinding operation should produce a recess with a minimum radius of 20 mm and a length along the link bar greater or equal to six times its depth.

Note:

Sandblasting prior to MPI may damage the machined surfaces and should be avoided. Alternative methods of cleaning should be used. The maximum permissible depth of grinding is 5% of the nominal diameter. The minimum acceptable cross-sectional area in way of the grinding repair, due to the combined effect of local grinding and general corrosion/abrasion is 90% of the nominal cross-sectional area.

The minimum acceptable diameter in way of the grind repair, due to the combined effect of local grinding and general corrosion/abrasion, is 95% of the nominal diameter.

8.2.4 General Corrosion/Abrasion

The minimum acceptable cross-sectional area due to generally uniform corrosion/abrasion is 90% of the nominal cross-sectional area (equivalent to an uniform 5% reduction in diameter).

8.2.5 Tapered pins holding the covers of connecting links together should make good contact at both ends and the recess of counterbore at the large end of the pin holder should be solidly plugged with a peened lead slug to prevent the pin from working out.

8.2.6 Looseness Upon Re-Assembly

Any joining-shackles of Kenter or similar designs which are loose upon re-assembly should be accepted only after special consideration in each case.

Note:

Looseness between the mating faces will significantly reduce the remaining fatigue life of a joining-shackle. Stud movement in the longitudinal direction of the stud of more than 0.5 mm is also likely to significantly reduce the remaining fatigue life of a joining-shackle.

9 WIRE ROPE SURVEYS

9.1 Acceptance Criteria

Acceptance criteria should be guided by ISO-Standard 4309. Further insight may be gained from the 'discard' guidance provided by API RP 2I, (R2015) 3rd edition, Figures 18 and 19.

It should be borne in mind that ISO-Standard 4309 is primarily intended for lifting appliances where the Factor of Safety may be higher than for mooring wires.

The Surveyor should exercise great care in his interpretation of the condition of the wire. An obvious acceptance or rejection is comparatively easy, but the "grey" area between is difficult to evaluate. The Surveyor must make a sound evaluation and technical judgment based on all available evidence.

In general, the age or time in service of the wire does not directly have a bearing on the acceptance or rejection of the wire other than as a factor to be taken into consideration by the Surveyor when deciding on the extent of survey.

9.2 Survey and Inspection

100% visual examination and diameter measurements should be performed.

9.2.1 Visual examination should identify and record the following items for each steel wire anchor line:
- the nature and number of wire breaks,
- wire breaks at the termination,
- external wear and corrosion,
- localized grouping of wire breaks,
- deformation,
- fracture of strands,
- termination area,
- reduction of rope diameter, including breaking or extrusion of the core.

9.2.2 Diameter measurements should be taken at approximately 100 m intervals, at the discretion of the attending Surveyor. If areas of special interest are found, the survey may be concentrated on these areas and diameter measurements taken at much smaller intervals.

9.2.3 An internal examination should be undertaken as far as practicable if indications of severe internal corrosion or possible breakage of the core or wire breaks in underlaying areas. See API RP 2I (R2015) 3rd edition, Section 3.3.6.3, for guidance on the internal inspection of wire rope.

9.3 Guidance on Wire Rope Damage

The cause of wire rope failures may be deduced from the observed damage to the rope. The information summarized below covers most types of wire rope failure.

More detailed information, including photographic examples, is available in ISO-Standard 4309 and API RP 2I (R2015) 3rd edition.

9.3.1 Broken wires at the termination indicate high stresses at the termination and may be caused by incorrect fitting of the termination, fatigue, overloading or mishandling during deployment or retrieval.

Distribution of broken wires, illustrated by figures 9 through 12 of API RP 2I (R2015) 3rd edition may indicate the reason for their failure.

Crown breaks or breakage of individual wires at the top of strands may be caused by excessive tension, fatigue, wear or corrosion.

Excessive tension is indicated by necking down of the broken end of the wire.

Fatigue is indicated by broken faces perpendicular to the axis of the wire.

Corrosion and wear may be indicated by reduced cross sections of the wire.

Valley breaks, at the interface between two strands indicate tightening of the strands, usually caused by a broken core or internal corrosion which has reduced the diameter of the core.

Valley breaks can be caused by high loads, tight sheaves, and sheaves of too small diameter.

Locally grouped broken wires in a single strand or adjacent strand may be due to local damage. Once begun, this type of damage will usually worsen.

9.3.2 Changes in rope diameter can be caused by external wear, interwire and interstrand wear, stretching or corrosion.

A localized reduction in rope diameter may indicate a break in the core. Conversely, an increase in rope diameter may indicate a swollen core due to corrosion.

9.3.3 Wear on the crown of outer strands in the rope may be caused by rubbing against fairleads, unit structure, or the sea bed depending on the location of the wear.

Internal wear between individual strands and wires in the rope is caused by friction and is accelerated by bending of the rope and corrosion.

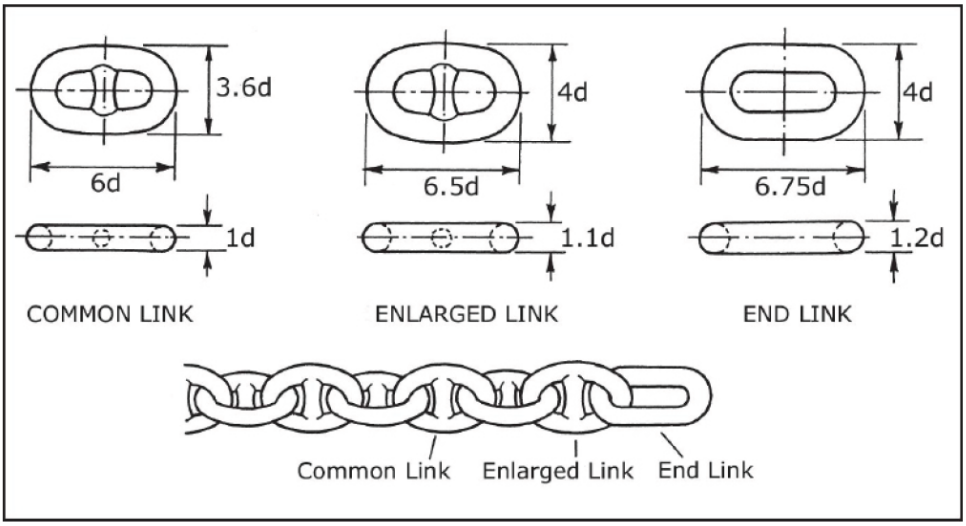
9.3.4 Corrosion decreases rope strength by reducing the cross-sectional area and accelerated fatigue by creating an irregular surface which invites stress cracking. Corrosion is indicated by the following:
– the diameter of the rope at fairleads will grow smaller;
– the diameter of stationary ropes may actually grow larger, due to rust under the outer layer of strands. Diameter growth is rare for mooring lines.

9.3.5 Deformation, i.e. distortion of the rope from its normal construction, may result in an uneven stress distribution in the rope. Kinking, bending, scrubbing, crushing and flattening are common wire rope deformations. Ropes with slight deformations will not lose significant strength. Severe distortions can accelerate rope deterioration and lead to premature failure.

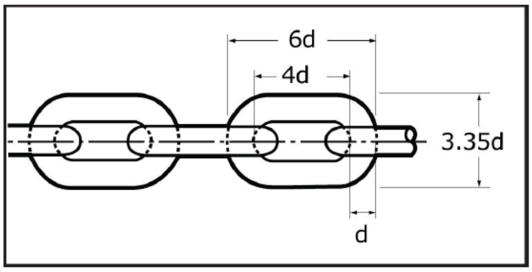
9.3.6 Thermal damage, although rare for mooring ropes in normal service, may be indicated by discoloration. Prompt attention should be given to damage caused by excessively high or low temperatures. The effect of very low temperatures on wire rope is unclear except for the known detrimental effect on lubricants.

ANNEX

CHAINS



STUD LINK CHAIN



STUDLESS CHAIN

Additional information on the geometric relations between different parts of other chain elements can be found in PN-ISO 1704 Standard.

STUD LINK CHAIN

Shot = 90 ft = 27.5 m

Weight kg / shot incl Kenter	mm	inches	U2		U3		ORQ	
			PL kN	BL kN	PL kN	BL kN	PL kN	BL kN
222	19	3/4	150	211	211	301		
306	22	7/8	200	280	280	401		
418	26	1	278	389	389	556		
497	28	1 1/8	321	449	449	642		
652	32	1 1/4	417	583	583	833		
734	34	1 5/16	468	655	655	937		
826	36	1 7/16	523	732	732	1050		
919	38	1 1/2	581	812	812	1160		
1105	42	1 5/8	703	981	981	1400		
1209	44	1 3/4	769	1080	1080	1540		
1437	48	1 7/8	908	1280	1280	1810		
1555	50	2	981	1370	1370	1960	1400	2110
1809	54	2 1/8	1140	1590	1590	2270	1620	2441
1946	56	2 3/16	1220	1710	1710	2430	1746	2639
2100	58	2 5/16	1290	1810	1810	2600	1854	2797
2253	60	2 3/8	1380	1940	1940	2770	1976	2978
2573	64	2 1/2	1560	2190	2190	3130	2230	3360
2742	66	2 5/8	1660	2310	2310	3300	2361	3559
3097	70	2 3/4	1840	2580	2580	3690	2634	3970
3374	73	2 7/8	1990	2790	2790	3990	2846	4291
3681	76	3	2150	3010	3010	4300	3066	4621
4187	81	3 3/16	2410	3380	3380	4820	3453	5209
4832	87	3 7/16	2750	3850	3850	5500	3924	5916
5385	92	3 5/8	3040	4260	4260	6080	4342	6544
5723	95	3 3/4	3230	4510	4510	6440	4599	6932
6613	102	4	3660	5120	5120	7320	5220	7868

All dimensions are approximate

9.81 kN = 1 tonne
PL = Proof Load
BL = Breaking Load

STUD LINK / STUDLESS CHAINS
OIL INDUSTRY GRADES

	Break Load						Weight	
Grade	ORQ	R3/ NVR3	R3S	R4	R4S	R5		
C Factor	0,0211	0,0223	0,0249	0,0274	0,0304	0,032	Stud	Studless
mm	kN	kN	kN	kN	kN	kN	kg/m	kg/m
70	3970	4196	4685	5156	5720	6021	107	98
73	4291	4535	5064	5572	6182	6507	117	107
76	4621	4884	5454	6001	6658	7009	126	116
78	4847	5123	5720	6295	6984	7351	133	122
81	5194	5490	6130	6745	7484	7877	144	131
84	5550	5866	6550	7208	7997	8418	155	141
87	5916	6252	6981	7682	8523	8971	166	151
90	6289	6647	7422	8167	9062	9539	177	162
92	6544	6916	7722	8497	9428	9924	185	169
95	6932	7326	8180	9001	9987	10512	198	181
97	7195	7604	8490	9343	10366	10911	206	188
100	7596	8028	8964	9864	10944	11520	219	200
102	7868	8315	9285	10217	11336	11932	228	208
105	8282	8753	9773	10754	11932	12560	241	221
107	8561	9048	10103	11118	12335	12984	251	229
111	9130	9650	10775	11856	13154	13847	270	246
114	9565	10109	11287	12420	13780	14506	285	260
117	10005	10574	11807	12993	14415	15174	300	274
120	10452	11047	12334	13573	15059	15852	315	288
122	10753	11365	12690	13964	15493	16308	326	298
124	11057	11686	13048	14358	15930	16768	337	308
127	11516	12171	13591	14955	16592	17466	353	323
130	11981	12663	14139	15559	17262	18171	370	338
132	12294	12993	14508	15965	17713	18645	382	348
137	13085	13829	15441	16992	18852	19844	411	375
142	13887	14677	16388	18033	20008	21061	442	403
147	14700	15536	17347	19089	21179	22294	473	432
152	15522	16405	18317	20156	22363	23540	506	462
157	16352	17282	19297	21234	23559	24799	540	493
162	17188	18166	20284	22320	24764	26068	575	525
167	18030	19056	21278	23414	25977	27345	611	558
172	18876	19950	22276	24513	27196	28628	648	592
177	19725	20847	23278	25615	28420	29915	686	627

All dimensions are approximate

	Proof Load											Weight	
Grade	ORQ	R3	NVR3	R3S Stud	R3S Stud-less	R4 Stud	R4 Stud-less	R4S Stud	R4S Stud-less	R5 Stud	R5 Stud-less		
C fac-tor	0,014	0,0148	0,0156	0,018	0,0174	0,0216	0,0192	0,024	0,0213	0,0251	0,0223	Stud	Stud-less
mm	kN	kN	kN	kN	kN	kN	kN	kN	kN	kN	kN	kg/m	kg/m
70	2634	2785	2935	3387	3274	4064	3613	4516	4008	4723	4196	107	98
73	2847	3010	3172	3660	3538	4392	3904	4881	4331	5104	4535	117	107
76	3066	3242	3417	3942	3811	4731	4205	5257	4665	5498	4884	126	116
78	3216	3400	3584	4135	3997	4962	4411	5514	4893	5766	5123	133	122
81	3446	3643	3840	4431	4283	5317	4726	5908	5243	6179	5490	144	131
84	3683	3893	4104	4735	4577	5682	5051	6313	5603	6602	5866	155	141
87	3925	4149	4374	5046	4878	6056	5383	6729	5972	7037	6252	166	151
90	4173	4412	4650	5365	5187	6439	5723	7154	6349	7482	6647	177	162
92	4342	4590	4838	5582	5396	6699	5954	7443	6606	7784	6916	185	169
95	4599	4862	5125	5913	5716	7096	6307	7884	6997	8246	7326	198	181
97	4774	5047	5319	6138	5933	7365	6547	8184	7263	8559	7604	206	188
100	5040	5328	5616	6480	6264	7776	6912	8640	7668	9036	8028	219	200
102	5220	5519	5817	6712	6488	8054	7159	8949	7942	9359	8315	228	208
105	5495	5809	6123	7065	6829	8478	7536	9420	8360	9851	8753	241	221
107	5681	6005	6330	7304	7060	8764	7790	9738	8643	10184	9048	251	229
111	6058	6404	6750	7789	7529	9347	8308	10385	9217	10861	9650	270	246
114	6346	6709	7071	8159	7887	9791	8703	10879	9655	11378	10109	285	260
117	6639	7018	7397	8535	8251	10242	9104	11380	10100	11902	10574	300	274
120	6935	7331	7728	8916	8619	10700	9511	11889	10551	12434	11047	315	288
122	7135	7542	7950	9173	8868	11008	9785	12231	10855	12792	11365	326	298
124	7336	7755	8175	9432	9118	11319	10061	12576	11161	13153	11686	337	308
127	7641	8078	8515	9824	9497	11789	10479	13099	11626	13700	12171	353	323
130	7950	8404	8858	10221	9880	12265	10903	13628	12095	14253	12663	370	338
132	8157	8623	9089	10488	10138	12585	11187	13984	12411	14625	12993	382	348
137	8682	9178	9674	11162	10790	13395	11906	14883	13209	15565	13829	411	375
142	9214	9741	10267	11847	11452	14216	12637	15796	14019	16520	14677	442	403
147	9753	10311	10868	12540	12122	15048	13376	16720	14839	17487	15536	473	432
152	10299	10887	11476	13241	12800	15890	14124	17655	15669	18464	16405	506	462
157	10850	11469	12089	13949	13484	16739	14879	18599	16507	19452	17282	540	493
162	11405	12056	12708	14663	14174	17596	15641	19551	17351	20447	18166	575	525
167	11963	12647	13330	15381	14869	18458	16407	20508	18201	21448	19056	611	558
172	12525	13240	13956	16103	15566	19324	17177	21471	19055	22455	19950	648	592
177	13088	13836	14584	16827	16267	20193	17949	22437	19912	23465	20847	686	627

All dimensions are approximate

Note: c can be found in the formula relating the break/proof load to the chain link diameter.

List of amendments effective as of 1 January 2021

Item	*Title/Subject*	*Source*
A lot of items	API standard	IACS REC 38 Rev.2