

## Application information

GN mooring type connectors are used in mobile, temporary and long term mooring lines. All types such as Shackles, H-links, Forged H-links, Plate connectors and PMS/LTM sockets are designed and made in our production facility located in the Netherlands.

GN is a DNV-GL, ABS, Lloyd's and BV approved manufacturer for mooring chain accessories. Our inhouse engineering department is able to design the right connector, FEA strength, Fatigue calculation, Classification design approvals, and a complete product certificate for use of this products in the mooring lines.

Shackles are mainly used on chain end links and can be made in all sizes to give the best fit connection.

Forged H-links can be special designed to fit common links and other connection points.

Plate connectors are mainly designed to connect chain to rope or rope to rope.

LTM Sockets are Forged and used on steel wire rope. Different type such as open and closed sockets can be made in any size and configuration.

For special designs which are not in accordance with ISO1704, Classification design approval must be considered for full certification!



## Testing and inspection

All mooring connectors must be proof load tested, 1 of every 25 pieces or heat treatment batch must be break load tested. All mooring connectors must be 100% MPI and US inspected. Mechanical testing every heat treatment batch or 1 of every 25 pieces. Mechanical testing must be performed on a real size product, test specimens are not allowed by the classification bureaus. DNV and BV allows to do the mechanical test out of a break loaded shackle, however ABS require to do this from a proof loaded shackle.

Standard impact test is carried out at -20 degrees Celsius. On request we can inform you about low temperature impact values, such as -40, -50 and -60 degrees Celsius.

Grade	Yield stress Re N/mm <sup>2</sup>	Tensile strength Rm N/mm <sup>2</sup>	Elongation A5 %	Reduction of area Z %	Charpy V-notch		
					Temperature °C	Average energy Joule	Single energy Joule
R3	410	690	17	50	0	60	45
					-20	40	30
R3S	490	770	15	50	0	65	49
					-20	45	34
R4	580	860	12	50	-20	50	38
R4S	700	960	12	50	-20	56	42
R5	760	1000	12	50	-20	58	44

Part of mooring line	Corrosion allowance referred to the chain diameter	
	Regular inspection	Requirements for the Norwegian continental shelf
	(mm/year)	(mm/year)
Splash zone	0.4	0.8
Catenary	0.3	0.2
Bottom	0.4	0.2

## Loads

Proof load and Break loads for the mooring chain accessories are minimum the same as the used chain and grade. According to the Mooring chain guides the Proof load and Break load of studless chain must be used, even as it is used for stud-less chain. Fatigue loads can be calculated by FEA in accordance with the required classification bureau or API-RP-2SK. Life time is to be advised by the customer. Standard Life time safety factor is 10 times, or otherwise requested by customer. All our designs are calculated with corrosion allowance taken into account. Standard corrosion allowance used are in accordance with DNV specification DNV-OS-E301.

	Grade R3 (kN)	Grade R3S (kN)	Grade R4 (kN)	Grade R4S (kN)	Grade R5 (kN)
Proof load, studless link	0.0156d <sup>2</sup> (44-0.08d)	0.0174d <sup>2</sup> (44-0.08d)	0.0192d <sup>2</sup> (44-0.08d)	0.0213d <sup>2</sup> (44-0.08d)	0.0223d <sup>2</sup> (44-0.08d)
Proof load, stud link	0.0156d <sup>2</sup> (44-0.08d)	0.0180d <sup>2</sup> (44-0.08d)	0.0216d <sup>2</sup> (44-0.08d)	0.0240d <sup>2</sup> (44-0.08d)	0.0251d <sup>2</sup> (44-0.08d)
Break load	0.0223d <sup>2</sup> (44-0.08d)	0.0249d <sup>2</sup> (44-0.08d)	0.0274d <sup>2</sup> (44-0.08d)	0.0304d <sup>2</sup> (44-0.08d)	0.0320d <sup>2</sup> (44-0.08d)

d is the chain nominal diameter

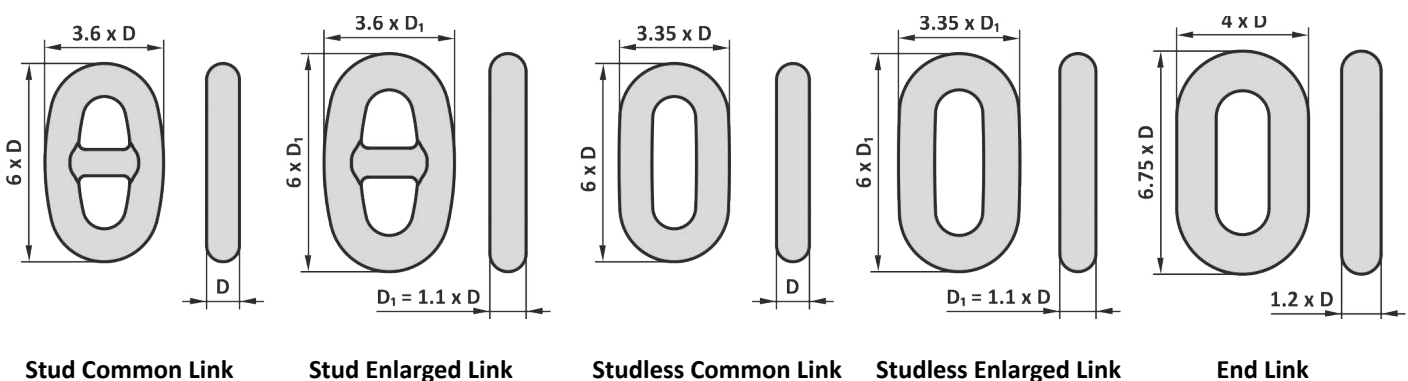
Table as per DNV-GL OS-E302

## Dimensions and tolerances

Standard dimensions are given in our data sheets in this chapter. Special dimensions on request.

In accordance with the mooring chain guides standard tolerances are described as follows:

The diameter must have no negative tolerance. Unless otherwise specified, the plus tolerance on diameter shall not exceed 5% and tolerances on other dimensions shall not exceed plus or minus 2.5%.



Stud Common Link

Stud Enlarged Link

Studless Common Link

Studless Enlarged Link

End Link

## Testloads

Grade	Proof load studless link					Proof load stud link					Break load				
	R3	R3S	R4	R4S	R5	R3	R3S	R4	R4S	R5	R3	R3S	R4	R4S	R5
C-factor	0.0156	0.0174	0.0192	0.0213	0.0223	0.0156	0.018	0.0216	0.024	0.0251	0.0223	0.0249	0.0274	0.0304	0.032
mm	kN	kN	kN	kN	kN	kN	kN	kN	kN	kN	kN	kN	kN	kN	kN
68	2782	3102	3423	3798	3976	2782	3209	3851	4279	4475	3976	4440	4885	5420	5706
70	2935	3274	3613	4008	4196	2935	3387	4064	4516	4723	4196	4685	5156	5720	6021
73	3172	3538	3904	4331	4535	3172	3660	4392	4881	5104	4535	5064	5572	6182	6507
76	3417	3811	4205	4665	4884	3417	3942	4731	5257	5498	4884	5454	6001	6658	7009
78	3584	3997	4411	4893	5123	3584	4135	4962	5514	5766	5123	5720	6295	6984	7351
81	3840	4283	4726	5243	5490	3840	4431	5317	5908	6179	5490	6130	6745	7484	7877
84	4104	4577	5051	5603	5866	4104	4735	5682	6313	6602	5866	6550	7208	7997	8418
87	4374	4878	5383	5972	6252	4374	5046	6056	6729	7037	6252	6981	7682	8523	8971
90	4650	5187	5723	6349	6647	4650	5365	6439	7154	7482	6647	7422	8167	9062	9539
92	4838	5396	5954	6606	6916	4838	5582	6699	7443	7784	6916	7722	8497	9428	9924
95	5125	5716	6307	6997	7326	5125	5913	7096	7884	8246	7326	8180	9001	9987	10512
97	5319	5933	6547	7263	7604	5319	6138	7365	8184	8559	7604	8490	9343	10366	10911
100	5616	6264	6912	7668	8028	5616	6480	7776	8640	9036	8028	8964	9864	10944	11520
102	5817	6488	7159	7942	8315	5817	6712	8054	8949	9359	8315	9285	10217	11336	11932
105	6123	6829	7536	8360	8753	6123	7065	8478	9420	9851	8753	9773	10754	11932	12560
107	6330	7060	7790	8643	9048	6330	7304	8764	9738	10184	9048	10103	11118	12335	12984
111	6750	7529	8308	9217	9650	6750	7789	9347	10385	10861	9650	10775	11856	13154	13847
114	7071	7887	8703	9655	10109	7071	8159	9791	10879	11378	10109	11287	12420	13780	14506
117	7397	8251	9104	10100	10574	7397	8535	10242	11380	11902	10574	11807	12993	14415	15174
120	7728	8619	9511	10551	11047	7728	8916	10700	11889	12434	11047	12334	13573	15059	15852
122	7950	8868	9785	10855	11365	7950	9173	11008	12231	12792	11365	12690	13964	15493	16308
124	8175	9118	10061	11161	11686	8175	9432	11319	12576	13153	11686	13048	14358	15930	16768
127	8515	9497	10479	11626	12171	8515	9824	11789	13099	13700	12171	13591	14955	16592	17466
130	8858	9880	10903	12095	12663	8858	10221	12265	13628	14253	12663	14139	15559	17262	18171
132	9089	10138	11187	12411	12993	9089	10488	12585	13984	14625	12993	14508	15965	17713	18645
137	9674	10790	11906	13209	13829	9674	11162	13395	14883	15565	13829	15441	16992	18852	19844
142	10267	11452	12637	14019	14677	10267	11847	14216	15796	16520	14677	16388	18033	20008	21061
147	10868	12122	13376	14839	15536	10868	12540	15048	16720	17487	15536	17347	19089	21179	22294
152	11476	12800	14124	15669	16405	11476	13241	15890	17655	18464	16405	18317	20156	22363	23540
157	12089	13484	14879	16507	17282	12089	13949	16739	18599	19452	17282	19297	21234	23559	24799
162	12708	14174	15641	17351	18166	12708	14663	17596	19551	20447	18166	20284	22320	24764	26068
165	13081	14590	16100	17861	18699	13081	15094	18112	20125	21047	18699	20879	22976	25491	26833
168	13455	15008	16560	18372	19234	13455	15525	18631	20701	21649	19234	21477	23633	26221	27601
171	13831	15427	17022	18884	19771	13831	15959	19150	21278	22253	19771	22076	24292	26952	28371
175	14333	15986	17640	19569	20488	14333	16538	19845	22050	23061	20488	22877	25174	27930	29400
178	14709	16407	18104	20084	21027	14709	16972	20367	22630	23667	21027	23479	25836	28665	30173
180	14961	16687	18414	20428	21387	14961	17263	20715	23017	24072	21387	23880	26278	29155	30689
185	15590	17389	19188	21287	22286	15590	17989	21586	23985	25084	22286	24884	27383	30381	31980
188	15968	17810	19652	21802	22825	15968	18424	22109	24565	25691	22825	25487	28046	31116	32754
191	16345	18231	20116	22317	23364	16345	18859	22631	25146	26298	23364	26089	28708	31851	33527
194	16721	18651	20580	22831	23903	16721	19294	23152	25725	26904	23903	26690	29369	32585	34300
197	17097	19070	21043	23344	24440	17097	19727	23673	26303	27509	24440	27290	30029	33317	35071
200	17472	19488	21504	23856	24976	17472	20160	24192	26880	28112	24976	27888	30688	34048	35840
205	18094	20182	22270	24706	25866	18094	20878	25054	27837	29113	25866	28881	31781	35261	37116

GENERAL  
SHACKLES  
THIMBLES  
SOCKETS  
LINKS  
SWIVELS  
HOOKS  
OTHERS

## Markings

As minimum the following markings must be hard stamped in the shackle:

Production number

- Classification certificate number
- Proof load
- Date: month and year
- Production number
- Heat treatment number

