

Super Arch and Arch Fenders



Arch fenders are simple and rugged, providing reliable and trouble-free service for a wide variety of berths even under the most severe conditions.

The SAN / AN-fender is a traditional rubber faced unit whilst the SANP / ANP-fender can be fitted with either UHMW-PE face pads or connected to a steel panel.

FEATURES

- Simple one-piece design
- Strong and hard wearing
- Excellent shear performance
- Large range of standard sizes

APPLICATIONS

- RoRo berths
- General cargo
- Workboat harbors
- Barge and tug berths

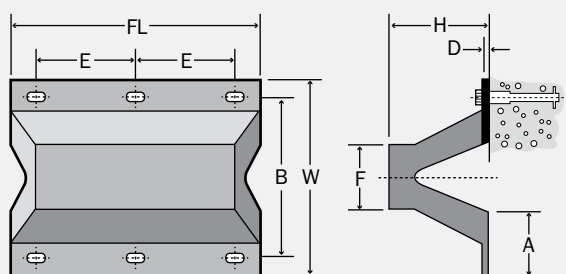
SAN / SANP Super Arch Fenders

DIMENSIONS

BODY DIMENSIONS SAN / SANP								WEIGHT (kg/m)	
H	A	B	W	F	D	P	Q	SAN	SANP
SAN/SANP 150	98	240	300	112	24	24	48	37	44
SAN/SANP 200	130	320	400	150	24	28	56	61	70
SAN/SANP 250	162.5	410	500	187.5	25	28	56	90	102
SAN/SANP 300	195	480	600	225	30	34	68	135	154
SAN/SANP 400	260	670	800	300	35	40	80	252	288
SAN/SANP 500	325	840	1000	375	40	46	92	363	409
SAN/SANP 600	390	1010	1200	450	45	52	104	543	607
SAN/SANP 800	520	1340	1600	600	50	60	120	931	1028
SAN/SANP 1000	650	1680	2000	750	60	60	120	1495	1633

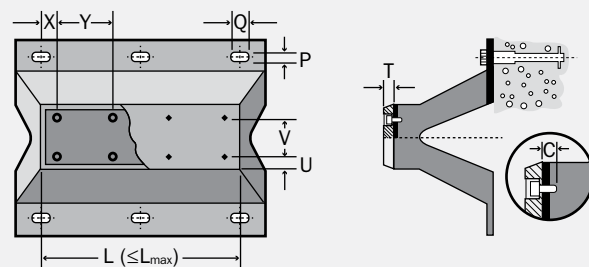
[Units: mm, kg/m]

SAN SUPER ARCH FENDER



$$FL = L + H \times 0.5$$

SANP SUPER ARCH FENDER



FOOT BOLTING DIMENSIONS

FENDER	ANCHORS / HEAD BOLTS ^	L = 1000		L = 1500		L = 2000		L = 2500		L = 3000	
		E	Qty	E	Qty	E	Qty	E	Qty	E	Qty
SAN/SANP 150	M20	855	4	675	6	620	8	750	8	715	10
SAN/SANP 200	M24	860	4	680	6	620	8	760	8	715	10
SAN/SANP 250	M24	865	4	680	6	620	8	780	8	715	10
SAN/SANP 300	M30	870	4	685	6	625	8	790	8	715	10
SAN/SANP 400	M36	900	4	700	6	635	8	800	8	725	10
SAN/SANP 500	M42	930	4	715	6	645	8	810	8	730	10
SAN/SANP 600	M48	930	4	725	6	650	8	820	8	740	10
SAN/SANP 800	M56	930	4	725	6	650	8	820	8	760	10
SAN/SANP 1000	M56	930	4	725	6	650	8	865	8	775	10

[Units: mm]

HEAD BOLTING DIMENSIONS

FENDER	U	V	C	UHMW-PE FACE PADS				STEEL FRAME	
				X	Y	T	BOLT SIZE	X	Y
SANP 150	52.5	0	20-30	60-70	330-410	30	M12	70-90	250-300
SANP 200	30	80	30-45	60-70	330-410	30	M16	70-90	250-300
SANP 250	30	115	30-45	70-85	330-415	30	M16	70-90	250-300
SANP 300	30	150	30-45	70-85	330-415	40	M16	70-90	250-300
SANP 400	40	200	30-50	70-85	330-415	40	M20	70-90	250-300
SANP 500	40	270	30-50	70-85	330-415	50	M20	70-90	250-300
SANP 600	40	340	35-60	70-85	330-415	50	M24	70-90	250-300
SANP 800	40	480	50-70	70-85	330-415	60	M30	70-90	250-300
SANP 1000	50	600	50-70	70-85	330-415	60	M30	70-90	250-300

Larger bolts are required when connecting SANP fenders to steel panels. Refer to your local offices.

[Units: mm]

^ Fender anchors / head bolts indicated are based on fenders RDP performance using a particular grade of steel. Please contact our local office for precise size, material and type for different grades of fenders pertaining to the project requirements.

SAN / SANP Super Arch Fenders

PERFORMANCE DATA*

			E 1.0	E 1.1	E 1.2	E 1.3	E 1.4	E 1.5	E 1.6	E 1.7	E 1.8	E 1.9	E 2.0
150	CV	E	5.0	5.4	5.8	6.2	6.6	7.0	7.2	7.4	7.6	7.8	8.0
		R	86.0	89.6	93.2	96.8	100.4	104.0	107.4	110.8	114.2	117.6	121.0
	RPD	E _R	6.0	6.5	7.0	7.4	7.9	8.4	8.6	8.9	9.1	9.4	9.6
		R _R	103.2	107.5	111.8	116.2	120.5	124.8	128.9	133.0	137.0	141.1	145.2
200	CV	E	10.0	10.4	10.8	11.2	11.6	12.0	12.4	12.8	13.2	13.6	14.0
		R	114.0	118.8	123.6	128.4	133.2	138.0	142.8	147.6	152.4	157.2	162.0
	RPD	E _R	12.0	12.5	13.0	13.4	13.9	14.4	14.9	15.4	15.8	16.3	16.8
		R _R	136.8	142.6	148.3	154.1	159.8	165.6	171.4	177.1	182.9	188.6	194.4
250	CV	E	15.0	15.6	16.2	16.8	17.4	18.0	18.6	19.2	19.8	20.4	21.0
		R	143.0	149.0	155.0	161.0	167.0	173.0	178.8	184.6	190.4	196.2	202.0
	RPD	E _R	17.9	18.6	19.3	20.0	20.7	21.4	22.1	22.8	23.6	24.3	25.0
		R _R	170.2	177.3	184.5	191.6	198.7	205.9	212.8	219.7	226.6	233.5	240.4
300	CV	E	22.0	22.8	23.6	24.4	25.2	26.0	27.0	28.0	29.0	30.0	31.0
		R	171.0	178.2	185.4	192.6	199.8	207.0	214.2	221.4	228.6	235.8	243.0
	RPD	E _R	26.0	26.9	27.8	28.8	29.7	30.7	31.9	33.0	34.2	35.4	36.6
		R _R	201.8	210.3	218.8	227.3	235.8	244.3	252.8	261.3	269.7	278.2	286.7
400	CV	E	38.0	39.6	41.2	42.8	44.4	46.0	47.6	49.2	50.8	52.4	54.0
		R	229.0	238.4	247.8	257.2	266.6	276.0	285.6	295.2	304.8	314.4	324.0
	RPD	E _R	44.5	46.3	48.2	50.1	51.9	53.8	55.7	57.6	59.4	61.3	63.2
		R _R	267.9	278.9	289.9	300.9	311.9	322.9	334.2	345.4	356.6	367.8	379.1
500	CV	E	60.0	62.6	65.2	67.8	70.4	73.0	75.4	77.8	80.2	82.6	85.0
		R	286.0	297.8	309.6	321.4	333.2	345.0	357.0	369.0	381.0	393.0	405.0
	RPD	E _R	69.3	72.3	75.3	78.3	81.3	84.3	87.1	89.9	92.6	95.4	98.2
		R _R	330.3	344.0	357.6	371.2	384.8	398.5	412.3	426.2	440.1	453.9	467.8
600	CV	E	86.0	89.6	93.2	96.8	100.4	104.0	107.6	111.2	114.8	118.4	122.0
		R	343.0	357.2	371.4	385.6	399.8	414.0	428.4	442.8	457.2	471.6	486.0
	RPD	E _R	98.9	103.0	107.2	111.3	115.5	119.6	123.7	127.9	132.0	136.2	140.3
		R _R	394.5	410.8	427.1	443.4	459.8	476.1	492.7	509.2	525.8	542.3	558.9
800	CV	E	154.0	160.4	166.8	173.2	179.6	186.0	192.4	198.8	205.2	211.6	218.0
		R	457.0	476.0	495.0	514.0	533.0	552.0	571.2	590.4	609.6	628.8	648.0
	RPD	E _R	174.8	182.1	189.3	196.6	203.8	211.1	218.4	225.6	232.9	240.2	247.4
		R _R	518.7	540.3	561.8	583.4	605.0	626.5	648.3	670.1	691.9	713.7	735.5
1000	CV	E	240.0	250.0	260.0	270.0	280.0	290.0	300.0	310.0	320.0	330.0	340.0
		R	571.0	594.8	618.6	642.4	666.2	690.0	714.0	738.0	762.0	786.0	810.0
	RPD	E _R	268.8	280.0	291.2	302.4	313.6	324.8	336.0	347.2	358.4	369.6	380.8
		R _R	639.5	666.2	692.8	719.5	746.1	772.8	799.7	826.6	853.4	880.3	907.2

[Units: kNm, kN]

*Note:

- CV: performance data at slow speed constant velocity (2-8 cm/min) compression at 23 ±5°C temperature and 0° compression angle.
- RPD: Rated performance data, in accordance with PIANC with initial high speed berthing velocity 0.15 m/s.
 $RPD = CV \text{ (performance)} \times VF \text{ (velocity factor for Natural and Synthetic rubber blend)} \times TF \text{ (temperature factor)} \times AF \text{ (angle factor)}$.
 RPD is reported at 23 ±5°C temperature and 0° compression angle, therefore $TF = 1, AF = 1$.

SAN / SANP Super Arch Fenders

PERFORMANCE DATA*

			E 2.1	E 2.2	E 2.3	E 2.4	E 2.5	E 2.6	E 2.7	E 2.8	E 2.9	E 3.0
150	CV	E	8.2	8.4	8.6	8.8	9.0	9.2	9.4	9.6	9.8	10.0
		R	124.6	128.2	131.8	135.4	139.0	142.6	146.2	149.8	153.4	157.0
	RPD	E _R	9.8	10.1	10.3	10.6	10.8	11.0	11.3	11.5	11.8	12.0
		R _R	149.5	153.8	158.2	162.5	166.8	171.1	175.4	179.8	184.1	188.4
200	CV	E	14.4	14.8	15.2	15.6	16.0	16.4	16.8	17.2	17.6	18.0
		R	166.8	171.6	176.4	181.2	186.0	190.8	195.6	200.4	205.2	210.0
	RPD	E _R	17.3	17.8	18.2	18.7	19.2	19.7	20.2	20.6	21.1	21.6
		R _R	200.2	205.9	211.7	217.4	223.2	229.0	234.7	240.5	246.2	252.0
250	CV	E	21.4	21.8	22.2	22.6	23.0	24.0	25.0	26.0	27.0	28.0
		R	208.0	214.0	220.0	226.0	232.0	238.0	244.0	250.0	256.0	262.0
	RPD	E _R	25.5	25.9	26.4	26.9	27.4	28.6	29.8	30.9	32.1	33.3
		R _R	247.5	254.7	261.8	268.9	276.1	283.2	290.4	297.5	304.6	311.8
300	CV	E	31.8	32.6	33.4	34.2	35.0	36.0	37.0	38.0	39.0	40.0
		R	250.2	257.4	264.6	271.8	279.0	286.0	293.0	300.0	307.0	314.0
	RPD	E _R	37.5	38.5	39.4	40.4	41.3	42.5	43.7	44.8	46.0	47.2
		R _R	295.2	303.7	312.2	320.7	329.2	337.5	345.7	354.0	362.3	370.5
400	CV	E	55.6	57.2	58.8	60.4	62.0	63.6	65.2	66.8	68.4	70.0
		R	333.4	342.8	352.2	361.6	371.0	380.6	390.2	399.8	409.4	419.0
	RPD	E _R	65.1	66.9	68.8	70.7	72.5	74.4	76.3	78.2	80.0	81.9
		R _R	390.1	401.1	412.1	423.1	434.1	445.3	456.5	467.8	479.0	490.2
500	CV	E	87.6	90.2	92.8	95.4	98.0	100.4	102.8	105.2	107.6	110.0
		R	416.8	428.6	440.4	452.2	464.0	476.0	488.0	500.0	512.0	524.0
	RPD	E _R	101.2	104.2	107.2	110.2	113.2	116.0	118.7	121.5	124.3	127.1
		R _R	481.4	495.0	508.7	522.3	535.9	549.8	563.6	577.5	591.4	605.2
600	CV	E	125.6	129.2	132.8	136.4	140.0	143.6	147.2	150.8	154.4	158.0
		R	500.2	514.4	528.6	542.8	557.0	571.4	585.8	600.2	614.6	629.0
	RPD	E _R	144.4	148.6	152.7	156.9	161.0	165.1	169.3	173.4	177.6	181.7
		R _R	575.2	591.6	607.9	624.2	640.6	657.1	673.7	690.2	706.8	723.4
800	CV	E	224.4	230.8	237.2	243.6	250.0	256.4	262.8	269.2	275.6	282.0
		R	667.0	686.0	705.0	724.0	743.0	762.0	781.0	800.0	819.0	838.0
	RPD	E _R	254.7	262.0	269.2	276.5	283.8	291.0	298.3	305.5	312.8	320.1
		R _R	757.0	778.6	800.2	821.7	843.3	864.9	886.4	908.0	929.6	951.1
1000	CV	E	350.0	360.0	370.0	380.0	390.0	400.0	410.0	420.0	430.0	440.0
		R	833.8	857.6	881.4	905.2	929.0	952.8	976.6	1000.4	1024.2	1048.0
	RPD	E _R	392.0	403.2	414.4	425.6	436.8	448.0	459.2	470.4	481.6	492.8
		R _R	933.9	960.5	987.2	1013.8	1040.5	1067.1	1093.8	1120.4	1147.1	1173.8

[Units: kNm, kN]

- For other initial berthing velocities, temperature and berthing angle, VF/ TF/ AF should be calculated separately and apply on CV performance to come to the final performance.
- If fenders are tested in decreasing velocity (DV) mode at initial velocity 0.15 m/s, 0° compression angle and 23 ±5°C testing temperature, RPD = DV (performance).
- Fender performance is subject to ±10% manufacturing tolerance (+10% for reaction force and -10% for energy).
- CV performance is based on a rubber compound blend of natural and synthetic rubber.

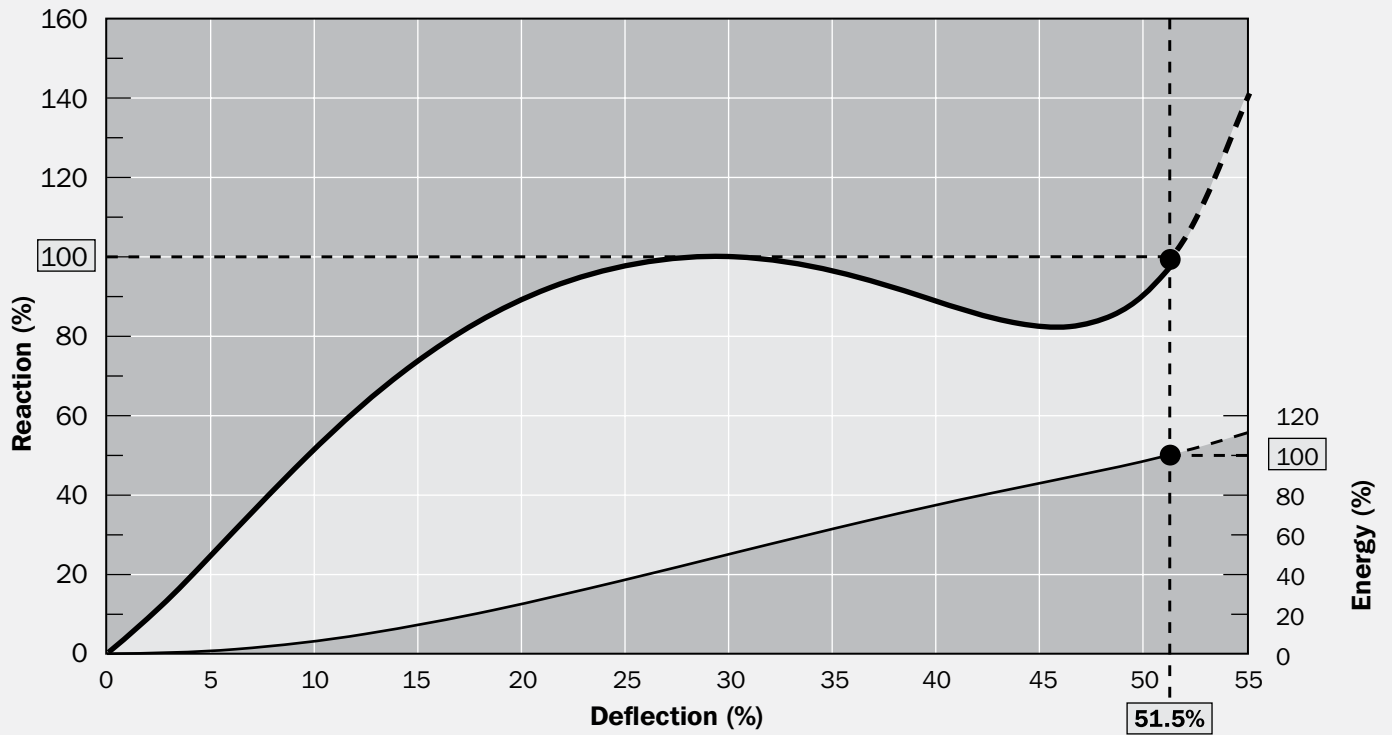
* Values are per 1000mm of length L.

SAN / SANP Super Arch Fenders

INTERMEDIATE DEFLECTIONS

D_i (%)	0	5	10	15	20	25	30	35	40	45	50	51.5	55
E_i (%)	0	1	6	14	25	37	50	63	74	85	96	100	111
R_i (%)	0	24	51	73	89	98	100	96	89	82	91	100	141

Nominal rated deflection may vary at RPD. Refer to the Performance Tolerances table in the Fender Application Design Manual.



Generic curve shown. Actual curve geometry may vary depending on grade, temperature, velocity and angle.

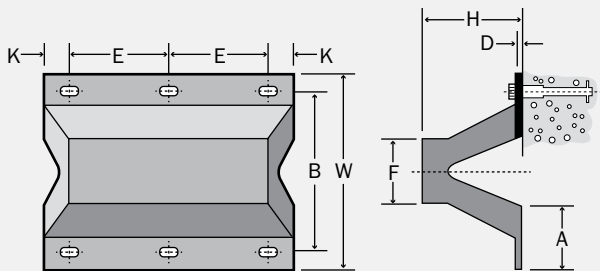
AN / ANP Arch Fenders

	L _{max}	H	A	B	W	F	D	K	E	PxQ	ANCHORS / HEAD BOLTS ^	WEIGHT	
												AN	ANP
AN / ANP 150	3000	150	108	240	326	98	16-20	50	500	20×40	M16	28	35
AN / ANP 200	3000	200	142	320	422	130	18-25	50	500	25×50	M20	48	62
AN / ANP 250	3500	250	164	400	500	163	20-30	62.5	500	28×56	M24	69	90
AN / ANP 300	3500	300	194	480	595	195	25-32	75	500	28×56	M24	107	128
AN / ANP 400	3500	400	266	640	808	260	25-32	100	500	35×70	M30	185	217
AN / ANP 500	3500	500	318	800	981	325	25-32	125	500	42×84	M36	278	352
AN / ANP 600	3000	600	373	960	1160	390	28-40	150	500	48×96	M42	411	488
AN / ANP 800	3000	800	499	1300	1550	520	41-50	200	500	54×108	M48	770	871
AN / ANP 1000	3000	1000	580	1550	1850	650	50-62	250	500	54×108	M48	1289	1390

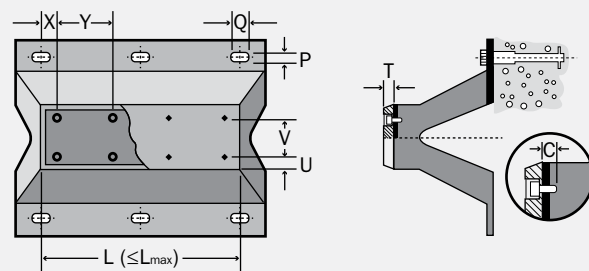
^ Fender anchors / head bolts indicated are based on fenders RDP performance using a particular grade of steel. Please contact our local office for precise size, material and type for different grades of fenders pertaining to the project requirements.

[Units: mm, kg/m]

AN ARCH FENDER



ANP ARCH FENDER



	U	V	C	UHMW-PE FACE PADS				STEEL FRAME	
				X	Y	T	BOLT SIZE	X	Y
ANP 150	49	0	20 - 30	60 - 70	330 - 410	30	M16	70 - 90	250 - 300
ANP 200	65	0	30 - 45	60 - 70	330 - 410	30	M16	70 - 90	250 - 300
ANP 250	45	73	30 - 45	70 - 85	330 - 410	30	M16	70 - 90	250 - 300
ANP 300	50	95	30 - 45	70 - 85	330 - 410	40	M16	70 - 90	250 - 300
ANP 400	60	140	30 - 50	70 - 85	330 - 410	40	M16	70 - 90	250 - 300
ANP 500	65	195	30 - 50	70 - 85	330 - 410	50	M20	70 - 90	250 - 300
ANP 600	65	260	35 - 60	70 - 85	330 - 410	50	M20	70 - 90	250 - 300
ANP 800	70	380	50 - 70	70 - 85	330 - 410	60	M24	70 - 90	250 - 300
ANP 1000	80	490	50 - 70	70 - 85	330 - 410	60	M24	70 - 90	250 - 300

Larger bolts are required when connecting ANP fenders to steel panels. Refer TMS.

[Units: mm]

L	ANCHORS
1000	6 No
1500	8 No
2000	10 No
2500	12 No
3000	14 No
3500	16 No

Non-standard lengths, profiles and bolting patterns are available on request.

AN Arch Fenders

PERFORMANCE DATA*

			E 1.0	E 1.1	E 1.2	E 1.3	E 1.4	E 1.5	E 1.6	E 1.7	E 1.8	E 1.9
150	CV	E	4.3	4.4	4.6	4.7	4.9	5.0	5.1	5.2	5.4	5.5
		R	74.0	76.2	78.4	80.7	82.9	85.1	87.3	89.5	91.8	94.0
	RPD	E _R	5.2	5.3	5.5	5.7	5.8	6.0	6.1	6.3	6.4	6.6
		R _R	88.8	91.5	94.1	96.8	99.5	102.1	104.8	107.4	110.1	112.8
200	CV	E	7.6	7.8	8.1	8.3	8.6	8.8	9.0	9.3	9.5	9.8
		R	98.6	101.5	104.4	107.2	110.1	113.0	116.0	119.0	122.0	125.0
	RPD	E _R	9.1	9.4	9.7	10.0	10.3	10.6	10.8	11.1	11.4	11.7
		R _R	118.3	121.8	125.2	128.7	132.1	135.6	139.2	142.8	146.4	150.0
250	CV	E	11.9	12.3	12.7	13.0	13.4	13.8	14.2	14.5	14.9	15.2
		R	123.0	126.8	130.6	134.4	138.2	142.0	145.6	149.2	152.8	156.4
	RPD	E _R	14.2	14.6	15.1	15.5	16.0	16.4	16.9	17.3	17.7	18.1
		R _R	146.4	150.9	155.4	159.9	164.5	169.0	173.3	177.5	181.8	186.1
300	CV	E	17.1	17.6	18.2	18.7	19.3	19.8	20.3	20.9	21.4	22.0
		R	148.0	152.4	156.8	161.2	165.6	170.0	174.4	178.8	183.2	187.6
	RPD	E _R	20.2	20.8	21.5	22.1	22.7	23.4	24.0	24.6	25.3	25.9
		R _R	174.6	179.8	185.0	190.2	195.4	200.6	205.8	211.0	216.2	221.4
400	CV	E	30.5	31.5	32.4	33.4	34.3	35.3	36.2	37.2	38.1	39.1
		R	197.0	203.0	209.0	215.0	221.0	227.0	232.8	238.6	244.4	250.2
	RPD	E _R	35.7	36.8	37.9	39.1	40.2	41.3	42.4	43.5	44.6	45.7
		R _R	230.5	237.5	244.5	251.6	258.6	265.6	272.4	279.2	285.9	292.7
500	CV	E	47.6	49.1	50.6	52.0	53.5	55.0	56.5	58.0	59.4	60.9
		R	247.0	254.4	261.8	269.2	276.6	284.0	291.4	298.8	306.2	313.6
	RPD	E _R	55.0	56.7	58.4	60.1	61.8	63.5	65.2	66.9	68.7	70.4
		R _R	285.3	293.8	302.4	310.9	319.5	328.0	336.6	345.1	353.7	362.2
600	CV	E	68.6	70.7	72.9	75.0	77.2	79.3	81.4	83.5	85.7	87.8
		R	296.0	305.0	314.0	323.0	332.0	341.0	349.8	358.6	367.4	376.2
	RPD	E _R	78.9	81.4	83.8	86.3	88.7	91.2	93.6	96.1	98.5	100.9
		R _R	340.4	350.8	361.1	371.5	381.8	392.2	402.3	412.4	422.5	432.6
800	CV	E	122.0	125.8	129.6	133.4	137.2	141.0	144.8	148.6	152.4	156.2
		R	394.0	406.0	418.0	430.0	442.0	454.0	465.8	477.6	489.4	501.2
	RPD	E _R	138.5	142.8	147.1	151.4	155.7	160.0	164.3	168.7	173.0	177.3
		R _R	447.2	460.8	474.4	488.1	501.7	515.3	528.7	542.1	555.5	568.9
1000	CV	E	191.0	197.0	203.0	209.0	215.0	221.0	226.8	232.6	238.4	244.2
		R	493.0	507.8	522.6	537.4	552.2	567.0	581.8	596.6	611.4	626.2
	RPD	E _R	213.9	220.6	227.4	234.1	240.8	247.5	254.0	260.5	267.0	273.5
		R _R	552.2	568.7	585.3	601.9	618.5	635.0	651.6	668.2	684.8	701.3

[Units: kNm, kN]

*Note:

- CV: performance data at slow speed constant velocity (2-8 cm/min) compression at 23 ±5°C temperature and 0° compression angle.
- RPD: Rated performance data, in accordance with PIANC with initial high speed berthing velocity 0.15 m/s.
 $RPD = CV \text{ (performance)} \times VF \text{ (velocity factor for Natural and Synthetic rubber blend)} \times TF \text{ (temperature factor)} \times AF \text{ (angle factor)}$
 RPD is reported at 23 ±5°C temperature and 0° compression angle, therefore $TF = 1$, $AF = 1$.

AN Arch Fenders

PERFORMANCE DATA*

			E 2.0	E 2.1	E 2.2	E 2.3	E 2.4	E 2.5	E 2.6	E 2.7	E 2.8	E 2.9	E 3.0
150	CV	E	5.6	5.8	6.0	6.1	6.3	6.5	6.7	6.9	7.0	7.2	7.4
		R	96.2	99.4	102.5	105.7	108.8	112.0	115.0	118.0	121.0	124.0	127.0
	RPD	E _R	6.7	6.9	7.2	7.4	7.6	7.8	8.0	8.2	8.4	8.7	8.9
		R _R	115.4	119.2	123.0	126.8	130.6	134.4	138.0	141.6	145.2	148.8	152.4
200	CV	E	10.0	10.3	10.6	11.0	11.3	11.6	11.9	12.2	12.5	12.8	13.1
		R	128.0	132.2	136.4	140.6	144.8	149.0	153.0	157.0	161.0	165.0	169.0
	RPD	E _R	12.0	12.4	12.8	13.2	13.5	13.9	14.3	14.6	15.0	15.4	15.7
		R _R	153.6	158.6	163.7	168.7	173.8	178.8	183.6	188.4	193.2	198.0	202.8
250	CV	E	15.6	16.1	16.6	17.1	17.6	18.1	18.6	19.1	19.5	20.0	20.5
		R	160.0	165.2	170.4	175.6	180.8	186.0	191.0	196.0	201.0	206.0	211.0
	RPD	E _R	18.6	19.2	19.8	20.3	20.9	21.5	22.1	22.7	23.3	23.8	24.4
		R _R	190.4	196.6	202.8	209.0	215.2	221.3	227.3	233.2	239.2	245.1	251.1
300	CV	E	22.5	23.2	23.9	24.6	25.3	26.0	26.7	27.4	28.1	28.8	29.5
		R	192.0	198.2	204.4	210.6	216.8	223.0	229.0	235.0	241.0	247.0	253.0
	RPD	E _R	26.6	27.4	28.2	29.0	29.9	30.7	31.5	32.3	33.2	34.0	34.8
		R _R	226.6	233.9	241.2	248.5	255.8	263.1	270.2	277.3	284.4	291.5	298.5
400	CV	E	40.0	41.3	42.5	43.8	45.0	46.3	47.5	48.8	50.0	51.3	52.5
		R	256.0	264.2	272.4	280.6	288.8	297.0	305.2	313.4	321.6	329.8	338.0
	RPD	E _R	46.8	48.3	49.7	51.2	52.7	54.2	55.6	57.1	58.5	60.0	61.4
		R _R	299.5	309.1	318.7	328.3	337.9	347.5	357.1	366.7	376.3	385.9	395.5
500	CV	E	62.4	64.4	66.3	68.3	70.2	72.2	74.2	76.1	78.1	80.0	82.0
		R	321.0	331.2	341.4	351.6	361.8	372.0	382.0	392.0	402.0	412.0	422.0
	RPD	E _R	72.1	74.3	76.6	78.9	81.1	83.4	85.7	87.9	90.2	92.4	94.7
		R _R	370.8	382.5	394.3	406.1	417.9	429.7	441.2	452.8	464.3	475.9	487.4
600	CV	E	89.9	92.5	95.1	97.8	100.4	103.0	105.6	108.2	110.8	113.4	116.0
		R	385.0	397.2	409.4	421.6	433.8	446.0	458.2	470.4	482.6	494.8	507.0
	RPD	E _R	103.4	106.4	109.4	112.4	115.4	118.5	121.4	124.4	127.4	130.4	133.4
		R _R	442.8	456.8	470.8	484.8	498.9	512.9	526.9	541.0	555.0	569.0	583.1
800	CV	E	160.0	165.0	170.0	175.0	180.0	185.0	190.0	195.0	200.0	205.0	210.0
		R	513.0	529.2	545.4	561.6	577.8	594.0	610.2	626.4	642.6	658.8	675.0
	RPD	E _R	181.6	187.3	193.0	198.6	204.3	210.0	215.7	221.3	227.0	232.7	238.4
		R _R	582.3	600.6	619.0	637.4	655.8	674.2	692.6	711.0	729.4	747.7	766.1
1000	CV	E	250.0	257.8	265.6	273.4	281.2	289.0	296.8	304.6	312.4	320.2	328.0
		R	641.0	661.4	681.8	702.2	722.6	743.0	763.2	783.4	803.6	823.8	844.0
	RPD	E _R	280.0	288.7	297.5	306.2	314.9	323.7	332.4	341.2	349.9	358.6	367.4
		R _R	717.9	740.8	763.6	786.5	809.3	832.2	854.8	877.4	900.0	922.7	945.3

[Units: kNm, kN]

- For other initial berthing velocities, temperature and berthing angle, VF/ TF/ AF should be calculated separately and apply on CV performance to come to the final performance.
- If fenders are tested in decreasing velocity (DV) mode at initial velocity 0.15 m/s, 0° compression angle and 23 ±5°C testing temperature, RPD = DV (performance).
- Fender performance is subject to ±10% manufacturing tolerance (+10% for reaction force and -10% for energy).
- CV performance is based on a rubber compound blend of natural and synthetic rubber.

* Values are per 1000mm of length L.

ANP Arch Fenders

PERFORMANCE DATA*

			E 1.0	E 1.1	E 1.2	E 1.3	E 1.4	E 1.5	E 1.6	E 1.7	E 1.8	E 1.9
150	CV	E	5.6	5.8	6.0	6.1	6.3	6.5	6.7	6.8	7.0	7.1
		R	88.8	91.4	94.1	96.7	99.4	102.0	104.6	107.2	109.8	112.4
	RPD	E _R	6.7	6.9	7.2	7.4	7.6	7.8	8.0	8.2	8.4	8.6
		R _R	106.6	109.7	112.9	116.1	119.2	122.4	125.5	128.6	131.8	134.9
200	CV	E	9.9	10.2	10.5	10.8	11.1	11.4	11.7	12.0	12.4	12.7
		R	118.0	121.6	125.2	128.8	132.4	136.0	139.6	143.2	146.8	150.4
	RPD	E _R	11.9	12.2	12.6	13.0	13.3	13.7	14.1	14.4	14.8	15.2
		R _R	141.6	145.9	150.2	154.6	158.9	163.2	167.5	171.8	176.2	180.5
250	CV	E	15.6	16.1	16.5	17.0	17.4	17.9	18.4	18.8	19.3	19.7
		R	148.0	152.4	156.8	161.2	165.6	170.0	174.4	178.8	183.2	187.6
	RPD	E _R	18.6	19.1	19.7	20.2	20.8	21.3	21.8	22.4	22.9	23.5
		R _R	176.1	181.4	186.6	191.8	197.1	202.3	207.5	212.8	218.0	223.2
300	CV	E	22.4	23.1	23.8	24.4	25.1	25.8	26.5	27.1	27.8	28.4
		R	178.0	183.4	188.8	194.2	199.6	205.0	210.2	215.4	220.6	225.8
	RPD	E _R	26.4	27.2	28.0	28.8	29.6	30.4	31.2	32.0	32.8	33.6
		R _R	210.0	216.4	222.8	229.2	235.5	241.9	248.0	254.2	260.3	266.4
400	CV	E	39.8	41.0	42.2	43.4	44.6	45.8	47.0	48.2	49.3	50.5
		R	237.0	244.2	251.4	258.6	265.8	273.0	280.0	287.0	294.0	301.0
	RPD	E _R	46.6	48.0	49.4	50.8	52.2	53.6	55.0	56.3	57.7	59.1
		R _R	277.3	285.7	294.1	302.6	311.0	319.4	327.6	335.8	344.0	352.2
500	CV	E	62.1	64.0	65.9	67.7	69.6	71.5	73.4	75.2	77.1	78.9
		R	296.0	305.0	314.0	323.0	332.0	341.0	349.8	358.6	367.4	376.2
	RPD	E _R	71.7	73.9	76.1	78.2	80.4	82.6	84.7	86.9	89.0	91.2
		R _R	341.9	352.3	362.7	373.1	383.5	393.9	404.0	414.2	424.3	434.5
600	CV	E	89.3	92.0	94.8	97.5	100.3	103.0	105.6	108.2	110.8	113.4
		R	355.0	365.8	376.6	387.4	398.2	409.0	419.6	430.2	440.8	451.4
	RPD	E _R	102.7	105.8	109.0	112.1	115.3	118.5	121.4	124.4	127.4	130.4
		R _R	408.3	420.7	433.1	445.5	457.9	470.4	482.5	494.7	506.9	519.1
800	CV	E	159.0	163.8	168.6	173.4	178.2	183.0	187.8	192.6	197.4	202.2
		R	473.0	487.2	501.4	515.6	529.8	544.0	558.2	572.4	586.6	600.8
	RPD	E _R	180.5	185.9	191.4	196.8	202.3	207.7	213.2	218.6	224.0	229.5
		R _R	536.9	553.0	569.1	585.2	601.3	617.4	633.6	649.7	665.8	681.9
1000	CV	E	249.0	256.4	263.8	271.2	278.6	286.0	293.4	300.8	308.2	315.6
		R	592.0	609.8	627.6	645.4	663.2	681.0	698.6	716.2	733.8	751.4
	RPD	E _R	278.9	287.2	295.5	303.7	312.0	320.3	328.6	336.9	345.2	353.5
		R _R	663.0	683.0	702.9	722.8	742.8	762.7	782.4	802.1	821.9	841.6

[Units: kNm, kN]

*Note:

- CV: performance data at slow speed constant velocity (2-8 cm/min) compression at 23 ±5°C temperature and 0° compression angle.
- RPD: Rated performance data, in accordance with PIANC with initial high speed berthing velocity 0.15 m/s.
 $RPD = CV \text{ (performance)} \times VF \text{ (velocity factor for Natural and Synthetic rubber blend)} \times TF \text{ (temperature factor)} \times AF \text{ (angle factor)}$
 RPD is reported at 23 ±5°C temperature and 0° compression angle, therefore $TF = 1, AF = 1$.

ANP Arch Fenders

PERFORMANCE DATA*

			E 2.0	E 2.1	E 2.2	E 2.3	E 2.4	E 2.5	E 2.6	E 2.7	E 2.8	E 2.9	E 3.0
150	CV	E	7.3	7.5	7.7	8.0	8.2	8.4	8.6	8.8	9.1	9.3	9.5
		R	115.0	118.6	122.2	125.8	129.4	133.0	136.4	139.8	143.2	146.6	150.0
	RPD	E _R	8.8	9.0	9.3	9.6	9.8	10.1	10.3	10.6	10.9	11.1	11.4
		R _R	138.0	142.3	146.6	151.0	155.3	159.6	163.7	167.8	171.8	175.9	180.0
200	CV	E	13.0	13.4	13.8	14.1	14.5	14.9	15.3	15.7	16.0	16.4	16.8
		R	154.0	158.6	163.2	167.8	172.4	177.0	181.6	186.2	190.8	195.4	200.0
	RPD	E _R	15.6	16.1	16.5	17.0	17.4	17.9	18.3	18.8	19.2	19.7	20.2
		R _R	184.8	190.3	195.8	201.4	206.9	212.4	217.9	223.4	229.0	234.5	240.0
250	CV	E	20.2	20.8	21.4	22.1	22.7	23.3	23.9	24.5	25.1	25.7	26.3
		R	192.0	197.8	203.6	209.4	215.2	221.0	226.8	232.6	238.4	244.2	250.0
	RPD	E _R	24.0	24.8	25.5	26.3	27.0	27.7	28.4	29.2	29.9	30.6	31.3
		R _R	228.5	235.4	242.3	249.2	256.1	263.0	269.9	276.8	283.7	290.6	297.5
300	CV	E	29.1	30.0	30.9	31.7	32.6	33.5	34.4	35.2	36.1	36.9	37.8
		R	231.0	238.0	245.0	252.0	259.0	266.0	272.8	279.6	286.4	293.2	300.0
	RPD	E _R	34.3	35.4	36.4	37.5	38.5	39.5	40.5	41.6	42.6	43.6	44.6
		R _R	272.6	280.8	289.1	297.4	305.6	313.9	321.9	329.9	338.0	346.0	354.0
400	CV	E	51.7	53.3	54.8	56.4	57.9	59.5	61.0	62.6	64.1	65.7	67.2
		R	308.0	317.2	326.4	335.6	344.8	354.0	363.2	372.4	381.6	390.8	400.0
	RPD	E _R	60.5	62.3	64.1	66.0	67.8	69.6	71.4	73.2	75.0	76.8	78.6
		R _R	360.4	371.1	381.9	392.7	403.4	414.2	424.9	435.7	446.5	457.2	468.0
500	CV	E	80.8	83.2	85.6	88.1	90.5	92.9	95.3	97.7	100.2	102.6	105.0
		R	385.0	396.6	408.2	419.8	431.4	443.0	454.4	465.8	477.2	488.6	500.0
	RPD	E _R	93.3	96.1	98.9	101.7	104.5	107.3	110.1	112.9	115.7	118.5	121.3
		R _R	444.7	458.1	471.5	484.9	498.3	511.7	524.8	538.0	551.2	564.3	577.5
600	CV	E	116.0	119.6	123.2	126.8	130.4	134.0	137.4	140.8	144.2	147.6	151.0
		R	462.0	475.8	489.6	503.4	517.2	531.0	544.8	558.6	572.4	586.2	600.0
	RPD	E _R	133.4	137.5	141.7	145.8	150.0	154.1	158.0	161.9	165.8	169.7	173.7
		R _R	531.3	547.2	563.0	578.9	594.8	610.7	626.5	642.4	658.3	674.1	690.0
800	CV	E	207.0	213.2	219.4	225.6	231.8	238.0	244.2	250.4	256.6	262.8	269.0
		R	615.0	633.6	652.2	670.8	689.4	708.0	726.4	744.8	763.2	781.6	800.0
	RPD	E _R	234.9	242.0	249.0	256.1	263.1	270.1	277.2	284.2	291.2	298.3	305.3
		R _R	698.0	719.1	740.2	761.4	782.5	803.6	824.5	845.3	866.2	887.1	908.0
1000	CV	E	323.0	332.8	342.6	352.4	362.2	372.0	381.6	391.2	400.8	410.4	420.0
		R	769.0	792.2	815.4	838.6	861.8	885.0	908.0	931.0	954.0	977.0	1000.0
	RPD	E _R	361.8	372.7	383.7	394.7	405.7	416.6	427.4	438.1	448.9	459.6	470.4
		R _R	861.3	887.3	913.2	939.2	965.2	991.2	1017.0	1042.7	1068.5	1094.2	1120.0

[Units: kNm, kN]

- For other initial berthing velocities, temperature and berthing angle, VF/ TF/ AF should be calculated separately and apply on CV performance to come to the final performance.
- If fenders are tested in decreasing velocity (DV) mode at initial velocity 0.15 m/s, 0° compression angle and 23 ±5°C testing temperature, RPD = DV (performance).
- Fender performance is subject to ±10% manufacturing tolerance (+10% for reaction force and -10% for energy).
- CV performance is based on a rubber compound blend of natural and synthetic rubber.

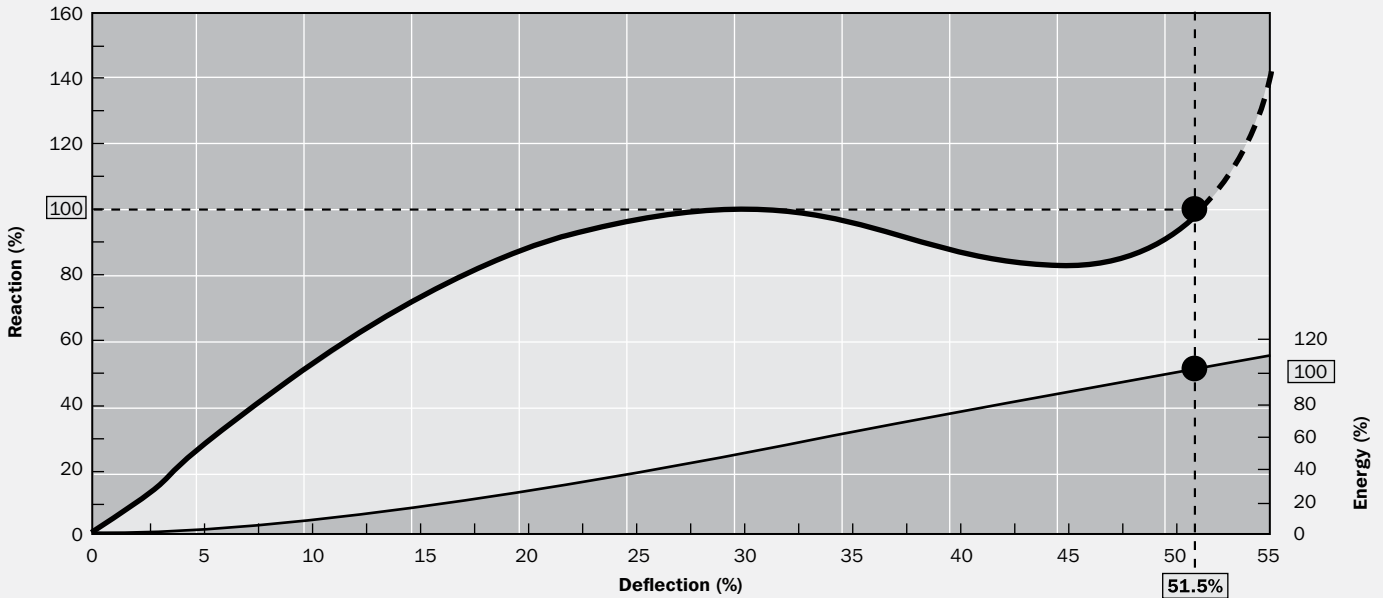
* Values are per 1000mm of length L.

AN Arch Fenders

INTERMEDIATE DEFLECTIONS

D_i (%)	0	5	10	15	20	25	30	35	40	45	50	51.5	55
E_i (%)	0	1	6	14	25	37	50	63	74	85	96	100	111
R_i (%)	0	24	51	73	89	98	100	96	89	82	91	100	141

Nominal rated deflection may vary at RPD. Refer to the Performance Tolerances table in the Fender Application Design Manual.

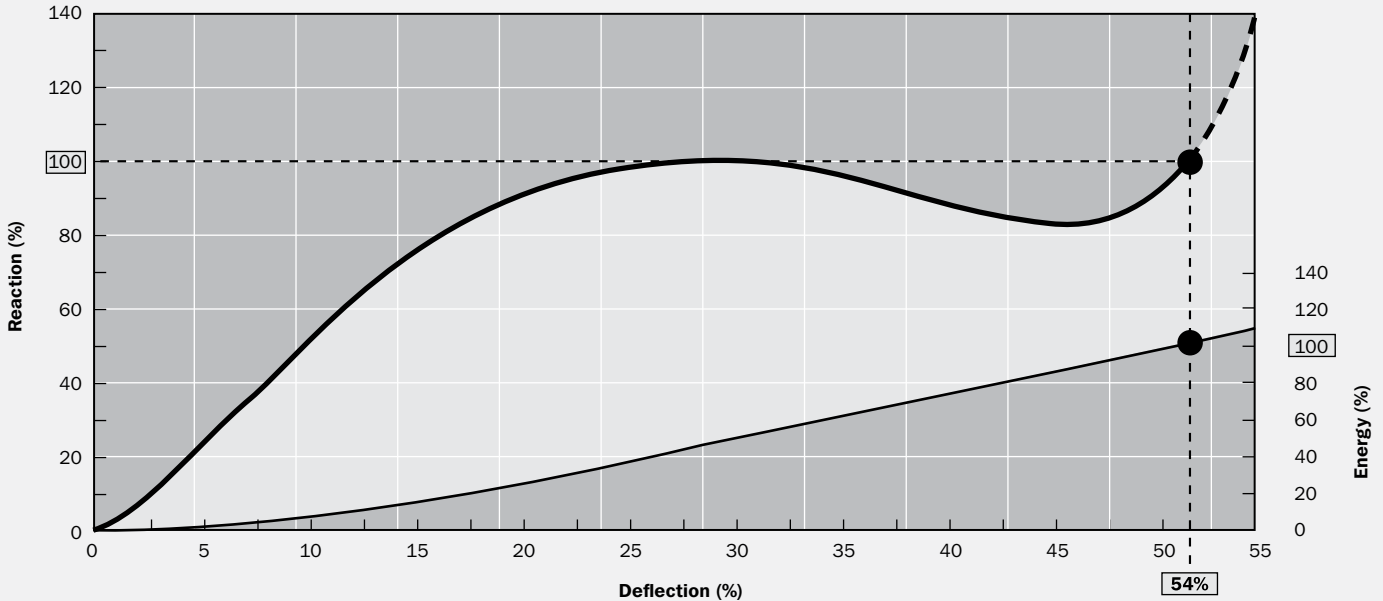


ANP Arch Fenders

INTERMEDIATE DEFLECTIONS

D_i (%)	0	5	10	15	20	25	30	35	40	45	50	54	57.5
E_i (%)	0	1	6	13	23	34	46	58	70	81	91	100	110
R_i (%)	0	23	49	71	87	96	100	98	92	84	84	100	139

Nominal rated deflection may vary at RPD. Refer to the Performance Tolerances table in the Fender Application Design Manual.



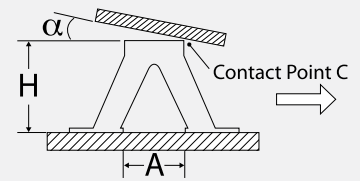
Super Arch and Arch Fenders

ANGLE FACTORS (AF) – TRANVERSE LOAD

Energy Correction Factors

A/H	α	DEFLECTION % AT POINT C	REACTION CORRECTION FACTOR	ENERGY CORRECTION FACTOR
3		57.5	1.000	0.999
5		57.5	0.991	0.987
6		57.5	0.986	0.973
7		57.5	0.980	0.960
8		57.5	0.974	0.947
9		57.5	0.967	0.934
10		57.5	0.959	0.922
12		57.5	0.962	0.896
15		57.5	0.986	0.857
20		57.5	1.001	0.787
25		57.5	0.999	0.716
30		57.5	0.969	0.649

- Reaction force is the maximum generated within the compression cycle.
- Correction factors may be used for any size and compound of the Arch and Super Arch Fender range.



Super Arch and Arch Fenders

ANGLE FACTORS (AF) – LONGITUDINAL LOAD

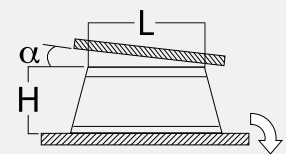
Energy Correction Factors

L/H \ α	0	5	6	7	8	9	10	12	15	20	25	30
0.750	1.000	0.924	0.910	0.896	0.882	0.868	0.854	0.825	0.781	0.706	0.632	0.563
1.000	1.000	0.901	0.882	0.863	0.844	0.824	0.805	0.765	0.703	0.602	0.509	0.434
1.100	1.000	0.891	0.870	0.850	0.828	0.807	0.785	0.740	0.672	0.561	0.466	0.394
1.200	1.000	0.882	0.859	0.836	0.812	0.788	0.764	0.715	0.640	0.522	0.428	0.361
1.300	1.000	0.872	0.847	0.822	0.796	0.770	0.743	0.689	0.608	0.486	0.395	0.334
1.400	1.000	0.863	0.836	0.808	0.780	0.751	0.722	0.663	0.578	0.453	0.367	0.310
1.500	1.000	0.853	0.824	0.794	0.764	0.733	0.701	0.638	0.547	0.423	0.342	0.289
1.600	1.000	0.844	0.812	0.780	0.747	0.714	0.680	0.613	0.518	0.396	0.321	0.271
1.700	1.000	0.834	0.800	0.766	0.730	0.695	0.659	0.588	0.491	0.373	0.302	0.255
1.800	1.000	0.824	0.788	0.751	0.713	0.675	0.637	0.564	0.465	0.352	0.285	0.241
1.900	1.000	0.814	0.776	0.736	0.696	0.656	0.616	0.540	0.441	0.334	0.270	0.228
2.000	1.000	0.804	0.763	0.722	0.679	0.637	0.595	0.517	0.419	0.317	0.257	0.217
3.000	1.000	0.700	0.636	0.574	0.515	0.462	0.416	0.348	0.279	0.211	0.171	0.145
4.000	1.000	0.594	0.514	0.445	0.390	0.347	0.312	0.261	0.209	0.159	0.128	0.108
5.000	1.000	0.495	0.415	0.356	0.312	0.277	0.250	0.209	0.168	0.127	0.103	0.087

Reaction Force Correction Factors

L/H \ α	0	5	6	7	8	9	10	12	15	20	25	30
0.750	1.000	0.873	0.866	0.862	0.862	0.864	0.867	0.878	0.896	0.921	0.926	0.907
1.000	1.000	0.863	0.862	0.865	0.870	0.878	0.886	0.903	0.922	0.921	0.817	0.777
1.100	1.000	0.862	0.863	0.869	0.876	0.885	0.895	0.912	0.926	0.907	0.824	0.708
1.200	1.000	0.862	0.866	0.873	0.883	0.893	0.903	0.919	0.927	0.882	0.767	0.649
1.300	1.000	0.863	0.869	0.879	0.890	0.900	0.911	0.924	0.923	0.849	0.709	0.600
1.400	1.000	0.865	0.873	0.885	0.897	0.908	0.917	0.927	0.914	0.806	0.658	0.556
1.500	1.000	0.867	0.878	0.891	0.903	0.914	0.922	0.927	0.899	0.759	0.614	0.519
1.600	1.000	0.871	0.883	0.897	0.909	0.919	0.925	0.924	0.879	0.712	0.576	0.487
1.700	1.000	0.874	0.888	0.903	0.915	0.923	0.927	0.917	0.854	0.670	0.542	0.458
1.800	1.000	0.878	0.893	0.908	0.919	0.926	0.927	0.908	0.823	0.632	0.512	0.433
1.900	1.000	0.882	0.899	0.913	0.923	0.927	0.924	0.894	0.789	0.599	0.485	0.410
2.000	1.000	0.887	0.903	0.917	0.925	0.927	0.920	0.878	0.752	0.569	0.461	0.389
3.000	1.000	0.922	0.927	0.912	0.876	0.819	0.747	0.624	0.501	0.379	0.307	0.260
4.000	1.000	0.919	0.876	0.795	0.699	0.622	0.561	0.468	0.376	0.285	0.230	0.195
5.000	1.000	0.858	0.745	0.639	0.560	0.498	0.448	0.375	0.301	0.228	0.184	0.156

- Reaction force is the maximum generated within the compression cycle.
- Correction factors may be used for any size and compound of the Arch and Super Arch Fender range.



Super Arch and Arch Fenders

VELOCITY FACTOR (VF) TABLE

COMPRESSION TIME (SECONDS)	BLEND OF NATURAL AND SYNTHETIC RUBBER (CATALOG COMPOUND)	100% NATURAL RUBBER	100% SYNTHETIC RUBBER (SBR)
	VF	VF	VF
1	1.20	1.14	1.31
2	1.16	1.10	1.25
3	1.14	1.09	1.22
4	1.13	1.07	1.20
5	1.11	1.06	1.19
6	1.10	1.06	1.17
7	1.09	1.05	1.16
8	1.09	1.04	1.15
9	1.08	1.04	1.14
10	1.07	1.03	1.14
11	1.07	1.03	1.13
12	1.06	1.02	1.12
13	1.06	1.02	1.12
14	1.05	1.02	1.11
15	1.05	1.01	1.11
16	1.05	1.01	1.10
17	1.04	1.01	1.10
18	1.04	1.01	1.09
19	1.04	1.00	1.09
20	1.03	1.00	1.08

Compression time needs to be calculated using the following formula: $t = d/(f \cdot V_d)$

Where:

t = compression time (seconds)*

d = rated deflection (mm)

V_d = initial berthing velocity (mm/s)

f = 0.74 deceleration factor (Peak reaction force occurs at between 30% - 40% deflection, where there has been a deceleration due to energy absorption. f represents the factor associated with deceleration).

* Applicable for both partial deflection and rated deflection.

TEMPERATURE FACTOR (TF) TABLE

TEMPERATURE (°C)	BLEND OF NATURAL AND SYNTHETIC RUBBER (CATALOG COMPOUND)	100% NATURAL RUBBER	100% SYNTHETIC RUBBER (SBR)
	TF	TF	TF
+50	0.916	0.914	0.918
+40	0.947	0.946	0.948
+30	0.978	0.978	0.979
+23	1.000	1.000	1.000
+10	1.030	1.025	1.038
+0	1.075	1.053	1.108
-10	1.130	1.080	1.206
-20	1.249	1.142	1.410
-30	1.540	1.315	1.877

Fender Fixings

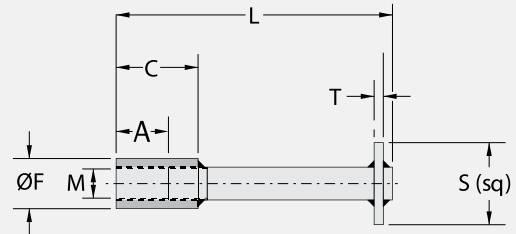
NC3 ANCHORS

THREAD	A	C	ØF	L	S (sq)	T	WEIGHT
M20	40	60	30	200	63	10	1.1
M22	44	66	32	225	63	10	1.4
M24	48	73	36	250	75	10	1.9
M27	54	84	40	265	75	10	2.4
M30	60	95	45	270	100	10	3.5
M36	72	112	54	320	100	12	5.5
M42	84	134	63	360	100	12	8.1
M48	96	156	72	400	100	15	12
M56	112	182	84	550	120	15	20
M64	128	208	100	600	130	20	30
M76	152	242	114	700	150	20	46

Anchors available in mid steel, HDG, SS 316 or super duplex

[Units: mm, kg]

The NC3 is a traditional cast-in anchor design used for installing fenders to new concrete. The NC3 anchor has a threaded socket, a long tail and a square anchor plate. Non-standard sizes and other cast-in anchor types are available on request.



Always check min/max clamping thickness and socket depths actual threaded length on bolts.

EC2 ANCHORS

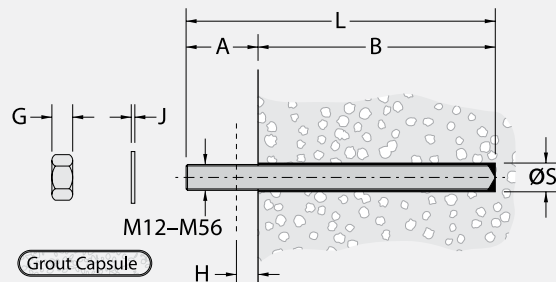
THREAD	B	E	G	J	L (typ.)	ØS	CAPSULE	WEIGHT
M12	110	5 – 8	10	2.5	–	15	1 × C12	0.15
M16	140	6 – 9	13	3	175	20	1 × C16	0.26
M20	170	6 – 9	16	3	240	25	1 × C20	0.57
M24	210	8 – 12	19	4	270	28	1 × C24	0.92
M27	240	8 – 12	22	4	330	30	1 × C24	1.42
M30	280	8 – 12	24	4	360	35	1 × C30	1.91
M36	330	10 – 15	29	5	420	40	1 × C30	3.21
M42	420	14 – 21	34	7	500	50	2 × C30	5.21
M48	480	16 – 24	38	8	580	54	2 × C30 + 1 × C24	7.90
M56	560	18 – 27	45	9	–	64	4 × C30	13.0

A = E + G + H + J, rounded up to nearest 10mm.

E = clear threads after assembly.

H = clamping thickness of fender.

The EC2 anchor is used for installing fenders onto existing concrete or where cast-in anchors are unsuitable. The anchor is usually secured into a drilled hole using special grout capsules. Non-standard sizes and other grout systems are available on request.



Always follow the manufacturer's instructions when installing EC2 anchors.

[Units: mm, kg]

Fender Fixings

BOLTS, NUTS AND WASHERS

SIZE	THREAD AREA *	WASHERS †				NUTS #			TYPICAL THREAD LENGTHS ‡		THREAD PITCH
	(mm ²)	OD	ID	t	WEIGHT	AF	T	WEIGHT	L ≤ 125	L > 125	
M16	157	30	18	3	0.01	24	13	0.04	38	44	2.0
M20	245	37	22	3	0.02	30	16	0.07	46	52	2.5
M24	353	44	26	4	0.03	36	19	0.12	54	60	3.0
M27	459	52	29	4	0.05	41	22	0.23	60	66	3.0
M30	561	56	33	4	0.06	46	24	0.24	66	72	3.5
M36	817	66	39	5	0.09	55	29	0.40	78	84	4.0
M42	1120	78	45	7	0.18	65	34	0.63	90	96	4.5
M48	1470	92	52	8	0.28	75	38	0.90	102	108	5.0
M56	2030	105	62	9	0.40	85	45	1.43	118	124	5.5
M64	2680	115	70	9	0.45	95	51	2.09	134	140	6.0

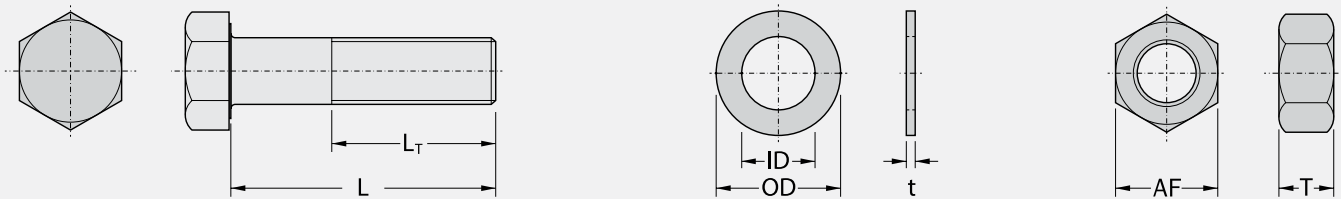
* Standard bolts given according to DIN933.

[Units: mm, kg]

† Standard washers given according to DIN125. Larger OD washers available on request.

‡ Thread lengths may vary depending on standard. Other lengths available.

Standard nuts given according to DIN934.



GRADES

	ISO 898 GALVANIZED		ISO 356 STAINLESS STEEL *	
Bolt grade	4.6	8.8	A-50 †	A-70 ‡
Nut grade	4	8	A-50 †	A-70 ‡
Tensile strength (MPa)	400	800	500	700
0.2% yield stress (MPa)	240	640	210	450

* Refer to Fender Application Design Manual for further details about PREN and galling.

† Size ≤ M39 unless agreed with manufacturer.

‡ Size ≤ M24 unless agreed with manufacturer.

Fenders must be properly fixed to operate correctly. Anchors are supplied to suit new or existing structures, in various strength ratings and with the choice of galvanized or various stainless steels.