

Tie Rod Systems for Marine Sheet Piles and Tieback Anchors

No. 619₁₂



Williams Tie Rod Advantages

- Lower costs with higher strengths and lighter weights.
- Continuously threaded for maximum versatility or threaded on ends only
- Durable threads and components capable of developing the full capacity of the bar
- Both right hand and left hand threads available upon request to tighten tie rods using turnbuckles or sleeve nuts.
- Up to 50 foot stock lengths, 60 foot available on special request.
- Several options of corrosion protection available from simple coatings to advanced designs for aggressive environments.





150 KSI All-Thread-Bar

Williams 150 KSI All-Thread Bar consist of high tensile steel available in seven diameters from 1" (26 mm) to 3" (75 mm) with guaranteed tensile strengths up to 1027 kips (4568 kN). All diameters are available in continuous lengths up to 50'. Bars are provided with cold rolled threads over all or a portion of the bar's length. All tension components for the systems are designed to develop 100% of the bars published ultimate strength. Bars are produced to ASTM A-722 physical standards. Williams All-Thread 150 KSI Bar must never be welded, subjected to the high heat of a torch, or used as a ground. Field cutting should be done with an abrasive wheel or band saw. All components of the systems are designed and manufactured in the United States and have been proven on job sites around the world.



Grade 75 & Grade 80 All-Thread Rebar

Williams Grade 75 and Grade 80 All-Thread Rebar is a continuously threaded bar specially designed to be used with fasteners. Common applications for All-Thread Rebar are tie rods and ground anchors. All-Thread Rebar is available in 12 diameters from #6 (20 mm) through #32 (102 mm) with ultimate tensile strengths up to 1278 kips (5685 kN). Diameters #6 to #24 are available in continuous lengths up to 50-foot, larger diameters up to 40-foot. The bars are provided with a special thread designed to meet the requirements of ASTM A615 and Canadian Rebar Specifications CSA-G30.18-M92.

Threads are cold rolled on the entire length or a portion of the bar as desired. Because of the full 360 degrees concentric thread, Williams All-Thread Rebar should only be bent under special provisions. All tension components are designed to develop 100% of the bar's published ultimate strengths. All components for the system are manufactured in North America.



Conversion Chart



Williams All-Thread-Bars are more economical than heavier ASTM A36 upset threaded rods. All-Thread Bars are usually on the order of 10-30% less expensive than A36 tie rods when bar comparisons are based on equivalent ultimate strengths. Not only are the bars less expensive but since the bars are smaller they are lighter. Additional savings result with smaller connectors, protective coatings and material freight. The bars below are shown in sizes relative to each other and have approximately equal yield strength.





Grade 75 All-Thread Rebar





150 KSI All-Thread-Bar

Actual Tie Rod Diameter	Heavy Upset Thread Diameter	Nominal Weight	Minimum Yield Strength	Minimum Ultimate Strength		Bar Designation & Nominal Diameter	Approx. Thread Major Dia.	Nominal Weight	Minimum Yield Strength	Minimum Ultimate Strength		Nominal Bar Diameter	Approx. Thread Major Dia.	Nominal Weight	Minimum Yield Strength	Minimum Ultimate Strength
1-1/4" (32 mm)	1-1/2" (38 mm)	4.17 lbs/ft (6.21 kg/m)	44.2 kips (197 kN)	71.2 kips (317 kN)	-	#8 - 1"	1-1/8"	2.7 lbs/ft	59.3 kips	79 kips	-					
1-3/8" (36 mm)	1-3/4" (43 mm)	5.05 lbs/ft (7.52 kg/m)	53.5 kips (238 kN)	86.2 kips (383 kN)	-	(25 mm)	(29 mm)	(3.94 kg/m)	(264 kN)	(351 kN)	-					
1-1/2" (38 mm)	2" (51 mm)	6.01 lbs/ft (8.94 kg/m)	63.6 kips (283 kN)	103 kips (456 kN)	-	#9 - 1-1/8"	1-1/4"	3.4 lbs/ft	75 kips	100 kips	-	1" (26 mm)	1-1/8" (29 mm)	3.09 lbs/ft (4.6 kg/m)	102 kips (454 kN)	128 kips (567 kN)
1-5/8" (41 mm)	2" (51 mm)	7.05 lbs/ft (10.5 kg/m)	74.7 kips (332 kN)	120 kips (535 kN)	-	(29 mm)	(32 mm)	(5.06 kg/m)	(334 kN)	(445 kN)	-					
1-3/4" (43 mm)	2-1/4" (57 mm)	8.18 lbs/ft (12.2 kg/m)	86.6 kips (385 kN)	140 kips (620 kN)	-	#10 - 1-1/4" (32 mm)	1-3/8" (35 mm)	4.3 lbs/ft (5.50 kg/m)	95.3 kips (424 kN)	127 kips (565 kN)	-					
2" (51 mm)	2-1/2" (65 mm)	10.7 lbs/ft (15.9 kg/m)	113 kips (503 kN)	182 kips (810 kN)	-	#11 - 1-3/8" (36 mm)	1-1/2" (38 mm)	5.3 lbs/ft (7.85 kg/m)	117 kips (521 kN)	156 kips (694 kN)	-	1-1/4"	1-7/16"	4.51 lbs/ft	150 kips	188 kips
2-1/4" (57 mm)	2-3/4" (70 mm)	13.5 lbs/ft (20.1 kg/m)	143 kips (636 kN)	231 kips (1026 kN)	-	#14 - 1-3/4" (43 mm)	1-7/8" (48 mm)	7.65 lbs/ft (11.8 kg/m)	169 kips (750 kN)	225 kips (1001 kN)	-	(32 mm)	(37 mm)	(6.71 kg/m)	(667 kN)	(834 kN)
2-1/2" (65 mm)	3-1/4" (83 mm)	16.7 lbs/ft (24.9 kg/m)	177 kips (787 kN)	285 kips (1266 kN)	-						-	1-3/8" (36 mm)	1-9/16" (40 mm)	5.71 lbs/ft (8.50 kg/m)	190 kips (843 kN)	237 kips (1054 kN)
2-3/4" (70 mm)	3-1/2" (89 mm)	20.2 lbs/ft (30.1 kg/m)	214 kips (952 kN)	345 kips (1532 kN)	-	#18 - 2-1/4"	2-7/16"	13.6 lbs/ft	300 kips	400 kips	-					
3" (76 mm)	3-3/4" (95 mm)	24.0 lbs/ft (35.7 kg/m)	254 kips (1130 kN)	410 kips (1823 kN)	-	(57 mm)	(62 mm)	(19.6 kg/m)	(1335 kN)	(1780 kN)	-	1-3/4" (46 mm)	2" (51 mm)	9.06 lbs/ft (13.5 kg/m)	312 kips (1388 kN)	390 kips (1734 kN)
3-1/4" (83 mm)	4" (102 mm)	28.2 lbs/ft (42.0 kg/m)	299 kips (1330 kN)	481 kips (2141 kN)	-						-					
3-1/2" (89 mm)	4-1/4" (108 mm)	32.7 lbs/ft (48.7 kg/m)	346 kips (1539 kN)	558 kips (2482 kN)	-	#20 - 2-1/2" (64 mm)	2-3/4" (70 mm)	16.7 lbs/ft (24.8 kg/m)	368 kips (1637 kN)	491 kips (2184 kN)	-					
3-3/4" (95 mm)	4-1/2" (114 mm)	37.6 lbs/ft (56.0 kg/m)	398 kips (1770 kN)	641 kips (2851 kN)	-						-	2-1/4" (57 mm)	2-1/2" (64 mm)	14.1 lbs/ft (20.8 kg/m)	490 kips (2181 kN)	613 kips (2727 kN)
4" (102 mm)	4-1/2" (114 mm)	43.1 lbs/ft (64.1 kg/m)	452 kips (2011 kN)	729 kips (3242 kN)	-	#24 - 3" (76 mm)	3-3/16" (81 mm)	24.0 lbs/ft (35.8 kg/m)	512 kips (2277 kN)	682 kips (3034 kN)	-					
4-1/4" (105 mm)	4-3/4" (121 mm)	48.6 lbs/ft (72.3 kg/m)	511 kips (2273 kN)	823 kips (3661 kN)	-						-	2-1/2"	2-3/4"	18.2 lbs/ft	622 kips	778 kips
4-1/2" (114 mm)	5" (127 mm)	54.5 lbs/ft (81.1 kg/m)	573 kips (2549 kN)	922 kips (4101 kN)	-						-	(65 mm)	(70 mm)	(27.1 kg/m)	(2766 kN)	(3457 kN)
4-3/4" (121 mm)	5-1/4" (133 mm)	60.7 lbs/ft (90.3 kg/m)	638 kips (2838 kN)	1028 kips (4573 kN)	-	#28 - 3-1/2" (89 mm)	3-3/4" (95 mm)	32.7 lbs/ft (48.6 kg/m)	720 kips (3206 kN)	961 kips (4274 kN)	-					
5" (127 mm)	5-1/2" (140 mm)	67.3 lbs/ft (100 kg/m)	707 kips (3145 kN)	1139 kips (5067 kN)	-						-	3" (75 mm)	3-1/8" (79 mm)	24.1 lbs/ft (35.8 kg/m)	822 kips (3656 kN)	1027 kips (4568 kN)
5-1/4" (133 mm)	5-3/4" (146 mm)	74.2 lbs/ft (110 kg/m)	779 kips (3465 kN)	1256 kips (5587 kN)	-	#32 - 4" (102 mm)	4-1/4" (108 mm)	43.0 lbs/ft (64.0 kg/m)	942 kips (4190 kN)	1278 kips (5685 kN)	-					

Old A36 Tie Rods





Connectors

	manual barrier		and the second second	
	Stop-Type Couplings	Sleeve Nuts	Turnbuckles	Clevis
Bar Desig. &	Outside Overall Part	Across Overall Part	Overall Working Part	Overall Working Part
Nominal Dia.	Diameter Length Number	Flats Length Number	Length Load Number	Length Load Number
Grade 75	Grade 75 Couplings	Grade 75 Sleeve Nuts	Grade 75 Turnbuckles	Grade 75 Clevis
#6 - 3/4"	1-1/4" 3-1/2"	1-1/4" 5-1/2"	8-7/8" 9.3 kips	7-7/8" 15 kips
(19 mm)	(32 mm) (89 mm) R62-06	(32 mm) (140 mm) R63-06SN	(225 mm) (41 kN) CTB21G06	(200 mm) (67 kN) CL3G06
#7 - 7/8"	1-3/8" 4"	1-1/2" 6-1/2"	9-1/8" 11.6 kips	7-7/8" 15 kips
(22 mm)	(35 mm) (102 mm) R62-07	(38 mm) (165 mm) R63-07SN	(232 mm) (52 kN) CTB26G07	(200 mm) (67 kN) CL3G07
#8 - 1"	1-5/8" 4-1/2"	1-5/8" 7-1/2"	15-1/8" 15.2 kips	9-5/8" 21 kips
(25 mm)	(41 mm) (114 mm) R62-08	(41 mm) (191 mm) R63-08SN	(384 mm) (68 kN) CTB30G08	(244 mm) (93 kN) CL4G08
#9 - 1-1/8"	1-7/8" 5"	1-7/8" 8-1/2"	15-3/4" 21 kips	9-5/8" 21 kips
(29 mm)	(48 mm) (127 mm) R62-09	(48 mm) (216 mm) R63-09SN	(400 mm) (93 kN) CTB36G09	(244 mm) (93 kN) CL4G09
#10 - 1-1/4"	2" 5-1/2"	2-1/4" 9-1/4"	17-1/2" 26 kips	11-3/4" 37.5 kips
(32 mm)	(51 mm) (140 mm) R62-10	(57 mm) (235 mm) R63-10SN	(445 mm) (116 kN) CTB40G10	(298 mm) (167 kN) CL5G10
#11 - 1-3/8"	2-1/4" 6"	2-3/8" 10"	17-1/2" 37 kips	11-3/4" 37.5 kips
(36 mm)	(57 mm) (152 mm) R62-11	(60 mm) (254 mm) R63-11SN	(445 mm) (165 kN) CTB46G11	(298 mm) (167 kN) CL5G11
#14 - 1-3/4"	2-7/8" 6"	3" 12"	12-5/8" 48 kips	13-3/4" 54 kips
(43 mm)	(73 mm) (152 mm) R62-14	(76 mm) (305 mm) R63-14SN	(321 mm) (214 kN) CTB53G14	(349 mm) (240 kN) CL6G14
#18 - 2-1/4"	3-1/2" 7-1/8"	3-1/2" 13-1/2"	14-3/4" 79.4 kips	15-1/2" 68.5 kips
(57 mm)	(89 mm) (181 mm) R62-18	(89 mm) (343 mm) R63-18SN	(375 mm) (353 kN) CTB67G18	(394 mm) (305 kN) CL7G18
#20 - 2-1/2"	4" 8"	4" 14-1/2"	22-1/2" 100 kips	18-1/8" 135 kips
(64 mm)	(102 mm)(203 mm) R62-20	(102 mm)(368 mm)	(572 mm) (445 kN) CTB70G20	(460 mm) (601 kN) CL8G20
#24 - 3"	5 [°] 9-3/4 [°]	4-1/2" 16"	18" 168 kips	18-1/8" 135 kips
(76 mm)	(127 mm)(248 mm) R62-24	(114 mm) (406 mm) R64-24SN	(457 mm) (746 kN) CTB88G24	(460 mm) (601 kN) CL8G24
#28 - 3-1/2"	5-1/2" 12"	5-1/2" 18"	22-1/2" 234 kips	18-1/8" 135 kips
(89 mm)	(140 mm)(305 mm) R62-28	(140 mm)(457 mm) R64-28SN	(572 mm) (1040 kN) CTB98G28	(460 mm) (601 kN) CL8G28
150 KSI	150 KSI Couplings	150 KSI Sleeve Nuts	150 KSI Turnbuckles	150 KSI Clevis
1"	1-3/4" 4"	2" 6-1/2"	17-1/2" 26 kips	11-3/4" 37.5 kips
(26 mm)	(44 mm) (102 mm) R72-08	(51 mm) (165 mm) R73-08SN	(445 mm) (116 kN) CTB40K08	(298 mm) (167 kN) CL5K08
1-1/4"	2-1/8" 4-1/2"	2-1/2" 8"	17-1/2" 37 kips	11-3/4" 37.5 kips
(32 mm)	(54 mm) (114 mm) R72-10	(64 mm) (203 mm) R73-10SN	(445 mm) (165 kN) CTB50K10	(298 mm) (167 kN) CL5K10
1-3/8"	2-3/8" 5"	2-3/4" 9-1/2"	19-5/8" 48 kips	13-3/4" 54 kips
(36 mm)	(60 mm) (127 mm) R72-11	(70 mm) (241 mm) R73-11SN	(498 mm) (214 kN) CTB54K11	(349 mm) (240 kN) CL6K11
1-3/4"	3 [°] 8-1/2 [°]	3" 13"	22-1/2" 79.4 kips	15-1/2" 68.5 kips
(46 mm)	(76 mm) (216 mm) R72-14	(76 mm) (330 mm) R73-14SN	(572 mm) (353 kN) CTB65K14	(394 mm) (305 kN) CL7K14
2-1/4"	3-1/2" 8-1/2"	3-1/2" 14-1/4"	22-1/2" 122 kips	18-1/8" 135 kips
(57 mm)	(89 mm) (216 mm) R72-18	(89 mm) (362 mm) R73-18SN	(572 mm) (544 kN) CTB87K18	(460 mm) (601 kN) CL8K18
2-1/2"	4-1/4" 8-5/8"	4" 16-1/2"	18" 168 kips	18-1/8" 135 kips
(65 mm)	(108 mm)(219 mm) R72-20	(102 mm) (419 mm) R73-20SN	(457 mm) (746 kN) CTB88K20	(460 mm) (601 kN) CL8K20
3"	5" 11-7/8"	4-3/4" 18-1/4"	22-1/2" 234 kips	18-1/8" 135 kips
(75 mm)	(127 mm)(302 mm) R72-24	(121 mm)(464 mm)	(572 mm) (1040 kN) CTB98K24	(460 mm) (601 kN) CL8K24

Couplers

Williams mechanical couplers develop 100% of the All-Thread-Bar published ultimate strength. Couplers can be ordered Tap Thru or Stop-Type (ensuring 50:50 engagement). A coupler, as opposed to a turnbuckle or sleeve nut, is generally used when a splice is required and tensioning of the tie rod is easily accessible externally at the nut/plate interface.

Turnbuckles & Sleeve Nuts

Sleeve Nuts and Turnbuckles are ideal when tensioning or adjusting of the tie rods is required internally at the bar to bar connection. The sleeve nut is less susceptible to bending than the turnbuckle and will develop 100% of the All-Thread-Bar published ultimate strength, however the turnbuckle allows the installer to see the thread engagement. Both components require right and left hand threads.

Clevis

A clevis can be used when tie rods are designed for angle adjustment, or when access to the outer side of the sheet pile is difficult. Designers must provide the hole diameter required in the structural steel to allow for proper sizing of the clevis pin. Pin diameters are available from 3/4" through 4-1/4" diameter.

Articulating Coupler

Williams offers a specially designed articulating couplers for longer tie rod systems that allows the designer to mitigate soil backfill settlement concerns that potentially could cause failure of the tie rod in bending or shear. The articulating coupler allows freedom of vertical rotation on each side of the system as settlement occurs, and will develop 100% of the All-Thread-Bar published ultimate strength.



Clevis tapped for tie rod diameters



Other Accessories



Bar Desig



Round Collar Nut Hex Nuts / Collar Nuts

Bar Desig. & Nominal Dia.	Across Flats	Across Corners	Thickness	Part Number
Grade 75		Grade 75	Hex Nuts	
#6 - 3/4"	1-1/4"	1.44"	1-1/8"	D62.06
(19 mm)	(32 mm)	(37 mm)	(29 mm)	R03-00
#7 - 7/8"	1-7/16"	1.66"	1-1/4"	D63 07
(22 mm)	(37 mm)	(42 mm)	(32 mm)	1103-07
#8 - 1"	1-5/8"	1.88"	1-3/8"	R63-08
(25 mm)	(41 mm)	(48 mm)	(35 mm)	100 00
#9 - 1-1/8"	1-7/8"	2.17"	1-1/2"	R63-09
(29 mm)	(48 mm)	(55 mm)	(38 mm)	
#10 - 1-1/4"	2"	2.31"	2"	R63-10
(32 mm)	(51 mm)	(59 mm)	(51 mm)	
#11 - 1-3/8" (36 mm)	2-1/4" (57 mm)	2.60°	(54 mm)	R63-11
(30 1111)	(37 1111)	0.40"	(34 mm) 0"	
#14 - 1-3/4 (43 mm)	2-3/4 (70 mm)	3.18 (81 mm)	(76 mm)	R63-14
#18 2 1/4"	3 3/4"	/ 22"	3 3/4"	
(57 mm)	(95 mm)	(110 mm)	(95 mm)	R63-18
#20 - 2-1/2"	4"	4.62"	3-3/4"	D 00.00
(64 mm)	(102 mm)	(117 mm)	(95 mm)	R03-20
#24 - 3"	4-1/2"	OD 5"	4-3/8"	D61 21*
(76 mm)	(114 mm)	(127 mm)	(111 mm)	1.04-24
#28 - 3-1/2"	5-1/2"	OD 6"	5-1/2"	R64-28*
(89 mm)	(140 mm)	(152 mm)	(140 mm)	1104-20
150 KSI		150 KSI H	lex Nuts	
1"	1-3/4"	2.0"	1-5/8"	R73-08
(26 mm)	(44 mm)	(51 mm)	(41 mm)	11/0-00
1-1/4"	<u>2-1/4"</u>	2.6"	1-7/8"	R73-10
(32 mm)	(57 mm)	(66 mm)	(48 mm)	100 10
1-3/8"	2-1/2"	2.9"	2-1/8"	R73-11
(36 mm)	(64 mm)	(73 mm)	(54 mm)	
1-3/4"	$3^{"}$	3.5"	3-1/2"	R73-14
(46 mm)	(76 mm)	(88 mm)	(89 mm)	-
2-1/4" (57 mm)	3-3/4''	$4.3^{\prime\prime}$	3-3/4''	R73-18
(37 1111)		(1091111)		
2-1/2" (65 mm)	$4-1/4^{"}$	4.9°	(05 mm)	R73-20
2"	(100 1111)		(35 mm) E 1/0"	
ა (75 mm)	4-1/2 (114 mm)	(127 mm)	5-1/2 (140 mm)	R74-24*
(701111)	*Dounded			ļ
	Rounded		s with hats	

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Outside Dome	Thickness	Across Flats	Part Number
Grad	le 75 Sphe	erical Was	hers
2" (51 mm)	35/64" (14 mm)	-	R81-0675
2-1/4" (57 mm)	39/64" (15 mm)	-	R81-0775
2-1/2" (64 mm)	5/8" (16 mm)	-	R81-0875
2-3/4" (70 mm)	3/4" (19 mm)	-	R81-0975
3" (76 mm)	53/64" (21 mm)	-	R81-1075
3-1/4" (83 mm)	29/32" (23 mm)	-	R81-1175
3-3/4" (95 mm)	1-7/64" (28 mm)	-	R81-1475
5" (127 mm)	1-13/32" (36 mm)	-	R81-1875
5-1/4" (133 mm)	1-1/2" (38 mm)	-	R81-2075
6-1/2" (165 mm)	1-7/8" (48 mm)	-	R81-2475
7" (178 mm)	1-1/2" (38 mm)	-	R81-2875
150	KSI Sphei	rical Hex I	Nuts
2-1/2" (64 mm)	2-1/4" (57 mm)	1-3/4" (44 mm)	R88-08
3-1/8" (80 mm)	2-3/4" (70 mm)	2-1/4" (57 mm)	R88-10
3-5/8" (90 mm)	3-1/4" (83 mm)	2-1/2" (64 mm)	R88-11
4" (102 mm)	3-1/2" (89 mm)	3" (76 mm)	R88-14
5-1/2" (140 mm)	5-1/4" (133 mm)	3-1/2" (89 mm)	R73-18 * R81-18
6" (152 mm)	5-1/2" (140 mm)	4-1/4" (108 mm)	R73-20 * R81-20
7" (178 mm)	7-1/2" (191 mm)	4-1/4" (108 mm)	R74-24 ** R81-24

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Outside Diameter	Inside Diameter	Thickness	Part Number							
Grad	e 75 Hard	lened Was	shers							
1-3/4"	15/16"	5/32"	DOE 07 436							
(44 mm)	(24 mm)	(4 mm)	K9I -07-430							
2"	1-1/16"	5/32"								
(51 mm)	(29 mm)	(4 mm)	K9I -00-430							
2-1/4"	1-3/16"	5/32"	POF-00-136							
(57 mm)	(30 mm)	(4 mm)	K9I -09-430							
2-1/4"	1-3/16"	5/32"	POF-00-136							
(57 mm)	(30 mm)	(4 mm)	K9I -09-430							
2-1/2"	1-3/8"	5/32"	DOE 10 436							
(64 mm)	(35 mm)	(4 mm)	R9F-10-430							
3"	1-5/8"	5/32"	DOE 12 426							
(76 mm)	(41 mm)	(4 mm)	R9F-12-430							
3-3/8"	1-7/8"	7/32"	DOE 14 426							
(86 mm)	(48 mm)	(6 mm)	R9F-14-430							
4-1/2"	2-5/8"	9/32"	DOE 20 426							
(114 mm)	(67 mm)	(7 mm)	R9F-20-430							
5"	2-7/8"	9/32"								
(127 mm)	(73 mm)	(7 mm)	R9F-22-430							
6"	3-3/8"	9/32"								
(142 mm)	(86 mm)	(7 mm)	R9F-20-430							
7"	3-7/8"	9/32"								
(178 mm)	(98 mm)	(7 mm)	R9F-30-430							
150	KSI Harde	ened Was	hers							
2-1/4"	1-3/16"	5/32"								
(57 mm)	(30 mm)	(4 mm)	R9F-09-436							
2-3/4"	1-1/2"	5/32"								
(70 mm)	(38 mm)	(4 mm)	R9F-11-436							
3"	1-5/8"	5/32"								
(76 mm)	(41 mm)	(4 mm)	кян-12-436							
3-3/4"	2-1/8"	7/32"								
(95 mm)	(54 mm)	(6 mm)	R9F-16-436							
4-1/2"	2-5/8"	9/32"								
(114 mm)	(67 mm)	(7 mm)	R9F-20-436							
5"	2-7/8"	9/32"								
(127 mm)	(73 mm)	(7 mm)	R9F-22-436							

* Standard Nut with Spherical Washer assembly ** Rounded Collar Nut with Spherical Washer assembly.

Bearing Plates

Williams supplies anchorage plates that can be customized for each application. Plates can be flat, dished to accommodate spherical washers, include trumpets for corrosion protection continuity and holes that allow attachment to steel whalers and sheet pile.



3-3/8"

(86 mm)

washers must be used with R73 hex nuts.

To achieve full strength of the system, hardened

9/32'

(7 mm)

R9F-26-436

End Caps

Williams offers several different types end caps to provide corrosion protection at otherwise exposed anchor ends. Most often the caps are packed with corrosion inhibiting grease. Caps made from steel are used in exposed impact areas.

Screw-on Fiber **Reinforced Nylon Cap**





Steel Tube welded on

Flange with Threaded

Steel Tube with Jam Nut



Screw-on **PVC Cap**

6"

(152 mm)









Managar

Bearing Plate Round Hole ASTM A36 AASHTO M183

> PVC End Cap ASTM D1785 Schedule 40 PVC

> > Hardened Washer

> > > Heavy Duty Hex Nut

> > > > Spherical Hex Nut Ductile Iron

> > > > > Beveled Washers





6





Corrosion Protection

Corrosion Protection Method	Abrasion Resistance (4 = best) Thickness		Relative Cost (3 = highest)	Production Lead Time	Can be Applied to Accessories?	Can be Applied in the Field?
Hot Dip Galvanizing	4	3-4 mils	2	2-4 weeks	yes	no
Epoxy Coating	1	12-15 mils	1	2-3 weeks	yes	no
Pre-Grouted Bars	3	2", 3" or 4" tubing	3	2 weeks	no	yes
Bitumastic Tape	2	N.A.	2	field applied	yes	yes
Coal Tar Epoxy	3	up to 35 mils	1	2-3 weeks	yes	yes



Hot Dip Galvanizing

Zinc serves as a sacrificial metal corroding preferentially to the steel. Galvanized bars have excellent bond characteristics to grout or concrete and do not require as much care in handling as epoxy coated bars. However, galvanization of anchor rods is more expensive than epoxy coating and often has greater lead time. Hot dip galvanizing bars and fasteners should be done in accordance with ASTM A153. Typical galvanized coating thickness for steel bars and components is between 3 and 4 mils. 150 KSI high strength steel bars shall require special cleaning procedures to avoid problems associated with hydrogen embrittlement in compliance with ASTM A143.

Epoxy Coating

Fusion bonded epoxy coating of steel bars to help prevent corrosion has been successfully employed in many applications because of the chemical stability of epoxy resins. Epoxy coated bars and fasteners should be done in accordance with ASTM A775 or ASTM A934. Epoxy coated bars and components are subject to damage if dragged on the ground or mishandled. Heavy plates and nuts are often galvanized even though the bar may be epoxy coated since they are difficult to protect against abrasion in the field. Epoxy coating patch kits are often used in the field for repairing nicked or scratched epoxy surfaces.



Pre-Grouted Bars

Cement Grout filled corrugated polyethylene tubing is often used to provide an additional barrier against corrosion attack in highly aggressive soils. These anchors are often referred to as MCP or Multiple Corrosion Protection anchors. The steel bars are wrapped with an internal centralizer then placed inside of the polyethylene tube where they are then factory pre-grouted. When specifying couplings with MCP ground anchors, verify coupling locations with a Williams representative.



Petrolatum Tape

This is a non-woven synthetic fabric carrier, fully impregnated with a neutral petroleum-based compound. This product is stable in composition and plasticity over a wide temperature range. It is commonly applied over coupled bars in the field and is typically covered with an adhesive heat shrink sleeve or tape.



Coal Tar Epoxy

Coal tar epoxy has shown to be abrasion resistant, economical and durable. This product when specified should meet or exceed the requirements of (a) Corp of Engineers C-200, C200a and (b) AWWA C-210-92 for exterior. Typically the dry thickness is between 8 and 24 mils. Make sure the surfaces of the bar are clean and dry before coating.



Heat Shrink Tubing

Provides a corrosion protected seal when connecting smooth or corrugated segments.



Typical Applications





Tieback with Mechanical Soil Anchor



Tie Rods to Concrete Deadman



Tie Rods to Steel H-Pile Deadman



Tie Rods to A-Frames



Grout Bonded Rock or Soil Anchors







Manta Ray Soil Anchors

Manta Ray[®] earth anchors are driven tipping plate soil anchors dependant on soil strength for reaction of tensile loads. Manta Ray anchors have working loads up to 20 kips. After driving the anchor to the required depth, the driving tool (called drive steel) is removed. The anchor is then tipped and proof tested with Williams Anchor Locking Kit from its edgewise-driving position to present its bearing area to the soil. This is called "load locking" and provides an immediate proof test of each anchor.



Advantages

- Fast, easy installation
- Immediate proof test results
- No grout
- Inexpensive installation equipment
- Environmentally friendly
- No drilling required
- Anchors for a wide range of soils & applications

Applications

The simple, effective and low cost Manta Ray anchor system represents a major breakthrough in "anchoring technology" with a multitude of uses in the utility, civil engineering and construction markets for:

Underwater Applications

- Utility Poles
- Retaining Walls
- Sheet Piles
- Seawalls
- Pipelines
- Blockwalls

Erosion Control

Scaffolding

There are six **Manta Ray Anchors** with light to heavy duty holding capacities. All anchors are made of galvanized ductile iron, can be driven with the drive steel set and can be tested to the desired holding capacity with the load locker.

The anchors are designed to utilize solid steel rods as load carrying members. Bars and accessories for Manta Ray anchors can be found on pages 3-5.



	Max Safe	Soil	Ancho	Weight		
Anchor	Working Load (2:1 FS)	Reaction Area	Diameter	Part Number	per Each	
MR-68	2.5 kips (11 kN)	5.3 in ² (34 cm ²)	3/8" (10 mm)	B8S-03	1 lbs (0.5 kg)	
MR-88	5 kips (22 kN)	10.2 in ² (66 cm ²)	1/2" (12 mm)	B8S-04	2.1 lbs (1 kg)	
MR-3	10 kips (45 kN)	33.6 in ² (217 cm ²)	#6 - 3/4" (20 mm)	R61-06	7 lbs (3.2 kg)	
MR-2	20 kips (89 kN)	42.8 in ² (276 cm ²)	#6 - 3/4" (20 mm)	R61-06	12 lbs (5.4 kg)	
MR-1	20 kips (89 kN)	71.9 in ² (464 cm ²)	#6 - 3/4" (20 mm)	R61-06	14 lbs (6.4 kg)	
MR-SR	20 kips (89 kN)	143.4 in^2	#6 - 3/4"	R61-06	22 lbs	

Williams Anchor Rods are fully threaded and can be field cut and coupled. R61 lengths up to 50 feet uncoated. B8S up to 20 feet. *Galvanized rods should be cut to size prior to galvanizing to insure good nut fit.*

Manta Ray Estimated Holding Capacities in Listed Soils

Common Soil Type Description	Typical Blow Count "N" per ASTM D1586	MR-68	MR-88	MR-3	MR-2	MR-1	MR-SR
Very dense/cemented sands; coarse gravel and cobbles	60 - 100+	2.5 kips (1, 3)	5 kips (1, 3)	10 kips (1, 3)	20 kips (1, 3)	(5)	(5)
Dense fine sand; very hard silts and clays	45 - 60	1.5-2 kips (2, 3, 4)	4-5 kips (2, 3, 4)	8.5-10 kips (2, 3, 4)	10.5-14 kips (2, 4)	18-20 kips (1, 3, 4)	20 kips (1, 3)
Dense clays, sands and gravel; hard slits and clays	35 - 50	1.1-1.5 kips (4)	2-3 kips (4)	6-9 kips (2, 4)	7.5-11 kips (2, 4)	12-18 kips (2, 4)	16-20 kips (2, 3, 4)
Medium dense sandy gravel; very stiff to hard silts and clays	24 - 40	0.75-1 kips (4)	1.5-2 kips (4)	4.5-7 kips (4)	6-9 kips (4)	9-10 kips (2, 4)	12-17 kips (2, 4)
Medium dense coarse sand and sandy gravel; stiff to very stiff silts and clays	14 - 25	0.5575 kips (4)	1-1.5 kips (4)	3.5-4.5 kips (4)	4.5-6 kips (4)	7.5-10 kips (4)	9-12 kips (4)
Loose to medium dense fine to coarse sand; firm to stiff clays and silts	7 - 14	0.45-0.6 kips (4)	0.75-1.25 kips (4)	2.5-4 kips (4)	3.5-5 kips (4)	5-7.5 kips (4)	7-9 kips (4)
Loose fine sand; alluvium; soft-firm clays; varied clays; fills	4 - 8	0.3-0.5 kips (4)	0.45-0.75 kips (4, 6)	1.5-2.5 kips (4, 6)	2.5-4 kips (4, 6)	4-6 kips (4, 6)	4.5-7 kips (4, 6)
Peat, organic silts; inundates silts fly ash	0 - 5	(5)	0.1-0.45 kips (4, 6)	0.4-1.5 kips (4, 6)	1-2.5 kips (4, 6)	1.5-4 kips (4, 6)	2-6 kips (4, 6)

Drilled hole required to install.

2 - Installation may be difficult. Pilot hole may be required.

3 - Holding capacity limited by max safe working load of anchors.

4 - Holding capacity limited by soil strength.

5 - Not recommended in these soils.

- Wide variation in soil properties reduces prediction accuracy.

Use this chart for estimation only, true capacity must be tested with anchor locker. The values in chart are based on minimum 3' embedment depth for models MR-68 & MR-88 and 7' for Models MR-3 thru MR-SR. (Minimum overburden depth is 4'.) Field testing is recommended for other possible depths.

Manta Ray Anchor Structural Properties

Project Photos



Project: Pier 3 Replacement Contractor: Weeks Marine Location: Portsmout, VA



Project: Igor's Seawall Contractor: R&R Drilling Location: Carlsbad, CA



Project: Ohio River Bridge Contractor: Walsh Construction Location: Louisville, KY



Project: East Cliff Drive Bluff Stabilization Contractor: Drill Tech Drilling & Shoring Location: Santa Cruz, CA



Project: Elgin Air Force Base Contractor: C.W. Roberts Contracting & Contech Construction Products Location: Destin, FL



Project: San Clemente Island, Wilson Cove Pier Contractor: American Pacific Marine Location: San Diego, CA





Williams offers a full line of Ground Anchors, Concrete Anchors, Post-Tensioning Systems, Wind Turbine Foundation Systems, Marine Tieback Systems and Concrete Forming Hardware Systems for whatever your needs may be. Please visit our website for the most current information.



Also available from Williams are Rock & Soil Anchor Sample Specifications and High Capacity Concrete Anchor Sample Specifications



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