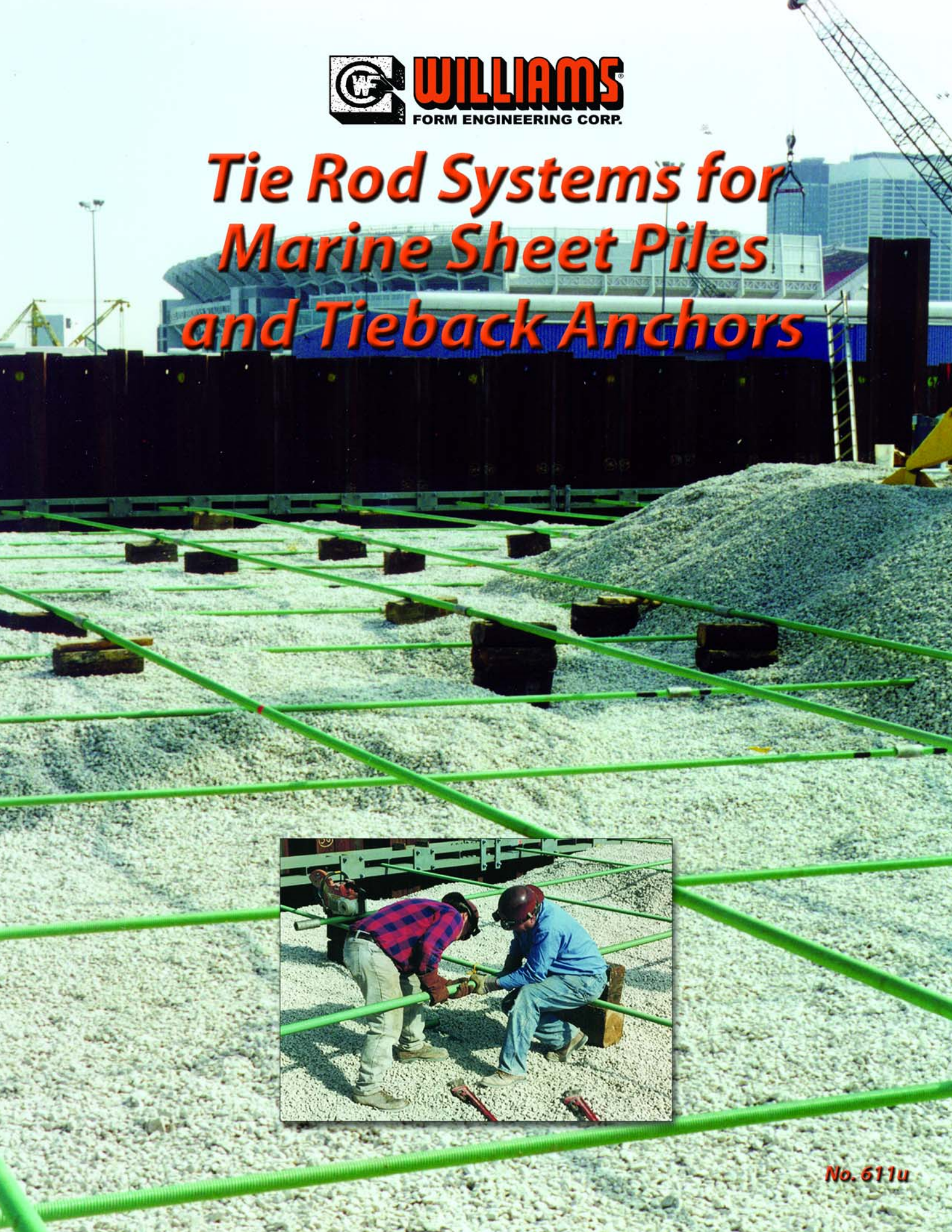




# *Tie Rod Systems for Marine Sheet Piles and Tieback Anchors*



No. 611u

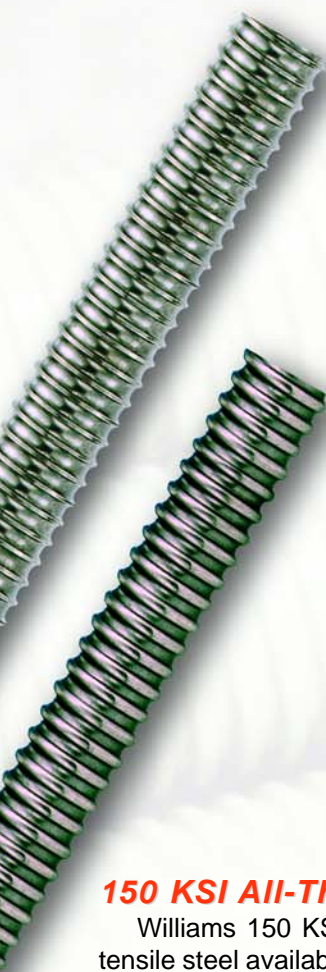




# The All-Thread Advantage

## Williams Tie Rod Advantages

- Lighter weights with higher strengths and lower costs
- Continuously threaded for maximum versatility or threaded on ends only
- Durable threads and components capable of developing the full capacity of the bar
- Right and left hand capability for use with sleeve nuts and turnbuckles
- 50 foot stock lengths
- Several options of corrosion protection from simple to multiple protection 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 969 kips (4311 kN). Lengths of up to 50 feet are available on most diameters. 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-722-07 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 field proven around the world.

### **Grade 75 All-Thread Rebar**

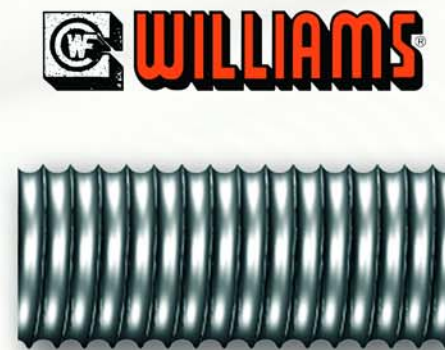
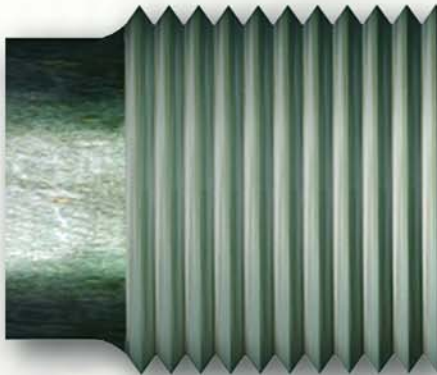
Williams 75 All-Thread Rebar is a continuously threaded bar specially designed to be used with fasteners. Common applications for the Grade 75 All-Thread Rebar are marie tie rods and ground anchors. All-Thread Rebar is available in 11 diameters from #6 (20 mm) through #28 (89 mm) with ultimate tensile strengths up to 960 kips (4274 kN) and lengths up to 50 feet. 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 bar over all or a portion of the length 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 bars published ultimate strength. All components for the system are manufactured in North America.



## Conversion Chart

Williams All-Thread-Bars are more economical than heavier ASTM A36 or upset threaded rods. All-Thread Bars are usually on the 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, additional savings may result with the connectors and material freight. In addition, since smaller diameter bars have smaller surface areas than larger bars, corrosion protection may be more economical. It is not uncommon to see cost savings up to 30% when comparing the Williams All-Thread tie rod systems to upset threaded or A36 rod systems. Bars shown actual size.



### Old A36 Tie Rods

### Grade 75 All-Thread Rebar

### 150 KSI All-Thread-Bar

Actual Tie Rod Diameter	Heavy Upset Thread Dia. & Threads per Inch	Weight per Linear ft. (Meters)	Minimum Ultimate Strength of Rod	Bar Desig. & Nominal Diameter	Approx. Thread Major Dia. & Threads per Inch	Weight per Linear ft. (Meters)	Minimum Yield Strength of Rebar	Minimum Ultimate Strength of Rebar	Nominal Bar Diameter	Approx. Thread Major Dia. & Threads per Inch	Weight per Linear ft. (Meters)	Minimum Yield Strength of Bar	Minimum Ultimate Strength of Bar
1-1/4" (32 mm)	1-1/2" - 6 (38 mm)	4.17 lbs. (1.9 KG)	71.2 kips (317 kN)	#8 - 1" (25 mm)	1-1/8" - 3-1/2 (29 mm)	2.7 lbs. (1.2 KG)	59.3 kips (264 kN)	79.0 kips (351 kN)	1" (25 mm)	1-1/8" - 4 (29 mm)	3.09 lbs (4.6 Kg)	102 kips (454 kN)	127.5 kips (567 kN)
1-3/8" (35 mm)	1-3/4" - 5 (44 mm)	5.05 lbs (2.3 KG)	86.2 kips (383 kN)	#9 - 1-1/8" (29 mm)	1-1/4" - 3-1/2 (32 mm)	3.4 lbs. (1.5 KG)	75.0 kips (334 kN)	100.0 kips (445 kN)					
1-1/2" (38 mm)	2" - 4-1/2 (51 mm)	6.01 lbs. (2.7 KG)	102.5 kips (456 kN)	#10 - 1-1/4" (32 mm)	1-3/8" - 3 (35 mm)	4.30 lbs. (2.0 KG)	95.3 kips (424 kN)	127.0 kips (565 kN)	1-1/4" (32 mm)	1-7/16" - 4 (37 mm)	4.51 lbs. (6.71 Kg)	150 kips (667 kN)	187.5 kips (834 kN)
1-5/8" (41 mm)	2" - 4-1/2 (51 mm)	7.05 lbs. (3.2 KG)	120.3 kips (535 kN)	#11 - 1-3/8" (35 mm)	1-1/2" - 3 (38 mm)	5.30 lbs. (2.4 KG)	117.0 kips (520 kN)	156.0 kips (694 kN)					
1-3/4" (44 mm)	2-1/4" - 4-1/2 (57 mm)	8.18 lbs. (3.7 KG)	139.5 kips (620 kN)	#14 - 1-3/4" (44 mm)	1-7/8" - 3 (48 mm)	7.65 lbs. (3.5 KG)	168.7 kips (750 kN)	225.0 kips (1001 kN)	1-3/8" (35 mm)	1-9/16" - 4 (40 mm)	5.71 lbs (8.50 Kg)	189.6 kips (843 kN)	237.0 kips (1054 kN)
1-7/8" (48 mm)	2-1/4" - 4-1/2 (57 mm)	9.39 lbs. (4.3 KG)	160.1 kips (712 kN)	#18 - 2-1/4" (57 mm)	2-7/16" - 3 (62 mm)	13.60 lbs. (6.2 KG)	300.0 kips (1334 kN)	400.0 kips (1779 kN)					
2" (51 mm)	2-1/2" - 4 (64 mm)	10.68 lbs. (4.8 KG)	182.2 kips (810 kN)	#20 - 2-1/2" (64 mm)	2-3/4" - 2-3/4 (70 mm)	16.69 lbs. (7.6 KG)	368.0 kips (1637 kN)	491.0 kips (2184 kN)	2-1/4" (57 mm)	2-1/2" - 3-1/2 (64 mm)	14.1 lbs. (20.8 KG)	490 kips (2181 kN)	613 kips (2727 kN)
2-1/8" (54 mm)	2-1/2" - 4 (64 mm)	12.06 lbs. (5.5 KG)	205.7 kips (915 kN)	#24 - 3" (76 mm)	3-3/16" 2-3/4 (81 mm)	24.0 lbs. (35.8 KG)	511 kips (2273 kN)	682 kips (3034 kN)					
2-1/4" (57 mm)	2-3/4" - 4 (70 mm)	13.52 lbs. (6.1 KG)	230.6 kips (1026 kN)	#28 - 3-1/2" (89 mm)	3-3/4" - 2-3/4 (95 mm)	32.7 lbs. (14.8 KG)	720.0 kips (3203 kN)	960.0 kips (4270 kN)	2-1/2" (64 mm)	2-3/4" - 3 (70 mm)	18.20 lbs. (27.1 Kg)	622.4 kips (2766 kN)	778.0 kips (3461 kN)
2-3/8" (60 mm)	2-3/4" - 4 (70 mm)	15.06 lbs. (6.8 KG)	256.9 kips (1143 kN)										
2-1/2" (64 mm)	3-1/4" - 4 (83 mm)	16.69 lbs. (7.6 KG)	284.7 kips (1266 kN)										
2-5/8" (67 mm)	3-1/4" - 4 (83 mm)	18.40 lbs. (8.3 KG)	313.9 kips (1396 kN)										
2-3/4" (70 mm)	3-1/2" - 4 (89 mm)	20.20 lbs. (9.2 KG)	344.5 kips (1532 kN)										
2-7/8" (73 mm)	3-1/2" - 4 (89 mm)	22.07 lbs. (10.0 KG)	376.5 kips (1675 kN)										
3" (76 mm)	3-3/4" - 4 (95 mm)	24.03 lbs. (10.9 KG)	409.9 kips (1823 kN)										
3-1/8" (80 mm)	3-3/4" - 4 (95 mm)	26.08 lbs. (11.8 KG)	444.9 kips (1979 kN)										
3-1/4" (83 mm)	4" - 4 (102 mm)	28.21 lbs. (12.8 KG)	481.4 kips (2141 kN)										
3-3/8" (86 mm)	4" - 4 (102 mm)	30.42 lbs. (13.8 KG)	519.1 kips (2309 kN)										
3-1/2" (89 mm)	4-1/4" - 8 (108 mm)	32.71 lbs. (14.8 KG)	558.0 kips (2482 kN)										
3-5/8" (92 mm)	4-1/4" - 8 (108 mm)	35.09 lbs. (15.9 KG)	598.6 kips (2663 kN)										
3-3/4" (95 mm)	4-1/2" - 8 (114 mm)	37.55 lbs. (17.0 KG)	640.9 kips (2851 kN)										
4" (102 mm)	4-1/2" - 8 (114 mm)	42.72 lbs. (19.4 KG)	728.9 kips (3242 kN)										

Substitute with Higher Strength  
Williams Grade 75 All-Thread-Rebar

Substitute with Higher Strength  
Williams 150 KSI All-Thread-Bar





## Connectors

### Stop-Type Couplings

Bar Desig. & Nominal Dia.	Outside Diameter	Overall Length	Part Number
<b>Grade 75 All-Thread Rebar</b>			
#8 - 1" (25 mm)	1-5/8" (41.4 mm)	4-1/2" (114 mm)	R62-08
#9 - 1-1/8" (28 mm)	1-7/8" (47.7 mm)	5" (127 mm)	R62-09
#10 - 1-1/4" (32 mm)	2" (50.8 mm)	5-1/2" (140 mm)	R62-10
#11 - 1-3/8" (35 mm)	2-1/4" (57.2 mm)	6" (152 mm)	R62-11
#14 - 1-3/4" (45 mm)	2-7/8" (73.0 mm)	7-7/8" (200 mm)	R62-14
#18 - 2-1/4" (55 mm)	3-1/2" (88.9 mm)	9-1/8" (233 mm)	R62-18
#20 - 2-1/2" (64 mm)	4" (102 mm)	9-1/2" (241 mm)	R62-20
#24 - 3" (76 mm)	5" (127 mm)	11-1/4" (286 mm)	R62-24
#28 - 3-1/2" (89 mm)	5-1/2" (140 mm)	12" (305 mm)	R62-28
<b>150 KSI All-Thread Bar</b>			
1" (26 mm)	1-3/4" (45 mm)	4-1/4" (108 mm)	R72-08
1-1/4" (32 mm)	2-1/8" (54 mm)	5-1/4" (133 mm)	R72-10
1-3/8" (36 mm)	2-3/8" (60 mm)	5-3/4" (146 mm)	R72-11
1-3/4" (45 mm)	3" (76 mm)	8-1/2" (216 mm)	R72-14
2-1/4" (57 mm)	3-1/2" (89 mm)	9" (229 mm)	R72-18
2-1/2" (65 mm)	4-1/4" (108 mm)	9-3/8" (238 mm)	R72-20
3" (75 mm)	5" (127 mm)	11-7/8" (302 mm)	R72-24

### Turnbuckles

Bar Desig. & Nominal Dia.	Overall Length	Part Number
<b>Grade 75 All-Thread Rebar</b>		
#8 - 1" (25 mm)	12-5/8" (321 mm)	32044
#9 - 1-1/8" (28 mm)	13-1/2" (343 mm)	32045
#10 - 1-1/4" (32 mm)	14-3/8" (365 mm)	32059
#11 - 1-3/8" (35 mm)	14-3/4" (375 mm)	32048
#14 - 1-3/4" (45 mm)	16-7/8" (429 mm)	32085
#18 - 2-1/4" (55 mm)	22-1/2" (572 mm)	32098
#20 - 2-1/2" (64 mm)	N/A	N/A
#24 - 3" (76 mm)	N/A	N/A
#28 - 3-1/2" (89 mm)	N/A	N/A
<b>150 KSI All-Thread Bar</b>		
1" (26 mm)	14-3/8" (365 mm)	32059
1-1/4" (32 mm)	16-5/8" (422 mm)	32049
1-3/8" (36 mm)	16-7/8" (429 mm)	32085
1-3/4" (45 mm)	22-1/2" (572 mm)	32098
2-1/4" (57 mm)	N/A	N/A
2-1/2" (65 mm)	N/A	N/A
3" (75 mm)	N/A	N/A

### Sleeve Nuts

Bar Desig. & Nominal Dia.	Across Flats	Overall Length
<b>Grade 75 All-Thread Rebar</b>		
#8 - 1" (25 mm)	1-5/8" (41 mm)	7-1/2" (191 mm)
#9 - 1-1/8" (28 mm)	1-7/8" (48 mm)	8-1/2" (216 mm)
#10 - 1-1/4" (32 mm)	2-1/8" (54 mm)	9-1/4" (235 mm)
#11 - 1-3/8" (35 mm)	2-3/8" (60 mm)	10" (254 mm)
#14 - 1-3/4" (45 mm)	3" (76 mm)	12-1/2" (318 mm)
#18 - 2-1/4" (55 mm)	3-1/2" (89 mm)	14-1/2" (368 mm)
#20 - 2-1/2" (64 mm)	4" (102 mm)	16-1/2" (419 mm)
#24 - 3" (76 mm)	4-1/2" (114 mm)	16" (486 mm)
#28 - 3-1/2" (89 mm)	5-1/2" (140 mm)	18" (457 mm)
<b>150 KSI All-Thread Bar</b>		
1" (26 mm)	2" (51 mm)	6-1/2" (159 mm)
1-1/4" (32 mm)	2-1/2" (65 mm)	8" (203 mm)
1-3/8" (36 mm)	2-3/4" (70 mm)	9-1/2" (241 mm)
1-3/4" (45 mm)	3" (76 mm)	13" (330 mm)
2-1/4" (57 mm)	N/A	N/A
2-1/2" (65 mm)	4" (102 mm)	16-1/2" (419 mm)
3" (75 mm)	N/A	N/A



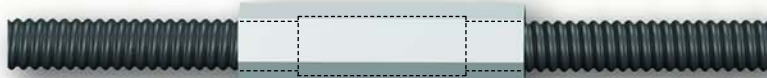
### Couplers

Williams mechanical couplers develop 100% of the All-Thread-Bar published ultimate strength. Couplers can be ordered Tap Thru (common with larger diameter bars) or Stop Type (ensuring 50:50 engagement). Williams couplers are used when the tie rods are to be tensioned or adjusted externally at the anchor nut/plate interface.



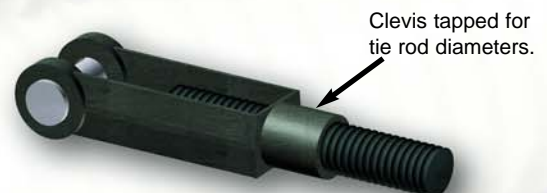
### Turnbuckles & Sleeve Nuts

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, 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 sizes of hole and structural steel for pin. Pin diameters are available from 3/4" through 4-1/4" diameter (135K W.L.).



Clevis tapped for tie rod diameters.



## Other Accessories



Provides up to 5° angle when used with a dished plate.

### Washers

Bar Desig. & Nominal Dia.	Hardened Washers	Beveled Washers	Degree of Bevel
<b>Grade 75 All-Thread Rebar</b>			
#8 - 1" (25 mm)	R9F-09-436	R8M-09S	15°
#9 - 1-1/8" (28 mm)	R9F-09-436	R8M-09S	15°
#10 - 1-1/4" (32 mm)	R9F-10-436	R8M-12S	15°
#11 - 1-3/8" (35 mm)	R9F-12-436	R8M-13S	10°
#14 - 1-3/4" (45 mm)	R9F-14-436	R8M-16	5°
#18 - 2-1/4" (55 mm)	R9F-20-436	R8M-18	15°
#20 - 2-1/2" (64 mm)	R9F-22-436	R8M-20	10°
#24 - 3" (76 mm)	R9F-24-436	R8M-24	10°
#28 - 3-1/2" (89 mm)	R9F-30-436	R8M-28	10°
<b>150 KSI All-Thread Bar</b>			
1" (26 mm)	R9F-09-436	R8M-08-150	10°
1-1/4" (32 mm)	R9F-11-436	R8M-10-150	15°
1-3/8" (36 mm)	R9F-12-436	R8M-11-150	15°
1-3/4" (45 mm)	R9F-16-436	R8M-14-150	10°
2-1/4" (57 mm)	R9F-20-436	R8M-20-150	10°
2-1/2" (65 mm)	R9F-22-436	R8M-20-150	10°
3" (75 mm)	R9F-26-436	R8M-26-150	10°

Two Bevel Washers are required for angle adjustment

### Hex Nuts

Bar Desig. & Nominal Dia.	Across Flats	Thickness	Part Number
<b>Grade 75 All-Thread Rebar</b>			
#8 - 1" (25 mm)	1-5/8" (41.3 mm)	2" (50.8 mm)	R63-08
#9 - 1-1/8" (28 mm)	1-7/8" (47.8 mm)	2" (51 mm)	R63-09
#10 - 1-1/4" (32 mm)	2" (50.8 mm)	2-3/16" (55.6 mm)	R63-10
#11 - 1-3/8" (35 mm)	2-1/4" (57.2 mm)	2-13/32" (61.1 mm)	R63-11
#14 - 1-3/4" (45 mm)	2-3/4" (73.0 mm)	3-1/4" (82.6 mm)	R63-14
#18 - 2-1/4" (55 mm)	3-1/2" (88.9 mm)	3-1/2" (88.9 mm)	R63-18
#20 - 2-1/2" (64 mm)	4" (102 mm)	4" (102 mm)	R63-20
#24 - 3" (76 mm)	4-1/2" (114 mm)	5" (127 mm)	R64-24*
#28 - 3-1/2" (89 mm)	5-1/2" (140 mm)	6" (142 mm)	R64-28*
<b>150 KSI All-Thread Bar</b>			
1" (26 mm)	1-3/4" (45 mm)	2" (51 mm)	R73-08
1-1/4" (32 mm)	2-1/4" (57 mm)	2-1/2" (64 mm)	R73-10
1-3/8" (36 mm)	2-1/2" (63.5 mm)	2-3/4" (70 mm)	R73-11
1-3/4" (45 mm)	3" (76 mm)	3-1/2" (89 mm)	R73-14
2-1/4" (57 mm)	3-1/2" (89 mm)	4-1/4" (105 mm)	R73-18
2-1/2" (65 mm)	4-1/4" (108 mm)	4-3/4" (120 mm)	R73-20
3" (75 mm)	4-1/4" (108 mm)	6-1/8" (156 mm)	R74-24*

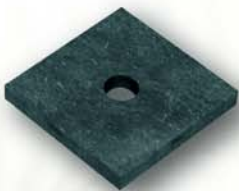
\* Rounded Collar Nut

### Spherical Washers/Hex Nuts

Bar Desig. & Nominal Dia.	Thickness	Outside Dome	Part Number
<b>Grade 75 All-Thread Rebar</b>			
#8 - 1" (25 mm)	5/8" (15.9 mm)	2-1/2" (64 mm)	R81-0875
#9 - 1-1/8" (28 mm)	3/4" (19.1 mm)	2-3/4" (70 mm)	R81-0975
#10 - 1-1/4" (32 mm)	53/64" (21.0 mm)	3" (76 mm)	R81-1075
#11 - 1-3/8" (35 mm)	29/32" (23.0 mm)	3-1/4" (83 mm)	R81-1175
#14 - 1-3/4" (45 mm)	1-7/64" (28.2 mm)	3-3/4" (95 mm)	R81-1475
#18 - 2-1/4" (55 mm)	1-13/32" (35.7 mm)	5" (127 mm)	R81-1875
#20 - 2-1/2" (64 mm)	1-1/2" (38.1 mm)	5-1/4" (133 mm)	R81-2075
#24 - 3" (76 mm)	1-7/8" (48 mm)	6-1/2" (165 mm)	R81-2475
#28 - 3-1/2" (89 mm)	1-1/2" (38.1 mm)	7" (178 mm)	R81-2875
<b>150 KSI All-Thread Bar</b>			
1" (26 mm)	2-1/4" (57 mm)	2-1/2" (63.5 mm)	R88-08*
1-1/4" (32 mm)	2-3/4" (70 mm)	3-1/8" (79.5 mm)	R88-10*
1-3/8" (36 mm)	3-1/4" (82.5 mm)	3-5/8" (90.2 mm)	R88-11*
1-3/4" (45 mm)	3-1/2" (89 mm)	4" (102 mm)	R88-14*
2-1/4" (57 mm)	5-3/4" (146 mm)	5-1/2" (140 mm)	R73-18 R81-18
2-1/2" (65 mm)	6-1/2" (165 mm)	6" (152 mm)	R73-20 R81-20
3" (75 mm)	8-1/8" (206 mm)	7" (178 mm)	R74-24 R81-24

\* Spherical Hex Nut

### Bearing Plates



Williams supplies anchorage plates that are customized for each application. Plate dimensions should be specified by the project, keeping in mind corrosion protection and tie rod angle.



### End Caps

Williams offers end caps produced from fiber reinforced nylon, steel or PVC to provide corrosion protection at otherwise exposed anchor ends. Most often the caps are packed with corrosion inhibiting wax or grease. Caps made from reinforced nylon and steel are used in exposed impact areas. The fiber reinforced nylon end cap meets the Florida DOT standards.



Fiber Reinforced Nylon Cap



Steel Tube welded on Flange with Threaded Screw Connections



Steel Tube with Jam Nut



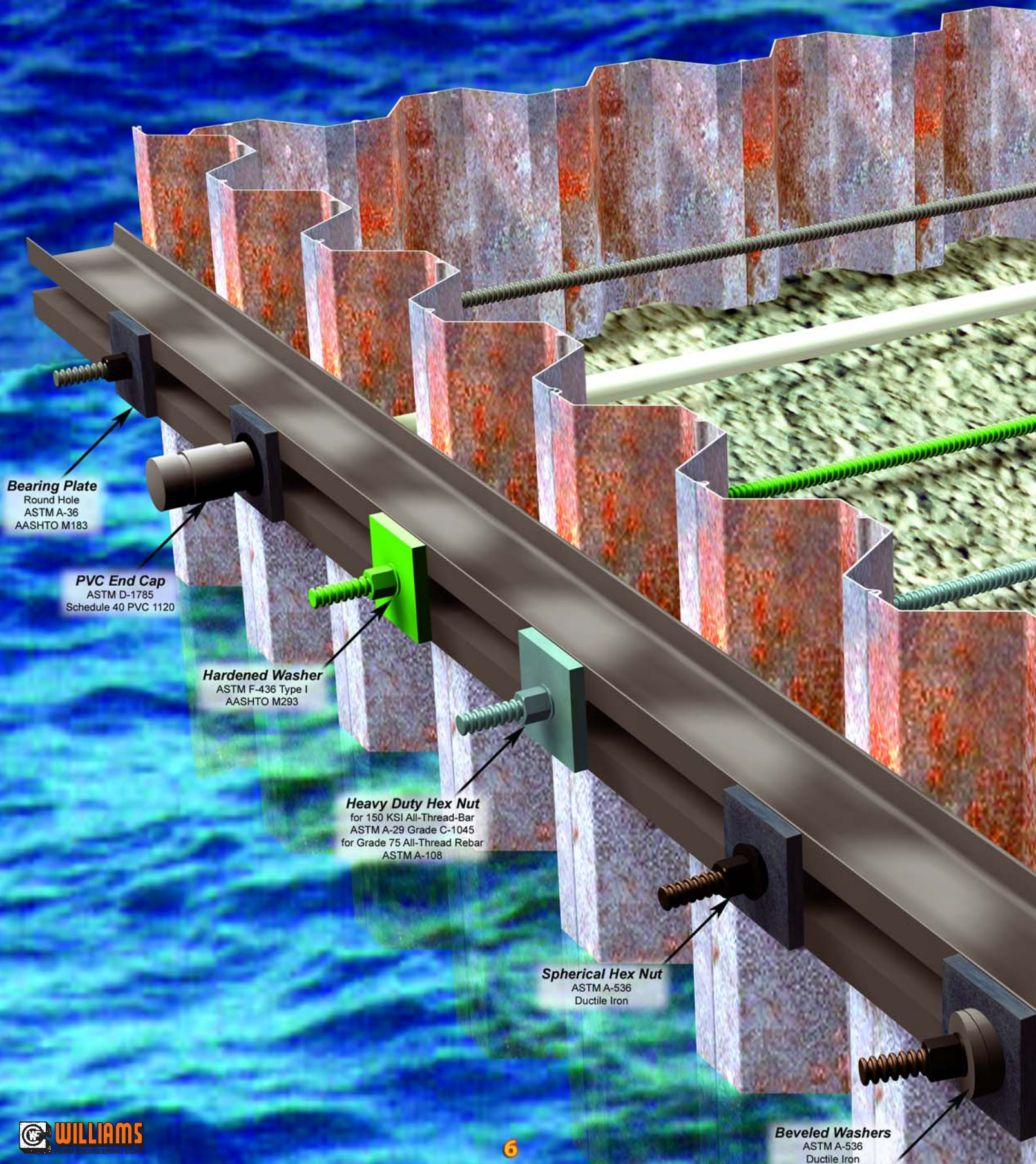
Screw-On PVC Cap with Plastic Nut



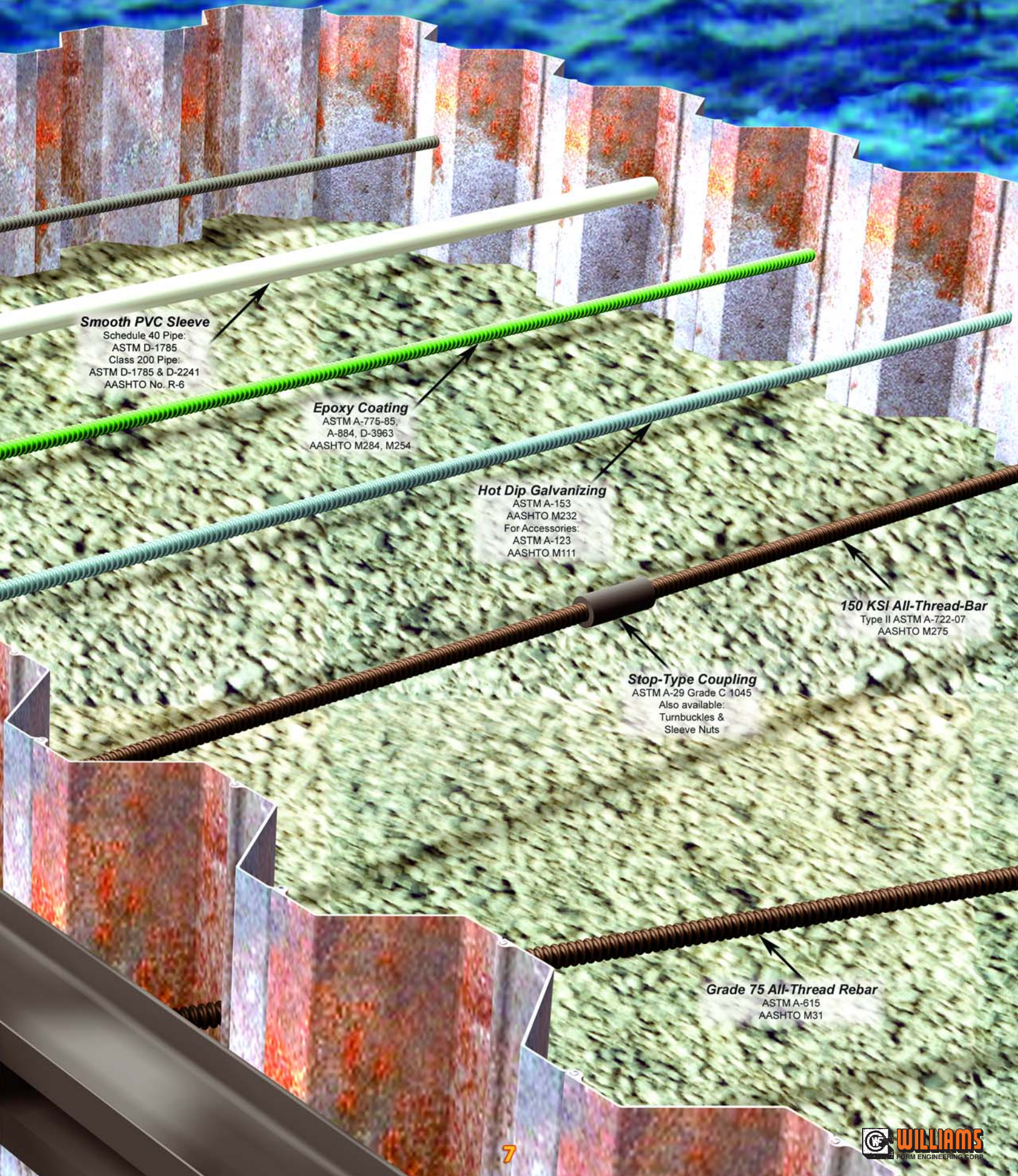
Slip-On PVC Cap



# Specifications







**Smooth PVC Sleeve**  
Schedule 40 Pipe:  
ASTM D-1785  
Class 200 Pipe:  
ASTM D-1785 & D-2241  
AASHTO No. R-6

**Epoxy Coating**  
ASTM A-775-85,  
A-884, D-3963  
AASHTO M284, M254

**Hot Dip Galvanizing**  
ASTM A-153  
AASHTO M232  
For Accessories:  
ASTM A-123  
AASHTO M111

**150 KSI All-Thread-Bar**  
Type II ASTM A-722-07  
AASHTO M275

**Stop-Type Coupling**  
ASTM A-29 Grade C 1045  
Also available:  
Turnbuckles &  
Sleeve Nuts

**Grade 75 All-Thread Rebar**  
ASTM A-615  
AASHTO M31





Corrosion Protection Method	Abrasion Resistance (4 = best)	Typical Thickness	Relative Cost (4 = 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	7-12 mils	1	2-3 weeks	yes	no
Pre-Grouted Bars	3	2", 3" or 4" tubing	3	2 weeks	no	yes
Extruded Polyethylene Coating	2	23-25 mils	1	2-4 weeks	no	no
Bitumastic Tape	2	N.A.	2	field applied	yes	yes
Coal Tar Epoxy	3	up to 35 mils	1	2-3 weeks	yes	yes



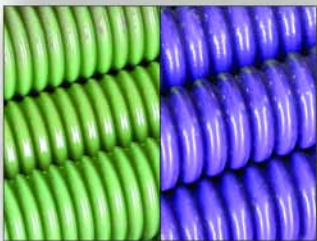
## Hot Dip Galvanizing

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 of 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 should always be mechanically cleaned (never acid washed) to avoid problems associated with hydrogen embrittlement in compliance with ASTM A143.**



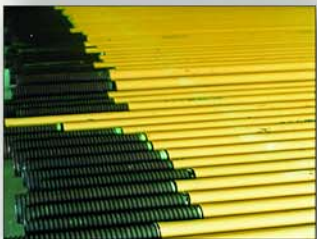
## Pre-Grouted Bars

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.



## 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. Coating thickness is generally specified between 7 to 12 mils. 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.



## Extruded Polyethylene

High density polyethylene is tightly bonded to the anchor bar by a flexible bituminous mastic. This effectively helps to eliminate migration of moisture and oxygen (requirements for corrosion). Polyethylene thickness is typically 23 to 25 mils., and can be done on bars ranging from #6 up to Williams largest bar diameters. Anchor threaded ends must be uncoated to allow for couplings and anchor nuts. Ends can be protected with end caps or corrosion inhibiting tape, or depending on the application, encased in concrete. Extruded polyethylene is generally less expensive than epoxy coating but requires sizable orders. Coating specifications are available from Williams upon request.



## Bitumastic Tape

This is a non-woven synthetic fabric, fully impregnated and coated with neutral petroleum based compound. This product is stable in composition and plasticity over a wide temperature range, and is commonly applied in the field. Bars should be cleaned thoroughly prior to use. Thickness is on the average 45 mils.

## Coal Tar Epoxy

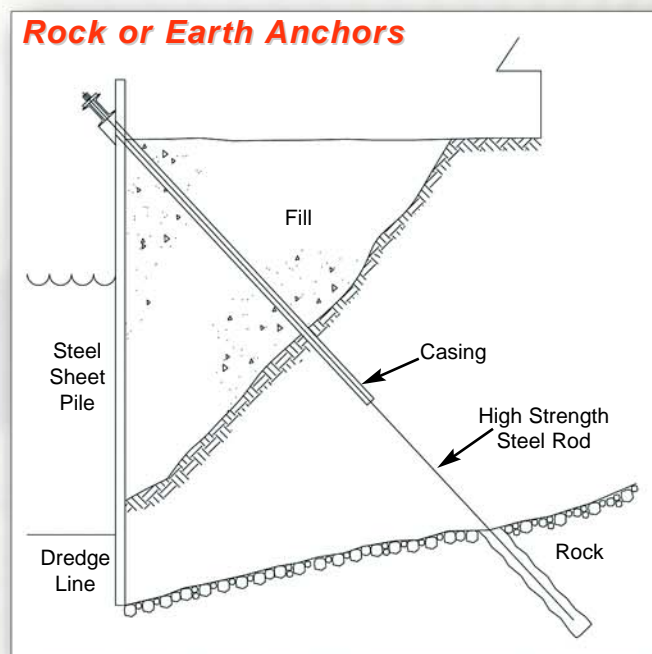
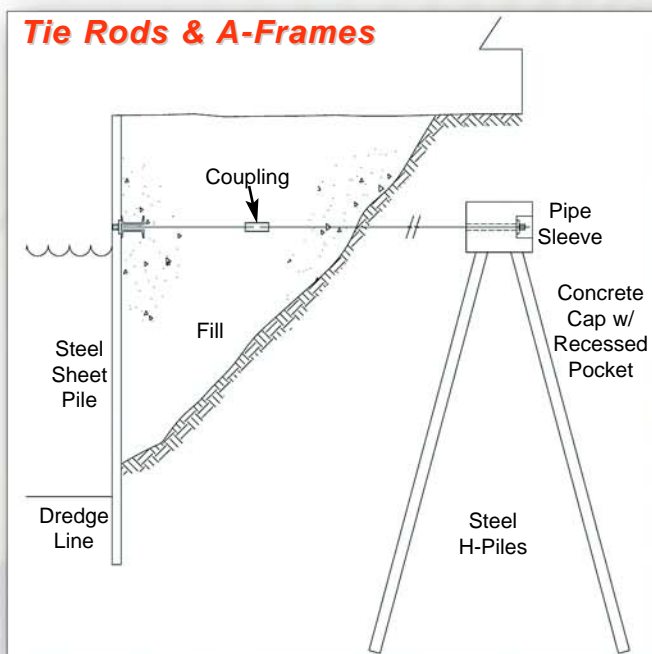
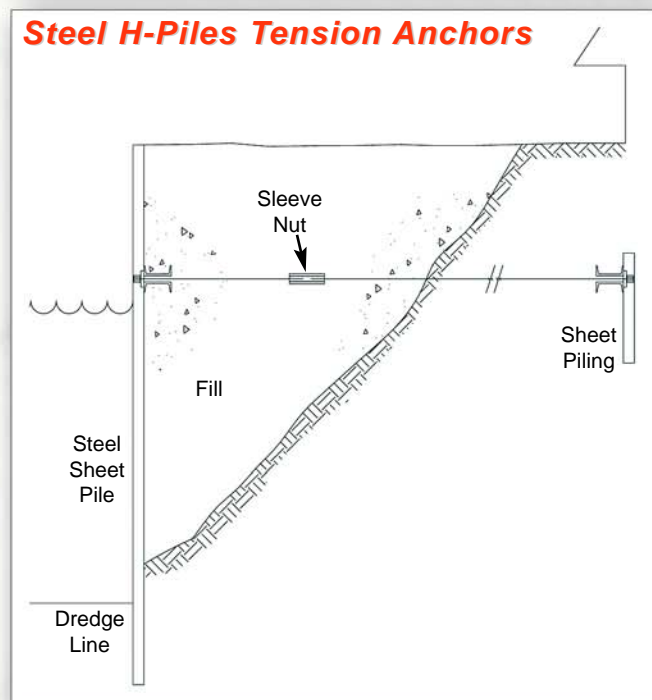
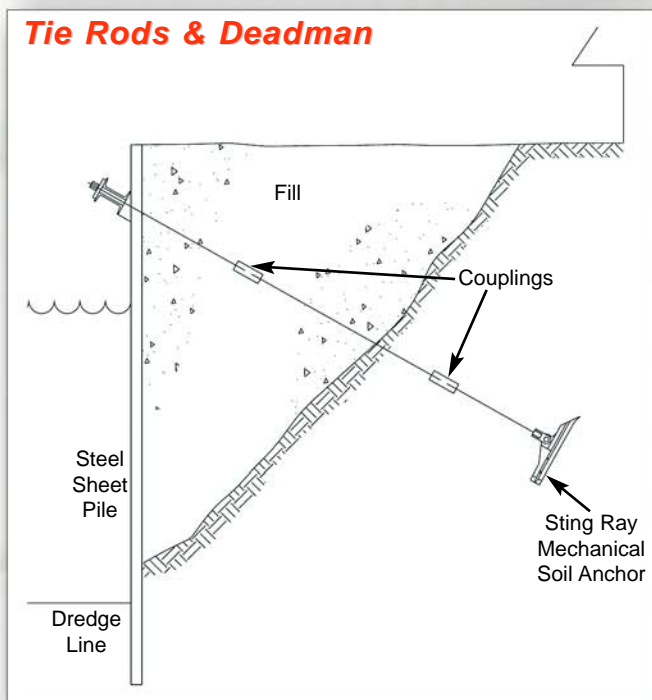
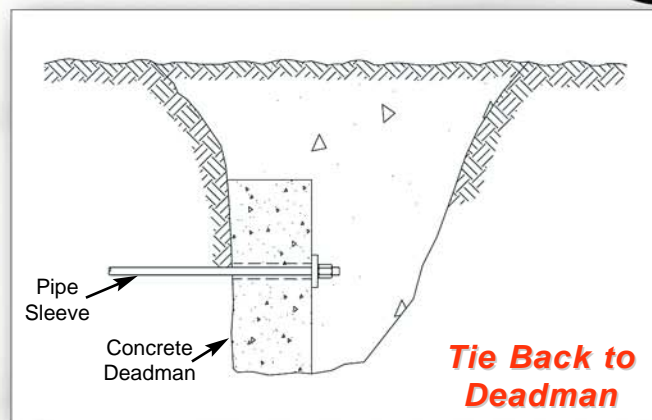
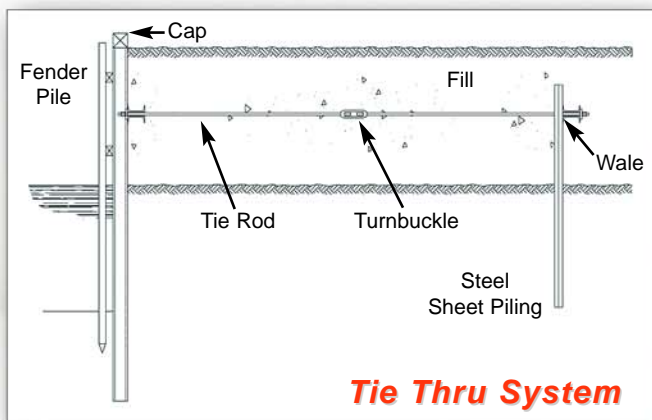
Coal tar epoxy has shown to be abrasion resistant, economical and durable. This product when specified should meet or exceed the requirements of (a) Corp of Engineers C-200, C200a and (b) AWWA C-210-92 for exterior. Typically the thickness is between 8 and 24 mils. Make sure that the surfaces of the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

## Heat Shrink Tubing

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











# Manta Ray Anchors

## Mechanical Soil Anchors



Manta Ray and Stingray 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, and Stingray anchors have working loads up to 50 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.



### Manta Ray and Stingray anchors offer many significant advantages:

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

### Stingray Anchor



There are eight **Manta Ray Anchors** and three **Stingray Anchors** with light to heavy duty holding capacities. Shown to the left are six different Manta Ray anchor heads. All anchors are made of galvanized ductile iron, can be driven with the drive steel set (except the MR-68 & M-88) 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.



### Manta Ray & Stingray Anchor Structural Properties

Anchor	Structural Safety Factor 2:1	Recommended Anchor Rod		Weight per Each
		Diameter *	Part Number	
<b>Manta Ray</b>				
MR-68	2.5 kips (11 kN)	3/8" (10 mm)	B8S-03	1 lbs. (0.45 kg)
MR-88	5 kips (22 kN)	1/2" (12 mm)	B8S-04	2.2 lbs. (1 kg)
MR-4	8.5 kips (36 kN)	#6 - 3/4" (20 mm)	R61-06	4.7 lbs. (2.1 kg)
MR-3	10 kips (45 kN)	#6 - 3/4" (20 mm)	R61-06	6 lbs. (2.7 kg)
MR-2	20 kips (89 kN)	#6 - 3/4" (20 mm)	R61-06	10 lbs. (4.5 kg)
MR-1	20 kips (89 kN)	#6 - 3/4" (20 mm)	R61-06	12 lbs. (5.4 kg)
MR-SR	20 kips (89 kN)	#6 - 3/4" (20 mm)	R61-06	21 lbs. (9.5 kg)
MK-B	20 kips (89 kN)	#6 - 3/4" (20 mm)	R61-06	85 lbs. (38.5 kg)
<b>Sting Ray</b>	<b>S.F.</b>	<b>Diameter *</b>	<b>Part Number</b>	<b>Weight</b>
SR-1	45.5 kips (198 kN)	#9 - 1-1/8" (28 mm)	R61-09	47 lbs. (21.3 kg)
SR-2	50 kips (223 kN)	#9 - 1-1/8" (28 mm)	R61-09	66 lbs. (30 kg)
SR-3	50 kips (223 kN)	#9 - 1-1/8" (28 mm)	R61-09	91 lbs. (41.2 kg)

Williams Anchor Rods are fully threaded and can be field cut and coupled.

\* Anchor rod lengths: R61-06 & R61-09 - Up to 50 feet uncoated  
B8S-03 & B8S-04 - Up to 20 feet

Recommended: Galvanized rods should be cut to size prior to galvanizing to insure good nut fit.



### Seawalls

The anchoring of seawalls with Manta Ray Anchors eliminates expensive and complicated tie-back methods. Minimal, if any, excavation is required. Using Manta Ray Anchors results in aesthetically pleasing and cost-effective seawall installations.

### Docks, Moorings, and Underwater Securing

From the Great Barrier Reef to the Red Sea, Manta Rays are used to anchor moorings that help protect coral reefs and other natural resources. Now there is an environmentally friendly anchor system that installs easily underwater with conventional equipment for buoys, floating docks, man made reefs and more.





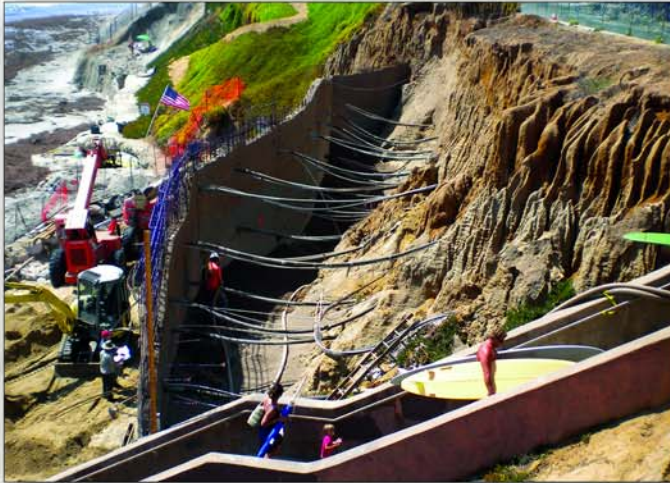
## Tie Rod & Tie Back Project Photos



**Project:** Pier 3 Replacement  
**Contractor:** Weeks Marine  
**Location:** Portsmouth, VA



**Project:** Lake Charles Harbor & Port Improvements  
**Contractor:** Cajun Contractors  
**Location:** Louisiana



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



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



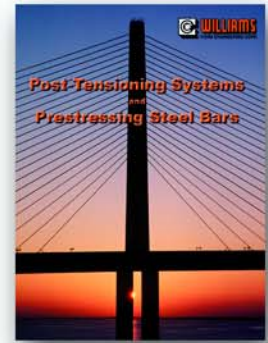
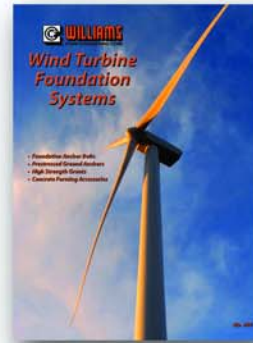
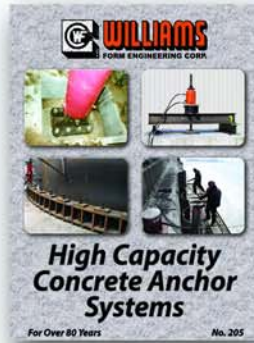
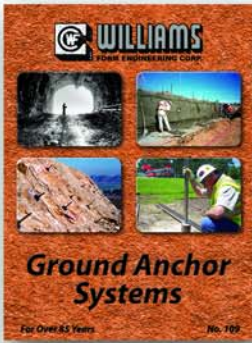
**Project:** Eglin Air Force Base  
**Contractor:** C.W. Roberts Contracting &  
Contech Construction Products  
**Location:** Destin, FL



**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, and Concrete Forming Hardware Systems for whatever your needs may be.



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



Please see website for most current information  
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