Tie Rod Systems for Marine Sheet Piles and Tieback Anchors
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.
- 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 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 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 961 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 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.
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.
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, 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.
**End Caps**

Williams offers end caps produced from fiber reinforced nylon, steel or PVC to provide corrosion protection at 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 UV exposed areas. The fiber reinforced nylon end cap meets the Florida DOT standards.

**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.

**Other Accessories**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Across Flats</th>
<th>Across Corners</th>
<th>Thickness</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot;</td>
<td>3/4&quot; (51 mm)</td>
<td>3/8&quot; (32 mm)</td>
<td>3&quot; (20 mm)</td>
<td>R63-06</td>
</tr>
<tr>
<td>1-1/4&quot;</td>
<td>1/2&quot; (29 mm)</td>
<td>3/8&quot; (32 mm)</td>
<td>2&quot; (51 mm)</td>
<td>R63-10</td>
</tr>
<tr>
<td>1-3/8&quot;</td>
<td>7/16&quot; (12 mm)</td>
<td>1/4&quot; (12 mm)</td>
<td>1-1/2&quot; (24 mm)</td>
<td>R63-09</td>
</tr>
<tr>
<td>1-7/16&quot;</td>
<td>3/16&quot; (5 mm)</td>
<td>1/16&quot; (4 mm)</td>
<td>1-7/8&quot; (24 mm)</td>
<td>R63-08</td>
</tr>
<tr>
<td>1-5/8&quot;</td>
<td>1/4&quot; (12 mm)</td>
<td>3/32&quot; (2 mm)</td>
<td>2&quot; (51 mm)</td>
<td>R63-10</td>
</tr>
<tr>
<td>1-7/16&quot;</td>
<td>3/16&quot; (5 mm)</td>
<td>1/16&quot; (4 mm)</td>
<td>2-1/4&quot; (57 mm)</td>
<td>R63-07</td>
</tr>
<tr>
<td>2-1/4&quot;</td>
<td>5/32&quot; (1.5 mm)</td>
<td>5/32&quot; (1.5 mm)</td>
<td>2-1/2&quot; (64 mm)</td>
<td>R63-11</td>
</tr>
<tr>
<td>2-3/4&quot;</td>
<td>7/32&quot; (2.2 mm)</td>
<td>7/32&quot; (2.2 mm)</td>
<td>3/4&quot; (19 mm)</td>
<td>R63-09</td>
</tr>
<tr>
<td>3&quot;</td>
<td>9/32&quot; (2.9 mm)</td>
<td>9/32&quot; (2.9 mm)</td>
<td>3/4&quot; (19 mm)</td>
<td>R63-09</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>5/32&quot; (1.5 mm)</td>
<td>5/32&quot; (1.5 mm)</td>
<td>3/4&quot; (19 mm)</td>
<td>R63-09</td>
</tr>
<tr>
<td>7/32&quot;</td>
<td>9/32&quot; (2.2 mm)</td>
<td>9/32&quot; (2.2 mm)</td>
<td>3/4&quot; (19 mm)</td>
<td>R63-09</td>
</tr>
</tbody>
</table>

### Screw-on Fiber Reinforced Nylon Cap

- **Nominal Dia.** (mm)
- **Bar Desig. & Nominal Dia.**
  - #6 - 3/4" (19 mm)
  - #7 - 7/8" (22 mm)
  - #8 - 1" (25 mm)
  - #9 - 1-1/8" (29 mm)
  - #10 - 1-1/4" (32 mm)
  - #11 - 1-3/8" (36 mm)
  - #14 - 1-3/4" (43 mm)
  - #18 - 2" (51 mm)
  - #20 - 2-1/2" (64 mm)
  - #24 - 3" (76 mm)
  - #28 - 3-1/2" (99 mm)
  - 150 KSI (152 mm)

### Screw-on PVC Cap

- **Nominal Dia.** (mm)
- **Bar Desig. & Nominal Dia.**
  - #6 - 3/4" (19 mm)
  - #7 - 7/8" (22 mm)
  - #8 - 1" (25 mm)
  - #9 - 1-1/8" (29 mm)
  - #10 - 1-1/4" (32 mm)
  - #11 - 1-3/8" (36 mm)
  - #14 - 1-3/4" (43 mm)
  - #18 - 2" (51 mm)
  - #20 - 2-1/2" (64 mm)
  - #24 - 3" (76 mm)
  - #28 - 3-1/2" (99 mm)
  - 150 KSI (152 mm)

### Slip-on PVC Cap w/ Plastic Nut

- **Nominal Dia.** (mm)
- **Bar Desig. & Nominal Dia.**
  - #6 - 3/4" (19 mm)
  - #7 - 7/8" (22 mm)
  - #8 - 1" (25 mm)
  - #9 - 1-1/8" (29 mm)
  - #10 - 1-1/4" (32 mm)
  - #11 - 1-3/8" (36 mm)
  - #14 - 1-3/4" (43 mm)
  - #18 - 2" (51 mm)
  - #20 - 2-1/2" (64 mm)
  - #24 - 3" (76 mm)
  - #28 - 3-1/2" (99 mm)
  - 150 KSI (152 mm)
Specifications

- **Bearing Plate**
  - Round Hole
  - ASTM A36
  - AASHTO M183

- **PVC End Cap**
  - ASTM D1785
  - Schedule 40 PVC

- **Hardened Washer**
  - ASTM F436 Type 1
  - AASHTO M293

- **Heavy Duty Hex Nut**
  - for 150 KSI All-Thread Bar
  - ASTM A29 Grade C1045
  - for Grade 75 All-Thread Rebar
  - ASTM A108

- **Spherical Hex Nut**
  - ASTM A536
  - Ductile Iron

- **Beveled Washers**
  - ASTM A536
  - Ductile Iron

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**Specifications**

- **Bearing Plate**
  - Round Hole
  - ASTM A36
  - AASHTO M183

- **PVC End Cap**
  - ASTM D1785
  - Schedule 40 PVC

- **Hardened Washer**
  - ASTM F436 Type 1
  - AASHTO M293

- **Heavy Duty Hex Nut**
  - for 150 KSI All-Thread Bar
  - ASTM A29 Grade C1045
  - for Grade 75 All-Thread Rebar
  - ASTM A108

- **Spherical Hex Nut**
  - ASTM A536
  - Ductile Iron

- **Beveled Washers**
  - ASTM A536
  - Ductile Iron
Specifications

**Smooth PVC Sleeve**
- Schedule 40 Pipe: ASTM D1785
- Class 200 Pipe: ASTM D1785 & D2241
  - AASHTO No. R-6

**Epoxy Coating**
- ASTM A775, A884, D3963
  - AASHTO M284, M254

**Hot Dip Galvanizing**
- ASTM A153
  - AASHTO No. M232
  - For Accessories: ASM A123
  - AASHTO M111

**150 KSI All-Thread-Bar**
- Type II ASTM A722
  - AASHTO M275

**Stop-Type Coupling**
- ASTM A101 Grade C1045
  - Also available: Turnbuckles & Sleeve Nuts

**Factory Bitumastic Tape Wrap**
- AWWA C221

**Grade 75 All-Thread Rebar**
- ASTM A615
  - AASHTO M51

**Specifications**
- AWWA C217

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**Product Lines**
- Williams Service Tubing
- Epoxy Coating
- Hot Dip Galvanizing
- Stop-Type Coupling
- Factory Bitumastic Tape Wrap
- Grade 75 All-Thread Rebar
- Smooth PVC Sleeve

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**Contact Information**
- Williams Service Tubing
  - 123 Main St.
  - 555-1234
  - info@williams.com
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.

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.

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.

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.

### Corrosion Protection

<table>
<thead>
<tr>
<th>Corrosion Protection Method</th>
<th>Abrasion Resistance (4 = best)</th>
<th>Typical Thickness</th>
<th>Relative Cost (3 = highest)</th>
<th>Production Lead Time</th>
<th>Can be Applied to Accessories?</th>
<th>Can be Applied in the Field?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Dip Galvanizing</td>
<td>4</td>
<td>3-4 mils</td>
<td>2</td>
<td>2-4 weeks</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Epoxy Coating</td>
<td>1</td>
<td>7-12 mils</td>
<td>1</td>
<td>2-3 weeks</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Pre-Grouted Bars</td>
<td>3</td>
<td>2&quot;, 3&quot; or 4&quot; tubing</td>
<td>3</td>
<td>2 weeks</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Bitumastic Tape</td>
<td>2</td>
<td>N.A.</td>
<td>2</td>
<td>field applied</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Coal Tar Epoxy</td>
<td>3</td>
<td>up to 35 mils</td>
<td>1</td>
<td>2-3 weeks</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>
Typical Applications

**Tie Thru System**
- Tie Rods to A-Frames
- Tie Rods to Steel H-Pile Deadman
- Tieback with Mechanical Soil Anchor
- Grout Bonded Rock or Soil Anchors

**Tie Rods to Concrete Deadman**
- Tie Rods to Concrete Deadman

**Steel Sheet Pile**
- Steel Sheet Pile

**Articulating Coupling**
- Articulating Coupling

**Wale**
- Wale

**Sleeve Nut or Turn Buckle**
- Sleeve Nut or Turn Buckle

**Concrete Cap**
- Concrete Cap

**Tie Rod**
- Tie Rod

**Concrete Deadman**
- Concrete Deadman

**Steel H-Piles**
- Steel H-Piles

**Dredge Line**
- Dredge Line

**Grout**
- Grout

**PVC Sheath**
- PVC Sheath

**High Strength Steel Rod**
- High Strength Steel Rod

**Sleeve Nut or Turn Buckle**
- Sleeve Nut or Turn Buckle

**Sleeve Nut or Turn Buckle**
- Sleeve Nut or Turn Buckle

**Sleeve Nut or Turn Buckle**
- Sleeve Nut or Turn Buckle

**Sleeve Nut or Turn Buckle**
- Sleeve Nut or Turn Buckle

**Sting Ray Mechanical Soil Anchor**
- Sting Ray Mechanical Soil Anchor

**Couplings**
- Couplings

**Coupling**
- Coupling

**Concrete Cap**
- Concrete Cap

**PVC Sheath**
- PVC Sheath
Manta Ray & Stingray Soil Anchors

Manta Ray® and Stingray® earth anchors are driven tipping plate soil anchors dependent 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
• Anchors for a wide range of soils & applications

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

<table>
<thead>
<tr>
<th>Anchor</th>
<th>Structural Safety Factor 2:1</th>
<th>Recommended Anchor Rod</th>
<th>Weight per Each</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Diameter</td>
<td>Part Number</td>
</tr>
<tr>
<td>Manta Ray</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MR-68</td>
<td>2.5 kips (11 kN)</td>
<td>3/8” (10 mm)</td>
<td>B8S-03</td>
</tr>
<tr>
<td>MR-88</td>
<td>5 kips (22 kN)</td>
<td>1/2” (12 mm)</td>
<td>B8S-04</td>
</tr>
<tr>
<td>MR-4</td>
<td>8.5 kips (36 kN)</td>
<td>#6 - 3/4” (20 mm)</td>
<td>R61-06</td>
</tr>
<tr>
<td>MR-3</td>
<td>10 kips (45 kN)</td>
<td>#6 - 3/4” (20 mm)</td>
<td>R61-06</td>
</tr>
<tr>
<td>MR-2</td>
<td>20 kips (89 kN)</td>
<td>#6 - 3/4” (20 mm)</td>
<td>R61-06</td>
</tr>
<tr>
<td>MR-1</td>
<td>20 kips (89 kN)</td>
<td>#6 - 3/4” (20 mm)</td>
<td>R61-06</td>
</tr>
<tr>
<td>MR-SR</td>
<td>20 kips (89 kN)</td>
<td>#6 - 3/4” (20 mm)</td>
<td>R61-06</td>
</tr>
<tr>
<td>MK-B</td>
<td>20 kips (89 kN)</td>
<td>#6 - 3/4” (20 mm)</td>
<td>R61-06</td>
</tr>
<tr>
<td>Sting Ray</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SR-1</td>
<td>45.5 kips (198 kN)</td>
<td>#9 - 1-1/8” (28 mm)</td>
<td>R61-09</td>
</tr>
<tr>
<td>SR-2</td>
<td>50 kips (223 kN)</td>
<td>#9 - 1-1/8” (28 mm)</td>
<td>R61-09</td>
</tr>
<tr>
<td>SR-3</td>
<td>50 kips (223 kN)</td>
<td>#9 - 1-1/8” (28 mm)</td>
<td>R61-09</td>
</tr>
</tbody>
</table>

Williams Anchor Rods are fully threaded and can be field cut and coupled.
Anchor rod lengths: R61-06 & R61-09 - Up to 50 feet
B8S-03 & B8S-04 - Up to 20 feet

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

Manta Ray & Stingray Anchors

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 or rehabilitations.

Floating Docks & Moorings
From the Great Barrier Reef to the Red Sea, MANTA RAY anchors 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.

 Pipelines
Prevent movement of underwater pipeline with the MANTA RAY anchor. Simple installation procedures equate to significant time and cost savings.
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.

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