



*Post-Tensioning System  
and  
Prestressing Steel Bars*



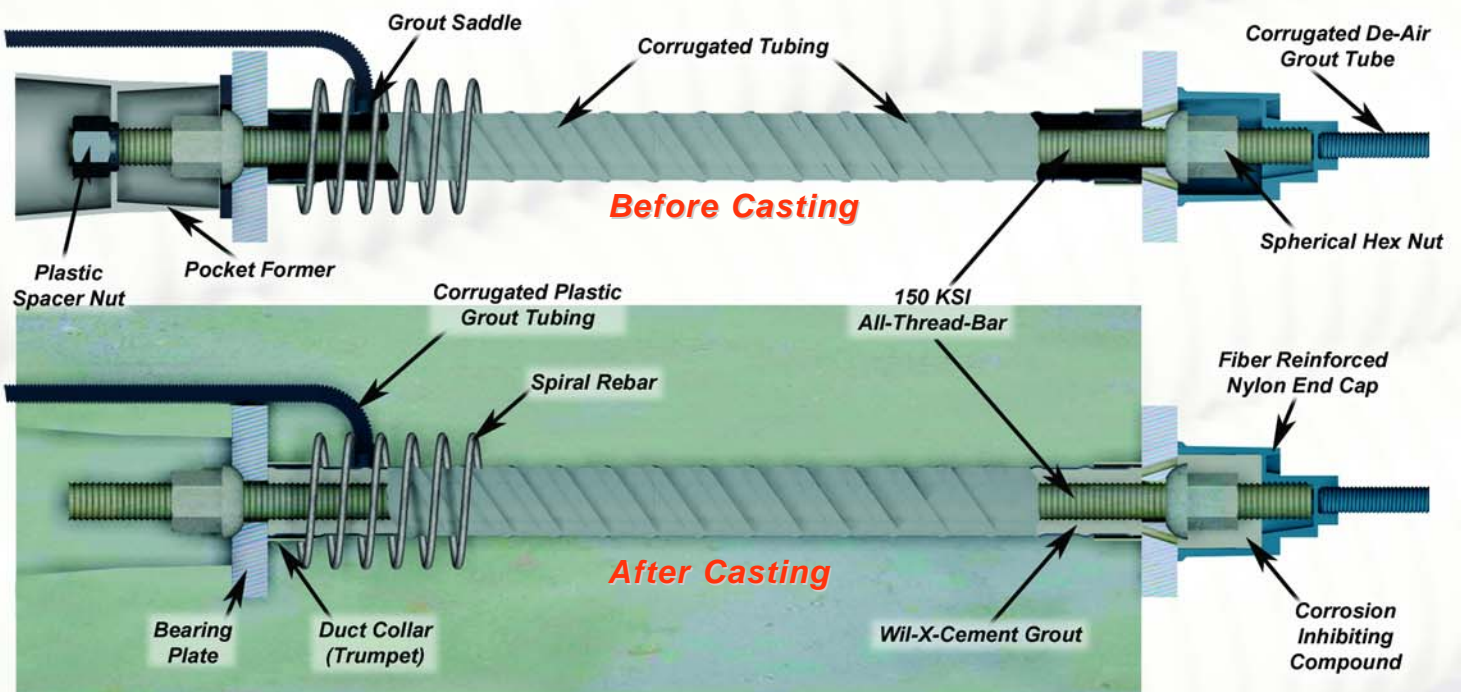
## Williams Systems

Williams Pre-Stressing / Post Tensioning Systems consist of high tensile steel bars available in seven diameters from 1" (26 mm) to 3" (75 mm) with guaranteed tensile strengths to 969 kips (4311 kN). They 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 bar strength. All components of the systems are designed and manufactured in the United States. Williams All-Thread-Bar systems have been field proven around the world.

### Applications

Williams All-Thread-Bars were developed for use as Pre-Stressing bars. Over the years many other applications have been adopted such as:

- Transverse Post Tensioning
- Longitudinal Post Tensioning
- Pile Test Anchors
- Rock Anchors
- Concrete Ties
- Hanger Bolts
- Jacks
- Structural Steel Frame Ties
- Shear Pins
- Bridge Retrofit Applications
- Pre-Stressed Block and Brick Construction
- Seismic (earthquake) Restrainer Systems
- Ground Anchors and Soil Nails
- Wood Structure Post-Tension Bars
- Temporary High Strength Connections
- Tower Base Plate Anchor Bolts
- Sheet Pile Ties and Tie-backs
- High Strength Concrete Reinforcement Bars
- Multiple Corrosion Protection Anchors





## 150 KSI All-Thread-Bar



### R71 150 KSI All-Thread-Bar - ASTM A722

Nominal Bar Diameter & Pitch	Minimum Net Area Thru Threads	Minimum Ultimate Strength	Prestressing Force			Nominal Weight	Approx. Thread Major Dia.	Part Number
			0.80f pu A	0.70f pu A	0.60f pu A			
1" - 4 (26 mm)	0.85 in <sup>2</sup> (549 mm <sup>2</sup> )	127.5 kips (567 kN)	102 kips (454 kN)	89.3 kips (397 kN)	76.5 kips (340 kN)	3.09 lbs./ft. (4.6 Kg/M)	1-1/8" (29 mm)	R71-08
1-1/4" - 4 (32 mm)	1.25 in <sup>2</sup> (807 mm <sup>2</sup> )	187.5 kips (834 kN)	150 kips (667 kN)	131 kips (584 kN)	113 kips (500 kN)	4.51 lbs./ft. (6.71 Kg/M)	1-7/16" (37 mm)	R71-10
1-3/8" - 4 (36 mm)	1.58 in <sup>2</sup> (1019 mm <sup>2</sup> )	237 kips (1054 kN)	190 kips (843 kN)	166 kips (738 kN)	142 kips (633 kN)	5.71 lbs./ft. (8.50 Kg/M)	1-9/16" (40 mm)	R71-11
1-3/4" - 3-1/2 (46 mm)	2.60 in <sup>2</sup> (1664 mm <sup>2</sup> )	400 kips (1779 kN)	320 kips (1423 kN)	280 kips (1245 kN)	240 kips (1068 kN)	9.06 lbs./ft. (13.5 Kg/M)	2" (51 mm)	R71-14
2-1/4" - 3-1/2 (57 mm) *	4.08 in <sup>2</sup> (2632 mm <sup>2</sup> )	613 kips (2727 kN)	490 kips (2181 kN)	429 kips (1909 kN)	368 kips (1636 kN)	14.1 lbs./ft. (20.8 Kg/M)	2-1/2" (64 mm)	R71-18
2-1/2" - 3 (65 mm)	5.19 in <sup>2</sup> (3350 mm <sup>2</sup> )	778 kips (3457 kN)	622 kips (2766 kN)	545 kips (2422 kN)	467 kips (2074 kN)	18.2 lbs./ft. (27.1 Kg/M)	2-3/4" (70 mm)	R71-20
3" - 3 (75 mm) *	6.46 in <sup>2</sup> (4169 mm <sup>2</sup> )	969 kips (4311 kN)	775 kips (3448 kN)	678 kips (3018 kN)	581 kips (2587 kN)	22.3 lbs./ft. (32.7 Kg/M)	3-3/4" (78 mm)	R71-24

\* The 2-1/4" & 3" diameter bars are not covered under ASTM A722.

- Effective cross sectional areas shown are as required by ASTM A722-07. Actual areas may exceed these values.

- ACI 355.1R section 3.2.5.1 indicates an ultimate strength in shear has a range of .6 to .7 of the ultimate tensile strength. Designers should provide adequate safety factors for safe shear strengths based on the condition of use.

- Per PTI recommendations for anchoring, anchors should be designed so that:
  - The design load is not more than 60% of the specified minimum tensile strength of the prestressing steel.
  - The lock-off load should not exceed 70% of the specified minimum tensile strength of the prestressing steel.
  - The maximum test load should not exceed 80% of the specified minimum tensile strength of the prestressing steel.

### Sizes

Williams 150 KSI bars are manufactured in 7 diameters from 1" (26 mm) through 3" (75 mm). Most diameters are available in continuous lengths up to 50' (15.2 m).

### Threads

All-Thread-Bars are cold rolled threaded to close tolerances under continuous monitoring procedures for quality control. Threads for Williams 150 KSI bar are specially designed with a rugged thread pitch wide enough to be fast under job site conditions and easy to assemble. They also have a smooth, wide, concentric, surface suitable for torque tensioning. This combination offers tremendous installation savings over inefficient, hot rolled, non-concentric thread forms. Threads are available in both right and left hand.

Williams All-Thread-Bars are threaded around the full circumference enabling the load transfer from the bar to the fasteners to occur efficiently without eccentric point loading. Williams fasteners easily meet the allowable load transfer limitations set forth by the Post Tensioning Institute. Williams 150 KSI All-Thread-Bars and fasteners are machined to tight tolerances for superior performance and mechanical lock. Precision machining greatly reduces concern of fastener loosening or detensioning. 150 KSI bars meet or exceed the deformation requirements under ASTM A615 for concrete reinforcing bars. Williams special thread deformation pattern projects ultra high relative rib area, much greater than conventional rebar. This provides for superior bond performance in concrete.

### Cutting (No Welding)

Williams 150 KSI All-Thread-Bar should not be subjected to the heat of a torch, welding or used as a ground. Field cutting should be done with an abrasive wheel or band saw.

### Steel Quality

Williams 1", 1-1/4", & 1-3/8" 150 KSI bars are smooth, hot rolled, high strength prestressing steel. The bars are cold-stressed and stress relieved to produce the above properties. The 1-3/4" through 3" 150 KSI bars are from an alloy based steel that is hot rolled, quenched-tempered and stress relieved. All bars are produced to the prescribed mechanical properties shown in ASTM A722-07.

Thorough inspection and traceability are carried out during all phases of manufacturing to assure the highest standards of quality. Mill certifications and certificates of conformance can be provided with each shipment as an assurance that the mechanical properties of Williams All-Thread-Bar are as shown.

### Properties

Williams 150 KSI bars are manufactured in strict compliance with ASTM A722-07 and AASHTO M275 Highway Specifications. The prestressing steel is high in strength yet ductile enough to exceed the specified elongation and reduction of area requirements. Selected heats can also pass the 135° supplemental bend test when required. Testing has shown Williams 150 KSI All-Thread-Bars to meet or exceed post tensioning bar and rock anchoring criteria as set by the Post Tensioning Institute including dynamic test requirements beyond 500,000 cycles of loading.

Williams 360° continuous thread deformation pattern has the ideal relative rib area configuration to provide excellent bond strength capability to grout or concrete, far better than traditional reinforcing deformation patterns.

### Tensile Strength & Working Loads

Williams 150 KSI bars are available with ultimate tensile strengths and working loads as displayed above. Safety factors and functional working loads are at the discretion of the project design engineer, however test loads should never exceed 80% of the published ultimate bar strength.



# Post-Tensioning & Prestressing Systems

## 150 KSI All-Thread-Bar Accessories

Williams All-Thread-Bar fasteners are machine threaded (no cast threads) to specific tolerances for precision adjustments. The All-Thread-Bar fasteners below are designed to develop 100% of the All-Thread Bar ultimate strength meeting all criteria set forth for anchorages by the Post-Tensioning Institute and ASTM A-722-07 specifications. Standard hex nuts and spherical base hex nuts are available to be used with standard or dished plates, respectively.

Standard All-Thread-Bar couplings are stop-type having both ends tapped equal distance with an untapped section in the center. Stop-type couplings allow for proper engagement of each All-Thread-Bar. Couplings tapped completely through are available by special request.



### R73 Hex Nuts - ASTM A29

Nominal Bar Diameter	Across Flats	Across Corners	Thickness	Part Number
1" (26 mm)	1-3/4" (45 mm)	2.02" (51.3 mm)	2" (51 mm)	R73-08
1-1/4" (32 mm)	2-1/4" (57 mm)	2.60" (66.0 mm)	2-1/2" (64 mm)	R73-10
1-3/8" (36 mm)	2-1/2" (63.5 mm)	2.89" (73.4 mm)	2-3/4" (70 mm)	R73-11
1-3/4" (46 mm)	3" (76 mm)	3.46" (87.9 mm)	3-1/2" (89 mm)	R73-14
2-1/4" (57 mm)	3-1/2" (89 mm)	4" (102 mm)	4-1/4" (105 mm)	R73-18
2-1/2" (65 mm)	4-1/4" (108 mm)	4.91" (124.7 mm)	4-3/4" (120 mm)	R73-20
3" * (75 mm)	4-1/4" (108 mm)	5" (127 mm)	6-1/8" (156 mm)	R74-24

\* Rounded collar nut with OD of 5" (127 mm).

### R72 Stop-Type Coupling - ASTM A29, Grade C1045

Nominal Bar Diameter	Outside Diameter	Overall Length	Part Number
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" (46 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



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

### R9F Hardened Washers - ASTM F436

Nom. Bar Diameter	Outside Diameter	Inside Diameter	Thickness	Part Number
1" (26 mm)	2-1/4" (57 mm)	1-1/4" (32 mm)	5/32" (4.0 mm)	R9F-09-436
1-1/4" (32 mm)	2-3/4" (70 mm)	1-1/2" (38 mm)	5/32" (3.9 mm)	R9F-11-436
1-3/8" (36 mm)	3" (76 mm)	1-5/8" (41 mm)	5/32" (4.0 mm)	R9F-12-436
1-3/4" (46 mm)	3-3/4" (95 mm)	2-1/8" (54 mm)	7/32" (5.6 mm)	R9F-16-436
2-1/4" (57 mm)	4-1/2" (114 mm)	2-5/8" (67 mm)	9/32" (7.1 mm)	R9F-20-436
2-1/2" (65 mm)	5" (127 mm)	2-7/8" (73 mm)	9/32" (7.1 mm)	R9F-22-436
3" (75 mm)	6" (152 mm)	3-3/8" (86 mm)	5/16" (7.87 mm)	R9F-26-436

### R88 Spherical Hex Nuts - ASTM A536

Nominal Bar Diameter	Across Flats	Thickness	Outside Dome	Part Number
1" (26 mm)	1-3/4" (45 mm)	2-1/4" (57 mm)	2-1/2" (63.5 mm)	R88-08
1-1/4" (32 mm)	2-1/4" (57 mm)	2-3/4" (70 mm)	3-1/8" (79.5 mm)	R88-10
1-3/8" (36 mm)	2-1/2" (63.5 mm)	3-1/4" (82.5 mm)	3-5/8" (90.2 mm)	R88-11
1-3/4" (46 mm)	3" (76 mm)	3-1/2" (89 mm)	4" (101.6 mm)	R88-14
2-1/4" * (57 mm)	3-1/2" (89 mm)	5-3/4" (146 mm)	5-1/2" (140 mm)	R73-18 R81-18
2-1/2" * (65 mm)	4-1/4" (108 mm)	6-1/2" (165 mm)	6" (152 mm)	R73-20 R81-20
3" ** (75 mm)	4-1/4" (108 mm)	8-1/8" (206 mm)	7" (178 mm)	R74-24 R81-24

\* Requires a standard nut with spherical washer assembly.  
\*\* Requires rounded collar nut with spherical washer assembly.

### Placing Bars

Williams All-Thread-Bars can be placed prior to the concrete pour or assembled through ducting in cast concrete. Care should be taken not to impact the bars or subject them to excessive bending. When coupled bars are used in pre-cast concrete, upset ducting may be used on one end when casting the concrete to allow the coupled bar to slide into place. Stop-type couplings are provided with Williams All-Thread-Bars to assure proper engagement of each bar. As a safety measure, it is always a good idea to mark the end of each All-Thread-Bar to be coupled with the proper engagement length. A grease pencil or similar tool can be used.

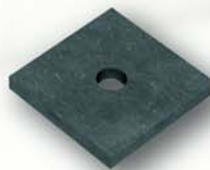


## Other Bar Accessories

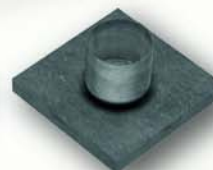
### Steel Bearing Plates - ASTM A36 or A572

Williams steel bearing plates, available in Grades 36 or 50, are standard with a round hole or dished plates for use with spherical hex nuts. They can be drilled to provide free access for grout tube entry. Bearing plates are customized for each application. Plate dimensions should be specified around the parameters of the project. In addition, corrosion protection should be considered along with specifying hole diameter, bar angle and duct size.

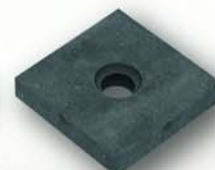
S1K - with Round Hole



S3K - Plate with Welded Trumpet



R80 - with Dished Hole



### Pocket Former



Nominal Bar Diameter Range	Minimum Diameter	Maximum Diameter	Length	Part Number
1" to 1-3/8" (26 to 36 mm)	5-5/16" (135 mm)	6-1/4" (159 mm)	8-1/2" (216 mm)	R85-K
1-3/4" (46 mm)	7" (178 mm)	8-1/4" (210 mm)	10-1/2" (267 mm)	R85-2K



### Local Zone Reinforcing

The compressive strength of the concrete in the local zone (area directly under the bearing plate) can be enhanced when necessary by use of lateral confinement of spiral reinforcement. The rebar spirals are available in #3 through #5 diameters of Grade 60 Rebar and made to the project design requirements for diameter, pitch, and length. They are also available with or without a deformation pattern.



### Galvanized Metal Corrugated Duct - ASTM A653

Williams Galvanized Spiral Metal Duct meets all physical and structural recommendations for post tensioning duct as indicated by the Post Tensioning Institute. The Duct is available in 2", 3", and 4" diameter with couplings and reducer couplings for all sizes.

### Spacer Nut for Pocket Former

Nom. Bar Diameter	Part Number
1" (26 mm)	R8608
1-1/4" (32 mm)	R8610
1-3/8" (36 mm)	R8611
1-3/4" (46 mm)	R73-14JN



These Jam Nuts can't be substitute for full strength nuts and can't be used on bars other than Williams 150 KSI All-Thread-Bars of the same diameter.

### R73-JN Jam Nuts - ASTM A29, C1045

Nominal Bar Diameter	Across Flats	Thickness	Part Number
1" (26 mm)	1-3/4" (45 mm)	1/2" (12.7 mm)	R73-08JN
1-1/4" (32 mm)	2-1/4" (57 mm)	5/8" (15.9 mm)	R73-10JN
1-3/8" (36 mm)	2-1/2" (63.5 mm)	11/16" (17.5 mm)	R73-11JN
1-3/4" (46 mm)	3" (76 mm)	7/8" (22.2 mm)	R73-14JN
2-1/4" * (57 mm)	3-1/4" (83 mm)	1" (25 mm)	R73-18JN
2-1/2" (65 mm)	4" (102 mm)	1-3/16" (30.2 mm)	R73-20JN
3" * (75 mm)	4-1/2" (114 mm)	2" (51 mm)	R74-24JN

\* Rounded collar nut



### Polypropylene Corrugated Duct - ASTM D4104

### Polyethylene Corrugated Duct - ASTM F405

The stable characteristics of Williams polypropylene & polyethylene duct are normally preferred where additional corrosion protection is desirable. Polypropylene Duct has been approved by the Florida DOT for internal tendons and is available in 2-3/8" internal diameter. Polyethylene Duct is available in 2", 3", and 4" diameters. Couplings are available for all sizes.



# Post-Tensioning & Prestressing Systems

## Project Photos



**Project: Richmond - San Rafael Bridge**  
**Contractor: Tutor Saliba**  
**Location: San Rafael, CA**



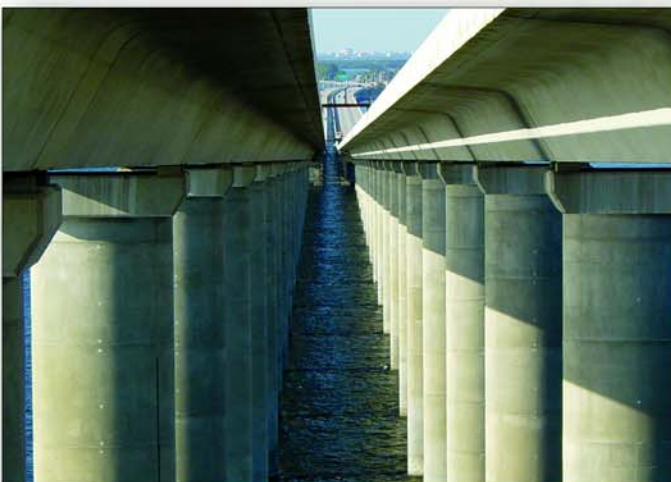
**Project: Spaghetti Bowl**  
**Contractor: Walter & SCI Construction**  
**Location: Las Vegas, NV**



**Project: Memorial Causeway Bridge**  
**Contractor: PCL / VSL**  
**Location: Clearwater, FL**



**Project: MIC-MIA Connector Station**  
**Contractor: Turner Construction / VSL**  
**Location: Miami, FL**



**Project: Sunshine Skyway High Level Approach Column Repair**  
**Contractor: Delta Construction Specialties / VSL**  
**Location: St. Petersburg, FL**



**Project: Belleair Beach Causeway**  
**Contractor: Johnson Brothers Corporation & Misner Marine Construction / VSL**  
**Location: Pinellas County, FL**



## Project Photos



**Project: 4 Bears Bridge**  
**PT Contractor: VStructural**  
**Location: New Town, ND**



**Project: Galena Creek Bridge**  
**Contractor: CC Meyers**  
**Location: Reno, NV**



**Project: Devil's Slide Bridge**  
**Contractor: Disney Construction**  
**Post-Tensioning Supplier: Schwager Davis, Inc.**  
**Location: Pacifica, CA**



**Project: Colorado River Bridge**  
**General Contractor: Obayashi / PSM, JV**  
**Post-Tensioning Supplier: Schwager Davis, Inc.**  
**Location: Hoover Dam, NV**



**Project Name: San Francisco - Oakland East Bay Skyway Bridge**  
**Designer: T.Y. Lin / Moffet & Nichol, JV**  
**Contractor: Kiewit / FCI / Manson, JV**  
**Post-Tensioning Supplier: Schwager Davis, Inc.**



**Project: Precast Post-Tensioned Panel Wall**  
**Contractor: Morgan & Oswood**  
**Location: Hoback Junction, WY**



## Corrosion Protection



### Cement Grout

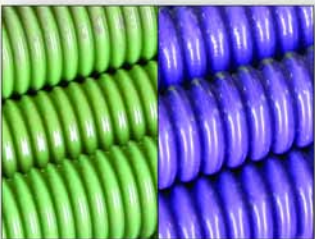
In *Comments on Corrosion for Williams Form Engineering Corp.* (1986), Erlin, Hime Associates state the following: "When steel is directly exposed to moisture and oxygen it will corrode. Accordingly, protection must be afforded to steel systems that would otherwise be so exposed. One of the most effective protection methods is embedment in a Portland cement system (e.g. grout, mortar or concrete). Because of the strong alkalinity of hydrated portland cement, steel is rendered "passive"; that is thermodynamically stable and not subject to rusting."

Williams recommends a portland cement based, shrinkage compensated or expansive, grout as the primary corrosion protection for post-tension applications. Grout can be injected after post-tension forces are locked off by the use of grout saddles/tubes or injection ports designed into the post tension system.



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



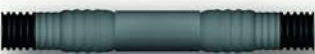
### Epoxy Coating

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. 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.



### Corrosion Inhibiting Wax or Grease

Williams corrosion inhibiting compounds can be placed in the end caps or in the trumpet areas. Each are of an organic compound with either a grease or wax base. They provide the appropriate polar moisture displacement and have corrosion inhibiting additives with self-healing properties. They can be pumped or applied manually. Corrosion inhibiting compounds stay permanently viscous, chemically stable and non-reactive with the prestressing steel, duct materials or grout. Both compounds meet PTI standards for Corrosion Inhibiting Coating.



### Heat Shrink Tubing and Canusa

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

### End Caps

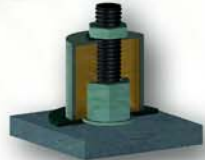
Williams offers end caps produced from fiber reinforced nylon or steel to provide corrosion protection at otherwise exposed anchor ends. Most often the caps are packed with corrosion inhibiting wax or grease. The fiber reinforced nylon end cap meets the Florida DOT standards for *New Directions of Post Tensioned Bridges*.



**Fiber Reinforced Nylon Cap**



**Steel Tube welded on Flange with Threaded Screw Connections**



**Steel Tube with Jam Nut**



## Grouting Accessories

### 55Z WIL-X CEMENT GROUT

Conforms to ASTM C845-76 T

Wil-X is chemically compensated for shrinkage. It has a high bond value and is crack resistant for permanent installations. Because it is a cement-grout, it is non-explosive and has a long shelf life when kept dry.



94 lbs. bag

Compressive Strength  
Wil-X Cement Grout & Water  
(74° F Dry Environment)  
0.44 w/c ratio

Time	PSI	MPa
1 Day	3,200	22.2
3 Days	4,800	33.1
7 Days	6,700	46.2
28 Days	10,200	70.3



5 gallon, resealable,  
moisture proof,  
polypropylene pails

Wil-X may be used to build up leveling pads by simply mixing with sand or pea gravel. This mixture should not be run through the grout pump.

**Setting Time:** Gilmore Needles (ASTM C266). Initial set 45 minutes; final set 10 hours.

**Comparative compressive strength test in PSI** (modified ASTM C109) Actual strengths as mixed according to Williams Instructions range from 6,000 to 10,200 PSI depending on water content. Copy of ASTM Modification available upon request.

### T3P Heavy Duty Plastic Grout Tube

Furnished in product lengths or in rolls.

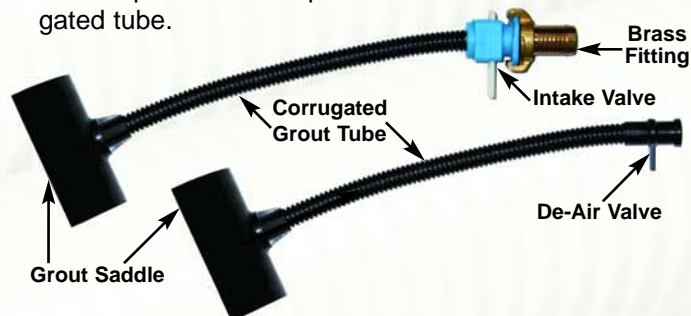
O.D.	I.D.
3/8" (9.5 mm)	1/4" (6.4 mm)
1/2" (12.7 mm)	3/8" (9.5 mm)
5/8" (15.9 mm)	1/2" (12.7 mm)
3/4" (19.1 mm)	5/8" (15.9 mm)
3/4"* (19.1 mm)	5/8"* (15.9 mm)



\* Corrugated Grout Tube

### Grout Saddle System

Complete with two plastic ties. For 3/4" O.D. corrugated tube.



### Super Plasticizer

Plasticizer is available and is used as a water reducer for ease of pumping grout through tubes at lower water to cement ratios.

### Colloidal Grout Plant

The heavy duty, high volume Colloidal Grout Plant is favored for precision post-tension grouting. The unit features a high speed shear mixer that thoroughly wets each particle and discharges the mixed material into a 13 cubic foot capacity agitating holding tank. A direct coupled progressing cavity pump delivers slurries at a rate of up to 20 gpm and pressures of up to 261 psi. The unit easily mixes and pumps slurries of Portland cement, fly ash, bentonite, and lime flour. All controls are conveniently located on the operator platform for easy one-man control.

#### Pump

Pump Type: 31.6 progressing cavity  
Output/Pressure: variable up to 20 gpm, 261 psi

#### Colloidal Mixer

Mix Tank: 13.0 CF with bottom clean out  
Mixing Pump: 2 x 3 x 6 diffuser-type centrifugal  
Holding Tank: 13.0 CF paddle agitating

#### Drive Power

Air: 300 CFM, 100 psi

#### Physical Specifications

Dimensions: 96"L x 60"W x 63"H  
Weight: 1800-2800 lbs.

### Grouting

Grouting equipment shall be capable of properly mixing a low water to portland cement mix ratio. Equipment shall be capable of pumping at pressures up to 200 PSI. Standby equipment for flushing must be available. Grouting procedures should always assure the duct is grouted from the lowest gravitational point and vented to the highest.





## Tensioning

### Torque Tensioning

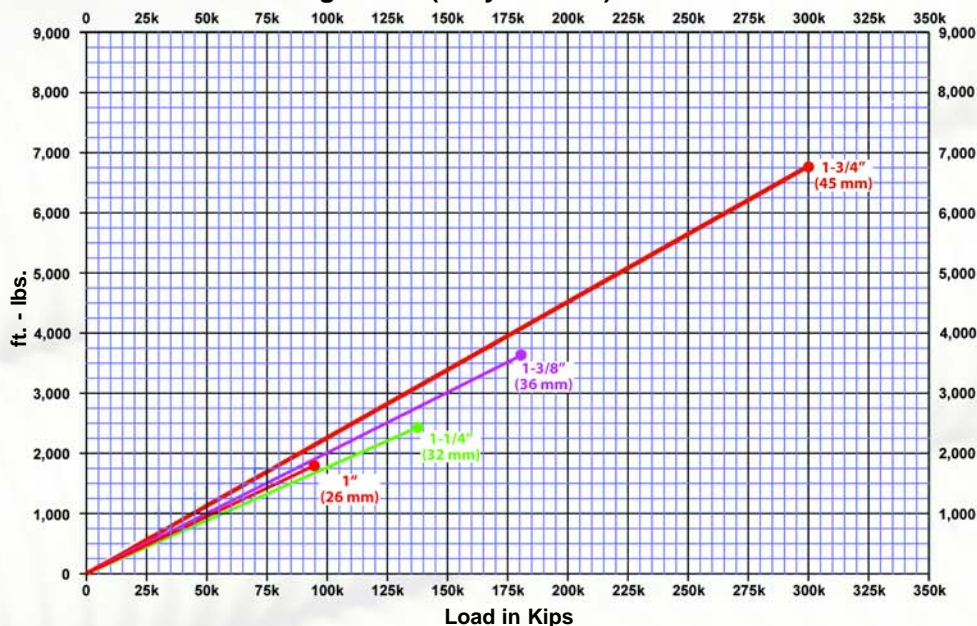
The high quality rolled thread of Post-Tensioning Bars can be torque tensioned in limited situations up to 60% of the bar's ultimate strength. This eliminates the costly and time-consuming process of lifting heavy jacking equipment on and off with a crane. The entire process takes only minutes by workers already in place and relieves expensive crane equipment to be utilized elsewhere on the project. Due to many variables of a torque tension relationship, Williams does not recommend the torque method of applying the load as an accurate substitute for direct tensioning with a hydraulic jack.

### Tensioning By Jacking

Tensioning by jacking can be accomplished with the various capacity tensioning jacks shown below. Williams T80 Post-Tensioning Jacks are designed to be especially helpful for recessed situations, while the T7Z Hydraulic Test Jacks are designed for open areas. Jacks are matched with electric or air pumps. Jacks may be purchased or rented as required. Rental equipment packages include ram on mounted stand, hoses, pull rod, gauges, power unit and knocker wrench for transferring the load from the jack to the anchor head.

### R71 150 KSI All-Thread-Bar Torque Tension Chart

All data based on greased (MolyCoat Gn) threads and surfaces.



## Torque Equipment

### T8Z Hydraulic Torque Wrench

The hydraulic torque wrench is used for tensioning anchors in tight fitting locations where it would be difficult to use an hydraulic jack. The wrench is also recommended for use when setting the large diameter Spin-Lock anchors. The torque wrenches are light weight and can achieve a maximum of 7,400 ft.-lbs. All Hydraulic Torque Wrenches have 1-1/2" square drive outputs.

Maximum Torque	Length	Height	Weight
5,590 ft./lbs. (773 kg/M)	11.11" (279 mm)	4.49" (114 mm)	16.75 lbs. (7.6 kg)
7,400 ft./lbs. (1,023 kg/M)	10.74" (273 mm)	7" (178 mm)	19 lbs. (11.3 kg)



### T8Z Manual Torque Wrench

For applying torque to the nut. Available for 1" to 1-3/8" dia. with a 1" square drive for up to 1,000 ft.-lbs. capacity.



### T3Z Hex Knocker Wrench

Hex Knocker Wrenches are used for safe hex nut adjustment inside of open frame jacks.



### T8Z-04 Torque Multiplier (4:1)

For use with T8Z Torque Wrench. Available with a 1" square drive input and 1-1/2" output for up to 4,000 ft.-lbs. maximum torque.



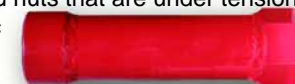
### T1Z Long Fitting Tool Adapters

For torquing hex nuts, the deep socket fits over the bar's end. Works with torque wrench or impact gun. Available with a 1-1/2" square drive.



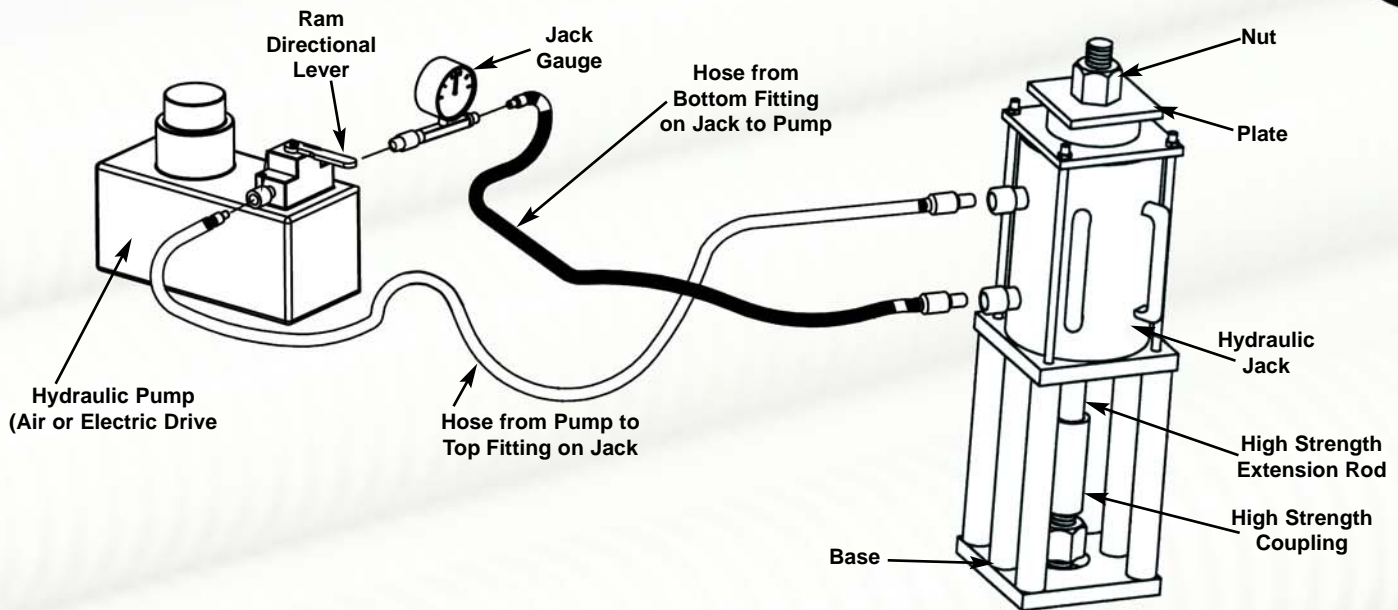
### K3F Long Fitting Wrench Adapter

For applying torque to recessed nuts that are under tension when using open frame hydraulic jacks. Available in all sizes.





## Hydraulic Jacks



### T7Z Open Frame Hydraulic Jacks

Used for testing and pre-stressing All-Thread-Bars. Available with up to 5-1/8" center hole. Unit comes with ram, pump, gauge, hoses, jack stand, high strength coupling, high strength test rod, plate, hex nut and knocker wrench.



Jack Capacity	Pump Method	Ram Height	Base Size	Ram Travel	Minimum Total Ram & Frame Height	Maximum Test Rod Diameter	Ram Area	Approx. Total Ram & Frame Weight
10 tons (89 kN)	Hand Single Acting	5-5/16" (135 mm)	3" Diameter (76 mm)	2-1/2" (64 mm)	8-3/8" (213 mm)	3/4" (19 mm)	2.12 in <sup>2</sup> (1,368 mm <sup>2</sup> )	12 lbs. (5.4 kg)
30 tons (267 kN)	Hand Single Acting	6-1/16" (154 mm)	8" x 8" (203 x 203 mm)	3" (76 mm)	19" (483 mm)	1-1/4" (32 mm)	5.89 in <sup>2</sup> (3,800 mm <sup>2</sup> )	80 lbs. (36 kg)
60 tons (534 kN)	Hand, Air, or Electric Double Acting	9-1/2" (241 mm)	8" x 8" (203 x 203 mm)	5" (127 mm)	29" (737 mm)	2" (51 mm)	12.31 in <sup>2</sup> (7,942 mm <sup>2</sup> )	153 lbs. (69 kg)
60 tons (534 kN)	Hand, Air, or Electric Double Acting	12-3/4" (324 mm)	9" x 9" (228 x 228 mm)	6-1/2" (165 mm)	29" (737 mm)	2" (51 mm)	12.73 in <sup>2</sup> (8,213 mm <sup>2</sup> )	225 lbs. (102 kg)
100 tons (890 kN)	Air or Electric Double Acting	13-1/2" (343 mm)	9" x 9" (228 x 228 mm)	6" (152 mm)	35" (889 mm)	3-1/8" (79 mm)	20.63 in <sup>2</sup> (13,310 mm <sup>2</sup> )	270 lbs. (123 kg)
100 tons (890 kN)	Air or Electric Double Acting	12-3/8" (314 mm)	9" x 9" (228 x 228 mm)	6" (152 mm)	28" (711 mm)	2" (51 mm)	20.03 in <sup>2</sup> (12,923 mm <sup>2</sup> )	192 lbs. (87 kg)
150 tons (1334 kN)	Air or Electric Double Acting	12-1/4" (311 mm)	12" x 12" (305 x 305 mm)	5" (127 mm)	32-1/4" (819 mm)	2-1/2" (64 mm)	30.1 in <sup>2</sup> (19,419 mm <sup>2</sup> )	350 lbs. (159 kg)
200 tons (1779 kN)	Air or Electric Double Acting	16" (406 mm)	12" x 12" (305 x 305 mm)	8" (203 mm)	34" (864 mm)	4" (102 mm)	40.45 in <sup>2</sup> (26,097 mm <sup>2</sup> )	518 lbs. (235 kg)
300 tons (2670 kN)	Electric Double Acting	27-1/2" (699 mm)	15" Dia. (381 mm)	15" (381 mm)	50-1/2" (1283 mm)	5-3/8" (137 mm)	78.5 in <sup>2</sup> (50,645 mm <sup>2</sup> )	1,400 lbs. (635 kg)
400 tons (3558 kN)	Electric Double Acting	18-3/4" (476 mm)	15" Dia. (381 mm)	6" (152 mm)	45-3/4" (1162 mm)	4-1/4" (108 mm)	91.5 in <sup>2</sup> (59,032 mm <sup>2</sup> )	1,300 lbs. (590 kg)
400 tons (3558 kN)	Electric Double Acting	20-3/8" (518 mm)	17" Dia. (432 mm)	8" (203 mm)	49" (1245 mm)	5" (127 mm)	118.2 in <sup>2</sup> (76,258 mm <sup>2</sup> )	1,500 lbs. (680 kg)

### T80 Post-Tension Hydraulic Jacks

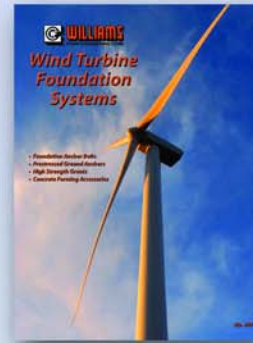
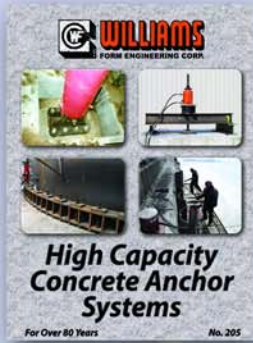
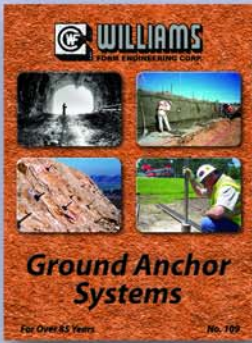
With the T80 series the enclosed bearing housing contains a geared socket drive to tighten the bolt hex nut during tensioning. Test jack housing will accommodate up to a 16" deep pocket (The 200 ton accommodates a 14-1/2" pock-



Jack Capacity	Pump Method	Ram Height	Base Size	Ram Travel	Minimum Total Ram & Frame Height	Maximum Test Rod Diameter	Ram Area	Approx. Total Ram & Frame Weight
60 tons (534 kN)	Hand, Air, or Electric Double Acting	9-1/2" (241 mm)	GearBox: 8.5" x 20.5" (215 x 520 mm) Nose: 3.63" Dia. (92 mm Dia.)	5" (127 mm)	33" (838 mm)	2" (51 mm)	12.31 in <sup>2</sup> (7,942 mm <sup>2</sup> )	122 lbs. (55 kg)
60 tons (534 kN)	Hand, Air, or Electric Double Acting	12-3/4" (324 mm)		6-1/2" (165 mm)	36" (914 mm)	2" (51 mm)	12.73 in <sup>2</sup> (8,213 mm <sup>2</sup> )	225 lbs. (102 kG)
100 tons (890 kN)	Air or Electric Double Acting	13-1/2" (343 mm)	GearBox: 8.5" x 20.5" (216 x 520 mm) Nose: 4.63" Dia. (118 mm Dia.)	6" (152 mm)	39" (990 mm)	3-1/8" (79 mm)	20.63 in <sup>2</sup> (13,310 mm <sup>2</sup> )	270 lbs. (123 kg)
150 tons (1334 kN)	Air or Electric Double Acting	12-1/4" (311 mm)		5" (127 mm)	28" (965 mm)	2-1/2" (64 mm)	30.1 in <sup>2</sup> (19,419 mm <sup>2</sup> )	243 lbs. (110 kg)
200 tons (1779 kN)	Air or Electric Double Acting	16" (406 mm)	Frame: 11"x11"x19.75" Nose: 7" Dia.	8" (203 mm)	43" (1097 mm)	4" (102 mm)	40.45 in <sup>2</sup> (26,097 mm <sup>2</sup> )	455 lbs. (203 kg)

Certification of gauge accuracy available on request prior to shipment only.

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*



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