

# Chapter 4

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# TYPICAL SPECIFICATION ECP Helical Torque Anchors™

## Section 1- General

### 1.01 Typical Installation Scope

Furnish labor, equipment, tools and material to install Helical Torque Anchors™ as described in this specification in a workmanlike manner and to design criteria. All work shall be performed in accordance with all applicable safety codes in effect at the time of installation. Only skilled, experienced workers, who are familiar with the requirements and procedures necessary to properly and safely accomplish the work outlined in this specification, shall be employed.

1. Prepare site for safe working conditions.
2. Thoroughly investigate the site for any and all underground utilities before excavating.
3. Excavate as required for installation of the product.
4. Install ECP Helical Torque Anchor™ to depth and torque specifications
5. Cut to length and install the pile cap or wall support assembly and load as required
6. Load test as required to verify design and capacity
7. Remove equipment from work area and clean work areas

### 1.02 Installation Plan

The torque anchors shall be installed as shown on the written repair plan that was prepared by the engineer or the installer and submitted to the owner or their representative. The plan shall include, but not be limited to:

1. Size and number of placements
2. Helical plate configuration on the helical torque anchor™
3. Spacing between helical torque anchors™
4. Minimum depth of embedment
5. Minimum target torque requirement
6. Load testing requirements

### 1.03 Delivery, Storage and Handling

All foundation repair products, tools and equipment shall be handled and transported with care to prevent any damage or deformation. Hydraulic components shall be protected from the weather and kept clean of any dust, dirt, mud or debris.

## Section 2 - Product Material

### 2.01 Torque Anchors Selection

Each helical torque anchor shall be manufactured from round corner square solid steel bar or structural tubing.

#### 2.011 Shaft Material

##### 2.0111 Solid Square Bar

- 1-1/2" square bar with a torque limit of 7,500 ft-lb
- 1-3/4" square bar with a torque limit of 11,000 ft-lb
- 2-1/4" square bar with a torque limit of 23,000 ft-lb

The round corner high strength solid square bar shall conform to ASTM A29. Yield strength of the bars shall be 90,000 psi.

##### 2.0112 Tubular Shaft

The tubular shaft shall conform to ASTM A53 with a minimum yield of 35,000 psi.

Helical Torque Anchor™ size available:

- 2-7/8" diameter x 0.203 wall thickness tubing, with a torque limit of 5,500 ft-lb

The tubular shafts shall conform to ASTM A500 with a minimum yield of 50,000 psi, or A513 Type 5 with a minimum yield of 70,000 psi.

Helical Torque Anchor™ sizes available:

- 2-7/8" diameter x 0.262 wall thickness tubing, with a torque limit of 9,500 ft-lb
- 3-1/2" diameter x 0.300 wall thickness tubing, with a torque limit of 13,000 ft-lb
- 4-1/2" diameter x 0.337 wall thickness tubing, with a torque limit of 22,000 ft-lb

##### 2.012 Leads

Each lead section shall have a 45-degree bevel to aid in starting the helical torque anchor™. The other end shall have one or more holes to attach an Extension Sections. Leads may be 10", 5', 7', or 10' long depending upon the application. (Limited lead configurations are available for the 2-7/8" x 0.203" product.) Welded to the Lead shall be one or more ASTM A572 Grade 50 or 80 round steel plates with specified thickness of either 3/8 or 1/2 inch, and a 3-inch helical

pitch on the circumference. Helical plate diameter shall be specified in any combination of equal or increasing diameters from 6 inches to 16 inches, in 2-inch increments.

If the design calls for the pier to be filled with grout under pressure, the lead shall have 9/16-inch diameter holes at 24 inches on center for use when grouting the torque anchor.

### **2.013 Hot Forged Extensions**

Extensions with 1-1/2" square bar, 1-3/4" square bar, and 2-7/8" diameter tubing shall have hot forged integral coupling feature. The Extension may be specified as 3', 5', 7' or 10' long as required by the application. Both ends of the Extension Section shall have one or more bolt holes for attachment to a previous section of torque anchor shaft. The opposite end of the extension shall have an expanded hot forged female receiver that will fit over the standard size shaft of an extension or lead. The hot forged extension shall be supplied with attachment hardware.

In higher load capacity projects or in very weak soil conditions, the hot forge extension may have one or more ASTM A572 round steel helical plates with specified thickness of either 3/8 or 1/2 inch, and a 3-inch helical pitch on the circumference. Helical plate diameter shall be specified in any combination of equal or increasing diameters from 6 inches to 16 inches, in 2-inch increments.

### **2.014 Coupled Extensions**

#### **2.0141 2-1/4" Square Bar Coupled Extensions**

Extensions fabricated from 2-1/4" round corner solid square bar shall use a separate mechanical coupler. The Extension may be specified as 3', 5', 7' or 10' long as required by the application. Both ends of the Extension Section shall have two 1-1/8" diameter bolt holes for attachment to a previous section of torque anchor shaft. Each extension shall be supplied with a coupler fabricated from class 90/60 grade SC8630 steel casting. Each coupler shall have four holes that match to the extension and shall be supplied with 1" diameter attachment hardware.

#### **2.0142 Tubular Coupled Extensions**

Extensions fabricated from 3-1/2" diameter x 0.300 wall tubing or 4-1/2" diameter x 0.337" thick wall tubing shall use a separate mechanical coupler. The Extension may be specified as 3', 5', 7' or 10' long as required by the application. Both ends of the Extension Section shall have bolt holes for attachment to a previous section of torque anchor shaft. Each extension shall be supplied with a coupler fabricated from 2-3/4" diameter x 0.375" thick wall tubing or 3-5/8" diameter x 0.375 wall tubing conforming to ASTM A513. Each coupler shall have attachment holes that match to the extension and shall be supplied with hardware.

### **2.015 Attachment Hardware**

Each extension shall be supplied with the appropriate quantity of SAE J429 Grade 8 bolts and nuts having a minimum ultimate tensile strength of 150,000 psi and a minimum yield of 130,000 psi. Bolt lengths range from 3" to 5-1/2".

## **2.02 Torque Anchor™ Termination**

### **2.021 Pile Cap Assembly**

Depending upon the application, the pile cap assembly shall be a welded assembly consisting of a steel plate welded to a steel tube of suitable size to fit the torque anchor shaft and shall be retained by gravity. The designer shall specify the plate size for the top of the pile cap. If the foundation will be subjected to uplifting forces, the pile cap assembly must be specified as an uplift application. The pile cap assemblies that shall be used in tension applications shall be supplied with attachment holes and attachment hardware as described in 2.014.

### **2.022 Transition (Tieback and Other Tension Applications)**

The transition is a component that attaches to one end the helical torque anchor™ and the other end has a threaded socket to accept a all thread bar or bolt.

#### **2.0221 1-1/2" Square Bar Light Duty Transitions**

The square bar transition is a welded assembly 3/8" or 1/2" thick steel plates. The plates are welded together to fit over the solid square torque anchor shaft. The other end of the transition shall have a captive welded nut of suitable size and strength to match the specified attachment hardware or design load.

#### **2.0222 Hot Forged Extensions**

Square bar transitions for 1-1/2" square bar and 1-3/4" square bar shall have hot forged integral coupling feature. The forged end of the transition shall have one bolt hole for attachment to the final section of torque anchor shaft. The opposite end of the transition shall have a threaded hole that will accept a continuously threaded shaft. The thread shall be sized to accept Williams Form WF-8 or WF-10 bars depending upon the torque anchor shaft size.

#### **2.0223 Tubular Transition**

The tubular shaft transition is a welded assembly of tubular sleeves and 3/8" to 3/4" thick steel plates. The plates are welded to a sleeve designed to fit over or inside the tubular anchor shaft and secured with two SAE J429 grade 8 bolts and nuts. The one end of the transition shall have a captive welded nut of suitable size and strength to match the specified attachment hardware or design load.

### 2.03 Pressure Grout (Optional)

The Pressure Grouting material shall be a non-shrink grout suitable for pumping into the tubular helical torque anchor. A minimum 3-day compressive strength of 3,000 PSI is required.

### 2.04 Weldments

All welded connections shall conform to the requirements of the American Welding Society, "Structural Welding Code AWS.01.1" and applicable revisions.

### 2.05 Corrosion Protection

ECP Torque Anchors™ shall be supplied with hot dipped zinc galvanized corrosion protection per ASTM A123 Grade 75 or Grade 100 and applicable revisions.

## Section 3 – Tools and Equipment

### 3.01 Hydraulic Gear Motor

A hydraulic gear motor is required to install the helical torque anchor™ to the desired torque and depth. The capacity of the gear motor generally will range between 2,000 to 30,000 foot-pounds, depending upon the soil conditions and torque anchor configuration and shall be fully reversible. The installation torque rating of the hydraulic gear motor shall be at least 25 percent higher than the planned installation torque. Rotation shall range between 5 and 20 revolutions per minute.

### 3.02 Torque Monitoring Device

The installation torque applied to the helical torque anchor™ shall be monitored continuously during installation. The torque monitoring device may be a part of the installing unit or may be a device in line with the hydraulics. Accuracy of the torque monitoring device shall be insured by having calibration data available for review by the engineer or the owner's representative.

### 3.03 Tooling

The hydraulic torque motor must be firmly mounted to machinery capable of positioning the torque anchor at the proper angle and capable of providing proper installation force (crowd) to advance the torque anchor. Adapters used to connect the motor to the helical torque anchor™ shall have a capacity exceeding the torque required to install the anchor and shall be mechanically connected to the anchor during installation.

### 3.04 Hand Pump

The hand pump assembly shall provide two stages of displacement at pressures up to 10,000 psi. Below 400 psi the displacement shall be 2.4 in<sup>3</sup> per stroke and above 400 psi, 0.15 in<sup>3</sup>. (Enerpac P-801 or equal)

### 3.05 Pressure Gauges

A pressure gauge shall be provided to monitor the lifting force applied to the structure during restoration. The pressure gauge shall be capable of measuring 0 – 10,000 psi with a minimum gauge face of 2-1/2" and minor graduations of 200 psi. (Enerpac G2535L or equal)

### 3.06 Single Acting Hollow Plunger Hydraulic Ram

A single acting hydraulic Ram shall be used during the load transfer phase when performing a axial compression load test. If the project requires a tension load test then the hydraulic ram must have a center hole to accept the threaded bar connected to the pile. The hydraulic cylinder shall be rated at 10,000 psi of hydraulic pressure and have heavy duty return spring. The capacity and stroke of the cylinder shall be determined by the application.

## Section 4 – Helical Torque Anchor™ Installation

The following specification contains the major steps to be undertaken to install helical torque anchors™. Variations may occur depending upon the application and the type of structural support required.



### Warnings:

#### Utilities:

**Thoroughly investigate the job site for the possible existence and location of all underground utilities before proceeding. Avoid all contact with ALL underground utilities!**

#### Excavations:

**Collapsing soil can be dangerous. Follow OSHA requirements at all times. Do not enter any excavation if there are any questions about the stability of the soil.**

#### Hazardous Machinery:

**The use and operation of hydraulic gear motors can be very hazardous due to the power of the motor. The torsional forces developed during operation can be**

extreme resulting in breakage of product and equipment. The transfer of these forces may be extremely quick leaving little or no time for personnel to react and/or avoid contact. Under no circumstances should the equipment be operated without proper training in procedures and knowledge of product capabilities. Do not allow observers close to the equipment during operation.

**Reaction Bar:** An unmovable object must be used when restraining a reaction bar. The reaction bar must be firmly secured against movements in all directions. Never stand close to or on a reaction bar during installation.

**Heavy Lifting:** Many pieces of equipment used to install steel foundation underpinning are very heavy. Use proper lifting techniques, back supports, and help from others when lifting heavy objects.



### **Warning!**

**FAILURE TO HEED THESE WARNINGS, OR TO FOLLOW SAFE WORK HABITS, OR IMPROPER USE OF THE EQUIPMENT AND MATERIALS MAY RESULT IN LIFE THREATENING SITUATIONS, BODILY INJURY AND/OR PROPERTY DAMAGE!**

#### **4.01 Torque Anchor™ Installation**

The hydraulic installation motor shall be installed to portable equipment or to a suitable machine capable providing the proper installation angle, reaction against installation torque, and downward force (crowd). The lead section shall be positioned with the shaft adjacent to the stem wall at the designated location. The opposite end shall be attached to the hydraulic installation motor with a pin(s) and retaining clip(s).

If using portable equipment, the torque reaction bar MUST be properly secured against movements in all directions. Torque Anchor™ lead sections shall be placed at the locations indicated on the plans. The lead section shall be advanced into the soil in a smooth and continuous manner using sufficient down pressure for uniform advancement. The installer shall have knowledge of the desired pressure differential that will produce the desired terminal installation torque approved by the engineer before beginning the installation.

Once the lead is installed, the motor shall be unpinned from the lead. One or more extensions shall be installed and securely bolted in place with the hardware supplied by the manufacturer.

- The hot forged coupling on the 1-1/2" solid square shaft, the 1-3/4" solid square shaft, and 2-7/8" diameter tubular sections shall be placed over the top of the previous section of torque anchor™ and secured with the high strength bolt(s) and nut(s) supplied by the manufacturer.
- The 2-1/4" solid shaft, 3-1/2" diameter x 0.300 wall thickness and 4-1/2" diameter x 0.337 wall tubular products are connected with a separate coupler. The coupler either fits over the solid shaft and secured with four high strength bolts and nuts or within the tubular section and shall be secured using four or six high strength bolts and nuts. Hardware shall be supplied by the manufacturer to match the product.

The torque anchor™ shall be continue to be driven to the average design torque until the bottom end of the torque anchor™ is at the design depth. Once the design torque at the design depth has been achieved, the installation motor shall be removed from the torque anchor™.

#### **4.02 Installation Requirements**

**4.021** The minimum average installation torque and the minimum length shown on the plans shall be satisfied prior to termination the installation. The installation torque shall be an average of the installation torques recorded during a minimum of the last three feet of installation.

**4.022** The torsional strength rating of the torque anchor™ shall not be exceeded during installation. If the torsional strength limit for the torque anchor™ has been reached, but the anchor has not reached the target depth, do the following:

**4.0221** If the torsional strength limit is achieved prior to reaching the target depth, the installation may be acceptable if reviewed and approved by the engineer and/or owner.

**4.0222** The installer may remove the torque anchor™ and install a new one with fewer and/or smaller diameter helical plates with the review and approval by the engineer and/or owner

**4.023** If the target is achieved, but the torsional requirement has not been met; the installer may do one of the following subject to the review and approval of the engineer and/or owner:

**4.0231** Install the torque anchor™ deeper to obtain the required installation torsion.

**4.0232** The installer may remove the torque anchor™ and install a new one with an additional helical plate and/or larger diameter helical plates.

**4.0233** Reduce the load capacity of the placement and provide additional helical torque anchors™ to achieve the required total support for the project.

**4.024** If the torque anchor™ hits an obstruction or is deflected from its intended path, the installation shall be terminated and the anchor removed. Either the obstruction must be removed or the torque anchor™ relocated as directed by the engineer and/or owner.

**4.025** In no case shall a torque anchor™ be backed out and reinstalled to the same depth. If an anchor must be removed for any reason, it must be installed a minimum of three feet farther.

#### **4.03 Torque Anchor™ Length Adjustment**

After meeting the installation requirements, the installer may remove the final plain extension section and replace it with a shorter one to obtain the design elevation, or he may cut the extension to length. The cut shall be smooth and at 90 degrees to the axis of the shaft. It is not permissible to reverse the installation to reach the desired coupling elevation.

#### **4.04 Load Testing**

The engineer and/or owner shall determine if a load test is required, the number of load tests required, locations for the test(s) and acceptable load and movement criteria. The load test(s) shall be in general conformance with ASTM D-1143.

##### **4.041 Equipment**

The load test equipment shall be capable of imposing incrementally increasing and decreasing loads on the test anchor. The reaction frame shall have sufficient rigidity and strength to minimize movements under load and prevent imposing an eccentric load to the test anchor. The test components shall also be assembled to minimize any eccentric loading. The hydraulic jack shall be capable of exerting at least twice the anticipated design load and have a stroke longer than the anticipated movement during the test. Pressure gauges shall be calibrated in 100 psi increments or less. Dial indicators with an accuracy of +/- 0.001" or a sight level and a engraved steel scale with increments of 1/64" or less may be used subject to engineer and/or owner approval.

All equipment used for load testing shall have been calibrated within one year of the test and subject to retest at the request of the engineer and/or owner if there is any concern or doubt about the accuracy of any component.

##### **4.042 Procedure**

###### **4.0421 Alignment Load**

An alignment load of no more than 10 percent of the design load shall be applied to the torque anchor™ prior to setting the deflection measuring equipment to zero or to the reference elevation. Once complete, the apparatus shall be checked for alignment and safety.

###### **4.0422 Incremental Load Test**

Axial load test either in tension or compression shall be conducted in an incremental fashion. The increments shall be 20 percent of the design load or as specified by the engineer and/or owner. Movement of the end of the anchor shall be recorded at the beginning of each increment and after time intervals. Recommended intervals are 1/2 minute, 1 minute, 5, minutes, 10 minutes and 20 minutes. The monitoring may be stopped if the recorded movement is less than 0.002" per minute measured over a minimum of 5 minutes.

###### **4.0423 Test Termination**

Load test increments shall continue to be applied until continuous jacking is required to maintain the load increment, the load equals 200 percent of the design load or if the deflection exceeds the criterion established by the engineer and/or owner prior to running the test.

###### **4.0424 Unloading**

The applied axial test load shall be removed in two or three approximately equal decrements. The hold time for each decrement shall be one minute except the final decrement, which shall equal the alignment load. This load shall be held for 5 minutes.

###### **4.0425 Documentation**

The field test data shall be collected and compiled into an easy to read report and submitted to the engineer and/or owner for review and approval.

#### **4.05 Documentation**

The installer shall carefully monitor the torque applied to the anchor as it is installed. It is recommended that the installation torque be recorded at one foot intervals, but should never exceed every two feet. The data may be collected from electronic torsion monitoring equipment that has been calibrated to the installation motor being used. Installation torque may also be monitored by noting the differential pressure across the installation motor and determining the torque from the manufacturer's published torque curves.

At the conclusion of the installation, the raw field data shall be converted into an installation report that includes the location of each placement, the installation depth, and the averaged installation torque over the final three feet.

#### **4.06 Torque Anchor™ Termination**

##### **4.061 Pile Cap**

The pile cap, slab pier bracket, utility bracket, or porch bracket shall be installed by placing the appropriate sleeve over the torque anchor™ shaft. If the foundation will be subjected to uplift the pile cap shall be bolted to the torque anchor using bolt(s) and nut(s) supplied by the manufacturer having the same size and strength as used to couple the pile

sections.

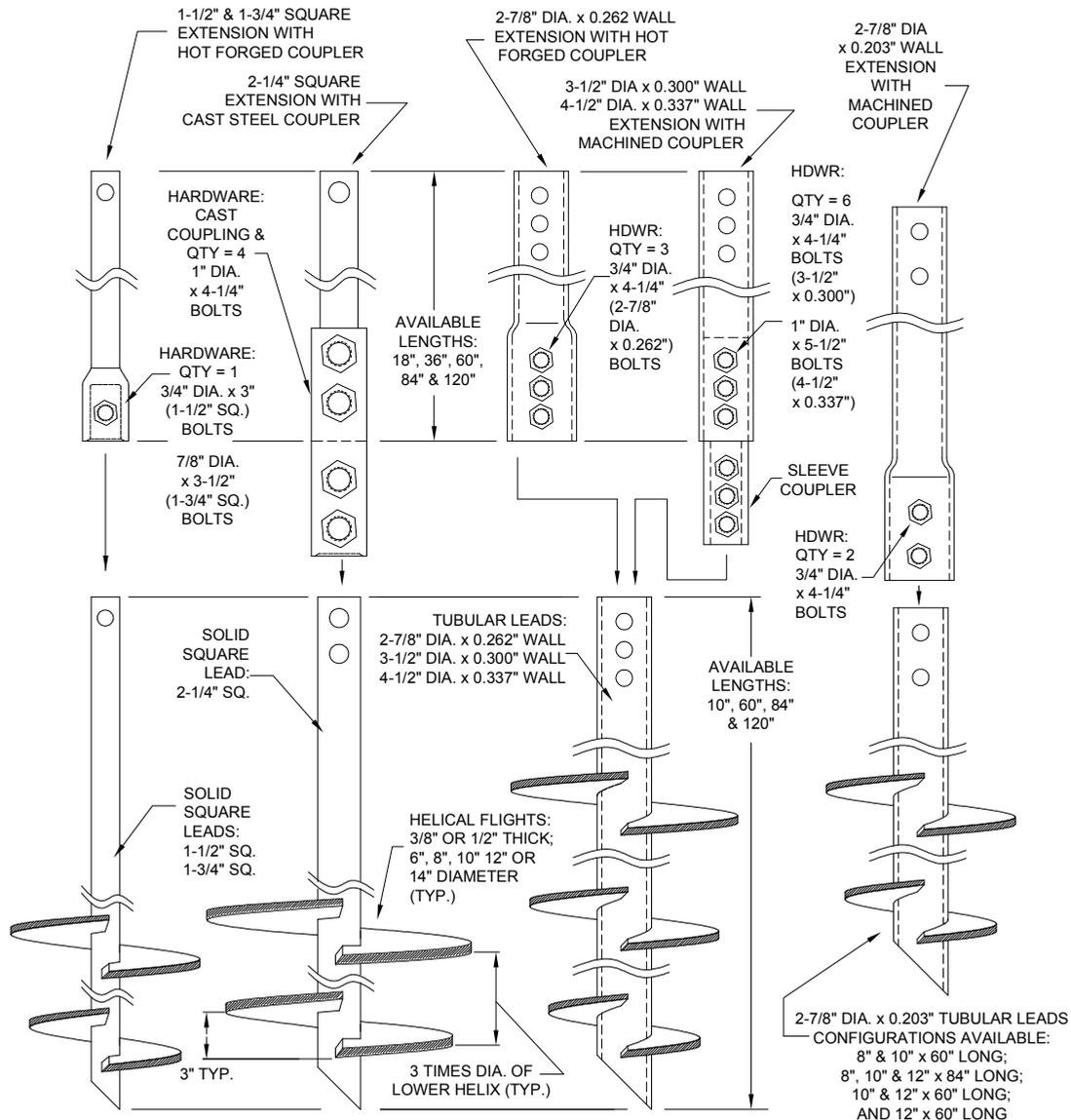
#### 4.062 Transition

The transition is sometimes used for equipment anchorage. The transition shall be bolted to the end of the torque anchor™ using the hardware supplied by the manufacturer. All threaded bar is attached between the transition and the equipment base. If required, the installer may place a center hole ram over the continuously threaded bars to preload pile in tension as specified. The mounting nuts shall then be tightened securely to maintain the preload. In less critical applications the wall plate nuts may be tightened to a torque specified by the engineer or owner.

#### 4.07 Cleanup

Remove all scrap and other construction debris from the site. Remove all tools and equipment, clean them and store them. Any disturbed soils in the area of work shall be restored to the dimensions and condition specified by the engineer and/or owner. Dispose of all construction in a safe and legal manner.

### END OF SPECIFICATION



Earth Contact Products, LLC reserves the right to change design features, specifications and products without notice, consistent with our efforts toward continuous product improvement. Please check with Earth Contact Products at 972 480-0007 or 913 393-0007 to verify that you are using the most recent specifications.



# TYPICAL SPECIFICATION

## Helical Torque Anchor™ Underpinning with Foundation Bracket

- **TAB-150-UB Utility Bracket with 1-1/2" Solid Square Shaft Pile**
- **TAB-288L-UB Utility Bracket with 2-7/8" Diameter x 0.203" Wall Tubular Pile**
- **TAB-288-LUB Large Utility Bracket with 2-7/8" Diameter x 0.262" Wall Tubular Pile**
- **TAB-350-LUB Large Utility Bracket with 3-1/2" Diameter Tubular Pile**
- **TAB-350-LUB Large Utility Bracket with 1-3/4" Solid Square Shaft Pile**

### Section 1- General

#### 1.01 Typical Installation Scope

Furnish labor, equipment, tools and material to install utility bracket and helical torque anchors™ as described in this specification in a workmanlike manner and to design criteria. All work shall be performed in accordance with all applicable safety codes in effect at the time of installation. Only skilled, experienced workers, who are familiar with the requirements and procedures necessary to properly and safely accomplish the work outlined in this specification, shall be employed.

1. Prepare site for safe working conditions.
2. Thoroughly investigate the site for any and all underground utilities before excavating.
3. Excavation and preparation of foundation as required for installation of the product.
4. Install ECP Helical Torque Anchor™ to depth and torque specifications
5. Secure Utility Bracket to foundation
6. Cut to torque anchor to length and install the tee-tube assembly
7. Install lift assemblies, hydraulic lift cylinders and connect hydraulics.
8. Load test as required to verify design and capacity
9. Transfer the load to the torque anchors™, lift the structure to designed specifications and mechanically secure to maintain elevation.
10. Remove equipment from work area.
11. Backfill and clean work areas.

#### 1.02 Installation Plan

The torque anchors shall be installed as shown on the written repair plan that was prepared by the engineer or the installer and submitted to the owner or their representative. The plan shall include, but not be limited to:

1. Size and number of placements
2. Helical plate configuration on the helical torque anchor™
3. Spacing between helical torque anchors™
4. Minimum depth of embedment
5. Minimum target torque requirement
6. Load testing requirements

#### 1.03 Delivery, Storage and Handling

All foundation repair products, tools and equipment shall be handled and transported with care to prevent any damage or deformation. Hydraulic components shall be protected from the weather and kept clean of any dust, dirt, mud or debris.

### Section 2 - Product Material

#### 2.01 Torque Anchors Selection

Each helical torque anchor shall be manufactured from round corner square solid steel bar or structural tubing.

##### 2.011 Shaft Material

###### 2.0111 Solid Square Bar

The round corner high strength solid square bar shall conform to ASTM A29. Yield strength of the bars shall be 90,000 psi.

- 1-1/2" square bar with a torque limit of 7,500 ft-lb
- 1-3/4" square bar with a torque limit of 11,000 ft-lb

###### 2.0112 Tubular Shaft

The tubular shafts shall conform to ASTM A500 with a minimum yield of 50,000 psi, or A513 Type 5 with a minimum yield of 70,000 psi. Helical Torque Anchor™ sizes available:

- 2-7/8" diameter x 0.203 wall thickness tubing, with a torque limit of 5,500 ft-lb
- 2-7/8" diameter x 0.262 wall thickness tubing, with a torque limit of 9,500 ft-lb

- 3-1/2" diameter x 0.300 wall thickness tubing, with a torque limit of 13,000 ft-lb

### **2.012 Leads**

Each lead section shall have a 45-degree bevel to aid in starting the helical torque anchor™. The other end shall have one or more holes to attach an Extension Sections. Leads may be 10", 5', 7', or 10' long depending upon the application. Welded to the Lead shall be one or more ASTM A572 Grade 50 or 80 round steel plates with specified thickness of either 3/8 or 1/2 inch, and a 3-inch helical pitch on the circumference. Helical plate diameter shall be specified in any combination of equal or increasing diameters from 6 inches to 14 inches, in 2-inch increments.

### **2.013 Hot Forged Extensions**

Extensions with 1-1/2" square bar, 1-3/4" square bar, and 2-7/8" diameter tubing shall have hot forged integral coupling feature. The Extension may be specified as 1-1/2', 3', 5', 7' or 10' long as required by the application. Both ends of the Extension Section shall have one or more bolt holes for attachment to a previous section of torque anchor shaft. The opposite end of the extension shall have an expanded hot forged female receiver that will fit over the standard size shaft of an extension or lead. The hot forged extension shall be supplied with attachment hardware.

### **2.014 Coupled Extensions**

Extensions fabricated from 3-1/2" diameter x 0.300 wall tubing shall use a separate mechanical coupler. The Extension may be specified as 3', 5', 7' or 10' long as required by the application. Both ends of the Extension Section shall have three bolt holes for attachment to a previous section of torque anchor shaft. Each extension shall be supplied with a coupler fabricated from 2-3/4" diameter x 0.375 wall tubing or 3-5/8" diameter x 0.375 wall tubing conforming to ASTM A513. Each coupler shall have six holes that match to the extension and shall be supplied with attachment hardware.

### **2.015 Attachment Hardware**

Each extension shall be supplied with the appropriate quantity of SAE J429 Grade 8 bolts and nuts having a minimum ultimate tensile strength of 150,000 psi and a minimum yield of 130,000 psi. Bolt lengths range from 3" to 5-1/2".

## **2.02 Torque Anchor™ Termination**

### **2.021 Utility Brackets**

#### **2.0211 Model TAB-150-UB and TAB-288L-UB Utility Bracket**

The utility bracket shall be designed to connect the structure to the torque anchor™ and to transfer the load of the structure to the torque anchor™. The utility bracket shall be a welded assembly new, clean steel with a thickness of 3/8" and 1/2" conforming to ASTM A-36. The utility bracket shall have a 68-1/4 square inch horizontal bearing surface that contacts the bottom of the foundation plate and a vertical mounting plate area of 70 square inches. The 3/8" thick vertical mounting plate shall have four 11/16" diameter holes that will accept 1/2" diameter concrete anchor bolts. The horizontal and vertical bearing plates shall be welded to two 3/8" thick laser cut side pieces, which measure 10-3/8" wide, by 10-1/2" tall. A 6" long piece of 1-1/4" square tube with a wall thickness of 0.188 inch shall be welded vertically to the outer side of each side piece. Two mounting studs shall be welded to the outer front edge of the side pieces. These studs shall be fabricated from 2-1/4" long pieces of 1/2"-13 all-thread bar. Each stud shall be supplied with a 1/2"-13 hex nut. Supplied with the bracket shall be two face plates that are used to secure the tee-tube assembly in proper alignment and position within the utility bracket. The face plates shall be 2" by 6-3/8" and contain two 9/16" slots to secure the face plates to the utility bracket. The TAB-150-UB bracket accepts vertically installed pile shafts. The TAB-288L-UB is designed for the tubular shaft to be installed at a 5° batter.

Supplied with the utility bracket shall be two 3/4-10 grade 5 all thread bars that measure 12" long and four 3/4-10 heavy duty hex nuts. The holding/lift rods and nuts shall be used to attach the tee-tube assembly to the utility bracket.

#### **2.0212 Model TAB-LUB Large Utility Bracket**

The utility bracket shall be designed to connect the structure to the torque anchor™ and to transfer the load of the structure to the torque anchor™. The utility bracket shall be a welded assembly new, clean steel with a thicknesses of 3/8" to 5/8" conforming to ASTM A-36. The utility bracket shall have a 75 square inch horizontal bearing surface that contacts the bottom of the foundation plate and a vertical mounting plate area of 104 square inches. The 1/2" thick vertical mounting plate shall have four 11/16" diameter holes that will accept 5/8" diameter concrete anchor bolts. The horizontal and vertical bearing plates shall be welded to two 1/2" thick laser cut side pieces, which measure 11-1/4" wide, by 18" tall. A 6-1/2" long piece of 1-1/2" square tube with a wall thickness of 0.188 shall be welded vertically to the outer side of each sidepiece. Six mounting studs shall be welded to the outer front edge of the side pieces. These studs shall be fabricated from 2-1/4" long pieces of 1/2"-13 all-thread bar. Each stud shall be supplied with a 1/2"-13 hex nut. Supplied with the bracket shall be three face plates that are used to secure the torque anchor™ shaft in proper alignment and position within the utility bracket. The face plates shall be 2" by 7-1/8" and contain two 5/8" diameter holes to secure the face plates to the large utility bracket.

Supplied with the utility bracket shall be two 7/8"-9 all thread bars that measure 18" long and four 7/8"-9 heavy duty hex nuts conforming to ASTM A-193 Grade B7. The holding/lift rods and nuts shall be used to attach the pile cap to the utility bracket.

### **2.022 Pile Caps**

#### **2.0221 Model TAB-150-UB T-Tube Pile Cap**

The T-Tube pile cap connects the torque anchor™ to the utility bracket and transfers the structural loads to the torque anchor™. The T-Tube pile cap shall be a welded assembly consisting of a steel plate welded to a steel tube sized to fit the torque anchor shaft. The pile cap plate shall be fabricated from 1-1/2" by 4" by 7-7/8" long steel conforming to ASTM A-36. The pile cap plate has two 7/8" diameter cut holes for attaching the holding cap plate to the utility bracket. The pile cap plate shall be welded to a 16" length of 2-1/2" diameter x 0.250 wall tubing, which forms a sleeve that slides over the torque anchor™ shaft.

#### **2.0222 Model TAB-288L-UB Pile Cap**

The pile cap plate shall be fabricated from 1-1/2" by 4" by 7-7/8" long steel conforming to ASTM A-36. The pile cap plate has two 7/8" diameter cut holes for attaching the holding cap plate to the utility bracket. Attached to the center of the pile cap plate shall be a piece of 2" schedule 40 pipe that is 3/4" long. This alignment ring shall have intermittent welds to the pile cap. Pipe shall conform to ASTM A53.

#### **2.0223 Model TAB-LUB Pile Caps**

The pile cap connects the torque anchor™ to the utility bracket and transfers the structural loads to the torque anchor™. The pile cap plate shall be fabricated from 1-1/2" by 4" by 9" long steel conforming to ASTM A-36 Gr. 50. The holding cap plate has two 1" diameter cut holes for attaching the holding cap plate to the large utility bracket. The each cap plate shall have welded to it a length of tubing, which retains the pile in alignment.

##### **2.02231 Model TAB-175-LUB – T-Tube Pile Cap for 1-3/4" Solid Square Bar Shaft Pile**

Welded to the center of the pile cap plate shall be a piece of 2-1/2" schedule 40 pipe that is 24" long. Pipe shall conform to ASTM A53.

##### **2.02232 Model TAB-288-LUB – Pile Cap for 2-7/8" Diameter Tubular Shaft Pile**

Attached to the center of the pile cap plate shall be a piece of 3" schedule 40 pipe that is 3/4" long. This alignment ring shall have intermittent welds to the pile cap. Pipe shall conform to ASTM A53.

##### **2.02233 Model TAB-350-LUB – Pile Cap for 3-1/2" Diameter Tubular Shaft**

Attached to the center of the pile cap plate shall be a piece of 2-3/4" diameter by 0.250" wall thickness DOM tube that is 3/4" long. This alignment ring shall have intermittent welds to the pile cap. Tubing shall conform to ASTM A513.

### **2.03 Lift Assembly**

The lift assembly shall consist of a lift head, two all thread bars, and two threaded bar couplers and two heavy duty hex nuts. The lift assembly is used to recover lost elevation and to allow for transfer of the structural load from the torque anchor™ to the utility bracket assembly. The couplers and lift head rods shall be used to extend the holding/lift rods to allow attachment of the lift head above the tee-tube assembly. A hydraulic ram shall be installed between the lift head and tee-tube assembly during structural load transfer and recovery of lost elevations

#### **2.031 Lift Head – Model TAB-150-UB and Model TAB-288L-UB**

The lift head shall be fabricated from 1-1/2" by 4" by 7-7/8" long steel conforming to ASTM A-36 Gr. 50. The lift head shall have two 7/8" diameter holes to accept the holding/lift rods. Supplied with the lift head shall be two 3/4-10 grade 7 all thread bars that measure nominally 9" long conforming to ASTM A-193 Grade B7. Also supplied shall be two 3/4-10 heavy duty hex nuts and two threaded bar couplers.

#### **2.051 Lift Head – Model TAB-LUB**

The lift head shall be fabricated from 1-1/2" by 4" by 9" long steel conforming to ASTM A-36 Gr. 50. The lift head shall have two 1" diameter holes to accept the holding/lift rods. Supplied with the lift head shall be two 7/8" - 9 all thread bars that measure nominally 9" long conforming to ASTM A-193 Grade B7. Also supplied shall be two 7/8" - 9 heavy duty hex nuts and two threaded bar couplers.

### **2.04 Anchor Bolts**

The expansion anchor shall be wedge type with a single piece three section wedge conforming to Federal Specification A-A 1923-A, Type 4 and ICC-ES Evaluation Report ESR-1385. Anchor shall be zinc plated conforming to ASTM B633. Anchor bolt size: 1/2" diameter by 7" long and shall be supplied with a flat washer and hex nut. (Hilti Kwik Bolt III #282529 or equal; or as specified by the engineer.)

### **2.05 Weldments**

All welded connections shall conform to the requirements of the American Welding Society, "Structural Welding Code AWS.01.1" and applicable revisions.

## **Section 3 – Tools and Equipment**

### **3.01 Hydraulic Installation Motor**

A hydraulic installation motor is required to install the helical torque anchor™ to the desired torque and depth. The capacity of the hydraulic motor generally will range between 2,000 to 10,000 foot-pounds, depending upon the soil conditions and torque

anchor configuration and shall be fully reversible. The installation torque rating of the hydraulic installation motor shall be at least 25 percent higher than the planned installation torque. Rotation shall range between 5 and 20 revolutions per minute.

### 3.02 Torque Monitoring Device

The installation torque applied to the helical torque anchor™ shall be monitored continuously during installation. The torque monitoring device may be a part of the installing unit or may be a device in line with the hydraulics. Having calibration data available for review by the engineer or the owner's representative shall insure accuracy of the torque monitoring device.

### 3.03 Tooling

The hydraulic installation motor must be firmly mounted to portable or machine mounted equipment capable of positioning the torque anchor™ at the proper angle, capable of resisting the reaction torque and capable of providing proper installation force (crowd) to advance the torque anchor™. Adapters used to connect the motor to the helical torque anchor™ shall have a capacity exceeding the torque required to install the anchor and shall be mechanically connected to the anchor during installation.

### 3.04 Hand Pump

One or more hand pumps may be required to transfer structural load and to recover lost elevation. The hand pump(s) are connected to hydraulic lifting rams via a manifold arrangement. This provides uniform force to several pier placements at the same time. The hand pump assembly shall provide two stages of displacement at pressures up to 10,000 psi. Below 400 psi the displacement shall be 2.4 in<sup>3</sup> per stroke and above 400 psi, 0.15 in<sup>3</sup>. (Enerpac P801 or equal)

### 3.05 Single Acting Hydraulic Cylinder

A single acting hydraulic cylinder shall be positioned at each placement during the load transfer phase of the restoration. The hydraulic cylinder shall be rated at 10,000 psi of hydraulic pressure and heavy duty return spring. The minimum cylinder bore shall be 5.16 in<sup>2</sup> and a stroke of 4". (Enerpac RC-254 or equal)

### 3.06 Pressure Gauge

A pressure gauge shall be provided to monitor the lifting force applied to the structure during restoration. The pressure gauge shall be capable of measuring 0 – 10,000 psi with a minimum gauge face of 2-1/2" and minor graduations of 200 psi. (Enerpac G2535L or equal)

## Section 4 – Helical Torque Anchor™ and Utility Bracket Installation

The following specification contains the major steps to be undertaken to install helical torque anchors™. Variations may occur depending upon the application and the type of structural support required.



### Warnings:

- Utilities:** Thoroughly investigate the job site for the possible existence and location of all underground utilities before proceeding. Avoid all contact with ALL underground utilities!
- Excavations:** Collapsing soil can be dangerous. Follow OSHA requirements at all times. Do not enter any excavation if there are any questions about the stability of the soil.
- Hazardous Machinery:** The use and operation of hydraulic installation motors can be very hazardous due to the power of the motor. The torsional forces developed during operation can be extreme resulting in breakage of product and equipment. The transfer of these forces may be extremely quick leaving little or no time for personnel to react and/or avoid contact. Under no circumstances should the equipment be operated without proper training in procedures and knowledge of product capabilities. Do not allow observers close to the equipment during operation.
- Reaction Bar:** An unmovable object must be used when restraining a reaction bar. The reaction bar must be firmly secured against movements in all directions. Never stand close to or on a reaction bar during installation.
- Heavy Lifting:** Many pieces of equipment used to install steel foundation underpinning are very heavy. Use proper lifting techniques, back supports, and help from others when lifting heavy objects.



### Warning!

**FAILURE TO HEED THESE WARNINGS, OR TO FOLLOW SAFE WORK HABITS, OR IMPROPER USE OF THE EQUIPMENT AND MATERIALS MAY RESULT IN LIFE THREATENING SITUATIONS, BODILY INJURY AND/OR PROPERTY DAMAGE!**

#### 4.01 Excavating to Expose Footing or Grade Beam

An excavation shall be prepared adjacent to the foundation to expose the stem wall and footing or the bottom of the grade beam. The excavation shall be to a depth of 14 inches below the bottom of the foundation and 10" beneath it. The excavated work area must be wide enough and tapered for safe working conditions, typically 3 to 4 feet wide by 3 to 4 feet away from the structure is usually adequate. Move excavated soil away from the excavation by at least two feet and store in such a manner that the soil will not erode or cause damage to the owner's property.

#### 4.02 Footing or Grade Beam Preparation

If the structure has a spread footing foundation, it shall be notched by removing the extended edge of the footing back to the stem wall for a distance of at least 15 inches in the area of the anchor placement. To accomplish this a pneumatic or electrical chipping hammer with a chipping bit followed by a bushing tool for smoothing the face shall be used. When preparing either a notched footing or a grade beam, the bottom area of concrete that bears upon the soil must be prepared to a smooth and level condition. Prior to acceptance of preparation, a level shall be used to verify that the portion of the footing upon which the bracket will bear is level both perpendicular to the foundation and parallel to the structure.

**Important: If any reinforcing bar becomes exposed during these operations, consult with an Engineer before removing or cutting any steel reinforcing.**

#### 4.03 Torque Anchor™ Installation

The hydraulic installation motor shall be installed to portable equipment or to a suitable machine capable providing the proper installation angle, reaction against installation torque, and downward force (crowd). The lead section shall be positioned with the shaft adjacent to the stem wall at the designated location. The opposite end shall be attached to the hydraulic installation motor with a pin(s) and retaining clip(s).

- The 1-1/2" square shaft lead section is usually aligned a close to parallel to the face of the structure as is possible.
- The 1-3/4" square shaft, 2-7/8" diameter tubular, or 3-1/2" diameter tubular lead section shall be aligned with the bottom edge of the proposed bearing area. The top end of the shaft shall be adjusted away from the structure at 5 degrees.

**Important: If using portable equipment, the torque reaction bar MUST be properly secured against movements in all directions.**

The torque anchor™ shall be driven to the design depth and torsion requirement. The installer shall have knowledge of the necessary pressure differential across the motor that produce the desired torsional torque approved by the engineer before beginning installation.

Once the lead is installed, the motor shall be unpinned from the lead. One or more extensions shall be attached to the shaft end and then installed in a similar manner. The coupling shall be attached to the previous section of torque anchor™ shaft and secured with the hardware supplied with the extension. Once the design torsion at the design depth has been achieved, the installation motor shall be removed from the torque anchor™. Refer to "Typical Specifications for ECP Helical Torque Anchors™" for specific installation requirements.

#### 4.04 Load Testing

Depending upon the engineer's specifications, a working load test may be required. This is normally performed on a single placement using the structure as a reaction.

In problem soils, critical applications, and when directed by the engineer an ultimate load test may be required. This test must be made at an alternate location on the site and under the direction of the engineer. Refer to "Typical Specifications for ECP Helical Torque Anchors™" for load test specifics.

#### 4.05 Documentation

The installer shall carefully monitor the torque applied to the anchor as it is installed. It is recommended that the installation torque be recorded at one foot intervals, but should never exceed every two feet. The data may be collected from electronic torsion monitoring equipment that has been calibrated to the installation motor being used. Installation torque may also be monitored by noting the differential pressure across the installation motor and determining the torque from the manufacturer's published torque curves. The installer shall have knowledge of the desired pressure differential that will produce the desired terminal installation torque approved by the engineer before beginning the installation.

At the conclusion of the installation, the raw field data shall be converted into an installation report that includes the location of each placement, the installation depth, and the averaged installation torque over the final five feet, the working load placed on each placement and the amount of recovery at each placement.

#### 4.06 Torque Anchor™ Length Adjustment

The top of the anchor shaft should be terminated above the top of the bracket by the amount of expected lift plus one-half inch. If the anchor shaft extends more than this, the installer needs to verify that he has sufficient all thread bar to connect the lift head assembly. If it is necessary to shorten the pile shaft in the field, carefully measure and cut the anchor shaft to length. Care must be taken to make the cut perpendicular to the axis of the shaft.

When installing square bar anchors, the installer must verify that there is adequate clearance provided between the top of the pile shaft and the first coupling to allow for the T-Tube pile cap to be fully installed. Model TAB-150-UB requires 16" and Model TAB-LUB-175 T-Tube pile cap requires 24". If shortening the shaft would reduce this required distance from end of shaft to the first coupling to less than stated above, then the torque anchor™ must be driven slightly deeper before cutting the shaft. Never cut the tee-tube without consulting the engineer as a reduction in product capacity will occur.

#### **4.07 Utility Bracket Installation Using the Lift Assembly**

Hold the utility bracket in the approximate installation location and attach the pile cap to the bracket using the all thread rods at either side of the utility bracket. The pile cap or T-Tube pile cap is installed over the shaft of the 1-1/2" or 1-3/4" square bar torque anchor™ shaft, then tapped with a hammer, if necessary, until the pile shaft contacts the bearing plate of the pile cap. Install the face plates over the studs on either side of the utility bracket and secure with nuts.

Install the appropriate lift assembly on top of the utility bracket and place a hydraulic ram between the lift assembly and the pile cap. Maneuver the bracket into place under the footing and activate the hydraulic ram with a hand pump to bring the bearing plate of the utility bracket in contact with the previously prepared area at the bottom of the footing or grade beam.

If careful inspection reveals that the vertical mounting plate and horizontal bearing plate of the utility bracket evenly bears across the entire bottom of the footing and against the vertical face of the foundation, then activate the cylinder to provide a snug temporary load that provides for solid, even bearing between the utility bracket and the footing. Drill and install two 1/2" x 7" long concrete anchors, flat washers and hex nuts to secure the utility bracket in position.

If the bracket does not evenly bear upon the foundation element, then remove the assembly and perform further preparation work. If only minor correction is required, lower the bracket about two inches and place quick setting, high strength grout on the bearing plate and realign the utility bracket. Carefully check alignment and for proper bearing between the utility bracket and the bottom of the footing, plus verify proper contact between the utility bracket and the vertical face of the foundation. Activate the cylinder to provide a load for solid, even bearing between the utility bracket and the footing. Drill and install concrete anchors, flat washers and hex nuts to secure the bracket in position. After the grout sets continue with the restoration.

#### **4.08 Load Transfer**

Transfer the structural load to the torque anchors™ uniformly and evenly by activating many hydraulic rams simultaneously. Each utility bracket shall have a lifting assembly and a 25-ton ram placed between each tee-tube assembly and lift assembly. Each of these rams shall be connected through a cut-off valve to one or more manifolds, gauge, and hydraulic hand pump systems. As the hand pump is actuated, force is applied to the pile caps. As the load is transferred from the foundation to the torque anchors™, the interior and exterior of the structure must be carefully monitored to insure that the restoration occurs to plan and the structure is stabilized or lifted to the design elevation. As each placement reaches the desired load and/or elevation, the cut-off valve for the ram on the torque anchor™ is closed and the pressure recorded. Advance the hex nuts that are located above the pile caps down to the surface of the holding cap plate and secure the hex nuts with a wrench.

Remove the lift assemblies, hydraulic rams and lifting hydraulics from each placement. Clean all hydraulics, replace dust caps on the hydraulic couplings and store the equipment in a clean, dry environment.

#### **4.09 Void Filling (Optional – Depending upon the type of foundation, type of soil and amount of lift)**

After the structural restoration is complete, the void created between the foundation and soil shall be filled with grout. The grouting material may consist of many different components depending upon the soil conditions; generally, a lean 2-1/2 sack soil/cement mix is acceptable in most places. The contractor shall inject the grout under the structure in a manner that fills the voids without creating air pockets. Any injection holes shall be repaired using high strength no shrink grout to a finish similar to the existing concrete after the void filling operation is complete. The plumbing system must be monitored before, during and after the grout injection. Any problems must be reported and corrected immediately.

#### **4.10 Backfill and Cleanup**

Remove all scrap and other construction debris from the site. Remove all tools and equipment, clean them and store them.

The excavations shall now be backfilled using the soil that was removed and stored nearby. The backfill shall be placed into the holes in small lifts of 6" to 8" and then properly tamped to achieve maximum density. After the backfilling operation is complete, the soil at the perimeter must have a positive slope away from the perimeter of the foundation.

Dispose of all construction in a safe and legal manner.

### **END OF SPECIFICATION**

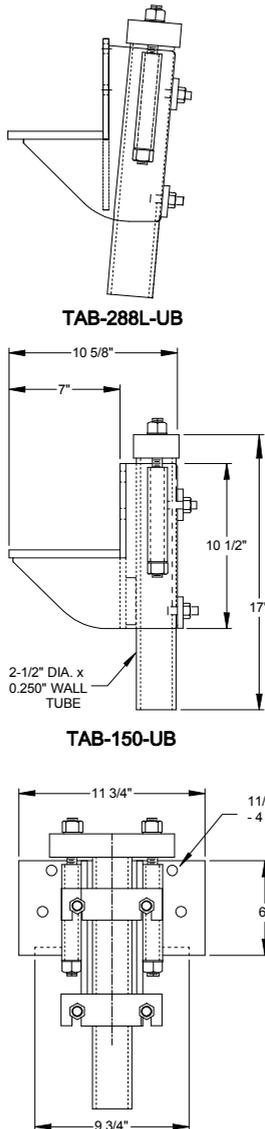
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# TAB-UB Utility Bracket

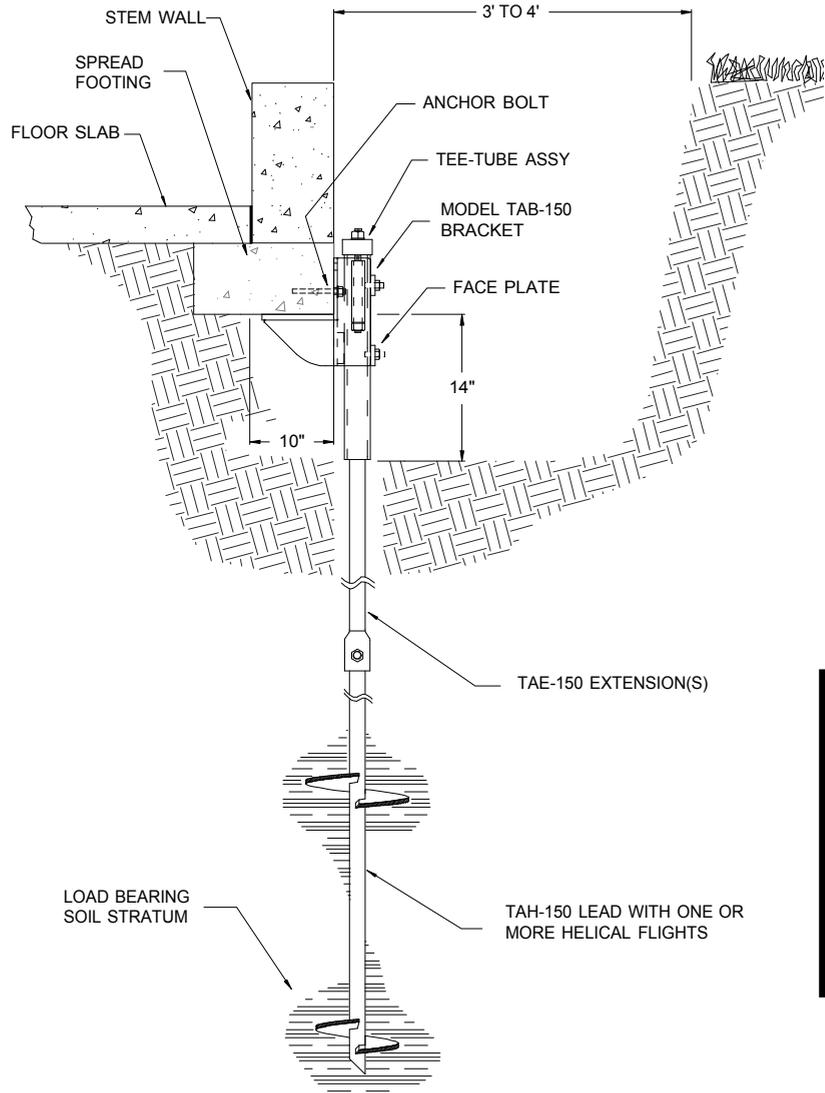
Model TAB-150-UB -- Fits 1-1/2" Solid Square Shaft

Model TAB-288L-UB -- Fits 2-7/8" Diameter x 0.203 Tubular Shaft

- 40,000 Pounds Ultimate Capacity
- 68 Square Inches Bearing Surface
- Standard Lift – 4"
- Fully Adjustable Lift
- Installs With Portable Equipment
- Installed With Little or No Vibration
- Installs Below The Unstable and Sinking Soil To Firm Bearing
- Easily Adjusted if Load or Soil Conditions Change



**TAB-150-UB (Sq. Shaft) &  
TAB-288L-UB (Tubular Shaft)  
Utility Bracket Details**



**TAB-150-UB Utility Bracket  
Application Drawing**

Earth Contact Products, LLC reserves the right to change design features, specifications and products without notice, consistent with our efforts toward continuous product improvement. Please check with Earth Contact Products at 972 480-0007 or 913 393-0007 to verify that you are using the most recent specifications.



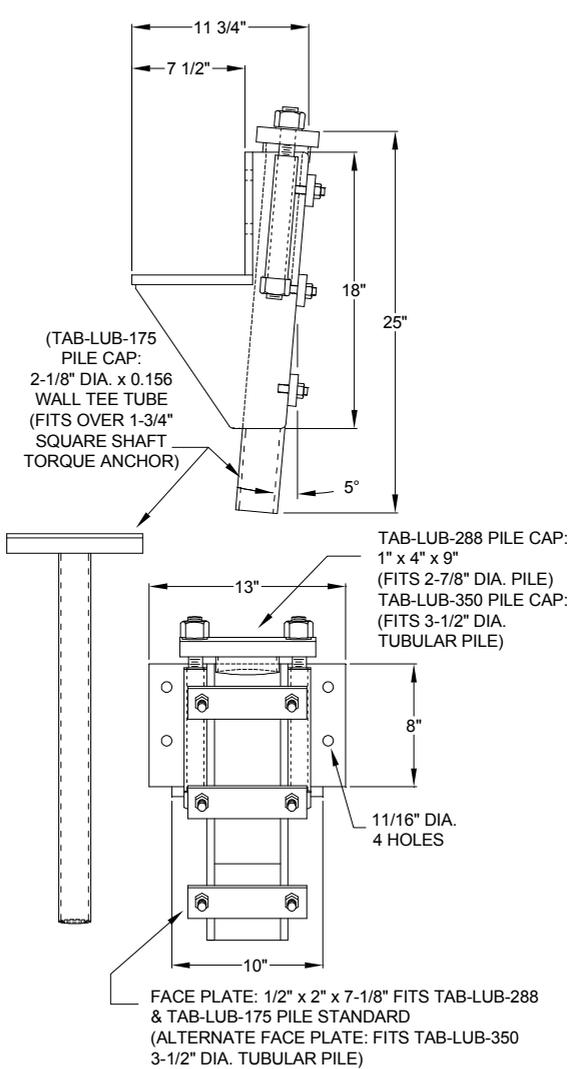
# TAB-LUB Large Utility Bracket

**Model TAB-288-LUB -- Fits 2-7/8" Diameter x 0.262 Tubular – 98,000 lb. Ultimate Capacity**

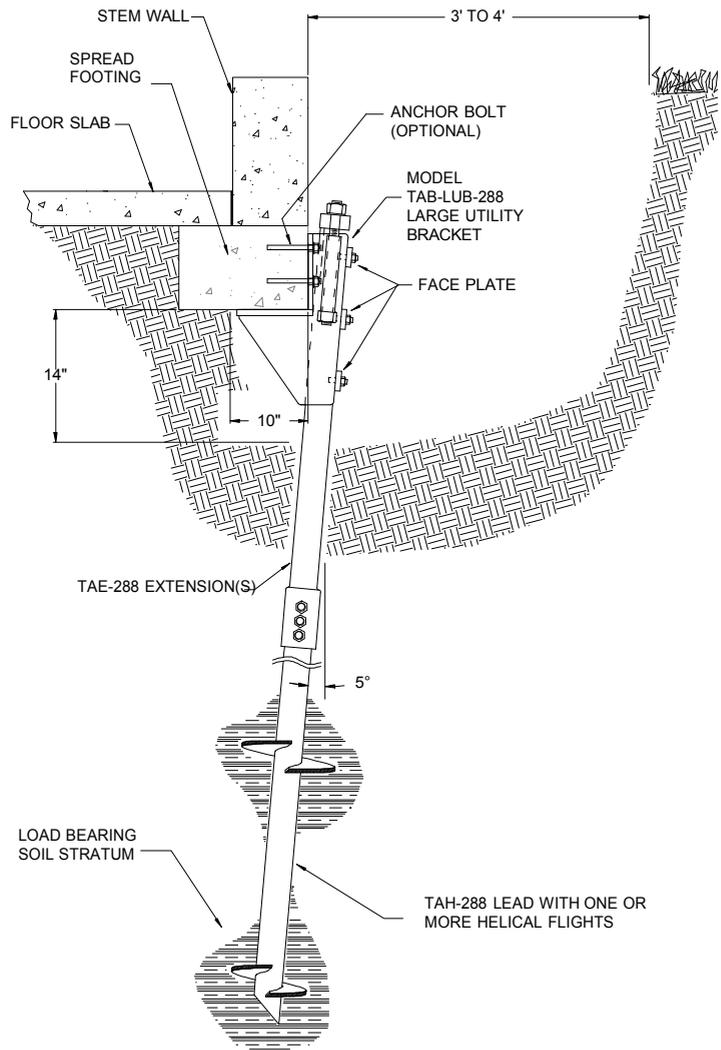
**Model TAB-350-LUB -- Fits 3-1/2" Diameter x 0.300 Tubular – 98,000 lb. Ultimate Capacity**

**Model TAB-175-LUB -- Fits 1-3/4" Solid Square Bar – 60,000 lb. Ultimate Capacity**

- Unlimited Lift Range – 5-1/2" Standard
- Up to 98,000 lb. Ultimate Capacity
- 75 Square Inches Bearing Surface
- Installs With Little or No Vibration
- Installs Below Unstable and Sinking Soil To Firm Bearing
- Easily Adjusted if Load or Soil Conditions Change



**Model TAB-LUB Large Utility Bracket Details**



**Model TAB-288-LUB Large Utility Bracket Application Drawing**



*The capacity of the TAB-LUB foundation support system is a function of the capacity of torque anchor™ shaft, helical plate(s), bearing stratum, foundation bracket, foundation strength and strength of the bracket to foundation connection. Actual capacities could be lower than the bracket capacity*

# TYPICAL SPECIFICATION

## ECP Helical Torque Anchor™ Tieback Systems

### Section 1- General

#### 1.01 Typical Installation Scope

Furnish labor, equipment, tools and material to install Helical Torque Anchor™ Tiebacks as described in this specification in a workmanlike manner and to design criteria. All work shall be performed in accordance with all applicable safety codes in effect at the time of installation. Only skilled, experienced workers, who are familiar with the requirements and procedures necessary to properly and safely accomplish the work outlined in this specification, shall be employed.

1. Prepare site for safe working conditions.
2. Thoroughly investigate the site for any and all underground utilities before excavating.
3. Excavate and/or core drill as required for installation of the product.
4. Install ECP Helical Torque Anchor™ to the installation angle, depth and torque specifications
5. Install the Transition, All Threaded Bar, Plate Washer, Bevel Washer and Wall Plate as required
6. Load test as required to verify design and capacity
7. Remove equipment from work area and clean work areas

#### 1.02 Installation Plan

The torque anchors shall be installed as shown on the written repair plan that was prepared by the engineer or the installer and submitted to the owner or their representative. The plan shall include, but not be limited to:

1. Size and number of placements
2. Helical plate configuration on the helical torque anchor™ tieback
3. Spacing between helical torque anchors™, installation angle, and minimum length of the anchor
4. Vertical spacing(s) on the wall
5. Minimum target torque requirement
6. Load testing requirements

#### 1.03 Delivery, Storage and Handling

All foundation repair products, tools and equipment shall be handled and transported with care to prevent any damage or deformation. Hydraulic components shall be protected from the weather and kept clean of any dust, dirt, mud or debris.

### Section 2 - Product Material

#### 2.01 Torque Anchors Selection

Each helical torque anchor shall be manufactured from round corner square solid steel bar or structural tubing.

##### 2.011 Shaft Material

###### 2.0111 Solid Square Bar

The round corner high strength solid square bar shall conform to ASTM A29. Yield strength of the bars shall be 90,000 psi.

- 1-1/2" square bar with a torque limit of 7,500 ft-lb
- 1-3/4" square bar with a torque limit of 11,000 ft-lb and
- 2-1/4" square bar with a torque limit of 23,000 ft-lb

###### 2.0112 Tubular Shaft

The tubular shafts shall conform to ASTM A500 with a minimum yield of 50,000 psi, or A513 Type 5 with a minimum yield of 70,000 psi.

Helical Torque Anchor™ sizes available:

- 2-7/8" diameter x 0.262 wall thickness tubing, with a torque limit of 9,500 ft-lb
- 3-1/2" diameter x 0.300 wall thickness tubing, with a torque limit of 13,000 ft-lb
- 4-1/2" diameter x 0.337 wall thickness tubing, with a torque limit of 22,000 ft-lb

##### 2.012 Leads

Each lead section shall have a 45-degree bevel to aid in starting the helical torque anchor™. The other end shall have one or more holes to attach an Extension Sections. Leads may be 10", 5', 7', or 10' long depending upon the application. Welded to the Lead shall be one or more ASTM A572 Grade 50 or 80 round steel plates with specified thickness of either 3/8 or 1/2 inch, and a 3-inch helical pitch on the circumference. Helical plate diameter shall be specified in any combination of equal or increasing diameters from 6 inches to 16 inches, in 2-inch increments.

If the design calls for the pier to be filled with grout under pressure, the lead shall have 9/16-inch diameter holes at 24 inches on center for use when grouting the torque anchor.

### **2.013 Hot Forged Extensions**

Extensions with 1-1/2" square bar, 1-3/4" square bar, and 2-7/8" diameter x 0.262 wall tubing shall have hot forged integral coupling feature. The Extension may be specified as 1-1/2', 3', 5', 7' or 10' long as required by the application. Both ends of the Extension Section shall have one or more bolt holes for attachment to a previous section of torque anchor shaft. The opposite end of the extension shall have an expanded hot forged female receiver that will fit over the standard size shaft of an extension or lead. The hot forged extension shall be supplied with attachment hardware.

In higher load capacity projects or in very weak soil conditions, the hot forge extension may have one or more ASTM A572 Grade 80 round steel plates with specified thickness of either 3/8 or 1/2 inch, and a 3-inch helical pitch on the circumference. Helical plate diameter shall be specified in any combination of equal or increasing diameters from 6 inches to 16 inches, in 2-inch increments.

### **2.014 Coupled Extensions**

#### **2.0141 2-1/4" Square Bar Coupled Extensions**

Extensions fabricated from 2-1/4" round corner solid square bar shall use a separate mechanical coupler. The Extension may be specified as 3', 5', 7' or 10' long as required by the application. Both ends of the Extension Section shall have two 1-1/8" diameter bolt holes for attachment to a previous section of torque anchor shaft. Each extension shall be supplied with a coupler fabricated from class 90/60 grade SC8630 steel casting. Each coupler shall have four holes that match to the extension and shall be supplied with 1" diameter attachment hardware.

#### **2.0142 Tubular Coupled Extensions**

Extensions fabricated from 3-1/2" diameter x 0.300 wall tubing or 4-1/2" diameter x 0.337 wall tubing shall use a separate mechanical coupler. The Extension may be specified as 3', 5', 7' or 10' long as required by the application. Both ends of the Extension Section shall have three bolt holes for attachment to a previous section of torque anchor shaft. Each extension shall be supplied with a coupler fabricated from 2-3/4" diameter x 0.375 wall tubing or 3-5/8" diameter x 0.375 wall tubing conforming to ASTM A513. Each coupler shall have six holes that match to the extension and shall be supplied with attachment hardware.

### **2.015 Attachment Hardware**

Each extension shall be supplied with the appropriate quantity of SAE J429 Grade 8 bolts and nuts having a minimum ultimate tensile strength of 150,000 psi and a minimum yield of 130,000 psi. Bolt lengths range from 3" to 5-1/2".

## **2.02 Tieback Termination**

### **2.021 Transition (Tieback and Other Tension Applications)**

The transition is a component that attaches to one end the helical torque anchor™ and the other end has a threaded socket to accept an all thread bar or bolt.

#### **2.0221 1-1/2" and 1-3/4" Square Bar Transitions**

The square bar transition is a welded assembly 3/8" or 1/2" thick steel plates. The plates are welded together to fit over the solid square torque anchor shaft. The other end of the transition shall have a captive welded nut of suitable size and strength to match the specified attachment hardware or design load.

#### **2.0222 Tubular Transition**

The tubular shaft transition is a welded assembly of tubular sleeves and 3/8" to 3/4" thick steel plates. The plates are welded to a sleeve designed to fit over or inside the tubular anchor shaft and secured with two SAE J429 grade 8 bolts and nuts. The one end of the transition shall have a captive welded nut of suitable size and strength to match the specified attachment hardware or design load.

### **2.022 Continuously Threaded Bar**

A continuously threaded bar provides the attachment between the transition and the wall attachment system. The continuously threaded bar shall be a threaded steel bar of specified diameter and length depending upon the application and loading. The bar shall meet ASTM A615 Grade 75, or 1" diameter B-12 Coil Rod for light duty applications using the 1-1/2" square shaft and having a maximum working load of 38,000 lb.

### **2.023 Plate Washers & Bevel Washers**

The plate washer consists of a rectangular piece of 3/8" to 1/2" thick steel plate with a hole in the center to accept the threaded bar from the transition. The plate washer generally is positioned between wall plate and bevel washer. The size and thickness of the plate washer shall be as determined by the application. As tieback anchors are usually installed with a downward angle between 15° and 30°, there is a need for a bevel washer to transmit the loading from the plate washer to the nut on the all thread shaft. The bevel washer shall be fabricated from thick wall structural tubing with inside diameter suitable to accept the all threaded bar. One end of the tube shall be cut perpendicular to the axis of the tube and the other shall have a taper angle to match the downward installation angle of the tieback shaft. Steel to conform to ASTM A-500.

## 2.024 Wall Plate

### 2.0241 Wall Plate

The wall plate is installed between the plate washer and the wall support structure. The wall plate shall be fabricated from 3/4 inch thick plate conforming to ASTM A572 with a mounting hole in the center to accept the threaded bar. The size of the wall plate is determined by the load and the attachment system at the wall.

### 2.0242 Basement Wall Plate

The wall plate is designed to spread the load of a helical torque anchor™ across the wall area where the anchor penetrates the wall. The wall plates may be either 11" x 18" or 12" x 24" and formed from 10 gauge hot rolled steel plate. Stiffness of the plate shall be accomplished by two reinforced ribs formed into the plate and by a 4" x 4" x 10 gauge washer that mounts on the treaded bar in front of the wall plate. Components shall be hot dip galvanized.

## 2.05 Weldments

All welded connections shall conform to the requirements of the American Welding Society, "Structural Welding Code AWS.01.1" and applicable revisions.

## 2.06 Corrosion Protection

ECP Torque Anchors™ shall be supplied with hot dipped zinc galvanized corrosion protection per ASTM A123 Grade 100 and applicable revisions.

## Section 3 – Tools and Equipment

### 3.01 Hydraulic Gear Motor

A hydraulic gear motor is required to install the helical torque anchor™ to the desired torque and depth. The capacity of the gear motor generally will range between 2,000 to 30,000 foot-pounds, depending upon the soil conditions and torque anchor configuration and shall be fully reversible. The installation torque rating of the hydraulic gear motor shall be at least 25 percent higher than the planned installation torque. Rotation shall range between 5 and 20 revolutions per minute.

### 3.02 Torque Monitoring Device

The installation torque applied to the helical torque anchor™ shall be monitored continuously during installation. The torque monitoring device may be a part of the installing unit or may be a device in line with the hydraulics. Accuracy of the torque monitoring device shall be insured by having calibration data available for review by the engineer or the owner's representative.

### 3.03 Tooling

The hydraulic torque motor must be firmly mounted to machinery capable of positioning the torque anchor at the proper angle and capable of providing proper installation force (crowd) to advance the torque anchor. Adapters used to connect the motor to the helical torque anchor™ shall have a capacity exceeding the torque required to install the anchor and shall be mechanically connected to the anchor during installation.

### 3.04 Hand Pump

The hand pump assembly shall provide two stages of displacement at pressures up to 10,000 psi. Below 400 psi the displacement shall be 2.4 in<sup>3</sup> per stroke and above 400 psi, 0.15 in<sup>3</sup>. (Enerpac P-801 or equal)

### 3.05 Pressure Gauges

A pressure gauge shall be provided to monitor the lifting force applied to the structure during restoration. The pressure gauge shall be capable of measuring 0 – 10,000 psi with a minimum gauge face of 2-1/2" and minor graduations of 200 psi. (Enerpac G2535L or equal)

### 3.06 Single Acting Hollow Plunger Hydraulic Ram

A single acting center hole hydraulic ram shall be used during the load transfer phase when preloading a tension application or when performing a tension load test. The hydraulic cylinder shall be rated at 10,000 psi of hydraulic pressure and have heavy duty return springs. The capacity and stroke of the cylinder shall be determined by the application.

## Section 4 – Helical Torque Anchor™ Installation

The following specification contains the major steps to be undertaken to install helical Torque Anchor™ Tiebacks. Variations may occur depending upon the application and the type of structural support required.



### Warnings:

#### Utilities:

**Thoroughly investigate the job site for the possible existence and location of all underground utilities before proceeding. Avoid all contact with ALL underground utilities!**

- Excavations:** Collapsing soil can be dangerous. Follow OSHA requirements at all times. Do not enter any excavation if there are any questions about the stability of the soil.
- Hazardous Machinery:** The use and operation of hydraulic gear motors can be very hazardous due to the power of the motor. The torsional forces developed during operation can be extreme resulting in breakage of product and equipment. The transfer of these forces may be extremely quick leaving little or no time for personnel to react and/or avoid contact. Under no circumstances should the equipment be operated without proper training in procedures and knowledge of product capabilities. Do not allow observers close to the equipment during operation.
- Reaction Bar:** An unmovable object must be used when restraining a reaction bar. The reaction bar must be firmly secured against movements in all directions. Never stand close to or on a reaction bar during installation.
- Heavy Lifting:** Many pieces of equipment used to install steel foundation underpinning are very heavy. Use proper lifting techniques, back supports, and help from others when lifting heavy objects.



**Warning!**

**FAILURE TO HEED THESE WARNINGS, OR TO FOLLOW SAFE WORK HABITS, OR IMPROPER USE OF THE EQUIPMENT AND MATERIALS MAY RESULT IN LIFE THREATENING SITUATIONS, BODILY INJURY AND/OR PROPERTY DAMAGE!**

**4.01 Preparation**

Depending upon the application, access may be required to install the lead section from behind the wall, in which case an excavation of suitable size and depth shall be dug at the proposed tieback installation. The wall shall be core drilled to a suitable size to clear the tieback shaft and attachment hardware, or when the entire system is to be installed through the wall; the core drilled hole shall be no smaller than the diameter of the largest helical plate on the tieback shaft.

**4.02 Torque Anchor™ Installation**

The hydraulic installation motor shall be installed to portable equipment or to a suitable machine capable providing the proper installation angle and with sufficient lateral force (crowd). The opposite end shall be attached to the hydraulic installation motor with a pin(s) and retaining clip(s).

If using portable equipment, the torque reaction bar MUST be properly secured against movements in all directions. Torque Anchor™ lead sections shall be placed at the locations indicated on the plans. The lead section shall be advanced into the soil in a smooth and continuous manner using sufficient lateral force for uniform advancement. The installer shall have knowledge of the desired pressure differential that will produce the desired terminal installation torque approved by the engineer at the required minimum embedment before beginning the installation.

Once the lead is installed, the motor shall be unpinned from the lead. One or more extensions shall be installed and securely bolted in place with the hardware supplied by the manufacturer.

- The hot forged coupling on the 1-1/2" solid square shaft, the 1-3/4" solid square shaft, and 2-7/8" diameter tubular sections shall be placed over the top of the previous section of torque anchor™ and secured with the high strength bolt(s) and nut(s) supplied by the manufacturer.
- The 2-1/4" solid shaft, 3-1/2" diameter x 0.300 wall thickness tubular and 4-1/2" diameter x 0.337 wall tubular products are connected with a separate coupler. The coupler either fits over the solid shaft and is secured with four high strength bolts and nuts or within the tubular section and shall be secured using six high strength bolts and nuts. Hardware shall be supplied by the manufacturer.

The torque anchor™ shall be continue to be driven to the average design torsion is achieved, and the end of the torque anchor™ is at the design embedment length and depth. Once the design torque at the design depth has been achieved, the installation motor shall be removed from the torque anchor™.

**4.03 Installation Requirements**

**4.031** The minimum average installation torque and the minimum length shown on the plans shall be satisfied prior to termination the installation. The installation torque shall be as specified or higher during a minimum of the last three feet of installation.

**4.032** The torsional strength rating of the torque anchor™ shall not be exceeded during installation. If the torsional strength limit for the torque anchor™ has been reached, but the anchor has not reached the target depth, do the following:

- 4.0321** If the torsional strength limit is achieved prior to reaching the target depth, the installation may be acceptable, but it must be reviewed and approved by the engineer and/or owner's representative.

**4.0322** The installer may remove the torque anchor™ and install a new one with fewer and/or smaller diameter helical plates with the review and approval by the engineer and/or owner's representative.

**4.033** If the target embedment is achieved, but the torsional requirement has not been met; the installer may do one of the following subject to the review and approval of the engineer and/or owner:

**4.0331** Install the torque anchor™ deeper to obtain the required installation torsion.

**4.0332** The installer may remove the torque anchor™ and install a new one with an additional helical plate and/or larger diameter helical plates.

**4.0333** Reduce the load capacity of the placement and provide additional helical torque anchors™ to achieve the required total support for the project.

**4.034** If the torque anchor™ hits an obstruction or is deflected from its intended path, the installation shall be terminated and the anchor removed. Either the obstruction must be removed or the torque anchor™ relocated as directed by the engineer and/or owner.

**4.035** In no case shall a torque anchor™ be backed out and reinstalled to the same depth. If an anchor must be removed for any reason, it must be installed to a minimum additional embedment of three feet.

#### **4.04 Torque Anchor™ Length Adjustment**

After meeting the installation requirements, the installer may remove the final plain extension section and replace it with a shorter one to obtain the design position to accept the transition, or he may continue to install the tieback to a suitable position provided that the torsion remain as good or higher than required by the design. It is not permissible to reverse the installation to reach the desired coupling elevation.

#### **4.05 Torque Anchor™ Termination**

The transition is used mainly for tieback applications, but it is sometimes used for equipment anchorage. The transition shall be bolted to the end of the torque anchor™ using the hardware supplied by the manufacturer. All thread bar is attached between the transition and the wall plate, equipment base, or cable eye. If required, the installer may place a center hole ram over the all thread bars to preload wall plates as specified. The wall plate nuts shall then be tightened securely to maintain the preload. In less critical applications the wall plate nuts may be tightened to a torque specified by the engineer or owner.

#### **4.06 Load Testing**

The engineer and/or owner shall determine if a load test is required, the number of load tests required, locations for the test(s) and acceptable load and movement criteria. The load test(s) shall be in general conformance with ASTM D-1143.

##### **4.061 Equipment**

The load test equipment shall be capable of imposing incrementally increasing and decreasing loads on the production tieback anchor. The system shall use a center hole ram to impose the test load on the tieback. The test components shall also be assembled to minimize any eccentric loading. The hydraulic ram shall be capable of exerting at least 1-1/2 times the anticipated design tension load and have a stroke longer than the anticipated movement during the test. Pressure gauges shall be calibrated in 100 psi increments or less. Dial indicators with an accuracy of +/- 0.001" shall be used subject to engineer and/or owner approval.

All equipment used for load testing shall have been calibrated within one year of the test and subject to retest at the request of the engineer and/or owner if there is any concern or doubt about the accuracy of any component.

##### **4.062 Procedure**

###### **4.0621 Alignment Load**

An alignment load of no more than 10 percent of the design load shall be applied to the tieback anchor prior to setting the deflection measuring equipment to zero or to the reference length. Once complete, the apparatus shall be checked for alignment and safety.

###### **4.0622 Incremental Load Test**

The tension load test shall be conducted in an incremental fashion. The increments shall be 20 percent of the design load or as specified by the engineer and/or owner. Movement of the end of the anchor shall be recorded at the beginning of each increment and after time intervals. Recommended intervals are 1/2 minute, 1 minute, 5, minutes, 10 minutes and 20 minutes. The monitoring may be stopped if the recorded movement is less than 0.002" per minute measured over a minimum of 5 minutes.

###### **4.0623 Test Termination**

Load test increments shall continue to be applied until the load equals 125 to 150 percent of the design load, or if the deflection exceeds the criterion established by the engineer and/or owner prior to running the test, or if continuous jacking is required to maintain the load increment.

###### **4.0624 Unloading**

The applied axial test load shall be removed until the design load is reached and the tieback anchor nut shall be install snug to the bevel washer, plate washer and wall plate.

###### **4.0625 Documentation**

The field test data shall be collected and compiled into an easy to read report and submitted to the engineer and/or owner for review and approval.

#### 4.07 Documentation

The installer shall carefully monitor the torque applied to the anchor as it is installed. It is recommended that the installation torque be recorded at one foot intervals, but should never exceed every two feet. The data may be collected from electronic torsion monitoring equipment that has been calibrated to the installation motor being used. Installation torque may also be monitored by noting the differential pressure across the installation motor and determining the torque from the manufacturer's published torque curves.

At the conclusion of the installation, the raw field data shall be converted into an installation report that includes the location of each placement, the installation angle, the installed length, the averaged torsion over the final three feet of installation, the working load placed on each placement after installation. Usually the tiebacks are not 100% load tested. The anchors that were tested should be flagged and the details of the test reported.

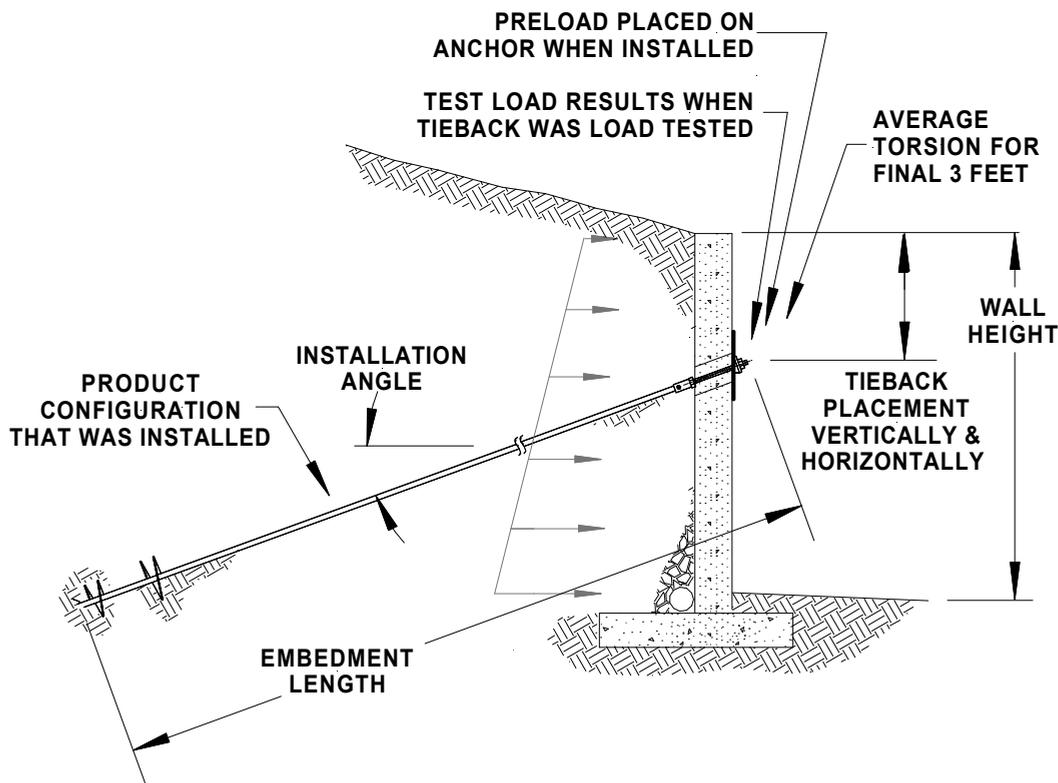
#### 4.08 Cleanup

Remove all scrap and other construction debris from the site. Remove all tools and equipment, clean them and store them. Any disturbed soils in the area of work shall be restored to the dimensions and condition specified by the engineer and/or owner.

Dispose of all construction in a safe and legal manner.

### END OF SPECIFICATION

*Earth Contact Products, LLC reserves the right to change design features, specifications and products without notice, consistent with our efforts toward continuous product improvement. Please check with Earth Contact Products at 972 480-0007 or 913 393-0007 to verify that you are using the most recent specifications.*



We recommend documenting the items that are shown above on any Torque Anchor™ tieback project.

# TYPICAL SPECIFICATION ECP Torque Anchor™ Soil Nails

## Section 1 - General

### 1.01 Typical Installation Scope

This work consists of furnishing labor, tools, equipment and materials associated with the preparation and installation of a soil nail system for lateral support of soil with or without surface surcharge loads according to the specifications contained herein. The work includes, but is not limited to, the following:

1. Diligent investigation of the possible existence and location of underground utilities situated at or near the area of work;
2. First incremental excavation to a depth of one foot below the proposed elevation of the first row of Soil Nails. The application of a flash coat of Shotcrete (if required by soil conditions);
3. Installation of the first row of ECP Torque Anchor™ Soil Nails to the required installation length;
4. Installation of Shotcrete to one-half specified face wall thickness;
5. Installation of the steel Welded Wire Mesh reinforcement to the wet Shotcrete, installation of Wall Plate Assembly to the Soil Nail and any additional steel reinforcing;
6. Installation of final coating of Shotcrete to the specified thickness;
7. Next incremental excavation, flash coat of Shotcrete (if required) and soil mass stabilization as itemized in items 6 through 9;
8. Clean up.

### 1.02 Installation Plan

The torque anchors shall be installed as shown on the written repair plan that was prepared by the engineer or the installer and submitted to the owner or their representative. The plan shall include, but not be limited to:

1. Sizes and number of placements at each row
2. Spacing between torque anchor™ Soil Nail placements, installation angle, and minimum length
3. Vertical spacing(s) on the wall

### 1.03 Delivery, Storage and Handling

All products shall be handled and transported carefully to prevent any deformation or damage. Care should be taken to prevent the accumulation of dirt, mud or other foreign matter on the steel materials. Such accumulation shall be completely removed prior to installation.

## Section 2 - Product Material

### 2.01 Helical Soil Nail

#### 2.011 Lead Section

The lead Section consists of a round corner square hot rolled steel lead section conforming to ASTM A29. The shaft may be specified in sizes 1-1/2 or 1-3/4 inches square. The length of the Lead Section shall be specified 5'-0" or 7'-0" feet long as required by the application. One end of the Lead Section shall have a 45-degree bevel to aid in starting the Soil Nail. The other end shall have one hole to receive an attachment bolt. Welded to the Lead Section shall be several 3/8" thick ASTM A570 Grade 50 steel helical plates spaced evenly along the shaft at approximately 29 inches. Plates shall have a diameter of 6" or 8" with a 3-inch pitch.

#### 2.012 Extension Section

The standard Extension Section shall be a welded assembly consisting of round corner square hot rolled steel section conforming to ASTM A29. The shaft may be specified in sizes 1-1/2 or 1-3/4 inches square. The length of the Extension Section shall be specified at 5'-0" or 7'-0" feet long as required by the application. One end of the Extension Section shall have an integral forged coupling that fits over the end of the previous shaft with one hole to receive an attachment bolt. The coupling shall be supplied with one SAE J429 bolt and nut. The other end of the Extension Section shall have one hole to receive an attachment bolt. Welded to the Extension Section shall be several 3/8" thick ASTM A570 Grade 50 steel helical plates spaced along the shaft at approximately 29 inches. Plates shall have a diameter of 6" or 8" and a 3-inch pitch.

### 2.02 Wall Plate

#### 2.021 Wall Plate with Rebar

The Wall Plate with Rebar is a welded assembly consisting of a 3/8" x 6" x 6" steel plate with a hole located in the center to accept either a 1-1/2" or 1-3/4" square bar. Welded to plate shall be a square array of four pieces #4 grade

60 steel reinforcing bar, 36" long. The bars shall be spaced at 4" on center each way to form a cross configuration; or as specified by the engineer. Part number designations: TAS-150 WPR 3/8 (6x6) or TAS-175 WPR 3/8 (6x6).

#### **2.022 Wall Plate**

The Wall Plate consists of a 1/2" thick x 12" x 12" steel plate, ASTM A36. In the center of the plate shall be a hole to accept either a 1-1/2" or 1-3/4" square bar; or as specified by the engineer. Part number designations: TAS-150 WP 1/2 (12x12) or TAS-175 WP 1/2 (12x12).

#### **2.03 Steel Mesh Reinforcement**

Steel Welded Wire Fabric shall be used for concrete reinforcement between Soil Nail placements. The fabric shall be WWM 6 x 6 W2.9 or WWM 6 x 6 W1.4 steel wire mesh; or as specified by the engineer.

#### **2.04 Shotcrete**

Shotcrete is concrete or mortar that is projected on to the vertical cut surface at high velocity. The shotcrete shall consist of Cement per AASHTO M85/ASTM C150, Type I, II, III or IV; water and fine aggregate of particles less than 3/4-inch sieve size with the majority of the aggregate classified as sand size per AASHTO M6/ASTM C33. Shotcrete shall be designed to provide good pumping qualities and proper adhesion. Placement properties are provided in FHWA-SA-96-069, Manual for Design and Construction Monitoring of Soil Nail Walls, November 1996.

##### **2.041 Aggregate Ratio**

- A. Sand: (1/4 inch (6 mm) minus): 60% by weight
- B. Coarse Aggregate: (3/4 inch 19 Maximum size): 40% by weight

##### **2.042 Cement and Accelerator**

- A. Cement: 650 to 700 lb/yd<sup>3</sup> (385 to 415 kg/m<sup>3</sup>)
- B. Accelerator: 3% to 4% by weight of cement quantity

##### **2.043 Water**

Water-Cement ratio shall be 0.38 to 0.45 by weight

##### **2.044 Design Properties**

- A. Compressive Strength at 8-hours = 1,000 lb/in<sup>2</sup>
- B. Compressive Strength at 7-days = 2,500 lb/in<sup>2</sup>
- C. Compressive Strength at 28-days = 3,000 lb/in<sup>2</sup>

#### **2.05 Weldments**

All welded connections shall conform to the requirements of the American Welding Society, "Structural Welding Code, AWS D1.1" and applicable revisions.

### **Section 3 – Tools and Equipment**

#### **3.01 Hydraulic Gear Motor**

A hydraulic gear motor is required to install the helical torque anchor™ to the desired torque and depth. The capacity of the gear motor generally will range between 2,000 to 10,000 foot-pounds, depending upon the soil conditions and torque anchor configuration and shall be fully reversible. The installation torque rating of the hydraulic gear motor shall be at least 25 percent higher than the planned installation torque. Rotation shall range between 5 and 20 revolutions per minute.

#### **3.02 Torque Monitoring Device**

The installation torque applied to the helical torque anchor™ shall be monitored continuously during installation. The torque monitoring device may be a part of the installing unit or may be a device in line with the hydraulics. Accuracy of the torque monitoring device shall be insured by having calibration data available for review by the engineer or the owner's representative.

#### **3.03 Tooling**

The hydraulic torque motor must be firmly mounted to machinery capable of positioning the torque anchor at the proper angle and capable of providing proper installation force (crowd) to advance the torque anchor. Adapters used to connect the motor to the helical torque anchor™ shall have a capacity exceeding the torque required to install the anchor and shall be mechanically connected to the anchor during installation.

### **Section 4 - Execution**

The following is intended to provide the controlling specification for the major steps undertaken in installation of the shoring system. Variations in the installation procedure may occur depending on the application, soils and the surcharge, if any.



#### **Warnings:**

**FAILURE TO HEED THESE WARNINGS, OR TO FOLLOW SAFE WORK HABITS, OR IMPROPER USE OF THE EQUIPMENT AND MATERIALS MAY RESULT IN LIFE THREATENING SITUATIONS, BODILY INJURY AND/OR PROPERTY DAMAGE!**

- DANGER!** Under no circumstances should these products or equipment be used without proper training in procedure and knowledge of product capacities. The use and operation of hydraulic gear motors can be **EXTREMELY HAZARDOUS** without proper training of field personnel. The torsional forces developed during installation can be extreme, resulting in possible breakage of materials and equipment. Rapid transfer of these forces to reaction assemblies can occur, leaving no time for personnel to avoid contact. **SERIOUS BODILY INJURY, PROPERTY DAMAGE AND POTENTIALLY LIFE THREATENING SITUATIONS CAN ARISE FROM IMPROPER USE OF EQUIPMENT AND MATERIALS USED IN THE INSTALLATION OF THESE PRODUCTS.**
- WARNING!** Thoroughly investigate the possible existence and location of all underground utilities situated at or near the area of work before proceeding. **SERIOUS INJURY MAY RESULT FROM FAILURE TO LOCATE AND AVOID CONTACT WITH ALL UNDERGROUND UTILITIES.**
- DANGER!** Inspect the site in the area of the proposed excavation for proper drainage. Surface water must not be allowed to collect anywhere near the area of work. Surface water must be directed away from the site by grading or other means. **STANDING WATER ON THE SURFACE BETWEEN THE SOIL NAILED WALL AND THE MOVEMENT PLANE MAY CAUSE UNEXPECTED FAILURE OF THE SYSTEM AND MAY RESULT IN SERIOUS BODILY INJURY, PROPERTY DAMAGE AND LIFE THREATENING SITUATIONS.**
- DANGER!** Collapsing soil can be dangerous. Follow OSHA requirements at all times. Do not enter any excavation if there are any questions about the stability of the soil.
- DANGER!** An unmovable object must be used when restraining a reaction bar. The reaction bar must be firmly secured against movements in all directions. Never stand close to or on a reaction bar during installation. **SERIOUS BODILY INJURY, PROPERTY DAMAGE AND POTENTIALLY LIFE THREATENING SITUATIONS CAN ARISE FROM IMPROPERLY SECURING A REACTION BAR.**
- WARNING!** Many pieces of equipment used to install steel foundation underpinning are very heavy. Use proper lifting techniques, back supports, and help from others when lifting heavy objects.

#### 4.01 Surcharge Stabilization (if required)

The Soil Nail system is designed to stabilize only the soil mass adjacent to a vertical cut excavation. If the site has a structure in close proximity to the proposed cut, a road, parking lot, etc; the surcharge load on the soil must be accounted for in the design of the Soil Nail system or the surcharge must be reduced prior to excavation and stabilization. Underpinning with an integrated Tieback Anchor is required whenever the surcharge load on the soil adjacent to the excavation is greater or equal to 4,000 pounds per lineal foot of perimeter foundation and/or the depth of the proposed cut is greater than 12 feet.

##### 4.011 Underpinning (if required)

The footing of the adjacent structure shall be underpinned with ECP Steel Piers™ Piers as specified by the design engineer. The Steel Piers shall be installed to a suitable bearing at a depth below the extent of the excavation. Pier Sleeving shall extend beyond the depth of the proposed excavation by at least 2 feet (minimum) with Sleeve joints offset to the Pier Pipe joints by at least 18 inches. The Pier Pipe at each placement shall be load tested to 150 per cent of the design load. After installing the Piers and prior to any additional work, each ECP Steel Pier™ shall be loaded to the project specified design load and locked off.

Preparation, installation, testing and loading of the ECP Steel Piers™ along with ECP Torque Anchor™ Tieback Adapter Assembly and ECP Torque Anchor™ Tiebacks shall be as specified in separate specifications in this chapter

##### 4.012 Integrated Tieback (if required)

If integral Torque Anchor™ Tiebacks are required on the project due to excessive depth of cut and/or heavy surcharge loads, a tieback anchor shall be installed at each underpinning location. The tieback must be installed to the proper installation angle, specified torque and target depth prior to the installation of the underpinning. The installation angle is critical due to the close proximity to the Soil Nails. The Torque Anchor™ Tiebacks are usually fabricated from 1-1/2

inch solid round corner square bars with one or more helical plates on the Lead Section. Because the design is site specific, each project will require slightly different configurations, depths, installation angles and torques.

Preparation, installation, and testing of the tieback anchors that are integrated to underpinning for lateral support shall be as specified separately as found later in this chapter.

#### **4.013 Attachment Of Tieback To Underpinning** (if required)

Following the Tieback and Underpinning installation, the Tieback shall be attached to the underpinning Pier Bracket. A Transition shall be installed to the end of the Tieback, which converts the square bar to a continuously threaded bar. The Tieback is secured to the Pier Bracket by means of a Tieback Adapter Assembly, which allows the all thread bar from the tieback to pass through the pier pipe. The Tieback shall be preloaded to the design load by applying the specified working load using a hydraulic ram or by applying a specified torque to the nut on the continuously threaded bar.

#### **4.02 Initial Excavation**

Upon the completion of the Underpinning and Tieback Anchor installations, load testing and preloading, if required, the initial excavation may commence. The depth of the excavation shall be no more than one-foot deeper than the specified depth to the first row of Soil Nails.

If the soils are generally cohesionless (sands, etc.) or there is any danger of the soil face sloughing off, a one-inch thick flash coat of Shotcrete shall immediately be placed against the face of the cut *as the excavation proceeds*. Fully trained and experienced operators shall install Shotcrete uniformly and with minimum of rebound and overspray. The same procedure shall be followed for subsequent incremental excavations.

If the cut soil is capable of standing by itself, then the first layer of Shotcrete (one-half of the total specified thickness) can be applied after the first incremental excavation is complete and Soil Nails installed. Under no circumstances should a cut of any height be left open at the face for more than two hours.

#### **4.03 Installation of the Soil Nail**

Each Soil Nail Lead Section is positioned with special attention given to the installation angle (usually between 5° and 15° from horizontal). In projects that include underpinning and tieback anchors to control surcharge loads, the Soil Nails are usually positioned adjacent to each underpinning Pier Pipe or as specified in the plans. The other end of the Soil Nail is coupled to the Hydraulic Gear Motor. The Soil Nail Lead is advanced into the soil until it reaches the target length and torque; or until the end of the shaft is near the cut face of the wall. If required, a Soil Nail Extension Section is attached to the Hydraulic Gear Motor's drive head and the other end of the Extension is connected to the Lead using a bolt and nut through the integral coupling. Additional Soil Nail Extension Sections are then installed as required. Driving shall cease when the end of the Soil Nail is located the proper distance from the exterior face of the wall to be retained. Do not exceed the maximum allowable shaft torsion of: 5,500 ft-lb – 1-1/2" square shaft; 11,000 ft-lb – 1-3/4" square shaft.

#### **4.04 Documentation**

The installer shall carefully monitor the torque applied to the Soil Nail System, the Tieback Anchors (if required) and the Underpinning driving pressures on the ECP Steel Piers™ (if required) as the products are installed. It is recommended that the Installation Torque be recorded at one-foot intervals, in no case should the measurements exceed every two feet unless directed otherwise by the Engineer. The driving force on the underpinning shall be recorded at the conclusion of driving each Pier Section (every 3-1/2 feet).

The form of the data may be from an electronic torque monitoring instrument that has been calibrated to the Torque Motor or the Installation Torque may be monitored by recording the differential pressure across the Torque motor. If this alternate method is selected, the installer must have available the torque curves for the selected Torque motor. At the specified intervals, the installer shall record the differential pressure across the ports of the Torque Motor. In addition, the installer shall know and have the desired terminal pressure differential approved by the Engineer prior to beginning the pier installation.

The underpinning installation force and load test forces shall be determined by multiplying the driving pressure and the effective driving cylinder area.

At the conclusion of the installation, the raw field data shall be converted to a Project Installation Summary. A copy of the Job Installation Summary shall be provided to the Engineer for review.

#### **4.05 Initial Shotcrete Installation**

Shotcrete shall be applied to the cut face to a thickness of one-half of the total specified Shotcrete thickness. This thickness shall include the flash coat Shotcrete, if installed earlier. Shotcrete shall be installed by fully trained and experienced operators uniformly and with minimum of rebound and overspray.

#### **4.06 Reinforcement**

Welded Wire Mesh Reinforcement shall be set against the face of the wet Shotcrete along the cut face of the wall. Excess reinforcement shall be provided at the bottom of the cut face and turned outward to allow for an 8" (minimum) overlap of

reinforcement on subsequent stages. This lower edge of reinforcement shall be protected from the shotcrete with a fabricated wooden mask or built-up soil.

The Wall Plate with Rebar or plain Wall Plat shall be installed over each Soil Nail Shaft and secured with a piece of #5 Rebar through the hole in the Soil Nail shaft. Any additional vertical reinforcing bars or horizontal walers shall be installed at this time.

#### 4.07 Final Shotcrete Installation

Shotcrete shall be placed on the cut face to create the total specified Shotcrete face wall thickness. Shotcrete shall be installed by fully trained and experienced operators uniformly and with minimum of rebound and overspray. Special care shall be taken to create a “notch” at the bottom of the excavation to allow for interlock for subsequent excavations and stabilization. The extra Welded Wire Mesh reinforcement at the bottom the excavation shall remain free of concrete.

In some instances, the designer will call for a steel wall plate to be situated at the outer limit of the Shotcrete wall. This may be set into the wet Shotcrete face wall at the finished thickness.



**WARNING! The soil slumps slightly as the Soil Nail Array is loaded after the installation sequence is complete. The elevation at the top of the excavation should be monitored prior to beginning a new cut and should be monitored periodically during work for signs of creep. COLLAPSING SOIL CAN BE DANGEROUS. FOLLOW OSHA REQUIREMENTS AT ALL TIMES. DO NOT ENTER ANY EXCAVATION IF THERE ARE ANY QUESTIONS ABOUT THE STABILITY OF THE SOIL.**

#### 4.08 Subsequent Excavations

Upon the completion of the current row of Soil Nailing, wall reinforcing and Shotcrete installation, subsequent excavations may commence after the Shotcrete face wall has been in place for at least 24 hours. The procedure shall be similar to that specified in paragraphs 4.02 through 4.04.

Following each subsequent incremental excavation, soil mass stabilization using Soil Nails, Reinforcement and Shotcrete shall be installed as specified in paragraphs 4.05 through 4.07 above.

#### 4.09 Clean Up

Once the site has been excavated and stabilized, all equipment shall be removed from the site. The site shall be left clean and neat. All construction debris and trash shall be removed from the site.

**END OF SPECIFICATION**

*Earth Contact Products, LLC reserves the right to change design features, specifications and products without notice, consistent with our efforts toward continuous product improvement. Please check with Earth Contact Products at 972 480-0007 or 913 393-0007 to verify that you are using the most recent specifications.*



# TYPICAL SPECIFICATION

## ECP Earth Plate Anchors

### Section 1- General

#### 1.01 Typical Installation Scope

Furnish labor, equipment, tools and material to install ECP Earth Plate Anchors as described in this specification in a workmanlike manner and to design criteria. All work shall be performed in accordance with all applicable safety codes in effect at the time of installation. Only skilled, experienced workers, who are familiar with the requirements and procedures necessary to properly and safely accomplish the work outlined in this specification, shall be employed.

1. Prepare site for safe working conditions.
2. Thoroughly investigate the site for any and all underground utilities before excavating.
3. Locate and install holes through basement or retaining wall
4. Carefully remove sod or paving and excavate holes for the plate earth anchors
5. Install anchor rod through the wall and into the plate earth anchor excavation
6. Placement of plate earth anchor into the excavation and attachment to the anchor rod
7. Installation the basement wall plate, washer and nut and tensioning the system
8. Remove equipment from work area and clean work areas

#### 1.02 Installation Plan

The plate earth anchors shall be installed as shown on the written repair plan that was prepared by an engineer or the installer and submitted to the owner or their representative. The plan shall include, but not be limited to:

1. Number of placements
2. Spacing between plate earth anchors
3. Minimum depth of embedment
4. Tensioning force

#### 1.03 Delivery, Storage and Handling

All foundation repair products, tools and equipment shall be handled and transported with care to prevent any damage or deformation.

### Section 2 - Product Material

#### 2.01 Earth Plate Anchor

The earth plate anchor shall be constructed from two 12" by 26", 10 gauge steel plates. The plates shall each have two stiffening ribs that run parallel with the long dimension. Each end of the narrow dimension shall have an earth cleat formed by a 1/2" right angle bend. The earth plate anchor when attached to the anchor rod has the configuration of a cross with the earth cleats facing toward the wall. The bearing area of the earth plate anchor system is 3 ft<sup>2</sup>. Plates shall be hot dip galvanized.

#### 2.02 Anchor Rod & Hardware

The anchor rod shall consist of a combination two or three 3/4"-10 all thread rods by 4'-6", 7'-0" and/or 9'-0" long and coupling(s). Two 3/4"-10 square nuts shall be supplied to attach the earth plate anchor and the wall plate to the anchor rod. Material shall conform to ASTM A193 B-7 and shall have a yield of 105 ksi. A 4" square by 3/16" thick plate washer shall conform to ASTM A36 and mounts between the wall plate and nut. Product shall be galvanized

#### 2.03 Wall Plate

The wall plate shall be constructed from 12" by 26", 10 gauge steel. The plate shall have two stiffening ribs that run parallel with the long dimension. Wall Plate shall be hot dip galvanized

### Section 3 –Earth Plate Anchor Installation

The following specification contains the major steps to be undertaken to install earth plate anchors. Variations may occur depending upon the application and the type of structural support required.

#### Warnings:



**Thoroughly investigate the job site for the possible existence and location of all underground utilities before proceeding. Avoid all contact with ALL underground utilities!**



**Collapsing soil can be dangerous. Follow OSHA requirements at all times. Do not enter any excavation if there are any questions about the stability of the soil.**



**Failure To Heed These Warnings, Or To Follow Safe Work Habits, Or Improper Use Of The Equipment And Materials May Result In Life Threatening Situations, Bodily Injury And/Or Property Damage!**

#### 4.01 Soil load on the wall.

The largest soil loads occur when water is present behind the wall. The following maximum load estimates may be used:

Estimated Basement Wall Load – Water Pressure Present			
Soil Height ft	Wall Load Estimate lb/lf	Wall Load – FS 1.5 lb/lf	Wall Load – FS 2 lb/lf
6ft	1,620	2,430	3,240
7ft	2,205	3,307	4,410
8ft	2,880	4,320	5,760

#### 4.02 Capacity of the Earth Plate Anchor in Soil

The following ECP Earth Plate Anchor capacities can be expected under the following soil conditions:

Estimated Bearing Capacity of Earth Plate Anchors			
Clay Soil – 5' Deep (min)		Sandy Soil – 5' Deep (min)	
SPT Blow Count "N"	Earth Plate Anchor Capacity	SPT Blow Count "N"	Earth Plate Anchor Capacity
2 blows/ft	6,000 lb	2 blows/ft	10,000 lb
4 blows/ft	12,000 lb	4 blows/ft	15,000 lb

#### 4.03 Wall Penetration

Based upon the load, soil capacity and ultimate anchor strength of 8,250 lb; determine the earth plate anchor spacing. Position the wall penetrations at the point of maximum bow in the wall. Bore 2" diameter holes through the wall at the designated locations.

#### 4.04 Excavate

Excavate the target location for installing the earth plate anchors. The excavations are recommended to be 13-1/2 to 17-1/2 feet from the wall but shall never be closer than 9 feet to the wall. Excavations shall be deep enough to install the plate earth anchor at a depth of at least one foot lower than the elevation of the wall penetration or below the frost depth, whichever is greater. The excavation shall be of suitable size and depth to accommodate the plate earth anchor. Barricade or cover the excavations for safety.

#### 4.05 Installation of Components

Drive the anchor rod assemblies through the holes in the wall into the soil to terminate in the excavations to accept the earth plate anchors. Anchor rod must emerge no higher than the depth prescribed in 4.04. Attach the earth plate anchor to the anchor rod with a nut. The earth cleats shall point toward the wall. Install the wall plate and square plate washer over the anchor rod and secure with a nut against the wall.

#### 4.06 Plate Anchor Tensioning

Tension the system by tightening the nut attaching the wall plate. The maximum dry torque that should be applied to the nut is 87 ft-lbs. This torque will provide an estimated clamping force of 8,250 lb. The Earth Plate Anchor System strength exceeds the strength of a typical concrete block basement wall. Caution is advised when tensioning the system.

#### 4.07 Documentation

At the conclusion of the installation, the raw field data shall be converted into an installation report that includes the location of each placement and the amount of load placed on each anchor. This may be filed in the job folder or provided to the client or engineer.

#### 4.08 Cleanup

Remove all scrap and other construction debris from the site. Remove all tools and equipment, clean them and store them.

The excavations shall now be backfilled using the soil that was removed and stored nearby. The backfill shall be placed into the holes in small lifts of 6" to 8" and then properly tamped to achieve maximum density. After the backfilling operation is complete, the sod, paving, etc. shall be replaced and restored to as close to preconstruction condition as possible.

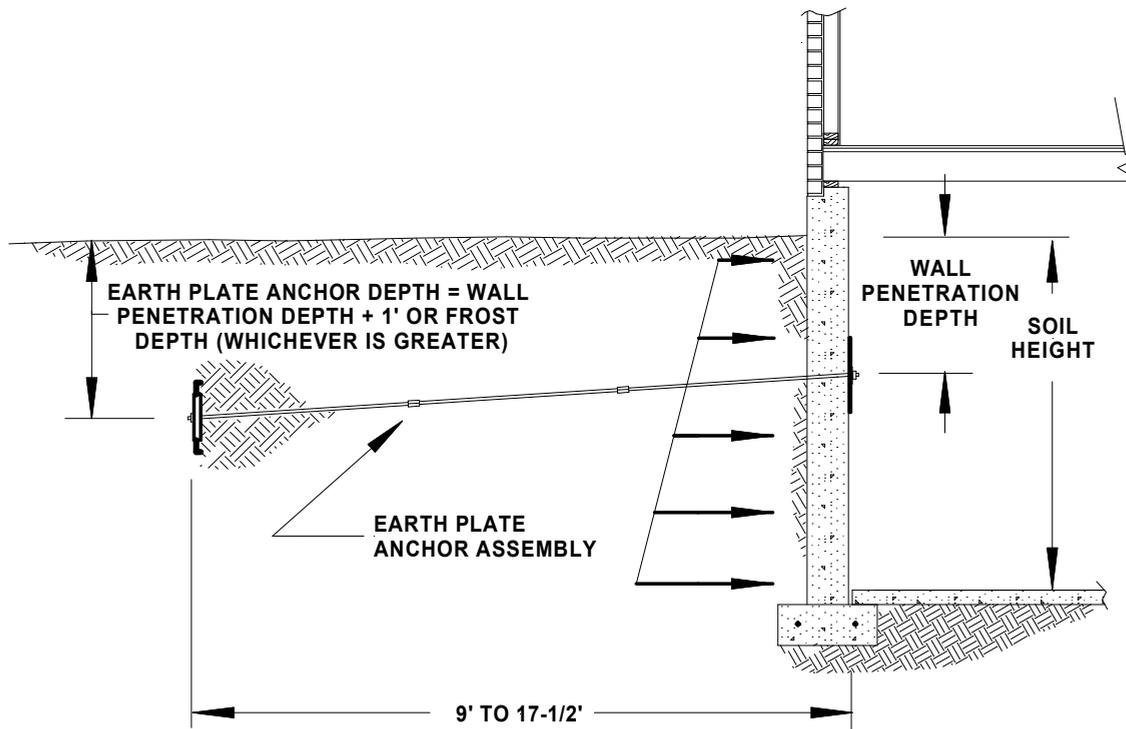
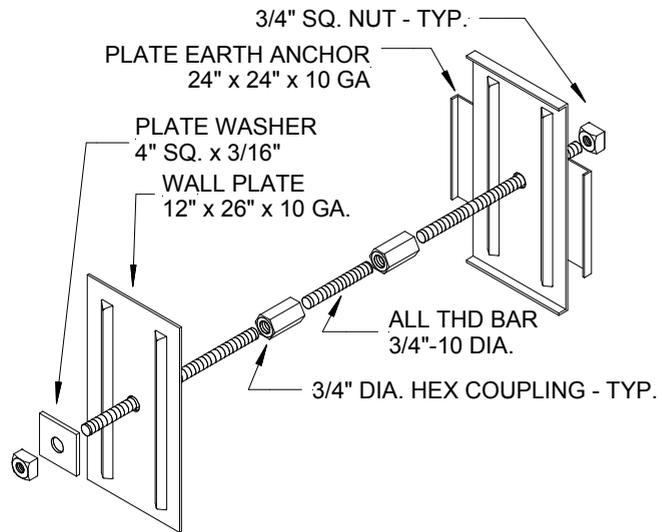
Dispose of all construction waste in a safe and legal manner.

**END OF SPECIFICATION**

## ECP Earth Plate Anchor

- 10,000 lb Ultimate Capacity
- 2.2 Square Feet Wall Bearing Surface
- 3 Square Feet Soil Bearing Surface
- Distance to Earth Plate Anchor Adjustable 9' to 17-1/2'
- Installs With Portable Equipment
- Installs With Little Disturbance to Landscape
- Installs With Little or No Vibration

ECP Earth Plate Anchor  
Component Details



Application Drawing

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# TYPICAL SPECIFICATION

## ECP Steel Pier™ Model 350 & Model 400 Utility Bracket

### Section 1- General

#### 1.01 Typical Installation Scope

Furnish labor, equipment, tools and material to install Model 350 Piers as described in this specification in a workmanlike manner and to design criteria.

1. Prepare site for safe working conditions.
2. Thoroughly investigate the site for any and all underground utilities before excavating.
3. Excavate as required for installation of the product.
4. Prepare stem wall, footing and/or grade beam of the foundation for pier bracket mounting.
5. Install ECP Steel Pier™ bracket and drive stand unit.
6. Securely anchor the drive stand and pier bracket to the structure.
7. Install the drive cylinder and connect hydraulics.
8. Hydraulically drive the steel pier sections to the required installation force.
9. Install lift assemblies, hydraulic lift cylinders and connect hydraulics.
10. Transfer the load to the piers, lift the structure to designed specifications and mechanically secure to maintain elevation.
11. Remove equipment from work area.
12. Backfill and clean work areas.

#### 1.02 Delivery, Storage and Handling

All foundation repair products, tools and equipment shall be handled and transported with care to prevent any damage or deformation. Hydraulic components shall be protected from the weather and kept clean of any dust, dirt, mud or debris.

### Section 2 - Product Material

#### 2.01 Pier Sections

##### 2.011 Model 350

Each pier section shall be manufactured from steel tubing having a nominal outside diameter of 3-1/2" outside diameter and a wall thickness of 0.165". The pier sections shall be fabricated from mill rolled, induction heat treated steel with a minimum yield strength of 55,000 psi. Each pier section shall be approximately 42" long and shall have a mill-installed coating of zinc-iron alloy, pure zinc galvanizing, a layer of zinc chromate compounds and a clear organic polymer coating. The materials conform to ASTM A500.

##### 2.0111 Lead Section

The lead section shall have a friction reduction collar welded to the bottom end of the pier pipe. The collar shall be fabricated from steel tubing having a nominal 4" outside diameter by 0.220" wall with a length of 1". The purpose of the collar is to reduce skin friction on the pier sections that follow; therefore the first section of pier pipe must have this collar attached.

##### 2.0112 Extension Section

The extension section shall have a coupling installed on one end of the pier pipe. This coupling shall be fabricated from steel tubing having a nominal 3-1/8" outside diameter by 0.180" wall thickness with a length of 5-7/8". Three inches of the coupling shall be inserted into the pier section and secured by two 1/2" button welds.

##### 2.0113 External Pier Sleeve

The external pier sleeve shall be manufactured from steel tubing having a nominal outside diameter of 4" outside diameter and a wall thickness of 0.220". The external pier sleeve sections shall be fabricated from mill rolled, induction heat treated steel with a minimum yield strength of 55,000 psi. Each external pier sleeve section shall be approximately 42" long and have mill finish. Welded to the external pier sleeve shall be a 3/4" x 3/4" x 3/4" piece of steel that forms a stop.

##### 2.0114 Inertia Sleeve (Optional)

The inertia sleeve is a pipe assembly that fits inside the pier pipe during installation to increase the moment of inertia of the pier pipe and strengthens the joints between pier sections. The inertia sleeve shall be installed to the pier pipe through areas of weak soil, areas of unsupported length of pier pipe or where additional pier wall strength is required. The inertia sleeve shall be fabricated from steel tube having a 3-1/8" outside diameter by 0.180" wall and 35-1/4" long. The coupling shall be fabricated from 2-5/8" diameter by 0.188" wall steel tubing that is 12 inches long. Three inches of the coupling shall be inserted into the inertia sleeve section and secured by two 1/2" button welds.

##### 2.012 Model 400

Each pier section shall be manufactured from steel tubing having a nominal outside diameter of 4" outside diameter and a wall thickness of 0.220". The pier sections shall be fabricated from mill rolled, induction heat treated steel with a

minimum yield strength of 55,000 psi. Each pier section shall be approximately 42" long and have mill finish. The materials conform to ASTM A500.

#### **2.0121 Lead Section**

The lead section shall have a friction reduction collar welded to the bottom end of the pier pipe. The collar shall be fabricated from steel tubing having a nominal 4.5" outside diameter by 0.237" wall with a length of 1". The purpose of the collar is to reduce skin friction on the pier sections that follow; therefore the first section of pier pipe must have this collar attached.

#### **2.0122 Extension Section**

The extension section shall have a coupling installed on one end of the pier pipe. This coupling shall be fabricated from steel tubing having a suitable outside diameter to fit to the inside of the pier pipe with a length of 5-7/8". Three inches of the coupling shall be inserted into the pier section and secured by two 1/2" button welds.

### **2.02 Pier Bracket**

The pier bracket shall be designed to connect the structure to the pier and to transfer the load of the structure to the pier pipe. The pier bracket shall be a welded assembly new, clean steel with a thickness of 1/2" or 5/8" and structural square tubing with a thickness of 3/16" or 1/4" that conforms to ASTM A-36.

The Utility pier bracket shall have a 74 square inch horizontal bearing surface that contacts the bottom of the foundation plate and a vertical mounting plate area of 91 square inches. The 1/2" thick vertical mounting plate shall have four 9/16" diameter holes that will accept 1/2" diameter concrete anchor bolts. The horizontal and vertical bearing plates shall be welded to side pieces, which measure 4" wide, by 18" long.

The following weldments and components attach to the bracket. A 9-7/8" long piece of 1-1/2" square tube with a wall thickness of 1/4" shall be welded vertically to the outer side of each side piece. Four mounting studs shall be welded to the outer front edge of the side pieces. These studs shall be fabricated from 2-1/4" long pieces of 1/2"-13 all-thread bar. Each stud shall be supplied with a 1/2"-13 hex nut. A control sleeve is required to maintain alignment of the 3-1/2" pier pipe within the drive stand. A control sleeve (Only supplied with the Model 350) shall be fabricated from 11-7/8" long piece of 4" square tubing with a wall thickness of 0.188". Welded to the control sleeve shall be a 3/4" x 3/4" x 3/4" piece of steel that forms a stop. Supplied with the bracket shall be two face plates that are used to secure the pier pipe and control sleeve in proper alignment and position within the pier bracket. The face plates shall be 2" by 7-1/4" and contain two 9/16" slots to secure the face plates to the pier bracket.

### **2.03 Pier Cap**

The pier cap is a welded assembly that connects the pier pipe to the pier bracket and transfers the structural load to the pier pipe. The pier cap shall be fabricated from 1-1/2" by 4" by 9" long steel conforming to ASTM A-36 Gr. 50. Attached to the center of this plate shall be a piece of tubing with a suitable diameter to fit over the pier pipe and shall be cut 1" long. This ring is used to maintain pier pipe alignment. The pier cap shall have two 1" diameter holes for attaching the pier cap to the pier bracket.

### **2.04 Bracket Rods and Hex Nuts**

Supplied with the pier bracket shall be two 7/8" – 9 all thread bars that measure 18" long and four 7/8" – 9 diameter heavy hex nuts conforming to ASTM A-193 Grade B7. The bracket rods and nuts shall be used to attach the pier cap to the pier bracket. These items provide for a maximum lift of the pier system of 4". Larger lifts may be accomplished by using longer bracket rods.

### **2.05 Lift Assembly**

The lift assembly shall consist of a lift head, two lift legs and two heavy hex nuts. The lift assembly is used to recover lost elevation and to allow for transfer of the structural load from the pier pipe to the pier bracket assembly. The lift legs are used as extensions to the bracket lift rods and allow attachment for the lift head above the pier cap. A hydraulic ram shall be installed between the lift head and pier cap during structural load transfer and recovery of lost elevations

#### **2.051 Lift Head**

The lift head shall be fabricated from 1-1/2" by 4" by 9" long steel conforming to ASTM A-36 Gr. 50. The lift head shall have two 1" diameter holes to accept the holding/lift rods.

#### **2.052 Lift Leg & Hex Nut**

Supplied with the lift head shall be two lift leg assemblies constructed from 7/8" – 9 all thread rod that measure nominally 9" long conforming to ASTM A-193 Grade B7. One end of the all thread bar shall be threaded into a 2-1/2" long thread bar coupler to a depth of 1" and welded in place. Also supplied with each lift leg shall be a 7/8" – 9, heavy hex nut. Total length of the lift leg shall be 10-1/2".

### **2.06 Anchor Bolts**

The expansion anchor shall be wedge type with a single piece three section wedge conforming to Federal Specification A-A 1923-A, Type 4 and ICC-ES Evaluation Report ESR-1385. Anchor shall be zinc plated conforming to ASTM B633. Anchor bolt size: 1/2" diameter by 7" long and shall be supplied with a flat washer and hex nut. (Hilti Kwik Bolt III #282529 or equal.; or as specified by the engineer.)

## Section 3 – Tools and Equipment

### 3.01 Drive Stand

The proprietary drive stand is a welded assembly designed to maintain vertical alignment of the pier bracket, drive cylinder and pier pipe during pier installation. The drive stand shall be a welded assembly of 1/2", 5/8" and 1" thick cold rolled flat bar stock conforming to ASTM A-36 and 3/8" and 1/2" thick hot rolled steel conforming to ASTM A-29. Supplied with the drive stand shall be three face plates and six hex nuts. The face plates shall be installed to enhance the integrity and safety of the drive stand under full load and provides pier pipe support. The upper face plate retains the drive cylinder and has two 9/16" mounting holes. The lower face plates retain and guide the pier pipe and have two 9/16" slots for attachment to the drive stand. Two drive stand pins are required to attach the drive stand to the pier bracket. These pins shall be formed from 15/16" diameter steel bar and shall be 15-1/2" long.

### 3.02 Drive Cylinder Assembly

The drive cylinder assembly shall be a double acting with a special cylinder head designed to fit the proprietary drive stand, a rod aligner and a pier drive adapter on the end of the piston rod designed to install the 3-1/2" diameter by 0.165 wall thickness pier pipe. The drive cylinder shall have a 3-1/4" diameter bore and 2" diameter cylinder rod. The stroke shall be 24". Working pressure may vary from 3,000 to 10,000 depending upon the installing contractor.

**CAUTION:** The operator must identify which cylinder he is using and verify the working pressure of the cylinder prior to using the hydraulics.

### 3.03 Hydraulic Pumps

#### 3.031 Pier Installation Pump

A gasoline or electrically operated hydraulic pump is required to install the pier pipe. The pump shall be capable of providing 10,000 psi of hydraulic pressure and a dual flow rate of 480 in<sup>3</sup>/min up to 2,000 psi and a rate of 100 in<sup>3</sup>/min above 2,000 psi. The pump shall have a 4-way, 3 position valve for double acting cylinder service. (Enerpac PGM-5204R or equal)

#### 3.032 Hand Pump

One or more hand pumps may be required to transfer structural load and to recover lost elevation. The hand pump(s) are connected to hydraulic lifting rams via a manifold arrangement. This provides uniform force to several pier placements at the same time. The hand pump assembly shall provide two stages of displacement at pressures up to 10,000 psi. Below 400 psi the displacement shall be 2.4 in<sup>3</sup> per stroke and above 400 psi, 0.15 in<sup>3</sup>. (Enerpac P801 or equal)

### 3.04 Single Acting Hydraulic Cylinder

A single acting hydraulic cylinder shall be positioned at each placement during the load transfer phase of the restoration. The hydraulic cylinder shall be rated at 10,000 psi of hydraulic pressure and heavy duty return spring. The minimum cylinder bore shall be 5.16 in<sup>2</sup> and a stroke of 4". (Enerpac RC-254 or equal)

### 3.05 Pressure Gauges

#### 3.051 Drive Cylinder Pressure Gauge

A pressure gauge shall be provided to monitor the installation force placed upon the pier pipe. The gauge shall be capable of measuring 0 – 10,000 psi with a minimum gauge face of 4" and minor graduations of 100 psi. (Enerpac G4088L or equal)

#### 3.052 Hand Pump Pressure Gauge

A pressure gauge shall be provided to monitor the lifting force applied to the structure during restoration. The pressure gauge shall be capable of measuring 0 – 10,000 psi with a minimum gauge face of 2-1/2" and minor graduations of 200 psi. (Enerpac G2535L or equal)

## Section 4 – Steel Pier Installation



### Warning!

- Utilities:** Thoroughly investigate the job site for the possible existence and location of all underground utilities before proceeding. Avoid any contact with ALL underground utilities!
- Excavations:** Collapsing soil can be dangerous. Follow OSHA requirements at all times. Do not enter any excavation if there are any questions about the stability of the soil.
- Pier Placement:** Excessive distance between pier placements can damage the concrete foundation from structural overload. Verify that the foundation has sufficient structural integrity to carry the load between placements.

- Pier Placement:** Thoroughly investigate the exterior of the structure adjacent to the proposed placement especially directly above the drive stand and drive cylinder. Movements of tools and equipment during pier installation may damage electrical boxes, faucets, windowsills, sliding doors and other architectural elements.
- Drive Cylinder:** Verify the working pressure of the hydraulic drive cylinder prior to using the hydraulics. Do not exceed the hydraulic drive cylinder manufacturer's working pressure during pier installation. When operating near the maximum cylinder pressure, cylinder rod extensions should be restricted to no more than 15 inches to prevent damage to the drive cylinder actuator rod.
- Hydraulic Equipment:** Inspect all hydraulic equipment prior to using. Do not use any leaking or damaged components such as cracked, crimped or cut hoses, leaking fittings, etc.
- Heavy Lifting:** Many pieces of equipment used to install steel foundation underpinning are very heavy. Use proper lifting techniques, back supports, and help from others when lifting heavy objects.
- Safety Devices:** When driving pier pipe all face plates must be fastened in place on the drive stand and pier bracket to enhance the integrity of the system and to secure the pier pipe.
- Safety Devices:** All persons in and around the work area must use personal safety protection.



**Warning!**

**FAILURE TO HEED THESE WARNINGS OR TO FOLLOW SAFE WORK HABITS MAY RESULT IN SERIOUS INJURY OR DEATH!**

**4.01 Excavating to Expose Footing or Grade Beam**

An excavation shall be prepared adjacent to the foundation to expose the stem wall and footing or the bottom of the grade beam. The excavation shall be to a depth of 14 inches below the bottom of the foundation and 12" beneath it. The excavated work area must be wide enough for safe working conditions, typically 3 to 4 feet wide by 3 to 4 feet away from the structure is usually adequate at the footing, taper or shore deep excavations per OSHA guidelines. Move excavated soil away from the work area by at least two feet and store in such a manner that the soil will not erode or cause damage to the owner's property.

**4.02 Footing or Grade Beam Preparation**

If the structure has a spread footing foundation, it shall be notched by removing the extended edge of the footing back to the stem wall for a distance along the footing of at least 18 inches in the area of the pier placement. To accomplish this a pneumatic or electrical chipping hammer with a chipping bit and then a bushing tool for smoothing the face shall be used. When preparing either a notched footing or a grade beam, the bottom area of concrete that will bear upon the pier bracket must be prepared to a smooth and level condition. Prior to acceptance of preparation, a level shall be used to verify that the portion of the footing upon which the bracket will bear is level both perpendicular to the foundation and parallel to the structure.

**IMPORTANT: If any reinforcing bar becomes exposed during these operations, consult with an Engineer before removing or cutting any steel reinforcing.**

**4.03 Pier Bracket Installation**

Place the steel installation base, or other suitable material, in the bottom of the excavation at the approximate point of the pier installation. Connect the lift assembly and pier cap to the pier bracket. Obtain a short piece of pier pipe, approximately 22" to 24" long depending upon the excavation, and place it in the pier bracket. Install the control sleeve over the pier pipe and face plates to the pier bracket by dropping the plates over the studs on either side of the pier bracket.

Maneuver the pier bracket into place under the footing; place the lower end of the piece of pier pipe into the centering ring of the installation base at the bottom of the excavation. Place a hydraulic ram between the lift assembly and the pier cap. Activate the hydraulic ram with a hand pump to bring the bearing plate of the pier bracket in contact with the previously prepared area at the bottom of the footing or grade beam.

If careful inspection reveals that the pier bracket is not plumb (vertical) and evenly bearing across all of the bottom of the footing and against the vertical face of the foundation, then the assembly must be removed and further preparation work must be performed. If only minor correction is required, lower the bracket about two inches and place quick setting, high strength grout on the bearing plate and realign the pier bracket.

Carefully check for alignment and proper bearing between the pier bracket and the bottom of the footing, plus verify proper contact between the pier bracket and the vertical face of the foundation. Activate the cylinder to achieve even bearing between the pier bracket and the footing. Drill and install two 1/2" x 7" long concrete expansion anchors, flat washers and hex nuts to secure the bracket in position. After the grout sets continue with the installation.

Remove the lift assembly and hydraulic ram from the pier bracket. Lower the drive stand into the excavated area then slide the drive stand horizontally over the two pieces of 1-1/2" square tubing on the pier bracket. The 15/16" diameter tapered drive stand locking bars shall be installed through the holes in the drive stand that are directly above and aligned with the two 1-1/2" square tubes, and into the lower drive stand holes.

Slide the lower end of the drive cylinder into slots at the top of the drive stand. Secure the drive cylinder to the drive stand by placing the upper face plate with two holes over the two studs at the top of the drive stand. Connect all of the hydraulics between the drive cylinder and the hydraulic pump.

With the installation base still at the bottom of the excavation, remove the face plates, control sleeve and short piece of pier pipe from the bracket. Place a lead pier section into the drive stand with the friction reduction collar facing downward. Slide the control sleeve over the pier pipe. Secure the face plate with pier guides over the studs and nuts on the drive stand and the face plates over each pair of studs on pier bracket. Activate the drive cylinder to apply a seating load on the drive stand assembly. When the drive stand has raised enough to remove all of the slack from fabrication tolerances, drill and install at least two 1/2" x 7" long concrete anchors, flat washers and hex nuts as required to secure the drive stand in position.

Retract the drive cylinder to take pressure off the lead pier section. Remove the installation base.

#### 4.04 Driving Pier Pipe

**IMPORTANT: The installation base plate must be removed from the bottom of the excavation and the control sleeve must be in place over the pier pipe before proceeding.**

Drive the lead pier section into the soil using the hydraulic drive cylinder to nearly the full extension of the cylinder rod. Retract the cylinder rod; install the coupling shoulder of a drive tool into the top of the installed pier section. Drive the pier downward into the soil again to the length of the hydraulic drive cylinder stroke. Repeat this operation with an additional drive tool as required to fully install the pier pipe. Retract the cylinder rod; remove the drive tools, guides and face plates. Document the force used to drive each section of pier pipe. (Optional – Install an inertia sleeve before installing the next pier section. – See 4.05) Install the coupled end of an extension pier section into the top of the driven pier section. Replace the guides and face plates.

**CAUTION: Safe operation dictates that the drive cylinder working pressure shall not be exceeded and all face plates be securely in place during pier installation. When operating near the maximum cylinder pressure, cylinder rod extensions should be restricted to no more than 15 inches to prevent damage to the drive cylinder actuator rod.**

The pier installation process shall continue adding extension pier sections until the design load or a suitable bearing stratum is reached. Hold the final driving load on the pier to check for pier creep.

#### 4.05 Installing Pier Sleeving (Optional – Only on Model 350)

Pier sleeving is used to stiffen the pier pipe and to strengthen the coupled joints between pier sections in weak soils or in applications where the pier pipe is unsupported. Sleeving shall extend at least three feet below the area of unsupported pipe or weak soil layer such as in areas where the Standard Penetration Test (SPT) blow count "N" is less than 5. Inertia sleeving must be installed concurrent with pier installation and external sleeving shall be installed after the pier has reached verified suitable bearing.

##### 4.051 Installing Inertia Sleeve (Optional – Only on Model 350)

**NOTE: The inertia sleeve must be installed concurrent with the pier sections. The installer must have general knowledge of depth to suitable load bearing for the pier to be able to calculate the point to commence inertia sleeve installation to be able to fully protect the pipe in the area of weak soils.**

When driving pier pipe, the inertia sleeve shall be installed into the pier section prior to inserting the next extension pier section. The coupling end of the inertia sleeve shall be inserted first into the pier pipe. The inertial sleeve shall drop by gravity into the coupling at the bottom end of the extension section. This process shall be continued through the area of weak soil or in areas where additional pier bending strength is required.

##### 4.052 Installing External Pier Sleeving (Optional- Only on Model 350)

The external pier sleeving shall be installed over the pier using the drive stand and drive cylinder. A specialized drive tool for installing the external pier sleeving shall be used to push the sleeve sections. Care must be taken to insure that the joints in the sleeving are staggered a minimum of 18 inches from the joints in the pier pipe. This process shall be continued through the area of weak soil or in areas where additional pier bending strength is required.

#### 4.06 Field Proof Loading

Load test the pier to the required proof load above the design or working load, or until lift of the structure is encountered. We do not recommend proof loading the system to a load greater than 1.5 times the anticipated service load.. The maximum proof load allowed for Model 350 Steel Pier™ system is 64,500 pounds and for Model 400 Steel Pier™ system is 74,000 pounds however many concrete footings will not be able to resist a loading of this magnitude.

Proof loads above the capacity of the drive cylinder may be tested by removing the drive cylinder, installing steel block bridging in the stand to accommodate a 25 to 50 ton short single acting ram between the pier pipe and the steel block.

Connect the ram to a hand pump and gauge assembly. Activate the ram to apply the required proof load to the system. Document the results of the proof test. Remove hydraulic drive cylinder and drive stand from the pier bracket.

#### **4.07 Cutting Final Pier Section to Length**

After verifying the pier capacity, it may be necessary to cut the final pier section. The pier pipe shall be cut very carefully to insure that the cut is perpendicular to the axis of the pipe. The pier bracket is shipped with bracket lift rods sized for lifts up to 4". For larger lifts, longer bracket lift rods are required. For most projects with lifts less than 4", the length of the final pier section must be cut to allow it to protrude above the top of the pier bracket approximately 4". The length to cut the pier section will vary depending upon the required lift.

##### **4.071 Critical Final Pier Section Length – 15" to 30" Long**

When the service load exceeds 35,000 pounds and the final pier section length is between 15 inches and 30 inches long, the coupled joint will be situated close to the bottom of the utility bracket. To prevent damage to the coupled joint one of the following must occur:

1. Exchange the final cut section and the last installed full length section of pipe. The exchange will place the full length of extension in the area of the pier bracket and the coupled joint 42 inches below the pier cap.
2. Install a 4" diameter by 42 inch long external pier sleeve over the coupled joint in the critical area. (Model 350 only)
3. Fill the pier sections with grout and transfer the load to the pier pipe only after the grout has cured.

#### **4.08 Load Transfer**

A pier cap, lift assembly and bracket lift rods shall be installed with nuts on each bracket. A 25-ton ram shall then be placed between each pier cap and lift assembly. Each ram shall be connected through a cut-off valve to one or more manifolds, gauges, and hydraulic hand pump systems. Transfer the structural load to the piers uniformly and evenly by activating many hydraulic rams simultaneously. As the hand pump is actuated, force is applied to the pier caps. As the load is transferred from the foundation to the piers, the interior and exterior of the structure must be carefully monitored to insure that the restoration occurs to plan and the structure is stabilized or lifted to the design elevation. As each placement reaches the desired load and/or elevation, the cut-off valve for the ram at the pier is closed and the pressure recorded for that placement. The hex nuts at the top of the bracket rods located above the pier caps shall be advanced to the surface of the pier cap and secured.

Remove the lift assemblies, hydraulic rams and lifting hydraulics from each pier placement. Clean all hydraulics, replace dust caps on the hydraulic couplings and store the equipment in a clean, dry environment.

**IMPORTANT: After the restoration is complete the void created between the foundation and soil may need to be filled with grout depending upon the type of foundation, type of soil on the site and the amount of lift. Consult a registered professional engineer when in doubt.**

#### **4.09 Backfill and Cleanup**

Remove all scrap and other construction debris from the site. Remove all tools and equipment, clean them and store them. The excavations shall now be backfilled using the soil that was removed and stored nearby. The backfill shall be placed into the holes in small lifts of 6" to 8" and then properly tamped to achieve maximum density. After the backfilling operation is complete, the soil at the perimeter must have a positive slope away from the perimeter of the foundation.

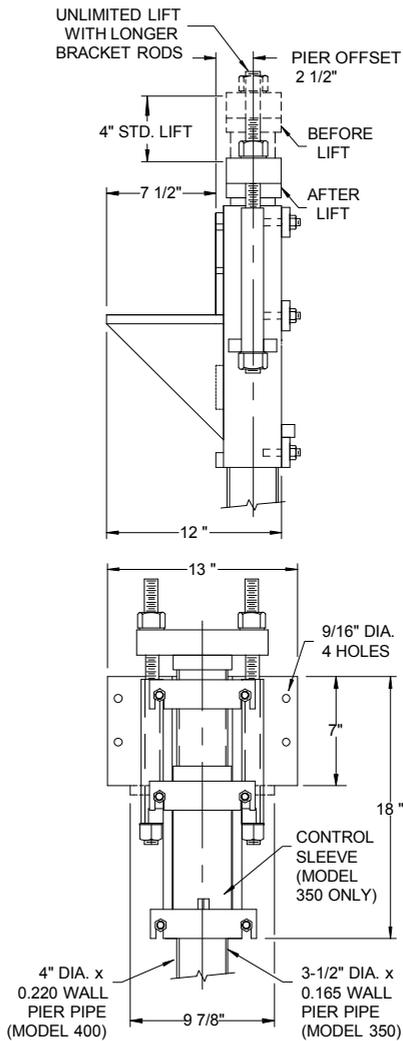
Dispose of all construction debris in a safe and legal manner.

### **END OF SPECIFICATION**

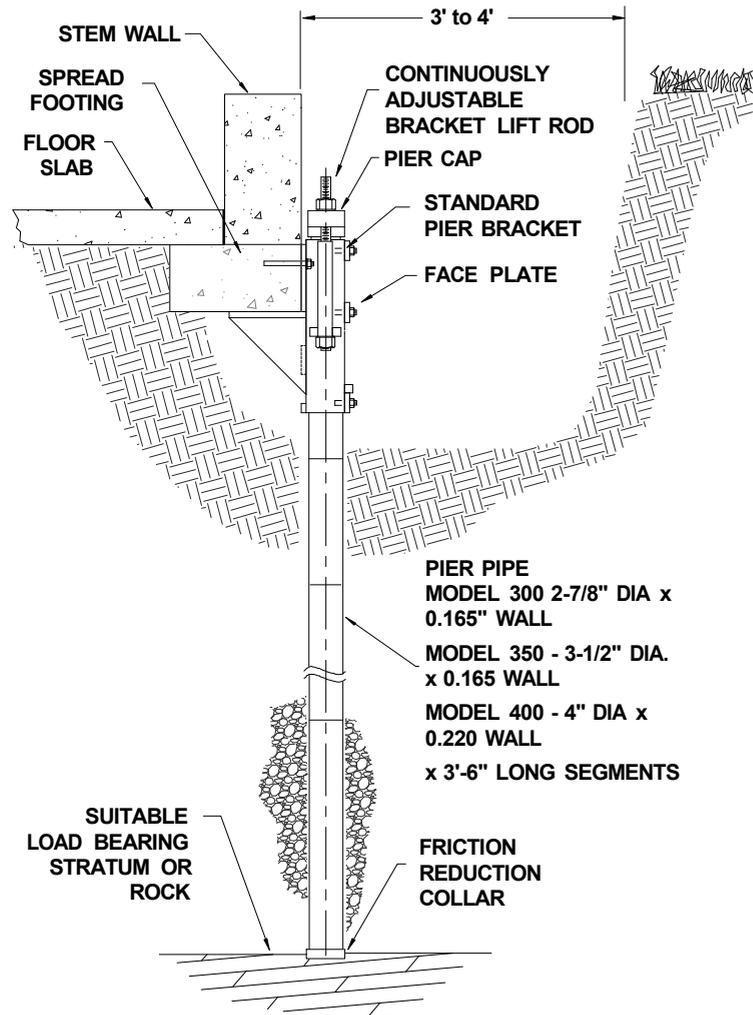
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## ECP Steel Pier™ -- Model 350 & Model 400 Utility Bracket Pier Systems

- Model 400 Ultimate Capacity – 99,000 lb.
- Model 400 Max. Proof Test – 74,000 lb.
- Model 350 Ultimate Capacity – 86,000 lb.
- Model 350 Max. Proof Test – 64,500 lb.
- 74 Square Inches Bearing Surface
- Installs From Outside or Inside Structure
- Standard Lift – 4” Fully Adjustable With Higher Lifts Available
- Friction Reduction Collar On Lead Pier Section
- 3-1/2” Diameter High Strength, Galvanized Tubular Pier Pipe
- Installs With Portable Equipment
- Installs With Little or No Vibration
- Installs To Rock or Verified Load Bearing Stratum
- 100% of Piers Proof Tested When Installed
- U.S. Patent No. 6,193,422
- Manufacturer’s Warranty



**Model 350 & Model 400 Utility Bracket Details**



**Model 350 & Model 400 Utility Bracket Application Drawing**



*The capacity of the Model 350 and Model 400 Utility foundation support system is a function of the capacity of pier pipe and soil surrounding the pipe, capacity of the load bearing stratum, foundation bracket, foundation strength and strength of the bracket to foundation connection. Actual capacities could be lower than the bracket capacity.*

# TYPICAL SPECIFICATION

## ECP Steel Pier™ Model 300 Utility Bracket System

### Section 1- General

#### 1.01 Typical Installation Scope

Furnish labor, equipment, tools and material to install Model 300 Piers as described in this specification in a workmanlike manner and to design criteria.

1. Prepare site for safe working conditions.
2. Thoroughly investigate the site for any and all underground utilities before excavating.
3. Excavate as required for installation of the product.
4. Prepare stem wall, footing and/or grade beam of the foundation for pier bracket mounting.
5. Install ECP Steel Pier™ bracket and drive stand unit.
6. Securely anchor the drive stand and pier bracket to the structure.
7. Install the drive cylinder and connect hydraulics.
8. Hydraulically drive the steel pier sections to the required installation force.
9. Install lift assemblies, hydraulic lift cylinders and connect hydraulics.
10. Transfer the load to the piers, lift the structure to designed specifications and mechanically secure to maintain elevation.
11. Remove equipment from work area.
12. Backfill and clean work areas.

#### 1.02 Delivery, Storage and Handling

All foundation repair products, tools and equipment shall be handled and transported with care to prevent any damage or deformation. Hydraulic components shall be protected from the weather and kept clean of any dust, dirt, mud or debris.

### Section 2 – Product Material

#### 2.01 Pier Sections

Each pier section shall be manufactured from steel tubing having a nominal outside diameter of 2-7/8" outside diameter and a wall thickness of 0.165". The pier sections shall be fabricated from mill rolled, induction heat treated steel with a minimum yield strength of 55,000 psi. Each pier section shall be approximately 42" long and shall have a mill-installed coating of zinc-iron alloy, pure zinc galvanizing, a layer of zinc chromate compounds and a clear organic polymer coating. The materials conform to ASTM A500.

##### 2.011 Lead Section

The lead section shall have a friction reduction collar welded to the bottom end of the pier pipe. The collar shall be fabricated from steel tubing having a nominal 3-3/8" outside diameter by 0.188" wall with a length of 1". The purpose of the collar is to reduce skin friction on the pier sections that follow; therefore the first section of pier pipe must have this collar attached.

##### 2.012 Extension Section

The extension section shall have a coupling installed on one end of the pier pipe. This coupling shall be fabricated from steel tubing having a nominal 2-1/2" outside diameter by 0.180" wall thickness with a length of 5-7/8". Three inches of the coupling shall be inserted into the pier section and secured by two 1/2" button welds.

##### 2.012 Inertia Sleeve (Optional)

The inertia sleeve is a pipe assembly that is gravity fed inside the pier pipe during installation to increase the moment of inertia of the pier pipe and strengthens the joints between pier sections. The inertia sleeve shall be used to strengthen the pier pipe through areas of weak soil, areas of unsupported length of pier pipe or where additional pier wall strength is required. The inertia sleeve shall be fabricated from steel tube having a 2-1/2" outside diameter by 0.180" wall and 35-1/4" long. The coupling shall be fabricated from 2-1/8" diameter by 0.188" wall steel tubing that is 12 inches long. Three inches of the coupling is inserted into the inertia sleeve section and secured by two 1/2" button welds.

#### 2.02 Pier Bracket

The pier bracket shall be designed to connect the structure to the pier and to transfer the load of the structure to the pier pipe. The pier bracket shall be a welded assembly new, clean steel with a thickness of 3/8" or 1/2" conforming to ASTM A-36. The pier bracket shall have a 68 square inch horizontal bearing surface that contacts the bottom of the foundation plate and a vertical mounting plate area of 82 square inches. The 3/8" thick vertical mounting plate shall have four 9/16" diameter holes that will accept 1/2" diameter concrete anchor bolts. The horizontal and vertical bearing plates shall be welded to two laser cut side pieces, which measure 3" wide, by 16" long. A 9" long piece of 1-1/4" square tube with a wall thickness of 0.188 shall be welded vertically to the outer side of each side piece. Six mounting studs shall be welded to the outer front edge of the side pieces. These studs shall be fabricated from 2-1/4" long pieces of 1/2"-13 all-thread bar. Each stud shall be supplied with a 1/2"-13 hex nut. Supplied with the bracket shall be three face plates that are used to secure the pier pipe in proper alignment

and position within the pier bracket. The face plates shall be 2" by 6-3/8" and contain two 9/16" slots to secure the face plates to the pier bracket.

### **2.03 Pier Cap**

The pier cap connects the pier pipe to the pier bracket and transfers the structural load to the pier pipe. The pier cap shall be fabricated from 1-1/2" by 4" by 7-7/8" long steel conforming to ASTM A-36 Gr. 50. The pier cap has two 7/8" diameter holes for attaching the pier cap to the pier bracket.

### **2.04 Bracket Lift Rods and Hex Nuts**

Supplied with the pier bracket shall be two 3/4-10 all thread bars conforming to ASTM A-193 Grade B5 that measure 17-7/8" long and four 3/4-10 hex nuts. The bracket lift rods and nuts shall be used to attach the pier cap to the pier bracket. These items provide for a maximum lift of the pier system of 4". Larger lifts may be accomplished by using longer bracket rods.

### **2.05 Lift Assembly**

The lift assembly shall consist of a lift head; two lift legs and two hex nuts. The lift assembly is used to recover lost elevation and to allow for transfer of the structural load from the pier pipe to the pier bracket assembly. The lift legs are used as extensions to the bracket lift rods and allow attachment for the lift head above the pier cap. A hydraulic ram shall be installed between the lift head and pier cap during structural load transfer and recovery of lost elevations

#### **2.051 Lift Head**

The lift head shall be fabricated from 1-1/2" by 4" by 7-7/8" long steel conforming to ASTM A-36 Gr. 50. The lift head shall have two 7/8" diameter holes to accept the continuous thread lift rods.

#### **2.052 Lift Legs, & Hex Nuts**

Supplied with the lift head shall be two lift leg assemblies constructed from 3/4-10, grade 5 all thread rod that measure nominally 9" long conforming to ASTM A-193 Grade B7. One end of the all thread shall be threaded into a 2-1/2" long thread bar coupler to a depth of 1" and welded in place. Also supplied with each lift leg shall be a 3/4-10 hex nut.

### **2.06 Anchor Bolts**

The expansion anchor shall be wedge type with a single piece three section wedge conforming to Federal Specification A-A 1923-A, Type 4 and ICC-ES Evaluation Report ESR-1385. Anchor shall be zinc plated conforming to ASTM B633. Anchor bolt size: 1/2" diameter by 7" long and shall be supplied with a flat washer and hex nut. (Hilti Kwik Bolt III #282529 or equal.; or as specified by the engineer.)

## **Section 3 – Tools and Equipment**

### **3.01 Drive Stand**

The proprietary drive stand is a welded assembly designed to maintain vertical alignment of the pier bracket, drive cylinder and pier pipe during pier installation. The drive stand shall be a welded assembly of 1/2", 5/8" and 1" thick cold rolled flat bar stock conforming to ASTM A-36 and 3/8" and 1/2" thick hot rolled steel conforming to ASTM A-29. Supplied with the drive stand shall be three face plates and six hex nuts. The face plates shall be installed to enhance the integrity and safety of the drive stand under full load and provides pier pipe support. The upper face plate retains the drive cylinder and has two 9/16" mounting holes. The lower face plates retain and guide the pier pipe and have two 9/16" slots for attachment to the drive stand. Two drive stand pins are required to attach the drive stand to the pier bracket. These pins shall be formed from 13/16" diameter steel bar and shall be 15" long.

### **3.02 Drive Cylinder Assembly**

The drive cylinder assembly shall be a double acting with a special cylinder head designed to fit the proprietary drive stand, a rod aligner and a pier drive adapter on the end of the piston rod designed to install the 2-7/8" diameter by 0.165 wall thickness pier pipe. The drive cylinder shall have a 2-3/4" diameter bore and 1-3/4" diameter cylinder rod. The stroke shall be 24". Working pressure may vary from 3,000 to 10,000 depending upon the cylinder used by the installer.

**CAUTION: The operator must identify which cylinder he is using and verify the working pressure of the cylinder prior to using the hydraulics.**

### **3.03 Hydraulic Pumps**

#### **3.031 Pier Installation Pump**

A gasoline or electrically operated hydraulic pump is required to install the pier pipe. The pump shall be capable of providing 10,000 psi of hydraulic pressure and a dual flow rate of 480 in<sup>3</sup>/min up to 2,000 psi and a rate of 100 in<sup>3</sup>/min above 2,000 psi. The pump shall have a 4-way, 3 position valve for double acting cylinder service. (Enerpac PGM-5204R or equal)

#### **3.032 Hand Pump**

One or more hand pumps may be required to transfer structural load and to recover lost elevation. The hand pump(s) are connected to hydraulic lifting rams via a manifold arrangement. This provides uniform force to several pier placements at the same time. The hand pump assembly shall provide two stages of displacement at pressures up to 10,000 psi. Below 400 psi the displacement shall be 2.4 in<sup>3</sup> per stroke and above 400 psi, 0.15 in<sup>3</sup>. (Enerpac P801 or equal)

### 3.04 Single Acting Hydraulic Cylinder

A single acting hydraulic cylinder shall be positioned at each placement during the load transfer phase of the restoration. The hydraulic cylinder shall be rated at 10,000 psi of hydraulic pressure and heavy duty return spring. The minimum cylinder bore shall be 5.16 in<sup>2</sup> and a stroke of 4". (Enerpac RC-254 or equal)

### 3.05 Pressure Gauges

#### 3.051 Drive Cylinder Pressure Gauge

A pressure gauge shall be provided to monitor the installation force placed upon the pier pipe. The gauge shall be capable of measuring 0 – 10,000 psi with a minimum gauge face of 4" and minor graduations of 100 psi. (Enerpac G4088L or equal)

#### 3.052 Hand Pump Pressure Gauge

A pressure gauge shall be provided to monitor the lifting force applied to the structure during restoration. The pressure gauge shall be capable of measuring 0 – 10,000 psi with a minimum gauge face of 2-1/2" and minor graduations of 200 psi. (Enerpac G2535L or equal)

## Section 4 – Steel Pier Installation



### Warning!

- Utilities:** Thoroughly investigate the job site for the possible existence and location of all underground utilities before proceeding. Avoid any contact with ALL underground utilities!
- Excavations:** Collapsing soil can be dangerous. Follow OSHA requirements at all times. Do not enter any excavation if there are any questions about the stability of the soil.
- Pier Placement:** Excessive distance between pier placements can damage the concrete foundation from structural overload. Verify that the foundation has sufficient structural integrity to carry the load between placements.
- Pier Placement:** Thoroughly investigate the exterior of the structure adjacent to the proposed placement especially directly above the drive stand and drive cylinder. Movements of tools and equipment during pier installation may damage electrical boxes, faucets, windowsills, sliding doors and other architectural elements.
- Drive Cylinder:** Verify the working pressure of the hydraulic drive cylinder prior to using the hydraulics. Do not exceed the hydraulic drive cylinder manufacturer's working pressure during pier installation. When operating near the maximum cylinder pressure, cylinder rod extension should be restricted to no more than 15 inches to prevent damage to the drive cylinder actuator rod.
- Hydraulic Equipment:** Inspect all hydraulic equipment prior to using. Do not use any leaking or damaged components such as cracked, crimped or cut hoses, leaking fittings, etc.
- Heavy Lifting:** Many pieces of equipment used to install steel foundation underpinning are very heavy. Use proper lifting techniques, back supports, and help from others when lifting heavy objects.
- Safety Devices:** When driving pier pipe all face plates must be fastened in place on the drive stand and pier bracket to enhance the integrity of the system and to secure the pier pipe.
- Safety Devices:** All persons in and around the work area must use personal safety protection.



### Warning!

**FAILURE TO HEED THESE WARNINGS OR TO FOLLOW SAFE WORK HABITS MAY RESULT IN SERIOUS INJURY OR DEATH!**

### 4.01 Excavating to Expose Footing or Grade Beam

An excavation shall be prepared adjacent to the foundation to expose the stem wall and footing or the bottom of the grade beam. The excavation shall be to a depth of 14 inches below the bottom of the foundation and 12" beneath it. The excavated work area must be wide enough for safe working conditions, typically 3 to 4 feet wide by 3 to 4 feet away from the structure is usually adequate, taper or shore deep excavations per OSHA guidelines. Move excavated soil away from the work area by at least two feet and store in such a manner that the soil will not erode or cause damage to the owner's property.

#### 4.02 Footing or Grade Beam Preparation

If the structure has a spread footing foundation, it shall be notched by removing the extended edge of the footing back to the stem wall for a distance of at least 18 inches in the area of the pier placement. A pneumatic or electrical chipping hammer with a chipping bit and then a bushing tool for smoothing the face shall be used. To prepare either a notched footing or a grade beam, the bottom area of concrete that bears upon the soil must be prepared to a smooth and level condition. Prior to acceptance of preparation, a level shall be used to verify that the portion of the footing upon which the bracket will bear is level both perpendicular to the foundation and parallel to the structure.

**IMPORTANT: If any reinforcing bar becomes exposed during these operations consult with an Engineer before removing or cutting any steel reinforcing.**

#### 4.03 Pier Bracket Installation

Place the steel installation base, or other suitable material, in the bottom of the excavation at the approximate point of the pier installation. Connect the lift assembly and pier cap to the pier bracket. Obtain a short piece of pier pipe, approximately 22" to 24" long depending upon the excavation, and place it in the pier bracket. Install the face plates to the pier bracket by dropping the plates over the studs on either side of the pier bracket.

Maneuver the pier bracket into place under the footing; place the lower end of the piece of pier pipe into the centering ring of the installation base at the bottom of the excavation. Place a hydraulic ram between the lift assembly and the pier cap. Activate the hydraulic ram with a hand pump to bring the bearing plate of the pier bracket in contact with the previously prepared area at the bottom of the footing or grade beam.

If careful inspection reveals that the pier bracket is not plumb (vertical) and evenly bearing across the entire bottom of the footing and against the vertical face of the foundation, then the assembly must be removed and further preparation work must be performed. If only minor correction is required, lower the bracket about two inches and place quick setting, high strength grout on the bearing plate and realign the pier bracket. .

Carefully check for alignment and proper bearing between the pier bracket and the bottom of the footing, plus verify proper contact between the pier bracket and the vertical face of the foundation. Activate the cylinder to achieve even bearing between the pier bracket and the footing. Drill and install two 1/2" x 7" long concrete anchors, flat washers and hex nuts to secure the bracket in position. After the grout sets continue with the installation.

Remove the lift assembly and hydraulic ram from the pier bracket. Lower the drive stand into the excavated area then slide the drive stand horizontally over the two pieces of 1-1/4" square tubing on the pier bracket. The 13/16" diameter drive stand locking pins shall be installed through the holes in the drive stand that are directly above and aligned with the two 1-1/4" square tubes, and into the lower drive stand holes.

Slide the lower end of the drive cylinder into slots at the top of the drive stand. Secure the drive cylinder to the drive stand by placing the upper face plate with two holes over the two studs at the top of the drive stand. Connect all of the hydraulics between the drive cylinder and the hydraulic pump.

With the installation base still at the bottom of the excavation, remove the face plates from the bracket. Place a lead pier section into the drive stand with the friction reduction collar facing downward. Secure the face plate with pier guides over the studs and nuts on the drive stand and the face plates over each pair of studs on pier bracket. Activate the drive cylinder to apply a seating load on the drive stand assembly. When the drive stand has raised enough to remove all of the slack from fabrication tolerances, drill and install 1/2" x 7" long concrete anchors, flat washers and hex nuts as required to secure the drive stand in position, then retract the drive cylinder to take pressure off of the lead pier section and remove the installation base.

**IMPORTANT: The installation base plate must be removed from the bottom of the excavation before proceeding.**

#### 4.04 Driving Pier Pipe

Drive the lead pier section into the soil using the hydraulic drive cylinder to nearly the full extension of the cylinder rod. Retract the cylinder rod; install the coupling shoulder of a drive tool into the top of the installed pier section. Drive the pier downward into the soil again to the length of the hydraulic drive cylinder stroke. Repeat this operation with an additional drive tool as required to fully install the pier pipe. Retract the cylinder rod; remove the drive tools, guides and face plates. Document the force used to drive each section of pier pipe. (Optional – Install an inertia sleeve before installing the next pier section. – See 4.05) Install the coupled end of an extension pier section into the top of the driven pier section. Replace the guides and face plates.

**CAUTION: Safe operation dictates that the drive cylinder working pressure shall not be exceeded and all face plates be securely in place during pier installation. When operating near the maximum cylinder pressure, cylinder rod extensions should be restricted to no more than 15 inches to prevent damage to the drive cylinder actuator rod.**

The pier installation process shall continue adding extension pier sections until the design load or a suitable bearing stratum is reached. Hold the final driving load on the pier to check for pier creep.

#### 4.05 Installing Inertia Sleeve (Optional)

**NOTE: The inertia sleeve must be installed concurrent with the pier sections. The installer must have general**

**knowledge of depth to suitable load bearing for the pier to be able to calculate the point to commence sleeve installation to be able to protect the pipe in the area of weak soils.**

The inertia sleeve increases the moment of inertia of the pier and strengthens the segment couplings in the area of weak soils or in areas of unsupported pier pipe. The inertia sleeve shall be installed into the pier section prior to inserting the next pier extension. The coupling end of the inertia pier section shall be inserted into the pier pipe. It shall drop by gravity into the pier pipe coupling at the bottom end of the extension section. This process shall be continued through the entire length where additional pier bending strength is required such as areas of exposed pier pipe or areas where the Standard Penetration Test (SPT) blow count "N" is less than 5 blows per foot.

#### **4.06 Field Proof Loading**

Load test the pier to the required proof load above the design or working load, or until lift of the structure is encountered. We do not recommend proof loading the system to a load greater than 51,000 pounds, which is 1.5 times the anticipated service load. Proof loads above the capacity of the drive cylinder may be tested by removing the drive cylinder, installing steel block bridging in the stand to accommodate a 25 to 50 ton short single acting ram between the pier pipe and the steel block. Connect the ram to a hand pump and gauge assembly. Activate the ram to apply the required proof load to the system. Document the results. Remove hydraulic drive cylinder and drive stand from the pier bracket.

#### **4.07 Cutting Final Pier Section To Length**

After verifying the pier capacity, it may be necessary to cut the final pier section. The pier pipe shall be cut very carefully to insure that the cut is perpendicular to the axis of the pipe. The pier bracket is shipped with bracket lift rods sized for lifts up to 4". For larger lifts, longer bracket lift rods are required. For most projects with lifts less than 4", the length of the final pier section must be cut to allow it to protrude above the top of the pier bracket approximately 4". The length to cut the pier section will vary depending upon the required lift.

##### **4.071 Critical Final Pier Section Length – 14" to 30" Long**

When the service load exceeds 28,000 pounds and the final pier section length is between 14 inches and 30 inches long, the coupled joint will be situated close to the bottom of the utility bracket. To prevent damage to the coupled joint one of the following must occur:

1. Exchange the final cut section and the last installed full length section of pipe. The exchange will place the full length of extension in the area of the pier bracket and the coupled joint 42 inches below the pier cap.
2. Fill the pier sections with grout and transfer the load to the pier pipe only after the grout has cured.

#### **4.08 Load Transfer**

Transfer the structural load to the piers uniformly and evenly by activating many hydraulic rams simultaneously. A pier cap, lift assembly and bracket lift rods shall be installed with nuts on each bracket. A 25-ton ram shall then be placed between each pier cap and lift assembly. Each ram shall be connected through a cut-off valve to one or more manifolds, gauge, and hydraulic hand pump systems. As the hand pump is actuated, force is applied to the pier caps. As the load is transferred from the foundation to the piers, the interior and exterior of the structure must be carefully monitored to insure that the restoration occurs to plan and the structure is stabilized or lifted to the design elevation. As each placement reaches the desired load and/or elevation, the cut-off valve for the ram at the pier is closed and the pressure recorded for that placement. The hex nuts at the top of the bracket rods and above the pier caps shall be advanced to the surface of the pier cap and secured.

Remove the lift assemblies, hydraulic rams and lifting hydraulics from each pier placement. Clean all hydraulics, replace dust caps on the hydraulic couplings and store the equipment in a clean, dry environment.

**IMPORTANT: After the restoration is complete the void created between the foundation and soil may need to be filled with grout depending upon the type of foundation, type of soil on the site and the amount of lift. Consult a registered professional engineer when in doubt.**

#### **4.09 Backfill and Cleanup**

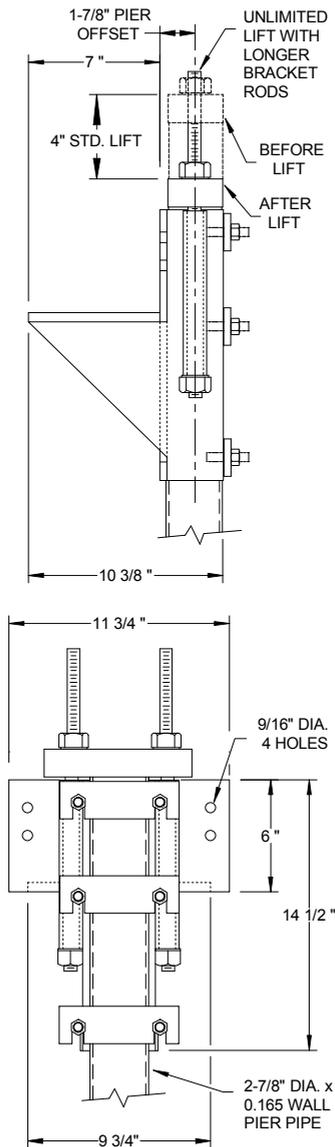
Remove all scrap and other construction debris from the site. Remove all tools and equipment, clean them and store them. The excavations shall now be backfilled using the soil that was removed and stored nearby. The backfill shall be placed into the holes in small lifts of 6" to 8" and then properly tamped to achieve maximum density. After the backfilling operation is complete, the soil at the perimeter must have a positive slope away from the perimeter of the foundation. Dispose of all construction debris in a safe and legal manner.

### **END OF SPECIFICATION**

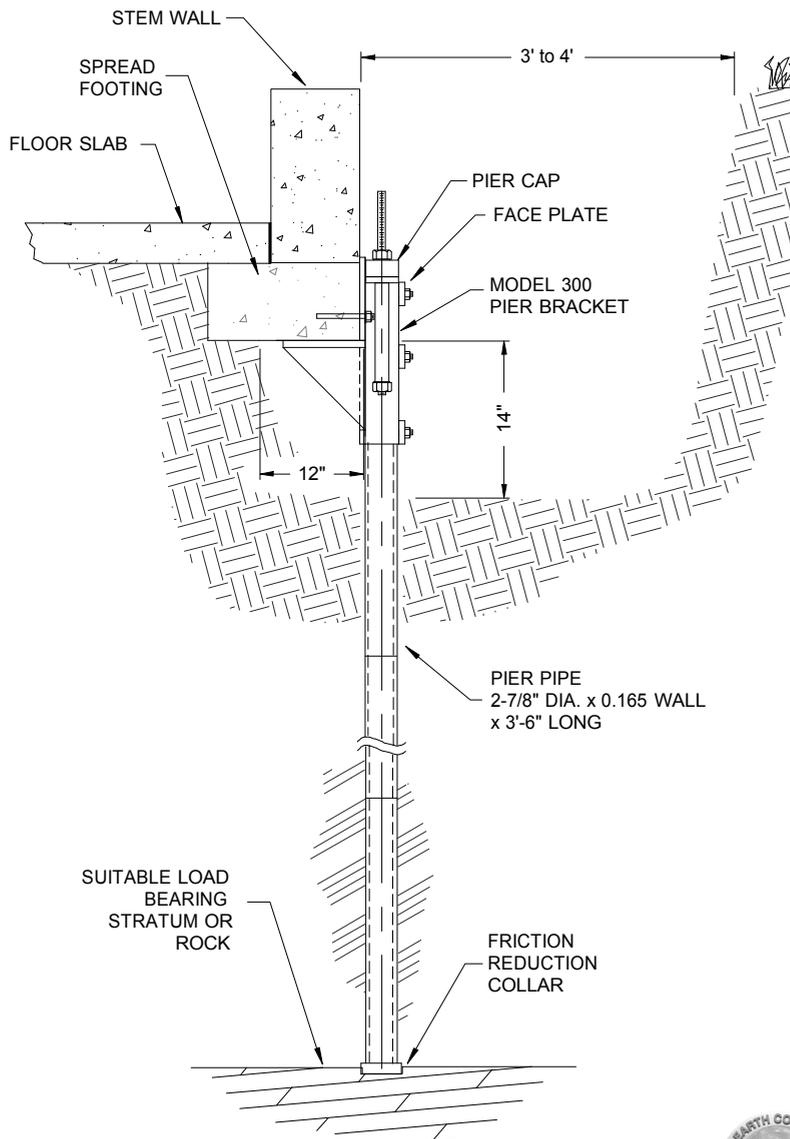
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## ECP Steel Pier™ -- Model 300 Utility Bracket Pier System

- **Model 300 Ultimate Capacity – 68,000 lb**
- **Maximum Proof Load – 51,000 lb**
- **68 Square Inches Bearing Surface**
- **Standard Lift – 4”**
- **Fully Adjustable Unlimited Lift Capability**
- **Installs From Outside or Inside Structure**
- **Friction Reduction Collar On Lead Pier Section**
- **2-7/8” Diameter High Strength, Galvanized Tubular Pier**
- **Installs With Portable Equipment**
- **Installed With Little or No Vibration**
- **Installs To Rock or Verified Load Bearing Stratum**
- **100% of Piers Proof Tested When Installed**
- **U.S. Patent No. 6,193,422**
- **Manufacturer’s Warranty**



**Model 300  
Utility Bracket Details**



**Model 300 Utility Bracket  
Application Drawing**

**ECP Steel Pier™  
Specifications**



*The capacity of the Model 300 foundation support system is a function of the capacity of pier pipe and soil surrounding the pipe, capacity of the load bearing stratum, foundation bracket, foundation strength and strength of the bracket to foundation connection. Actual capacities could be lower than the bracket capacity.*

# TYPICAL SPECIFICATION

## Wall Mounted Systems

**ECP Steel Pier™ Model 350-WM**

**ECP Steel Pier™ Model 400-WM**

**ECP Steel Pier™ Model 400-WM HD**

### Section 1- General

#### 1.01 Typical Installation Scope

Furnish labor, equipment, tools and material to install Model 400 Piers as described in this specification in a workmanlike manner and to design criteria.

1. Prepare site for safe working conditions.
2. Thoroughly investigate the site for any and all underground utilities before excavating.
3. Excavate as required for installation of the product.
4. Prepare stem wall, core drill the footing.
5. Install ECP Steel Pier™ wall mounted bracket over the drilled hole in the footing if applicable.
6. Mount the drive stand on to the pier bracket and securely anchor it to the structure.
7. Install the drive cylinder and connect hydraulics.
8. Hydraulically drive the steel pier sections to the required installation force.
9. Install lift assemblies, hydraulic lift cylinders and connect hydraulics.
10. Transfer the load to the piers, lift the structure to designed specifications and mechanically secure to maintain elevation.
11. Remove equipment from work area.
12. Backfill and clean work areas.

#### 1.02 Delivery, Storage and Handling

All foundation repair products, tools and equipment shall be handled and transported with care to prevent any damage or deformation. Hydraulic components shall be protected from the weather and kept clean of any dust, dirt, mud or debris.

### Section 2 - Product Material

#### 2.01 Pier Sections

##### 2.011 Model 350-WM

Each pier section shall be manufactured from steel tubing having a nominal outside diameter of 3-1/2" outside diameter and a wall thickness of 0.165". The pier sections shall be fabricated from mill rolled, induction heat treated steel with a minimum yield strength of 55,000 psi. Each pier section shall be approximately 42" long and shall have a mill-installed coating of zinc-iron alloy, pure zinc galvanizing, a layer of zinc chromate compounds and a clear organic polymer coating. The materials conform to ASTM A500.

##### 2.0111 Lead Section

The lead section shall have a friction reduction collar welded to the bottom end of the pier pipe. The collar shall be fabricated from steel tubing having a nominal 4" outside diameter by 0.220" wall with a length of 1". The purpose of the collar is to reduce skin friction on the pier sections that follow; therefore the first section of pier pipe must have this collar attached.

##### 2.0112 Extension Section

The extension section shall have a coupling installed on one end of the pier pipe. This coupling shall be fabricated from steel tubing having a nominal 3-1/8" outside diameter by 0.180" wall thickness with a length of 5-7/8". Three inches of the coupling shall be inserted into the pier section and secured by two 1/2" button welds.

##### 2.0113 External Pier Sleeve

The external pier sleeve shall be manufactured from steel tubing having a nominal outside diameter of 4" outside diameter and a wall thickness of 0.220". The external pier sleeve sections shall be fabricated from mill rolled, induction heat treated steel with a minimum yield strength of 55,000 psi. Each external pier sleeve section shall be approximately 42" long and have mill finish. Welded to the external pier sleeve shall be a 3/4" x 3/4" x 3/4" piece of steel that forms a stop.

##### 2.0114 Inertia Sleeve (Optional)

The inertia sleeve is a pipe assembly that fits inside the pier pipe during installation to increase the moment of inertia of the pier pipe and strengthens the joints between pier sections. The inertia sleeve shall be installed to the pier pipe through areas of weak soil, areas of unsupported length of pier pipe or where additional pier wall strength is required. The inertia sleeve shall be fabricated from steel tube having a 3-1/8" outside diameter by 0.180" wall and 35-1/4" long. The coupling shall be fabricated from 2-5/8" diameter by 0.188" wall steel tubing that is 12 inches long. Three inches of the coupling shall be inserted into the inertia sleeve section and secured by two 1/2" button welds.

### **2.012 Model 400-WM & Model 400-WM HD**

Each pier section shall be manufactured from steel tubing having a nominal outside diameter of 4" outside diameter and a wall thickness of 0.220". The pier sections shall be fabricated from mill rolled, induction heat treated steel with a minimum yield strength of 55,000 psi. Each pier section shall be approximately 42" long and have mill finish. The materials conform to ASTM A500.

#### **2.0121 Lead Section**

The lead section shall have a friction reduction collar welded to the bottom end of the pier pipe. The collar shall be fabricated from steel tubing having a nominal 4.5" outside diameter by 0.237" wall with a length of 1". The purpose of the collar is to reduce skin friction on the pier sections that follow; therefore the first section of pier pipe must have this collar attached.

#### **2.0122 Extension Section**

The extension section shall have a coupling installed on one end of the pier pipe. This coupling shall be fabricated from steel tubing having a suitable outside diameter to fit to the inside of the pier pipe with a length of 5-7/8". Three inches of the coupling shall be inserted into the pier section and secured by two 1/2" button welds.

## **2.02 Pier Bracket**

The pier bracket shall be designed to connect the structure to the pier and to transfer the load of the structure to the pier pipe. The pier bracket shall be a welded assembly new, clean steel with a thickness of 1/2" and 5/8" that conforms to ASTM A-36, and structural square tubing with a thickness of 3/16" that conforms to ASTM A-500. The following weldments and components are attached to the pier bracket. A 9-7/8" long piece of 1-1/2" square tube with a wall thickness of 3/16" shall be welded vertically to the outer side of each side piece. Six mounting studs shall be welded to the outer front edges of the sidepieces. These studs shall be fabricated from 2-1/4" long pieces of 1/2"-13 all-thread bar. Each stud shall be supplied with a 1/2"-13 hex nut. Supplied with the bracket shall be three faceplates that are used to secure the pier pipe in proper alignment and position within the pier bracket. The face plates shall be 2" by 7-1/4" and contain two 9/16" slots to secure the face plates to the pier bracket.

### **2.021 Model 350-WM & Model 400-WM Pier Bracket**

The wall mounted pier bracket shall have a 244 square inch vertical bearing surface that contacts the vertical face of the stem wall. This 5/8" thick vertical mounting plate shall have six 1-1/8" diameter holes that will accept 1" diameter concrete anchor bolts. The vertical bearing plate shall be welded to side pieces, which measure 4" wide, by 16" long.

### **2.022 Model 400-WM HD Pier Bracket**

The wall mounted pier bracket shall have a 320 square inch vertical bearing surface that contacts the vertical face of the stem wall. This 5/8" thick vertical mounting plate shall have six 1-1/8" diameter holes that will accept 1" diameter concrete anchor bolts. The vertical bearing plate shall be welded to side pieces, which measure 4" wide, by 20" long.

## **2.03 Pier Cap**

The pier cap is a welded assembly that connects the pier pipe to the pier bracket and transfers the structural load to the pier pipe. The pier cap shall be fabricated from 1-1/2" by 4" by 9" long steel conforming to ASTM A-36 Gr. 50. Attached to the center of this plate shall be a piece of tubing of appropriate diameter to fit over the pier pipe and is 1" long. This ring is used to maintain pier pipe alignment. The pier cap shall have two 1" diameter holes for attaching the pier cap to the pier bracket.

## **2.04 Holding/Lift Rods and Hex Nuts**

Supplied with the pier bracket shall be two 7/8" – 9 all thread bars that measure 17-3/4" long and four 7/8" – 9 diameter heavy hex nuts conforming to ASTM A-193 Grade B7. The bracket rods and nuts shall be used to attach the pier cap to the pier bracket. These items provide for a maximum lift of the pier system of 4". Larger lifts may be accomplished by using longer bracket rods.

## **2.05 Lift Assembly**

The lift assembly shall consist of a lift head; two lift legs and two heavy hex nuts. The lift assembly is used to recover lost elevation and to allow for transfer of the structural load from the pier pipe to the pier bracket assembly. The lift legs are used as extensions to the bracket lift rods and allow attachment of the lift head above the pier cap. A hydraulic ram shall be installed between the lift head and pier cap during structural load transfer and recovery of lost elevations

### **2.051 Lift Head**

The lift head shall be fabricated from 1-1/2" by 4" by 9" long steel conforming to ASTM A-36 Gr. 50. The lift head shall have two 1" diameter holes to accept the holding/lift rods.

### **2.052 Lift Leg & Hex Nut**

Supplied with the lift head shall be two lift leg assemblies constructed from 7/8" – 9 all thread rod that measure nominally 9" long conforming to ASTM A-193 Grade B7. One end of the all thread bar shall be threaded into a 2-1/2" long thread bar coupler to a depth of 1" and welded in place. Also supplied with each lift leg shall be a 7/8" – 9, heavy hex nut. Total length of the lift leg shall be 10-1/2".

#### **2.06 Anchor Bolts**

The anchor bolts shall be secured with a hybrid adhesive mortar in conjunction with a high strength threaded steel rod. Anchor system shall conform to ICC-ES 5193 and NSF/ANSI Standard 61. The threaded rod shall be 1" diameter by 12" long, having allowable shear strength of 16,690 pounds conforming to ASTM A193 B7. The rod shall be supplied with a nut and washer. The hybrid adhesive shall consist of a methacrylate resin, hardener, cement and water. The adhesive shall be furnished in containers which keep the components separate. The adhesive shall be introduced to the hole through a static mixing nozzle as supplied by the manufacturer. (Hilti HAS Super #68662 and HY-150 adhesive #371957, or equal.)

### **Section 3 – Tools and Equipment**

#### **3.01 Drive Stand**

The proprietary drive stand is a welded assembly designed to maintain vertical alignment of the pier bracket, drive cylinder and pier pipe during pier installation. The drive stand shall be a welded assembly of 1/2", 5/8" and 1" thick cold rolled flat bar stock conforming to ASTM A-36 and 3/8" and 1/2" thick hot rolled steel conforming to ASTM A-29. Supplied with the drive stand shall be two face plates and four hex nuts. The upper face plate retains the drive cylinder and has two 9/16" mounting holes. The lower face plate retains the pier pipe and has two 9/16" slots for attachment to the drive stand. Two drive stand pins are required to attach the drive stand to the pier bracket. These pins shall be formed from 15/16" diameter steel bar and shall be 15-1/2" long.

#### **3.02 Drive Cylinder Assembly**

The drive cylinder assembly shall be a double acting with a special cylinder head designed to fit the proprietary drive stand, a rod aligner and a pier drive adapter on the end of the piston rod designed to install the 4" diameter by 0.220 wall thickness pier pipe. The drive cylinder shall have a 3-1/4" diameter bore and 2" diameter cylinder rod. The stroke shall be 24". Working pressure may vary from 3,000 to 10,000 depending upon the cylinder manufacturer. **The operator must identify which cylinder he is using and verify the working pressure of the cylinder prior to using the hydraulics.**

#### **3.03 Hydraulic Pumps**

##### **3.031 Pier Installation Pump**

A gasoline or electrically operated hydraulic pump is required to install the pier pipe. The pump shall be capable of providing 10,000 psi of hydraulic pressure and a dual flow rate of 480 in<sup>3</sup>/min up to 2,000 psi and a rate of 100 in<sup>3</sup>/min above 2,000 psi. The pump shall have a 4-way, 3 position valve for double acting cylinder service. (Enerpac PGM-5204R or equal)

##### **3.032 Hand Pump**

One or more hand pumps may be required to transfer structural load and to recover lost elevation. The hand pump(s) are connected to hydraulic lifting rams via a manifold arrangement. This provides uniform force to several pier placements at the same time. The hand pump assembly shall provide two stages of displacement at pressures up to 10,000 psi. Below 400 psi the displacement shall be 2.4 in<sup>3</sup> per stroke and above 400 psi, 0.15 in<sup>3</sup>. (Enerpac P801 or equal)

#### **3.04 Single Acting Hydraulic Cylinder**

A single acting hydraulic cylinder shall be positioned at each placement during the load transfer phase of the restoration. The hydraulic cylinder shall be rated at 10,000 psi of hydraulic pressure and heavy duty return spring. The minimum cylinder bore shall be 5.16 in<sup>2</sup> and a stroke of 4". (Enerpac RC-254 or equal)

#### **3.05 Pressure Gauges**

##### **3.051 Drive Cylinder Pressure Gauge**

A pressure gauge shall be provided to monitor the installation force placed upon the pier pipe. The gauge shall be capable of measuring 0 – 10,000 psi with a minimum gauge face of 4" and minor graduations of 100 psi. (Enerpac G4088L or equal)

##### **3.052 Hand Pump Pressure Gauge**

A pressure gauge shall be provided to monitor the lifting force applied to the structure during restoration. The pressure gauge shall be capable of measuring 0 – 10,000 psi with a minimum gauge face of 2-1/2" and minor graduations of 200 psi. (Enerpac G2535L or equal)

### **Section 4 – Steel Pier Installation**



**Warning!**

- Utilities:** Thoroughly investigate the job site for the possible existence and location of all underground utilities before proceeding. Avoid any contact with ALL underground utilities!
- Excavations:** Collapsing soil can be dangerous. Follow OSHA requirements at all times. Do not enter any excavation if there are any questions about the stability of the soil.
- Pier Placement:** Excessive distance between pier placements can damage the concrete foundation from structural overload. Verify that the foundation has sufficient structural integrity to carry the load between placements.
- Pier Placement:** Thoroughly investigate the exterior of the structure adjacent to the proposed placement especially directly above the drive stand and drive cylinder. Movements of tools and equipment during pier installation may damage electrical boxes, faucets, windowsills, sliding doors and other architectural elements.
- Drive Cylinder:** Verify the working pressure of the hydraulic drive cylinder prior to using the hydraulics. Do not exceed the hydraulic drive cylinder manufacturer's working pressure during pier installation. When operating near the maximum cylinder pressure, cylinder rod extensions should be restricted to no more than 15 inches to prevent damage to the drive cylinder actuator rod.
- Hydraulic Equipment:** Inspect all hydraulic equipment prior to using. Do not use any leaking or damaged components such as cracked, crimped or cut hoses, leaking fittings, etc.
- Heavy Lifting:** Many pieces of equipment used to install steel foundation underpinning are very heavy. Use proper lifting techniques, back supports, and help from others when lifting heavy objects.
- Safety Devices:** When driving pier pipe all face plates must be fastened in place on the drive stand and pier bracket to enhance the integrity of the system and to secure the pier pipe.
- Safety Devices:** All persons in and around the work area must use personal safety protection.



**Warning!**

**FAILURE TO HEED THESE WARNINGS OR TO FOLLOW SAFE WORK HABITS MAY RESULT IN SERIOUS INJURY OR DEATH!**

**4.01 Excavating to Expose Footing or Grade Beam**

An excavation shall be prepared adjacent to the foundation to expose the stem wall and the top of the footing, if any. The excavated work area must be wide enough for safe working conditions, typically 3 to 4 feet wide by 3 to 4 feet away from the structure is usually adequate, taper or shore deep excavations per OSHA guidelines. Move excavated soil away from the work area by at least two feet and store in such a manner that the soil will not erode or cause damage to the owner's property.

**4.02 Footing or Grade Beam Preparation**

If the structure has a spread footing foundation, it shall be drilled with a core drill having a diameter not less than 4-1/2" to provide access for the pier pipe through the footing element at the proposed pile placement location. The centerline of the access hole shall be 2-3/4" from the face of the stem wall. The face of the stem wall shall be prepared smooth and vertical in the area where the pier bracket will be mounted. The bracket should not be mounted more than 12" above the upper surface of the spread footing. In situations where the pier will be heavily loaded and must be mounted higher than 12" above the footing, the engineer of record should be notified. The extra length of unsupported pier pipe could reduce the allowable capacity of the system and the engineer can provide this information and make any spacing adjustments to account for capacity changes.

**4.03 Pier Bracket Installation**

Where a spread footing exists, place a wooden spacer between the top of the spread footing and the bottom of the wall mount bracket and locate the centerline of the bracket directly over the centerline of the hole through the footing. Carefully mark the locations for the anchors on the concrete wall and put the wall mount bracket aside.

If there is no spread footing present, use the mounting plate of the wall mount bracket to make a template with the holes located and the centerline of the pier indicated. Place the template on the wall at the designated location approximately one to two feet from the bottom of the excavation or bottom of the wall. Use a spirit level along the pier centerline indicated on the template to align the template plumb. Mark the location of the anchors.

Drill and install the anchor bolts. The 1" diameter by 12" long threaded HAS super rod shall have an allowable shear strength of 16,690 pounds and conform to ASTM A193 B7 when installed as described. The adhesive anchor bolts shall be installed exactly as specified by the manufacturer. The capacity rating for this product is based upon installing the anchors to a

minimum depth of 8-1/4" into a concrete wall having a thickness of 10-1/2 inches or more and a minimum compressive strength of 3,000 psi. Anchor holes shall be drilled 1-1/16" diameter by 8-1/4" minimum depth.

After drilling the holes in the concrete to accept the anchors, clean the holes with a wire brush then insert an air nozzle to the bottom of the holes and blow out any remaining dust. Insert the adhesive mixing nozzle into each hole, and starting at the bottom of the hole, fill the hole 1/2 to 2/3 full. Apply the adhesive only when the temperature is between 23<sup>o</sup> F and 104<sup>o</sup> F. Insert the HAS Super Rod into the hole, twisting the rod while installing to the full depth of the hole. Do not disturb the anchor between gel time and cure time, which is typically 50 minutes at 68<sup>o</sup> F. The manufacturer estimates that one cartridge of adhesive will anchor 6 bolts. (Hilti HAS Super #68662 and HY-150 adhesive #371957, or equal.)

Once the adhesive has cured, install the wall mount bracket and tighten each bolt to 175 to 200 ft-lb. Lower the drive stand into the excavated area then slide the drive stand horizontally over the two pieces of 1-1/2" square tubing on the pier bracket. The 15/16" diameter tapered drive stand locking bars shall be installed through the holes in the drive stand that are directly above and aligned with the two 1-1/2" square tubes, and into the lower drive stand holes.

Slide the lower end of the drive cylinder into slots at the top of the drive stand. Secure the drive cylinder to the drive stand by placing the upper face plate with two holes over the two studs at the top of the drive stand. Connect all of the hydraulics between the drive cylinder and the hydraulic pump.

Place a lead pier section into the drive stand with the friction reduction collar facing downward. Secure the face plate with pier guides over the studs and nuts on the drive stand and the face plates over each pair of studs on pier bracket. Activate the drive cylinder to apply a seating load on the drive stand assembly. When the drive stand has raised enough to remove all of the slack from fabrication tolerances, drill and install 1/2" x 7" long concrete anchors, flat washers and hex nuts as required to secure the drive stand in position.

#### 4.04 Driving Pier Pipe

**IMPORTANT: The installation base plate must be removed from the bottom of the excavation and the control sleeve must be in place over the pier pipe before proceeding.**

Drive the lead pier section into the soil using the hydraulic drive cylinder to nearly the full extension of the cylinder rod. Retract the cylinder rod; install the coupling shoulder of a drive tool into the top of the installed pier section. Drive the pier downward into the soil again to the length of the hydraulic drive cylinder stroke. Repeat this operation with an additional drive tool as required to fully install the pier pipe. Retract the cylinder rod; remove the drive tools, guides and face plates. Document the force used to drive each section of pier pipe. Install the coupled end of an extension pier section into the top of the driven pier section. Replace the guides and face plates.

**CAUTION: Safe operation dictates that the drive cylinder working pressure shall not be exceeded and all faceplates are securely in place during pier installation. When operating near the maximum cylinder pressure, cylinder rod extensions should be restricted to no more than 15 inches to prevent damage to the drive cylinder actuator rod.**

The pier installation process shall continue adding extension pier sections until the design load or a suitable bearing stratum is reached. Hold the final driving load on the pier to check for pier creep.

#### 4.05 Installing Inertia Sleeve (Optional)

**NOTE: The inertia sleeve must be installed concurrent with the pier sections. The installer must have general knowledge of depth to suitable load bearing for the pier to be able to calculate the point to commence sleeve installation to be able to protect the pipe in the area of weak soils.**

The inertia sleeve increases the moment of inertia of the pier and strengthens the segment couplings in the area of weak soils or in areas of unsupported pier pipe. The inertia sleeve shall be installed into the pier section prior to inserting the next pier extension. The coupling end of the inertia pier section shall be inserted into the pier pipe. It shall drop by gravity into the pier pipe coupling at the bottom end of the extension section. This process shall be continued through the entire length where additional pier bending strength is required such as areas of exposed pier pipe or areas where the Standard Penetration Test (SPT) blow count "N" is less than 5 blows per foot.

#### 4.06 Field Proof Loading

Load test the pier to the required proof load above the design or working load, or until lift of the structure is encountered. We do not recommend proof loading the system to a load greater than 1.5 times the anticipated service load. The maximum proof load allowable for the Model 350-WM is 64,500 pounds, the Model 400-WM is 80,000 pounds, and the Model 400-WM HD is 86,000 pounds. Proof loads above the capacity of the drive cylinder may be tested by removing the drive cylinder, installing steel block bridging in the stand to accommodate a 25 to 50 ton short single acting ram between the pier pipe and the steel block. Connect the ram to a hand pump and gauge assembly. Activate the ram to apply the required proof load to the system. Document the results. Remove hydraulic drive cylinder and drive stand from the pier bracket.

#### 4.07 Cutting Final Pier Section to Length

After verifying the pier capacity, it may be necessary to cut the final pier section. The pier pipe shall be cut very carefully to insure that the cut is perpendicular to the axis of the pipe. The pier bracket is shipped with bracket lift rods sized for lifts up to

4". For larger lifts, longer bracket lift rods are required. For most projects with lifts less than 4", the length of the final pier section must be cut to allow it to protrude above the top of the pier bracket approximately 4". The length to cut the pier section will vary depending upon the required lift.

#### **4.08 Load Transfer**

Transfer the structural load to the piers uniformly and evenly by activating many hydraulic rams simultaneously. A pier cap, lift assembly and bracket lift rods shall be installed with nuts on each bracket. A 25-ton ram shall then be placed between each pier cap and lift assembly. Each ram shall be connected through a cut-off valve to one or more manifolds, gauge, and hydraulic hand pump systems. As the hand pump is actuated, force is applied to the pier caps. As the load is transferred from the foundation to the piers, the interior and exterior of the structure must be carefully monitored to insure that the restoration occurs to plan and the structure is stabilized or lifted to the design elevation. As each placement reaches the desired load and/or elevation, the cut-off valve for the ram at the pier is closed and the pressure recorded for that placement. The hex nuts at the top of the bracket rods and above the pier caps shall be advanced to the surface of the pier cap and secured.

Remove the lift assemblies, hydraulic rams and lifting hydraulics from each pier placement. Clean all hydraulics, replace dust caps on the hydraulic couplings and store the equipment in a clean, dry environment.

#### **4.09 Backfill and Cleanup**

Remove all scrap and other construction debris from the site. Remove all tools and equipment, clean them and store them.

The excavations shall now be backfilled using the soil that was removed and stored nearby. The backfill shall be placed into the holes in small lifts of 6" to 8" and then properly tamped to achieve maximum density. After the backfilling operation is complete, the soil at the perimeter must have a positive slope away from the perimeter of the foundation.

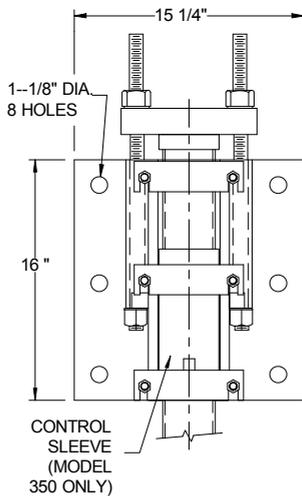
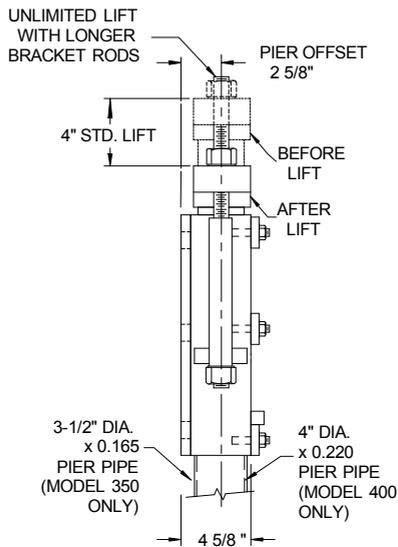
Dispose of all construction debris in a safe and legal manner.

### **END OF SPECIFICATION**

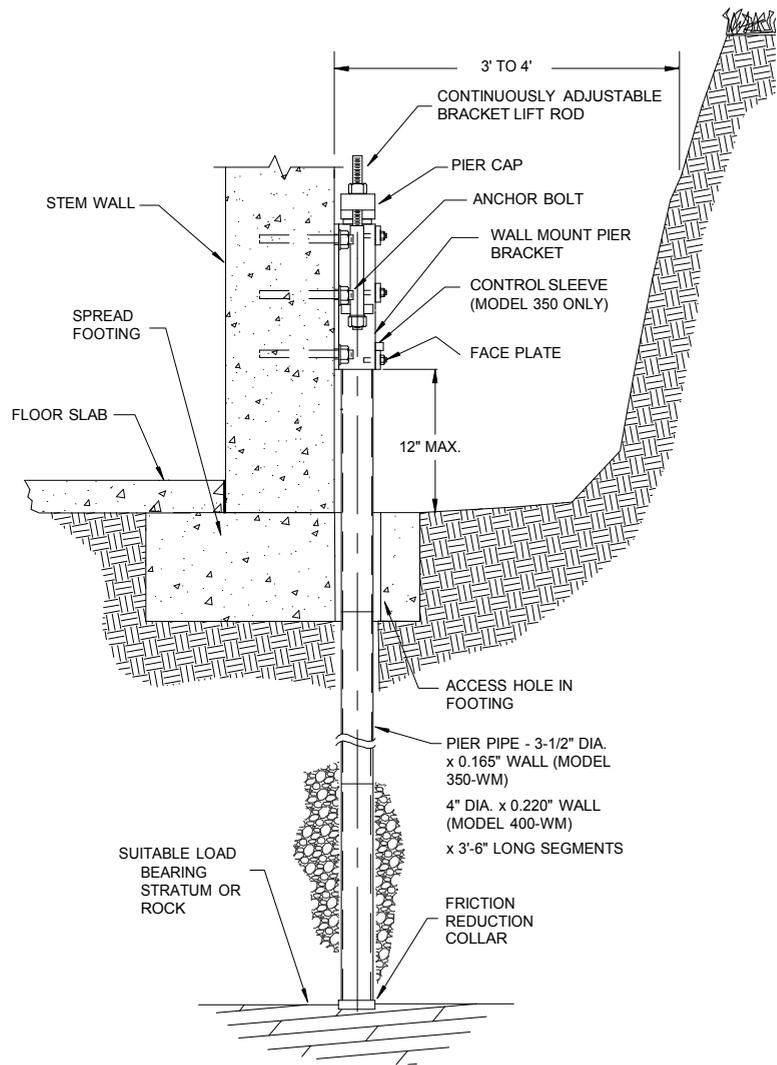
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## ECP Steel Pier™ -- Model 350-WM & Model 400-WM Wall Mounted Pier System

- Model 400-WM Ultimate Capacity – 107,000 lb.
- Model 400-WM Max. Proof Test – 80,000 lb.
- Model 350-WM Ultimate Capacity – 86,000 lb.
- Model 350-WM Max. Proof Test – 64,500 lb.
- 244 Square Inches Bearing Surface
- Installs From Outside or Inside Structure
- Standard Lift – 4”
- Fully Adjustable Unlimited Lift
- Friction Reduction Collar On Lead Pier Section
- 3-1/2” or 4” Diameter High Strength Pier Pipe
- Installs With Portable Equipment
- Installs With Little or No Vibration
- Installs To Rock or Verified Load Bearing Stratum
- 100% of Piers Proof Tested At Installation
- Manufacturer’s Warranty



**Model 350-WM & Model 400-WM  
Wall Mounted Bracket Details**



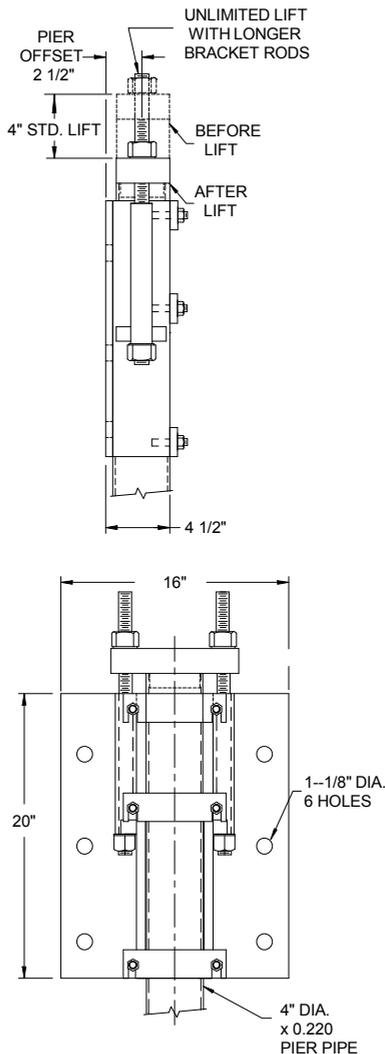
**Model 350-WM & Model 400-WM  
Wall Mounted Bracket Application Drawing**



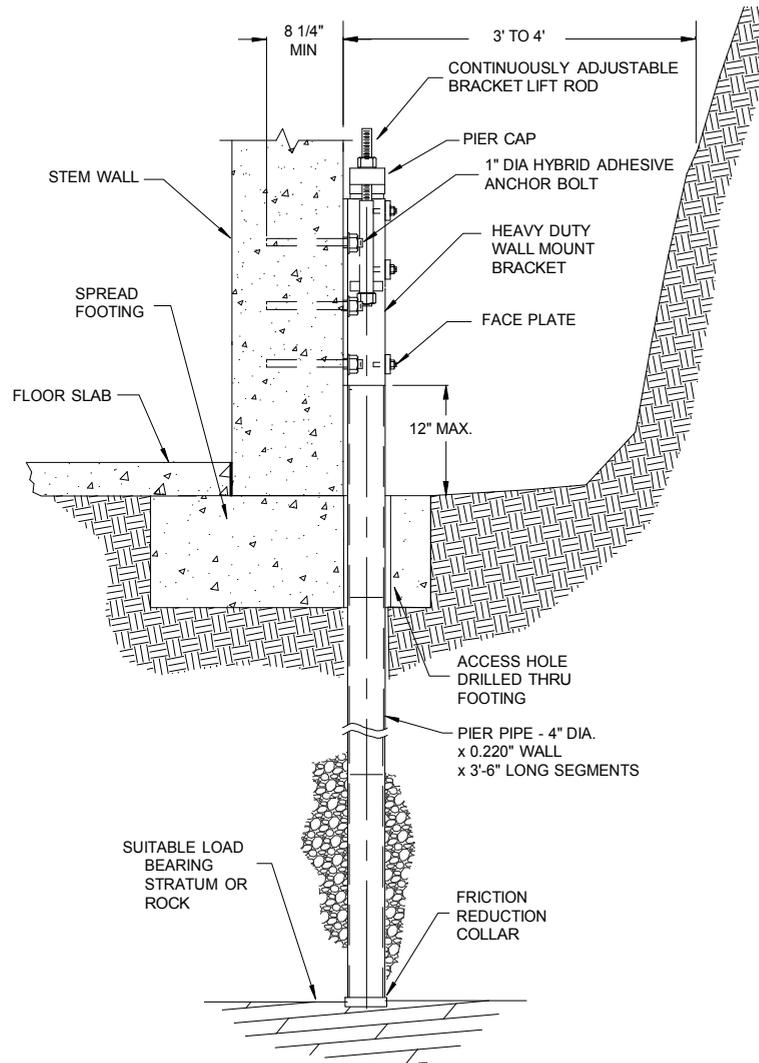
*The capacity of the wall mounted foundation support system is limited by the strength of the bracket to foundation connection and the anchor bolt capacity. It is also a function of the capacity of pier pipe and soil surrounding the pipe, capacity of the load bearing stratum, foundation bracket, and foundation strength. Actual capacities could be lower than the capacity of the anchor bolt or bracket.*

## ECP Steel Pier™ -- Model 400-WM HD Wall Mounted Pier System

- Model 400-WM HD Ult. Capacity: 115,000 lb
- Model 400-WM HD Max. Proof – 74,000 lb.
- 320 Square Inches Bearing Surface
- Installs From Outside or Inside Structure
- 4” Diameter High Strength Tubular Pier
- Installs With Portable Equipment
- Installs With Little or No Vibration
- Standard Lift – 4”
- Fully Adjustable Unlimited Lift Capability
- Friction Reduction Collar On Lead Pier Section
- Installs To Rock or Verified Load Bearing Stratum
- 100% of Piers Proof Tested At Installation
- Manufacturer’s Warranty



**Model 400-WM HD  
Wall Mounted Bracket Details**



**Model 400-WM HD  
Wall Mounted Bracket Application Drawing**



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**TYPICAL SPECIFICATION**  
**ECP Steel Pier™ Model 350-EP2 Eccentric Utility Bracket System**  
**ECP Steel Pier™ Model 400-EP2 Eccentric Utility Bracket System**  
**ECP Steel Pier™ Model 350-EP4 Eccentric Utility Bracket System**

**Section 1- General**

**1.01 Typical Installation Scope**

Furnish labor, equipment, tools and material to install Model 350 Piers with Eccentric Bracket as described in this specification in a workmanlike manner and to design criteria.

1. Prepare site for safe working conditions.
2. Thoroughly investigate the site for any and all underground utilities before excavating.
3. Excavate as required for installation of the product.
4. Prepare stem wall, footing and/or grade beam of the foundation for pier bracket mounting.
5. Drill pier hole through dense stratum
6. Install ECP Steel Pier™ eccentric bracket and drive stand unit.
7. Securely anchor the drive stand and pier bracket to the structure.
8. Install the drive cylinder and connect hydraulics.
9. Hydraulically drive the steel pier sections to the required installation force.
10. Install lift assemblies, hydraulic lift cylinders and connect hydraulics.
11. Transfer the load to the piers, lift the structure to designed specifications and mechanically secure to maintain elevation.
12. Remove equipment from work area.
13. Backfill and clean work areas.

**1.02 Delivery, Storage and Handling**

All foundation repair products, tools and equipment shall be handled and transported with care to prevent any damage or deformation. Hydraulic components shall be protected from the weather and kept clean of any dust, dirt, mud or debris.

**Section 2 - Product Material**

**2.01 Pier Sections**

Each pier section shall be manufactured from steel tubing having a nominal outside diameter of 3-1/2" outside diameter and a wall thickness of 0.165". The pier sections shall be fabricated from mill rolled, induction heat treated steel with a minimum yield strength of 55,000 psi. Each pier section shall be approximately 42" long and shall have a mill-installed coating of zinc-iron alloy, pure zinc galvanizing, a layer of zinc chromate compounds and a clear organic polymer coating. The materials conform to ASTM A500.

**2.011 Lead Section**

The lead section shall have a friction reduction collar welded to the bottom end of the pier pipe. The collar shall be fabricated from steel tubing having a nominal 4" outside diameter by 0.220" wall with a length of 1". The purpose of the collar is to reduce skin friction on the pier sections that follow; therefore the first section of pier pipe must have this collar attached.

**2.012 Extension Section**

The extension section shall have a coupling installed on one end of the pier pipe. This coupling shall be fabricated from steel tubing having a nominal 3-1/8" outside diameter by 0.180" wall thickness with a length of 5-7/8". Three inches of the coupling shall be inserted into the pier section and secured by two 1/2" button welds.

**2.013 Bracket Pier Sleeve**

The bracket pier sleeve shall be manufactured from steel tubing having a nominal outside diameter of 4" outside diameter and a wall thickness of 0.220". The external pier sleeve sections shall be fabricated from mill rolled, induction heat treated steel with a minimum yield strength of 55,000 psi. Each external pier sleeve section shall be approximately 42" long and have mill finish. Welded to the external pier sleeve shall be a 3/4" x 3/4" x 3/4" piece of steel that forms a stop.

**2.014 Inertia Sleeve (Optional)**

The inertia sleeve is a pipe assembly that fits inside the pier pipe during installation to increase the moment of inertia of the pier pipe and strengthens the joints between pier sections. The inertia sleeve shall be installed to the pier pipe through areas of weak soil, areas of unsupported length of pier pipe or where additional pier wall strength is required. The inertia sleeve shall be fabricated from steel tube having a 3-1/8" outside diameter by 0.180" wall and 35-1/4" long. The coupling shall be fabricated from 2-5/8" diameter by 0.188" wall steel tubing that is 12 inches long. Three inches of the coupling shall be inserted into the inertia sleeve section and secured by two 1/2" button welds.

**2.015 External Pier Sleeve (Optional)**

The external pier sleeve shall be manufactured from steel tubing having a nominal outside diameter of 4" outside diameter and a wall thickness of 0.220". The external pier sleeve sections shall be fabricated from mill rolled, induction

heat treated steel with a minimum yield strength of 55,000 psi. Each external pier sleeve section shall be approximately 42" long and have mill finish.

## **2.02 Eccentric Utility Pier Bracket**

### **2.021 Model 350-EP2 & Model 400-EP2 -- 2" Eccentric Utility Pier Bracket**

The pier bracket shall be designed to connect the structure to the pier and to transfer the load of the structure to the pier pipe. The pier bracket shall be a welded assembly new, clean steel with a thickness of 1/2" or 5/8" and structural square tubing with a thickness of 3/16" or 1/4" that conforms to ASTM A-36. The eccentric pier bracket shall have a 74 square inch horizontal bearing surface that contacts the bottom of the foundation plate and a vertical mounting plate area of 104 square inches. The 1/2" thick vertical mounting plate shall have four 9/16" diameter holes that will accept 1/2" diameter concrete anchor bolts. The horizontal and vertical bearing plates shall be welded to side pieces, which measure 6" wide, by 18" long. A 9-7/8" long piece of 1-1/2" square tube with a wall thickness of 3/16" shall be welded vertically to the outer side of each side piece. Six mounting studs shall be welded to the outer front edge of the side pieces. These studs shall be fabricated from 2-1/4" long pieces of 1/2"-13 all-thread bar. Each stud shall be supplied with a 1/2"-13 hex nut. A sleeve shall be installed to provide an additional eccentric offset from the standard pier. The sleeve shall be fabricated from 11-7/8" long piece of 4" square tubing with a wall thickness of 0.188". Supplied with the bracket shall be three face plates that are used to secure the pier pipe and control sleeve in proper alignment and position within the pier bracket. The face plates shall be 2" by 7-1/4" and contain two 9/16" slots to secure the face plates to the pier bracket. The eccentric pier bracket shall also have a 42" pier sleeve to assist in moment transfer. A Bracket Pier Sleeve shall be supplied with each bracket assembly.

### **2.022 Model 350-EP4 -- 4" Eccentric Utility Pier Bracket**

The pier bracket shall be designed to connect the structure to the pier and to transfer the load of the structure to the pier pipe. The components shall be as described in paragraph 2.02 except the horizontal and vertical bearing plates shall be welded to side pieces, which measure 8" wide, by 18" long.

## **2.03 Pier Cap**

The pier cap is a welded assembly that connects the pier pipe to the pier bracket and transfers the structural load to the pier pipe. The pier cap shall be fabricated from 1-1/2" by 4" by 9" long steel conforming to ASTM A-36 Gr. 50. Attached to the center of this plate shall be a piece of 4" diameter x 0.220 wall tubing that is 1" long and is used to maintain pier pipe alignment. The pier cap shall have two 1" diameter holes for attaching the pier cap to the pier bracket.

## **2.04 Bracket Rods and Hex Nuts**

Supplied with the pier bracket shall be two 7/8" – 9 all thread bars that measure 18" long and four 7/8" – 9 diameter heavy hex nuts conforming to ASTM A-193 Grade B7. The bracket rods and nuts shall be used to attach the pier cap to the pier bracket. These items provide for a maximum lift of the pier system of 4". Larger lifts may be accomplished by using longer bracket rods.

## **2.05 Lift Assembly**

The lift assembly shall consist of a lift head; two lift legs and two heavy hex nuts. The lift assembly is used to recover lost elevation and to allow for transfer of the structural load from the pier pipe to the pier bracket assembly. The lift legs are used as extensions to the bracket lift rods and allow attachment of the lift head above the pier cap. A hydraulic ram shall be installed between the lift head and pier cap during structural load transfer and recovery of lost elevations

### **2.051 Lift Head**

The lift head shall be fabricated from 1-1/2" by 4" by 9" long steel conforming to ASTM A-36 Gr. 50. The lift head shall have two 1" diameter holes to accept the holding/lift rods.

### **2.052 Lift Leg & Hex Nut**

Supplied with the lift head shall be two lift leg assemblies constructed from 7/8" – 9 all thread rod that measure nominally 9" long conforming to ASTM A-193 Grade B7. One end of the all thread bar shall be threaded into a 2-1/2" long thread bar coupler to a depth of 1" and welded in place. Also supplied with each lift leg shall be a 7/8" – 9, heavy hex nut.

## **2.06 Anchor Bolts**

The expansion anchor shall be wedge type with a single piece three section wedge conforming to Federal Specification A-A 1923-A, Type 4 and ICC-ES Evaluation Report ESR-1385. Anchor shall be zinc plated conforming to ASTM B633. Anchor bolt size: 1/2" diameter by 7" long and shall be supplied with a flat washer and hex nut. (Hilti Kwik Bolt III #282529 or equal; or as specified by the engineer.)

## **Section 3 – Tools and Equipment**

### **3.01 Drive Stand**

The proprietary drive stand is a welded assembly designed to maintain vertical alignment of the pier bracket, drive cylinder and pier pipe during pier installation. The drive stand shall be a welded assembly of 1/2", 5/8" and 1" thick cold rolled flat bar

stock conforming to ASTM A-36 and 3/8" and 1/2" thick hot rolled steel conforming to ASTM A-29. Supplied with the drive stand shall be two face plates and four hex nuts. The upper face plate retains the drive cylinder and has two 9/16" mounting holes. The lower face plate retains the pier pipe and has two 9/16" slots for attachment to the drive stand. Two drive stand pins are required to attach the drive stand to the pier bracket. These pins shall be formed from 15/16" diameter steel bar and shall be 15-1/2" long.

### 3.02 Drive Stand Spacer

A spacer that positions and secures the drive stand 4 inches away from the foundation stem wall shall be constructed from a 20-3/4" long piece of 4 inch square tubing having a 3/16" thick wall and conforming to ASTM A-500 Grade B. Supplied with the drive stand spacer shall be two 9/16-12 hex head cap screws, two hex nuts and four flat washers. The drive stand spacer is bolted to the mounting slots on the back side of the drive stand. The drive stand spacer is then secured to the foundation stem wall through the two 9/16" by 1" slots provided.

### 3.03 Control Sleeve

A control sleeve is required to maintain alignment of the 3-1/2" pier pipe within the drive stand during installation. The control sleeve shall be fabricated from 11-7/8" long piece of 4" square tubing with a wall thickness of 3/16". Welded to the control sleeve shall be a 3/4" x 3/4" x 3/4" piece of steel that forms a stop.

### 3.04 Drive Cylinder Assembly

The drive cylinder assembly shall be a double acting with a special cylinder head designed to fit the proprietary drive stand, a rod aligner and a pier drive adapter on the end of the piston rod designed to install the 3-1/2" diameter by 0.165 wall thickness pier pipe. The drive cylinder shall have a 3-1/4" diameter bore and 2" diameter cylinder rod. The stroke shall be 24". Working pressure may vary from 3,000 to 10,000 depending upon the installing contractor.

**CAUTION:** The operator must identify which cylinder he is using and verify the working pressure of the cylinder prior to using the hydraulics.

### 3.05 Hydraulic Pumps

#### 3.051 Pier Installation Pump

A gasoline or electrically operated hydraulic pump is required to install the pier pipe. The pump shall be capable of providing 10,000 psi of hydraulic pressure and a dual flow rate of 480 in<sup>3</sup>/min up to 2,000 psi and a rate of 100 in<sup>3</sup>/min above 2,000 psi. The pump shall have a 4-way, 3 position valve for double acting cylinder service. (Enerpac PGM-5204R or equal)

#### 3.052 Hand Pump

One or more hand pumps may be required to transfer structural load and to recover lost elevation. The hand pump(s) are connected to hydraulic lifting rams via a manifold arrangement. This provides uniform force to several pier placements at the same time. The hand pump assembly shall provide two stages of displacement at pressures up to 10,000 psi. Below 400 psi the displacement shall be 2.4 in<sup>3</sup> per stroke and above 400 psi, 0.15 in<sup>3</sup>. (Enerpac P802 or equal)

### 3.06 Single Acting Hydraulic Cylinder

A single acting hydraulic cylinder shall be positioned at each placement during the load transfer phase of the restoration. The hydraulic cylinder shall be rated at 10,000 psi of hydraulic pressure and heavy duty return spring. The minimum cylinder bore shall be 5.16 in<sup>2</sup> and a stroke of 4". (Enerpac RC-254 or equal)

### 3.07 Pressure Gauges

#### 3.051 Drive Cylinder Pressure Gauge

A pressure gauge shall be provided to monitor the installation force placed upon the pier pipe. The gauge shall be capable of measuring 0 – 10,000 psi with a minimum gauge face of 4" and minor graduations of 100 psi. (Enerpac G4088L or equal)

#### 3.052 Hand Pump Pressure Gauge

A pressure gauge shall be provided to monitor the lifting force applied to the structure during restoration. The pressure gauge shall be capable of measuring 0 – 10,000 psi with a minimum gauge face of 2-1/2" and minor graduations of 200 psi. (Enerpac G2535L or equal)



## Warnings!

## Section 4 - Steel Pier Installation

**Utilities:** Thoroughly investigate the job site for the possible existence and location of all underground utilities before proceeding. Avoid any contact with ALL underground utilities!

**Excavations:** Collapsing soil can be dangerous. Follow OSHA requirements at all times. Do not enter any excavation if there are any questions about the stability of the soil.

- Pier Placement:** Excessive distance between pier placements can damage the concrete foundation from structural overload. Verify that the foundation has sufficient structural integrity to carry the load between placements.
- Pier Placement:** Thoroughly investigate the exterior of the structure adjacent to the proposed placement especially directly above the drive stand and drive cylinder. Movements of tools and equipment during pier installation may damage electrical boxes, faucets, windowsills, sliding doors and other architectural elements.
- Drive Cylinder:** Verify the working pressure of the hydraulic drive cylinder prior to using the hydraulics. Do not exceed the hydraulic drive cylinder manufacturer's working pressure during pier installation. When operating near the maximum cylinder pressure, cylinder rod extensions should be restricted to no more than 15 inches to prevent damage to the drive cylinder actuator rod.
- Hydraulic Equipment:** Inspect all hydraulic equipment prior to using. Do not use any leaking or damaged components such as cracked, crimped or cut hoses, leaking fittings, etc.
- Heavy Lifting:** Many pieces of equipment used to install steel foundation underpinning are very heavy. Use proper lifting techniques, back supports, and help from others when lifting heavy objects.
- Safety Devices:** When driving pier pipe all face plates must be fastened in place on the drive stand and pier bracket to enhance the integrity of the system and to secure the pier pipe.
- Safety Devices:** All persons in and around the work area must use personal safety protection.



**Warning!**

**FAILURE TO HEED THESE WARNINGS OR TO FOLLOW SAFE WORK HABITS MAY RESULT IN SERIOUS INJURY OR DEATH!**

**4.01 Excavating to Expose Footing or Grade Beam**

An excavation shall be prepared adjacent to the foundation to expose the stem wall and footing or the bottom of the grade beam. The excavation shall be to a depth of 14 inches below the bottom of the foundation and 12" beneath it. The excavated work area must be wide enough for safe working conditions, typically 3 to 4 feet wide by 3 to 4 feet away from the structure is usually adequate at the footing, taper or shore deep excavations per OSHA guidelines. Move excavated soil away from the work area by at least two feet and store in such a manner that the soil will not erode or cause damage to the owner's property.

**4.02 Footing or Grade Beam Preparation**

If the structure has a spread footing foundation, it shall be notched by removing the extended edge of the footing back to the stem wall for a distance of at least 18 inches in the area of the pier placement. To accomplish this a pneumatic or electrical chipping hammer with a chipping bit and then a bushing tool for smoothing the face shall be used. When preparing either a notched footing or a grade beam, the bottom area of concrete that bears upon the soil must be prepared to a smooth and level condition. Prior to acceptance of preparation, a level shall be used to verify that the portion of the footing upon which the bracket will bear is level both perpendicular to the foundation and parallel to the structure.

**IMPORTANT:** If any reinforcing bar becomes exposed during these operations, consult with an Engineer before removing or cutting any steel reinforcing.

Drilling equipment shall then be used to install a 4" diameter hole through any dense soil, rock and/or debris. The centerline of the bore hole shall be located 6-1/2" off of the face of the stem wall. This boring will allow the pier pipe to reach the target stratum. Technicians fully trained and familiar with soil and rock drilling operations shall perform this work. Sufficient compressed air must be used to insure that all fines from the drilling operation are removed from the bore hole during drilling. Care shall be taken to prevent anything from falling into the hole prior to installing pier pipe.

**4.03 Eccentric Utility Pier Bracket Installation**

Place the steel installation base or other suitable material on the soil below the location for mounting the bracket. If dense soil or rock was drilled prior to pier installation, take care not to get any debris or soil in the bore hole when installing the installation base. Connect the lift assembly and pier cap to the pier bracket. Obtain a short piece of pier pipe, approximately 22" to 24" long depending upon the excavation, and place it in the pier bracket. Install the face plates to the pier bracket by dropping the plates over the studs on either side of the pier bracket.

Maneuver the bracket into place under the footing; place the lower end of the piece of pier pipe into the centering ring of the installation base over the bore hole. Place a hydraulic ram between the lift assembly and the pier cap. Activate the hydraulic ram with a hand pump to bring the bearing plate of the pier bracket in contact with the previously prepared area at the bottom of the footing or grade beam.

If careful inspection reveals that the pier bracket is not plumb (vertical) and evenly bearing across the entire bottom of the footing and against the vertical face of the foundation, then the assembly must be removed and further preparation work must be performed. If only minor correction is required, lower the bracket about two inches and place quick setting, high strength grout on the bearing plate and realign the pier bracket.

Carefully check for alignment and proper bearing between the pier bracket and the bottom of the footing, plus verify proper contact between the pier bracket and the vertical face of the foundation. Activate the cylinder to provide a load for even bearing between the pier bracket and the footing. Drill and install two 1/2" x 7" long concrete expansion anchors, flat washers and hex nuts into the lower mounting holes only to secure the bracket in position. (Note: Upper holes may be used to secure bracket if drilling encounters reinforcing steel in the lower holes.) After the grout sets continue with the installation.

Remove the lift assembly and hydraulic ram from the pier bracket. Remove the face plates and the length of pier pipe. Mount the Drive Stand Spacer to one set of mounting slots using 9/16"-12 hex bolts, nuts and washers. Lower the drive stand into the excavated area then slide the drive stand horizontally over the two pieces of 1-1/2" square tubing on the pier bracket. The 15/16" diameter tapered drive stand locking bars shall be installed through the holes in the drive stand that are directly above and aligned with the two 1-1/2" square tubes, and into the lower drive stand holes.

Activate the drive cylinder to apply a seating load on the drive stand assembly. When the drive stand has raised enough to remove all of the slack from fabrication tolerances, drill and install two 1/2" x 7" long concrete anchors, flat washers and hex nuts as required to secure the drive stand spacer to the wall.

Connect all of the hydraulics between the drive cylinder and the hydraulic pump.

**IMPORTANT: The installation base plate must be removed from the bottom of the excavation and the control sleeve must be in place over the pier pipe before proceeding.**

Carefully remove the installation base over the bore hole being careful not to let debris fall into the hole. Immediately place a lead pier section into the drive stand with the friction reduction collar facing downward and into the bore hole. Secure the face plate with pier guides over the studs and nuts on the drive stand and the face plates over each pair of studs on pier bracket.

#### 4.04 Driving Pier Pipe

Drive the lead pier section into the soil using the hydraulic drive cylinder to the full 24" extension of the cylinder rod. Retract the cylinder rod; install the coupling shoulder of a 22" long drive tool into the top of the installed pier section. Drive the pier downward into the soil again to the length of the hydraulic drive cylinder stroke. Retract the cylinder rod; remove the drive tool, control sleeve and face plates. Document the force used to drive each section of pier pipe. Install an inertia sleeve, if required, before installing the next pier section. (Optional – See 4.05) Install the coupled end of an extension pier section into the top of the driven pier section. Replace the control sleeve and face plates.

**CAUTION: Safe operation dictates that the drive cylinder working pressure shall not be exceeded and all face plates be securely in place during pier installation. When operating near the maximum cylinder pressure, cylinder rod extensions should be restricted to no more than 15 inches to prevent damage to the drive cylinder actuator rod.**

The process shall continue adding extension pier sections until the design load or a suitable bearing stratum is reached. Hold the final driving load on the pier to check for pier creep.

#### 4.05 Installing Pier Sleeving (Optional)

In applications where there will be unsupported pier pipe, the optional pier pipe sleeving must be used. Pier sleeving is used to stiffen the pier pipe and to strengthen the coupled joints between pier sections in weak soils or in applications where the pier pipe is unsupported. Sleeving shall extend at least three feet below the area of unsupported pipe or weak soil layer such as in areas where the Standard Penetration Test (SPT) blow count "N" is less than 5.

##### 4.501 Installing External Pier Sleeving (Optional)

In applications where there will be unsupported pier pipe, the optional pier pipe sleeving must be used below the Top Pier Sleeve that is specified in 4.08 below. The strongest method for increasing pier strength is by installing external 4" diameter sleeving over the pier pipe and insuring that the joints between pier sections and joints between sleeving are staggered by at least 12". The external pier sleeving shall be installed over the pier using the drive stand and drive cylinder. A specialized drive tool for installing the external pier sleeving shall be used to push the sleeve sections over the existing pier pipe. Care must be taken to insure that the joints in the sleeving are staggered a minimum of 12 inches from the joints in the pier pipe. This process shall be continued through the area of pier pipe exposure, weak soil or in areas where additional pier bending strength is required.

##### 4.502 Installing Inertia Sleeve (Optional)

The Inertia Sleeve is a quick and efficient way to provide added strength to the pier pipe and the coupled joints.

**NOTE: The inertia sleeve must be installed concurrent with the pier sections. The installer must have general knowledge of depth to suitable load bearing for the pier to be able to calculate the point to commence inertia sleeve installation to be able to fully protect the pipe in the area of weak soils or unsupported pier column length.**

When driving pier pipe, the inertia sleeve shall be installed into the pier section prior to inserting the next extension pier section. The coupling end of the inertia sleeve shall be inserted first into the pier pipe. The inertial sleeve shall drop by gravity into the coupling at the bottom end of the extension section. This process shall be continued through the area of weak soil or in areas where additional pier bending strength is required.

#### 4.06 Field Proof Loading

Load test the pier to the required proof load above the design or working load, or until lift of the structure is encountered. We do not recommend proof loading the system to a load greater than 1.5 times the anticipated service load. The maximum allowable proof load for the Model 350-EP2 is 37,750 pounds, the Model 400-EP2 is 40,500 pounds and the Model 350-EP4 is 31,500 pounds. Proof loads above the capacity of the drive cylinder may be tested by removing the drive cylinder, installing steel block bridging in the stand to accommodate a 25 to 50 ton short single acting ram between the pier pipe and the steel block. Connect the ram to a hand pump and gauge assembly. Activate the ram to apply the required proof load to the system. Document the results. Remove hydraulic drive cylinder and drive stand from the pier bracket.

#### 4.07 Cutting Final Pier Section to Length

After verifying the pier capacity, it may be necessary to cut the final pier section. The pier pipe shall be cut very carefully to insure that the cut is perpendicular to the axis of the pipe. The pier bracket is shipped with bracket lift rods sized for lifts up to 4". For larger lifts, longer bracket lift rods are required. For most projects with lifts less than 4", the length of the final pier section must be cut to allow it to protrude above the top of the pier bracket approximately 4". The length to cut the pier section will vary depending upon the required lift.

#### 4.08 Installing Top Pier Sleeve

Remove and discard the Control Sleeve and temporarily remove the final Pier Section. Install the Top Pier Sleeve section that consists of a 42" length of 4" diameter tubing with a wall thickness of 0.219" over the remaining Pier Pipe that is in the ground directly below the Pier Bracket. The Top Pier Sleeve shall be installed until the locator pin on the Top Pier Sleeve is between the upper and middle face plates on the Pier Bracket. This may require pressing the Top Pier Sleeve using the hydraulic drive cylinder. Remove the Drive Stand and Drive Cylinder and then install the final Pier Section within the Top Pier Sleeve, the Pier Cap and the Lift Assembly to the Pier System.

#### 4.09 Load Transfer

Transfer the structural load to the piers uniformly and evenly by activating many hydraulic rams simultaneously. The bracket pier sleeve shall be installed over the final section of pier pipe; then the pier cap, lift assembly and bracket lift rods shall be installed with nuts on each bracket. A 25-ton ram shall then be placed between each pier cap and lift assembly. Each ram shall be connected through a cut-off valve to one or more manifolds, gauges, and hydraulic hand pump systems. As the hand pump is actuated, force is applied to the pier caps. As the load is transferred from the foundation to the piers, the interior and exterior of the structure must be carefully monitored to insure that the restoration occurs to plan and the structure is stabilized or lifted to the design elevation. As each placement reaches the desired load and/or elevation, the cut-off valve for the ram at the pier is closed and the pressure recorded for that placement. The hex nuts at the top of the bracket rods located above the pier caps shall be advanced to the surface of the pier cap and secured.

Remove the lift assemblies, hydraulic rams and lifting hydraulics from each pier placement. Clean all hydraulics, replace dust caps on the hydraulic couplings and store the equipment in a clean, dry environment.

**IMPORTANT: After the restoration is complete the void created between the foundation and soil may need to be filled with grout depending upon the type of foundation, type of soil on the site and the amount of lift. Consult a registered professional engineer when in doubt.**

#### 4.10 Backfill and Cleanup

Remove all scrap and other construction debris from the site. Remove all tools and equipment, clean them and store them. The excavations shall now be backfilled using the soil that was removed and stored nearby. The backfill shall be placed into the holes in small lifts of 6" to 8" and then properly tamped to achieve maximum density. After the backfilling operation is complete, the soil at the perimeter must have a positive slope away from the perimeter of the foundation.

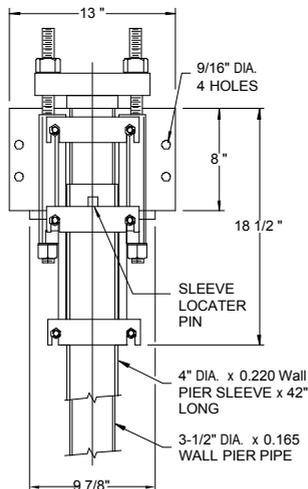
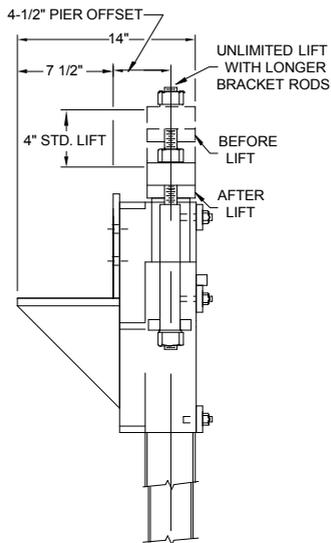
Dispose of all construction debris in a safe and legal manner.

### END OF SPECIFICATION

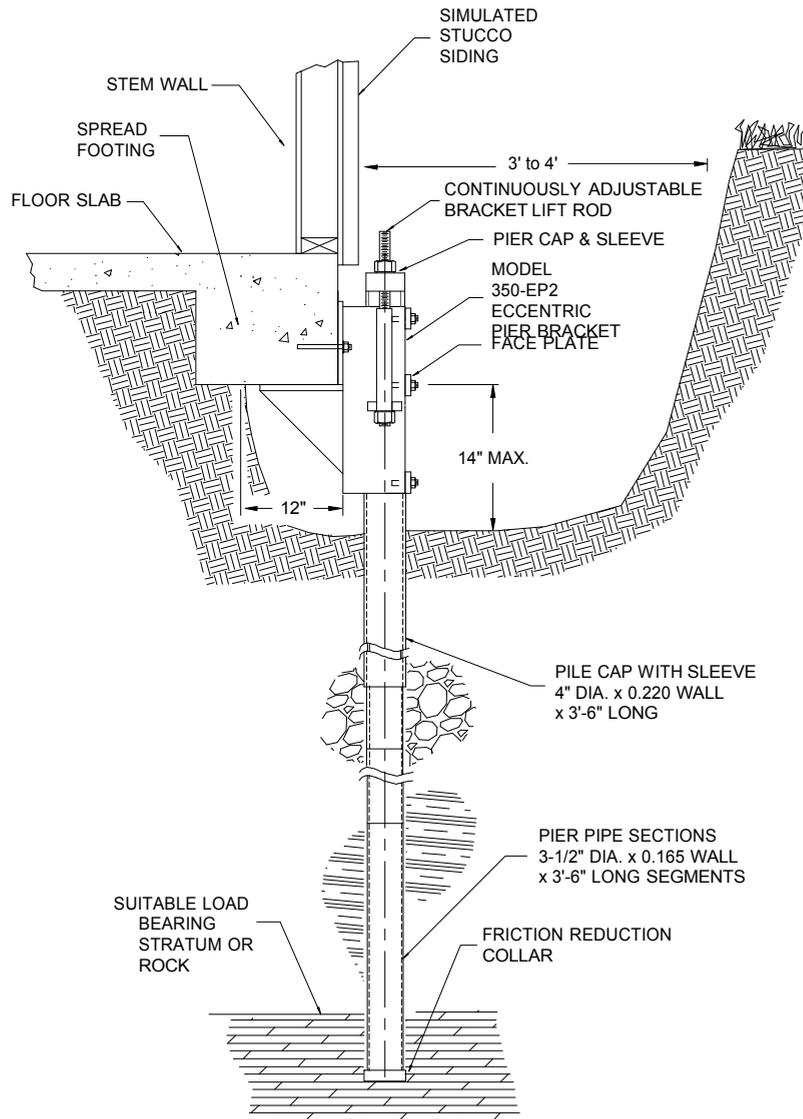
*Earth Contact Products, LLC reserves the right to change design features, specifications and products without notice, consistent with our efforts toward continuous product improvement. Please check with Earth Contact Products at 972 480-0007 or 913 393-0007 to verify that you are using the most recent specifications.*

## ECP Steel Pier™ -- Model 350-EP2 & Model 400 EP2 – 2” Eccentric Bracket Pier System

- Model 400-EP2 Ultimate Capacity – 54,000 lb.
- Model 400-EP2 Max. Proof Test – 40,500 lb.
- Model 350-EP2 Ultimate Capacity – 53,000 lb.
- Model 350-EP2 Max. Proof Test – 39,750 lb.
- Bracket Offset Allows for Siding or Stucco Over Hanging the Footing
- 74 Square Inches Bearing Surface
- Standard Lift – 4”
- Fully Adjustable Unlimited Lift Capability
- Friction Reduction Collar On Lead Section
- 3-1/2” or 4” Diameter High Strength, Galvanized Pier Pipe
- Installs With Portable Equipment
- Installed With Little or No Vibration
- Installs To Rock or Verified Load Bearing Stratum
- 100% of Piers Proof Tested At Installation
- Manufacturer’s Warranty



**Model 350-EP2  
2” Eccentric Utility  
Bracket Details**



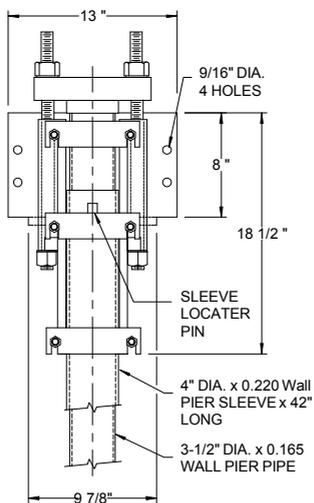
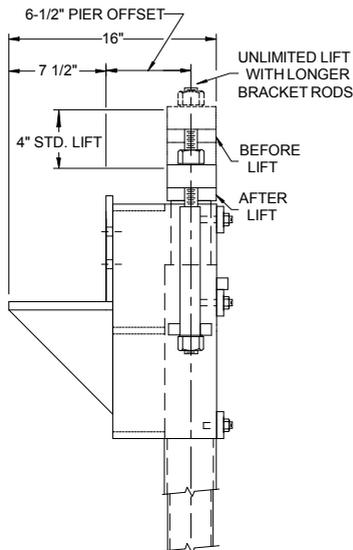
**Model 350-EP2  
2” Eccentric Utility Bracket Application Drawin**

*The capacity of the Model 350-EP2 foundation support system using the eccentric utility bracket is a function of the capacity of pier pipe and soil surrounding the pipe, capacity of the load bearing stratum, foundation bracket, foundation strength and strength of the bracket to foundation connection. Actual capacities could be lower than the bracket capacity.*

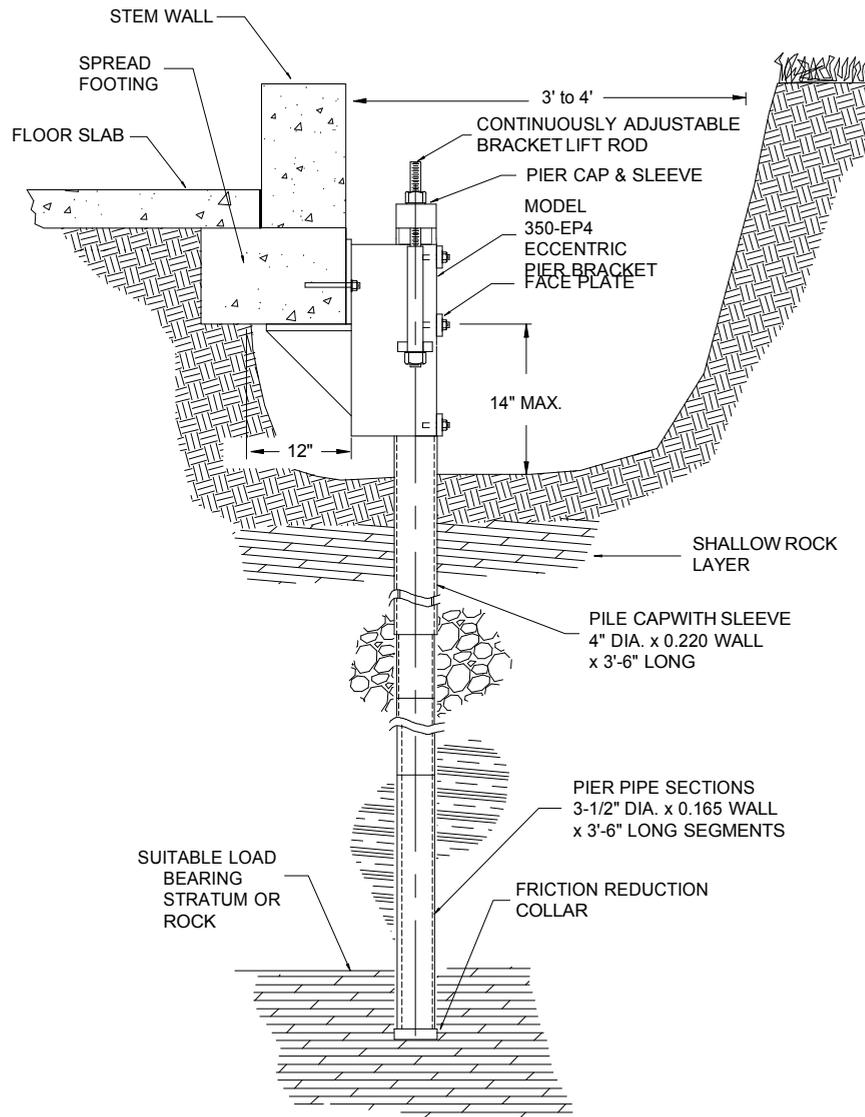


## ECP Steel Pier™ -- Model 350-EP4 – 4” Eccentric Utility Bracket Pier System

- Model 350-EP4 Ulti. Capacity – 42,000 lb.
- Model 400-EP4 Max. Proof Test – 31,500 lb.
- Installs In 4” Diameter Predrilled Hole Through Rock, Dense Soil & Debris
- 74 Square Inches Bearing Surface
- Standard Lift – 4”
- Fully Adjustable Unlimited Lift Capability
- Friction Reduction Collar On Lead Pier Section
- 3-1/2” Diameter High Strength, Galvanized Tubular Pier
- 4” Diameter by 42” Long Pier Sleeve
- Installs With Portable Equipment
- Installed With Little or No Vibration
- Installs To Rock or Verified Load Bearing Stratum
- 100% of Piers Proof Tested At Installation
- Manufacturer’s Warranty



**Model 350-EP4  
4” Eccentric Utility  
Bracket Details**



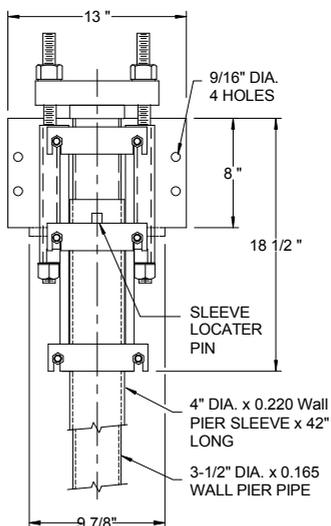
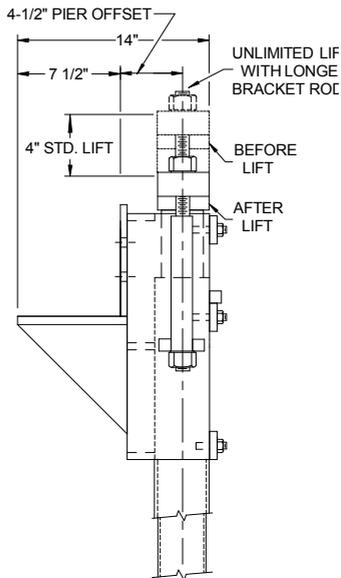
**Model 350-EP4  
4” Eccentric Utility Bracket Application Drawing**

*The capacity of the Model 350-EP4 foundation support system using the eccentric utility bracket is a function of the capacity of pier pipe and soil surrounding the pipe, capacity of the load bearing stratum, foundation bracket, foundation strength and strength of the bracket to foundation connection. Actual capacities could be lower than the bracket capacity.*

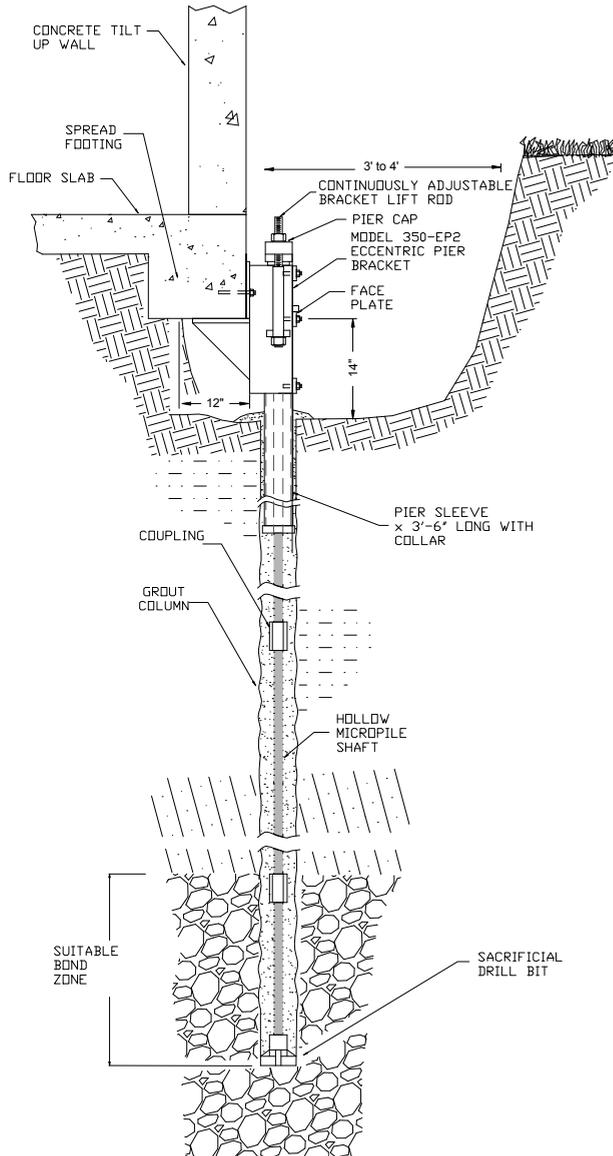


## ECP Steel Pier™ -- Model 350-MP2 – 2” Eccentric Utility Bracket Micro Pile

- Ultimate Brkt Capacity – Up to 68,000 lb.
- Installs Into Rock Through a Predrilled and Grouted Hole
- 74 Square Inches Bearing Surface
- Standard Lift – 4”
- Fully Adjustable Unlimited Lift Capability
- Hollow Micro Pile Shaft
- 42” Long Pier Sleeve
- Installs With Portable Equipment
- Installed With Little or No Vibration
- Installs To Rock
- U.S. Patent Pending
- Manufacturer’s Warranty



**Model 350-MP2 Micro Pile Bracket Details**



**Model 350-MP2 – Typical Micro Pile Application Drawing**

*The capacity of the Model 350-EP2 Micro Pile foundation support system using the eccentric utility bracket is a function of the capacity of pier pipe and soil surrounding the pipe sleeve near the surface, capacity of the load bearing stratum, foundation bracket, foundation strength and strength of the bracket to foundation connection. Actual capacities could be lower than the bracket capacity.*



# TYPICAL SPECIFICATION

## ECP Steel Pier™ Model 350 Utility Bracket System, ECP TA-150 Torque Anchor™ Tieback and Model 350-TA Tieback Adapter Assembly

### Section 1- General

#### 1.01 Typical Installation Scope

Furnish labor, equipment, tools and material to install Model 350 Utility Bracket, Steel Pier to end bearing and TA-150 Helical Tieback Anchor as described in this specification in a workmanlike manner and to design criteria.

1. Prepare site for safe working conditions.
2. Thoroughly investigate the site for any and all underground utilities before excavating.
3. Excavate as required for installation of the products.
4. Prepare stem wall, footing and/or grade beam of the foundation for pier bracket mounting.
5. Install Helical Torque Anchor™ Tieback under the footing
6. Install ECP Steel Pier™ bracket and drive stand unit.
7. Securely anchor the drive stand and pier bracket to the structure.
8. Install the drive cylinder and connect hydraulics.
9. Hydraulically drive the steel pier sections to the required installation force.
10. Cut final pier section to length and install Model 350-TA Pier Extension Assembly
11. Install all-thread bar from Tieback transition through Pier Extension Assembly, install Bearing Plate over threaded bar and secure to Pier Bracket using Face Plate nuts, install Bevel Washer and Nut.
12. Install lift assemblies and hydraulic lift cylinders to utility brackets then connect hydraulics.
13. Transfer the load to the piers, lift the structure to designed specifications and mechanically secure system to maintain elevation.
14. Tension Tieback Anchor to specifications
15. Remove equipment from work area.
16. Backfill and clean work areas.

#### 1.02 Delivery, Storage and Handling

All foundation repair products, tools and equipment shall be handled and transported with care to prevent any damage or deformation. Hydraulic components shall be protected from the weather and kept clean of any dust, dirt, mud or debris.

### Section 2 - Product Material

#### 2.01 Torque Anchors

The 1-1/2" round corner solid square bars shall conform to ASTM A29. Yield strength of the bars shall be 90,000 psi. The shaft shall have a torque limit of 7,500 ft-lb

##### 2.011 Leads

Each lead section shall have a 45-degree bevel to aid in starting the helical torque anchor™. The other end shall have one hole to attach an Extension Section or Transition. Leads may be 10', 5', 7', or 10' long depending upon the application. Welded to the lead shall be one or more ASTM A572 Grade 50 round steel plates with a 3/8" thickness and a 3-inch helical pitch. Helical plate diameter shall be specified in any combination of equal or increasing diameters from 6 inches to 14 inches, in 2-inch increments.

##### 2.012 Hot Forged Extensions

Extensions shall have a hot forged integral coupling feature. The Extension may be specified as 1-1/2', 3', 5', 7' or 10' long as required by the application. Both ends of the Extension Section shall have one bolt hole. The lower end of the extension shall have an expanded hot forged female receiver that will fit over the shaft of a previously installed extension or lead. The hole at the other end is for attachment to another section of tieback anchor shaft extension or to a transition to all-thread bar. The hot forged extension shall be supplied with attachment hardware.

In higher load capacity projects or in very weak soil conditions, the hot forge extension may have one or more ASTM A572 Grade 50 round helical steel plates as specified in section 2.011.

##### 2.013 Transition

The transition is a component that attaches to the terminal end of the helical tieback shaft and the other end has a threaded socket to accept a continuously threaded bar. The square bar transition shall be a welded assembly of three steel plates. The plates are welded together to form a socket that surrounds Williams R63-08, or equal. The transition fits over and bolts to end of the square shaft of the Torque Anchor™.

#### **2.014 Attachment Hardware**

Each extension and transition shall be supplied with one 3/4" diameter, appropriate length SAE J429 Grade 8 bolt and nut having a minimum ultimate tensile strength of 150,000 psi and a minimum yield of 130,000 psi.

#### **2.015 Continuous Threaded Bar and Nut**

Connection between the tieback anchor and the pier bracket shall be accomplished by an all-thread bar of suitable length. The bar shall have a nominal thread size of 1" diameter with an approximate major thread diameter of 1-1/8". Minimum ultimate strength shall be 79,000 pounds. Bar shall be supplied with a hex nut. (Williams R61-08 & R63-08 or equal)

#### **2.02 Tieback Bearing Plate**

The bearing plate is designed to transfer the load of the helical tieback anchor to the pier bracket. The bearing plate shall be fabricated from 1/2" x 5" x 7-1/4" hot rolled steel plate. The plate shall have slots suitable to accept the all-thread bar from the tieback transition and the bracket mounting studs.

#### **2.03 Bevel Washer**

A bevel washer having an outside diameter of 2-1/2" and an inside diameter of 1-1/4" with a 20° (+0°/-5°) bevel is used to transfer the tension load from the tieback anchor to the bearing plate. The bevel washer shall be 2" thick.

#### **2.04 Pier Sections**

Each pier section shall be manufactured from steel tubing having a nominal outside diameter of 3-1/2" outside diameter and a wall thickness of 0.165". The pier sections shall be fabricated from mill rolled, induction heat treated steel with a minimum yield strength of 55,000 psi. Each pier section shall be approximately 42" long and shall have a mill-installed coating of zinc-iron alloy, pure zinc galvanizing, a layer of zinc chromate compounds and a clear organic polymer coating. The materials conform to ASTM A500.

##### **2.041 Lead Section**

The lead section shall have a friction reduction collar welded to the bottom end of the pier pipe. The collar shall be fabricated from steel tubing having a nominal 4" outside diameter by 0.220" wall with a length of 1". The purpose of the collar is to reduce skin friction on the pier sections that follow; therefore the first section of pier pipe must have this collar attached.

##### **2.042 Extension Section**

The extension section shall have a coupling installed on one end of the pier pipe. This coupling shall be fabricated from steel tubing having a nominal 3-1/8" outside diameter by 0.180" wall thickness with a length of 5-7/8". Three inches of the coupling shall be inserted into the pier section and secured by two 1/2" button welds.

##### **2.043 Tieback Pier Extension Assembly**

The extension section assembly shall have a coupling installed as described in 2.042 installed on one end of a 22" long section of pier pipe. Attached over the pier pipe shall be a sleeve consisting of a 10-1/2" long piece of 4" diameter by 0.220" wall thickness tubing. Through the both the pier pipe and sleeve shall be a slot to accept the all-thread bar from the tieback. This slot shall be 1-3/16" wide by 8-1/2" long. (ECP Model 350-TA Pier Extension Assembly)

##### **2.044 External Pier Sleeve (Optional)**

The external pier sleeve shall be manufactured from steel tubing having a nominal outside diameter of 4" outside diameter and a wall thickness of 0.220". The external pier sleeve sections shall be fabricated from mill rolled, induction heat treated steel with a minimum yield strength of 55,000 psi. Each external pier sleeve section shall be approximately 42" long and have mill finish.

##### **2.045 Inertia Sleeve (Optional)**

The inertia sleeve is a pipe assembly that fits inside the pier pipe during installation to increase the moment of inertia of the pier pipe and strengthens the joints between pier sections. The inertia sleeve may be installed inside the pier pipe through areas of weak soil, areas of unsupported length of pier pipe or where additional pier wall strength is required. The inertia sleeve shall be fabricated from steel tube having a 3-1/8" outside diameter by 0.180" wall and 35-1/4" long. The coupling shall be fabricated from 2-5/8" diameter by 0.188" wall steel tubing that is 12 inches long. Three inches of the coupling shall be inserted into the inertia sleeve section and secured by two 1/2" button welds.

#### **2.05 Pier Bracket**

The pier bracket shall be designed to connect the structure to the pier and to transfer the load of the structure to the pier pipe. The pier bracket shall be a welded assembly new, clean steel with a thickness of 1/2" or 5/8" and structural square tubing with a thickness of 1/4" that conforms to ASTM A-36.

The pier bracket shall have a 74 square inch horizontal bearing surface that contacts the bottom of the concrete foundation and a vertical mounting plate area of 91 square inches. The 1/2" thick vertical mounting plate shall have four 9/16" diameter holes that will accept 1/2" diameter concrete anchor bolts. The horizontal and vertical bearing plates shall be welded to side pieces, which measure 4" wide, by 18" long.

The following weldments and components attach to the bracket. A 9-7/8" long piece of 1-1/2" square tube with a wall thickness of 1/4" shall be welded vertically to the outer side of each side piece. Four mounting studs shall be welded to the outer front edge of the side pieces. These studs shall be fabricated from 2-1/4" long pieces of 1/2"-13 all-thread bar. Each stud shall be supplied with a 1/2"-13 hex nut. A control sleeve is required to maintain alignment of the 3-1/2" pier pipe within the drive stand during pier pipe installation. A control sleeve shall be fabricated from 11-7/8" long piece of 4" square tubing with a wall thickness of 0.188". Welded to the control sleeve shall be a 3/4" x 3/4" x 3/4" piece of steel that forms a stop. Supplied with the bracket shall be two face plates that are used to secure the pier pipe and control sleeve in proper alignment and position within the pier bracket. The face plates shall be 2" by 7-1/4" and contain two 9/16" slots to secure the face plates to the pier bracket.

#### **2.06 Pier Cap**

The pier cap is a welded assembly that connects the pier pipe to the pier bracket and transfers the structural load to the pier pipe. The pier cap shall be fabricated from 1-1/2" by 4" by 9" long steel conforming to ASTM A-36 Gr. 50. Attached to the center of this plate shall be a piece of tubing with a suitable diameter to fit over the pier pipe and shall be cut 1" long. This ring is used to maintain pier pipe alignment. The pier cap shall have two 1" diameter holes for attaching the pier cap to the pier bracket.

#### **2.07 Bracket Rods and Hex Nuts**

Supplied with the pier bracket shall be two 7/8" – 9 all thread bars that measure 18" long and four 7/8" – 9 diameter heavy hex nuts conforming to ASTM A-193 Grade B7. The bracket rods and nuts shall be used to attach the pier cap to the pier bracket. These items provide for a maximum lift of the pier system of 4". Larger lifts may be accomplished by using longer bracket rods.

#### **2.08 Lift Assembly**

The lift assembly shall consist of a lift head, two lift legs and two heavy hex nuts. The lift assembly is used to recover lost elevation and to allow for transfer of the structural load from the pier pipe to the pier bracket assembly. The lift legs are used as extensions to the bracket lift rods and allow attachment for the lift head above the pier cap. A hydraulic ram shall be installed between the lift head and pier cap during structural load transfer and recovery of lost elevations

##### **2.081 Lift Head**

The lift head shall be fabricated from 1-1/2" by 4" by 9" long steel conforming to ASTM A-36 Gr. 50. The lift head shall have two 1" diameter holes to accept the holding/lift rods.

##### **2.082 Lift Leg & Hex Nut**

Supplied with the lift head shall be two lift leg assemblies constructed from 7/8" – 9 all thread rod that measure nominally 9" long conforming to ASTM A-193 Grade B7. One end of the all thread bar shall be threaded into a 2-1/2" long thread bar coupler to a depth of 1" and welded in place. Also supplied with each lift leg shall be a 7/8" – 9, heavy hex nut. Total length of the lift leg shall be 10-1/2".

#### **2.09 Anchor Bolts**

The expansion anchor shall be wedge type with a single piece three section wedge conforming to Federal Specification A-A 1923-A, Type 4 and ICC-ES Evaluation Report ESR-1385. Anchor shall be zinc plated conforming to ASTM B633. Anchor bolt size: 1/2" diameter by 7" long and shall be supplied with a flat washer and hex nut. (Hilti Kwik Bolt III #282529 or equal.; or as specified by the engineer.)

#### **2.10 Weldments**

All welded connections shall conform to the requirements of the American Welding Society, "Structural Welding Code AWS.01.1" and applicable revisions.

#### **2.11 Corrosion Protection**

ECP Torque Anchors™ shall be supplied with hot dipped zinc galvanized corrosion protection per ASTM A123 Grade 75 or Grade 100 and applicable revisions.

## **Section 3 – Tools and Equipment**

#### **3.01 Rotary Hydraulic Torque Motor**

A hydraulic gear motor is required to install the helical torque anchor™ to the desired torque and depth. The capacity of the gear motor generally will range between 4,000 to 8,000 foot-pounds, depending upon the soil conditions and shall be fully reversible. The installation torque rating of the hydraulic gear motor shall be at least 25 percent higher than the planned installation torque. Rotation shall range between 5 and 20 revolutions per minute.

#### **3.02 Torque Monitoring Device**

The installation torque applied to the helical torque anchor™ shall be monitored continuously during installation. The torque

monitoring device may be a part of the installing unit or may be a device in line with the hydraulics. Accuracy of the torque monitoring device shall be insured by having calibration data available for review by the engineer or the owner's representative.

### 3.03 Hydraulic Pumps

#### 3.031 Pier Installation Pump

A gasoline or electrically operated hydraulic pump is required to install the pier pipe. The pump shall be capable of providing 10,000 psi of hydraulic pressure and a dual flow rate of 480 in<sup>3</sup>/min up to 2,000 psi and a rate of 100 in<sup>3</sup>/min above 2,000 psi. The pump shall have a 4-way, 3 position valve for double acting cylinder service. (Enerpac PGM-5204R or equal)

#### 3.032 Tieback Installation Pump

A source of hydraulic pressure or a hydraulic pump is required to operate the rotary torque motor used to advance the helical tieback into the soil. The hydraulic requirements are dictated by the specific installation motor used but typically range from 2,400 to 3,000 psi of hydraulic pressure and a flow rate of 10 to 40 gallons per minute. The pump shall have the ability to control and reverse the flow of hydraulic oil. Many pieces of construction equipment such as excavators, backhoes, and skid steer machines can be adapted to mount the rotary torque motor, and meet the hydraulic pressure and flow requirements of the rotary torque motor. It is also possible to use a portable hydraulic pump, portable rotary torque motor and torque reaction bar for the installation.

#### 3.033 Hand Pump

One or more hand pumps may be required to transfer structural load, to recover lost elevation, and to tension the tieback anchors. The hand pump(s) are connected to hydraulic lifting rams via a manifold arrangement to provide uniform force to several pier placements at the same time, or to the hollow plunger cylinder. The hand pump assembly shall provide two stages of displacement at pressures up to 10,000 psi. Below 400 psi the displacement shall be 2.4 in<sup>3</sup> per stroke and above 400 psi, 0.15 in<sup>3</sup>. (Enerpac P801 or equal)

### 3.04 Tooling

The hydraulic torque motor must be firmly mounted to machinery capable of positioning the torque anchor at the proper angle and capable of providing proper installation force (crowd) to advance the torque anchor. Adapters used to connect the motor to the helical torque anchor™ shall have a capacity exceeding the torque required to install the anchor and shall be mechanically connected to the anchor during installation.

### 3.05 Drive Stand

The proprietary drive stand is a welded assembly designed to maintain vertical alignment of the pier bracket, drive cylinder and pier pipe during pier installation. The drive stand shall be a welded assembly of 1/2", 5/8" and 1" thick cold rolled flat bar stock conforming to ASTM A-36 and 3/8" and 1/2" thick hot rolled steel conforming to ASTM A-29. Supplied with the drive stand shall be three face plates and six hex nuts. The face plates shall be installed to enhance the integrity and safety of the drive stand under full load and provides pier pipe support. The upper face plate retains the drive cylinder and has two 9/16" mounting holes. The lower face plates retain and guide the pier pipe and have two 9/16" slots for attachment to the drive stand. Two drive stand pins are required to attach the drive stand to the pier bracket. These pins shall be formed from 15/16" diameter steel bar and shall be 15-1/2" long.

### 3.06 Drive Cylinder Assembly

The drive cylinder assembly shall be a double acting with a special cylinder head designed to fit the proprietary drive stand, a rod aligner and a pier drive adapter on the end of the piston rod designed to install the 3-1/2" diameter by 0.165 wall thickness pier pipe. The drive cylinder shall have a 3-1/4" diameter bore and 2" diameter cylinder rod. The stroke shall be 24". Working pressure may vary from 3,000 to 10,000 depending upon the cylinder manufacturer.

**CAUTION: The operator must identify which cylinder he is using and verify the working pressure of the cylinder prior to using the hydraulics.**

### 3.07 Single Acting Hydraulic Cylinders

#### 3.071 Single Acting Hydraulic Cylinder

A single acting hydraulic cylinder shall be positioned at each pier bracket during the load transfer phase of the restoration. The hydraulic cylinder shall be rated at 10,000 psi of hydraulic pressure and heavy duty return spring. The minimum cylinder bore shall be 5.16 in<sup>2</sup> and a stroke of 4". (Enerpac RC-254 or equal)

#### 3.072 Single Acting Hollow Plunger Hydraulic Cylinder

A single acting hydraulic cylinder shall be used during the load transfer phase to the helical tieback, or when performing a proof tension load test. The hydraulic cylinder shall be rated at 10,000 psi of hydraulic pressure and have heavy duty return spring. The capacity and stroke of the cylinder shall be determined by the application. (Enerpac RCH-202, RCH-302 or equal)

### 3.08 Pressure Gauges

#### 3.081 Drive Cylinder Pressure Gauge

A pressure gauge shall be provided to monitor the installation force placed upon the pier pipe. The gauge shall be capable of measuring 0 – 10,000 psi with a minimum gauge face of 4” and minor graduations of 100 psi. (Enerpac G4088L or equal)

#### 3.082 Hand Pump Pressure Gauge

A pressure gauge shall be provided to monitor the lifting force applied to the structure during restoration. The pressure gauge shall be capable of measuring 0 – 10,000 psi with a minimum gauge face of 2-1/2” and minor graduations of 200 psi. (Enerpac G2535L or equal)

## Section 4 – Helical Torque Anchor™ Installation

The following specification contains the major steps to be undertaken to install helical torque anchors™. Variations may occur depending upon the application and the type of structural support required.



### Warnings:

- Utilities:** Thoroughly investigate the job site for the possible existence and location of all underground utilities before proceeding. Avoid all contact with ALL underground utilities!
- Excavations:** Collapsing soil can be dangerous. Follow OSHA requirements at all times. Do not enter any excavation if there are any questions about the stability of the soil.
- Pier Placement:** Excessive distance between pier placements can damage the concrete foundation from structural overload. Verify that the foundation has sufficient structural integrity to carry the load between placements.
- Hazardous Machinery:** The use and operation of hydraulic gear motors can be very hazardous due to the power of the motor. The torsional forces developed during operation can be extreme resulting in breakage of product and equipment. The transfer of these forces may be extremely quick leaving little or no time for personnel to react and/or avoid contact. Under no circumstances should the equipment be operated without proper training in procedures and knowledge of product capabilities. Do not allow observers close to the equipment during operation.
- Reaction Bar:** An unmovable object must be used when restraining a reaction bar. The reaction bar must be firmly secured against movements in all directions. Never stand close to or on a reaction bar during installation.
- Heavy Lifting:** Many pieces of equipment used to install steel foundation underpinning are very heavy. Use proper lifting techniques, back supports, and help from others when lifting heavy objects.



### Warning!

**FAILURE TO HEED THESE WARNINGS, OR TO FOLLOW SAFE WORK HABITS, OR IMPROPER USE OF THE EQUIPMENT AND MATERIALS MAY RESULT IN LIFE THREATENING SITUATIONS, BODILY INJURY AND/OR PROPERTY DAMAGE!**

#### 4.01 Excavating to Expose Footing or Grade Beam

An excavation shall be prepared adjacent to the foundation to expose the stem wall and footing or the bottom of the grade beam. The excavation shall be to a depth of 14 inches below the bottom of the foundation and 12”, minimum, beneath it. The excavated work area must be wide enough for safe working conditions, typically an excavation is 3 to 4 feet wide by 3 to 4 feet away from the structure is usually adequate at the footing, taper or shore deep excavations per OSHA guidelines. Move the excavated soil away from the work area by a distance of at least two feet and store the soil in such a manner that the soil will not erode or cause damage to the owner’s property.

#### 4.02 Footing or Grade Beam Preparation

If the structure has a spread footing foundation, the toe of the footin shall be notched by removing the extended edge of the footing back to the stem wall for a distance along the footing of at least 18 inches in the area of the pier and tieback placement. To accomplish this pneumatic or electrical chipping hammer with a chipping bit and then a bushing tool for smoothing the face shall be used. When preparing either a notched footing or a grade beam, the bottom area of concrete that will bear upon the pier bracket must be prepared to a smooth and level condition. Prior to acceptance of the preparation, a level shall be used

to verify that the portion of the footing upon which the bracket will bear is level both perpendicular to the foundation and parallel to the structure.

**IMPORTANT: If any reinforcing bar becomes exposed during these operations, consult with an Engineer before removing or cutting any steel reinforcing.**

#### **4.03 Torque Anchor™ Installation**

The rotary hydraulic torque motor shall be attached to suitable portable installation equipment or to a suitable machine capable providing the proper installation angle, reaction against installation torque, and advancing force (crowd). The helical tieback lead sections shall be placed at a location indicated on the plans. The opposite end of the tieback shaft shall be attached to the rotary hydraulic torque motor and retained with a pin and retaining clip. If using portable equipment, the torque reaction bar MUST be properly secured against movements in all directions.

The lead section shall be situated under the footing at the location of the proposed centerline of the pier bracket. The tieback lead section shall be driven at a downward angle of between 15<sup>0</sup> and 20<sup>0</sup> unless directed by the engineer otherwise. The shaft shall be as near to the bottom of the footing as possible at the face of the stem wall. The tieback shall be advanced into the soil in a smooth and continuous manner using sufficient pressure for uniform advancement. The installer shall have knowledge of the desired shaft torsion requirement that will produce the desired ultimate capacity prior to beginning the installation.

Once the lead is installed, the motor shall be disconnected from the lead. One or more extensions as required to reach the specified length shall be bolted to the previously installed shaft. The hot forged coupling on the 1-1/2" solid square shaft shall be placed over the end of the previous section of torque anchor™ shaft and secured with the high strength bolt and nut supplied by the manufacturer.

The tieback anchor shall be advanced into the soil until the average design installation torsion at the required depth is achieved. Once the design torque at the design depth has been achieved, the installation motor shall be removed from the tieback shaft.

#### **4.04 Installation Requirements**

**4.041** The minimum average installation shaft torsion, the minimum shaft length and depth below grade as shown on the plans shall be satisfied prior to termination the installation. The required installation torsion shall be an average of the installation torques recorded during a minimum of the last three and one-half feet of installation.

**4.042** The torsional strength rating of the torque anchor™ shall not be exceeded during installation. If the torsional strength rating for the torque anchor™ has been reached, but the anchor has not reached the target depth, do the following:

**4.0421** If the torsional strength rating is achieved prior to reaching the target length, the installation may be acceptable if reviewed and approved by the engineer and/or owner.

**4.0422** The installer may remove the torque anchor™ and install a new one with fewer and/or smaller diameter helical plates to the design torsion, design depth and design shaft length with the review and approval by the engineer and/or owner

**4.043** If the target is achieved, but the torsional requirement has not been met; the installer may do one of the following subject to the review and approval of the engineer and/or owner:

**4.0431** Install the torque anchor™ deeper to obtain the required installation torsion.

**4.0432** The installer may remove the torque anchor™ and install a new one with an additional helical plate and/or larger diameter helical plates.

**4.0433** Reduce the load capacity of the placement and provide additional helical torque anchors™ and Model 350 Steel Pier™ systems to achieve the required total support for the project.

**4.044** If the torque anchor™ hits an obstruction or is deflected from its intended path, the installation shall be terminated and the anchor removed. Either the obstruction must be removed or the torque anchor™ relocated as directed by the engineer and/or owner.

**4.045** In no case shall a torque anchor™ be backed out and reinstalled to the same depth. If an anchor must be removed for any reason, it must be installed a minimum of three feet farther.

#### **4.05 Torque Anchor™ Length Adjustment**

After meeting the installation requirements, the installer may remove the final plain extension section and replace it with a shorter one that will provide a suitable termination point behind the pier bracket. The installer may advance the tieback, provided that the shaft has adequate torsional capacity, until the tieback shaft termination point under the footing is reached.

#### **4.06 Transition Installation**

The transition shall be bolted to the end of the tieback shaft using the hardware supplied by the manufacturer. The threaded socket for the all-thread rod shall be facing outward to allow for attachment to the pier bracket once the bracket is installed to

the foundation and the pier pipe driven to suitable bearing.

#### 4.07 Documentation

The installer shall carefully monitor the torsion applied to the anchor as it is installed. It is recommended that the installation torque be recorded at one foot intervals, but should never exceed recording every two feet. The data may be collected from electronic torsion monitoring equipment that has been calibrated to the installation motor being used. Although not as accurate, the installation torque may also be monitored by noting the differential pressure across the installation motor and determining the torque from the manufacturer's published torque curves.

At the conclusion of the installation, the raw field data shall be converted into an installation report that includes the location of each placement, the installed length, and the averaged installation torsion over the final three feet, and the pre-load or working load placed on each placement.

### Section 5 - Steel Pier Installation

The following specification contains the major steps to be undertaken to install the steel pier bracket, drive the pier pipe and transfer the structural loads to the pier pipe and the tieback. Variations may occur depending upon the application and the type of structural support required.



#### Warning!

- Pier Placement:** Thoroughly investigate the exterior of the structure adjacent to the proposed placement especially directly above the drive stand and drive cylinder. Movements of tools and equipment during pier installation may damage electrical boxes, faucets, windowsills, sliding doors and other architectural elements.
- Drive Cylinder:** Verify the working pressure of the hydraulic drive cylinder prior to using the hydraulics. Do not exceed the hydraulic drive cylinder manufacturer's working pressure during pier installation. When operating near the maximum cylinder pressure, cylinder rod extensions should be restricted to no more than 15 inches to prevent damage to the drive cylinder actuator rod.
- Hydraulic Equipment:** Inspect all hydraulic equipment prior to using. Do not use any leaking or damaged components such as cracked, crimped or cut hoses, leaking fittings, etc.
- Heavy Lifting:** Many pieces of equipment used to install steel foundation underpinning are very heavy. Use proper lifting techniques, back supports, and help from others when lifting heavy objects.
- Safety Devices:** When driving pier pipe all face plates must be fastened in place on the drive stand and pier bracket to enhance the integrity of the system and to secure the pier pipe.
- Safety Devices:** All persons in and around the work area must use personal safety protection.



#### Warning!

**FAILURE TO HEED THESE WARNINGS OR TO FOLLOW SAFE WORK HABITS MAY RESULT IN SERIOUS INJURY OR DEATH!**

#### 5.01 Pier Bracket Installation

Place the steel installation base, or other suitable material, in the bottom of the excavation at the approximate point of the pier installation. Connect the lift assembly and pier cap to the pier bracket. Obtain a short piece of pier pipe, approximately 22" to 24" long depending upon the excavation, and place it in the pier bracket. Install the control sleeve over the pier pipe and face plates to the pier bracket by dropping the plates over the studs on either side of the pier bracket.

Maneuver the pier bracket into place under the footing with the centerline of the bracket in line with the tieback shaft; place the lower end of the piece of pier pipe into the centering ring of the installation base at the bottom of the excavation. Place a hydraulic ram between the lift assembly and the pier cap. Activate the hydraulic ram with a hand pump to bring the bearing plate of the pier bracket in contact with the previously prepared area at the bottom of the footing or grade beam.

If careful inspection reveals that the pier bracket is not plumb (vertical) and evenly bearing across all of the bottom of the footing and against the vertical face of the foundation, then the assembly must be removed and further preparation work must be performed. If only minor correction is required, lower the bracket about two inches and place quick setting, high strength grout on the bearing plate and realign the pier bracket.

Carefully check for alignment and proper bearing between the pier bracket and the bottom of the footing, plus verify proper contact between the pier bracket and the vertical face of the foundation. Activate the cylinder to achieve even bearing between the pier bracket and the footing. Drill and install two 1/2" x 7" long concrete expansion anchors, flat washers and hex nuts to secure the bracket in position. After the grout sets continue with the installation.

Remove the lift assembly and hydraulic ram from the pier bracket. Lower the drive stand into the excavated area then slide the drive stand horizontally over the two pieces of 1-1/2" square tubing on the pier bracket. The 15/16" diameter tapered drive stand locking bars shall be installed through the holes in the drive stand that are directly above and aligned with the two 1-1/2" square tubes, and into the lower drive stand holes.

Slide the lower end of the drive cylinder into slots at the top of the drive stand. Secure the drive cylinder to the drive stand by placing the upper face plate with two holes over the two studs at the top of the drive stand. Connect all of the hydraulics between the drive cylinder and the hydraulic pump.

With the installation base still at the bottom of the excavation, remove the face plates, control sleeve and short piece of pier pipe from the bracket. Place a lead pier section into the drive stand with the friction reduction collar facing downward. Slide the control sleeve over the pier pipe. Secure the face plate with pier guides over the studs and nuts on the drive stand and the face plates over each pair of studs on pier bracket. Activate the drive cylinder to apply a seating load on the drive stand assembly. When the drive stand has raised enough to remove all of the slack from fabrication tolerances, drill and install at least two 1/2" x 7" long concrete anchors, flat washers and hex nuts as required to secure the drive stand in position. Retract the drive cylinder to take pressure off the lead pier section. Remove the installation base.

### 5.02 Driving Pier Pipe

**IMPORTANT: The installation base plate must be removed from the bottom of the excavation and the control sleeve must be in place over the pier pipe before proceeding.**

Drive the lead pier section into the soil using the hydraulic drive cylinder to nearly the full extension of the cylinder rod. Retract the cylinder rod; install the coupling shoulder of a drive tool into the top of the installed pier section. Drive the pier downward into the soil again to the length of the hydraulic drive cylinder stroke. Repeat this operation with an additional drive tool as required to fully install the pier pipe. Retract the cylinder rod; remove the drive tools, guides and face plates. Document the force used to drive each section of pier pipe. (Optional – Install an inertia sleeve before installing the next pier section. – See 5.032) Install the coupled end of an extension pier section into the top of the driven pier section. Replace the guides and face plates.

**CAUTION: Safe operation dictates that the drive cylinder working pressure shall not be exceeded and all face plates be securely in place during pier installation. When operating near the maximum cylinder pressure, cylinder rod extensions should be restricted to no more than 15 inches to prevent damage to the drive cylinder actuator rod.**

The pier installation process shall continue adding extension pier sections until the design load or a suitable bearing stratum is reached. Hold the final driving load on the pier to check for pier creep.

### 5.03 Installing Pier Sleeving (Optional)

In applications where there will be unsupported pier pipe, the optional pier pipe sleeving must be used. Pier sleeving is used to stiffen the pier pipe and to strengthen the coupled joints between pier sections in weak soils or in applications where the pier pipe is unsupported. Sleeving shall extend at least three feet below the area of unsupported pipe or weak soil layer such as in areas where the Standard Penetration Test (SPT) blow count "N" is less than 5.

#### 5.031 Installing External Pier Sleeving (Optional)

The strongest method for increasing pier strength is by installing external 4" diameter sleeving over the pier pipe and insuring that the joints between pier sections and joints between sleeving are staggered by at least 12". The external pier sleeving shall be installed over the pier using the drive stand and drive cylinder. A specialized drive tool for installing the external pier sleeving shall be used to push the sleeve sections over the existing pier pipe. Care must be taken to insure that the joints in the sleeving are staggered a minimum of 12 inches from the joints in the pier pipe. This process shall be continued through the area of pier pipe exposure, weak soil or in areas where additional pier bending strength is required.

#### 5.032 Installing Inertia Sleeve (Optional)

The Inertia Sleeve is a quick and efficient way to provide added strength to the pier pipe and the coupled joints.

**NOTE: The inertia sleeve must be installed concurrent with the pier sections. The installer must have general knowledge of depth to suitable load bearing for the pier to be able to calculate the point to commence inertia sleeve installation to be able to fully protect the pipe in the area of weak soils or unsupported pier column length.**

When driving pier pipe, the inertia sleeve shall be installed into the pier section prior to inserting the next extension pier section. The coupling end of the inertia sleeve shall be inserted first into the pier pipe. The inertial sleeve shall drop by gravity into the coupling at the bottom end of the extension section. This process shall be continued through the area of weak soil or in areas where additional pier bending strength is required.

#### **5.04 Field Proof Loading**

Load test the pier to the required proof load above the design or working load, or until lift of the structure is encountered. We do not recommend proof loading the system to a load greater than 1.5 times the anticipated service load. The maximum proof load allowed for Model 350 Steel Pier™ system is 64,500 pounds, however many concrete footings will not be able to resist a loading of this magnitude.

Proof loads above the capacity of the drive cylinder may be tested by removing the drive cylinder, installing steel block bridging in the stand to accommodate a 25 to 50 ton short single acting ram between the pier pipe and the steel block. Connect the ram to a hand pump and gauge assembly. Activate the ram to apply the required proof load to the system. Document the results of the proof test. Remove hydraulic drive cylinder and drive stand from the pier bracket.

#### **5.05 Cutting Final Pier Section to Length**

After field load testing to verify the capacity of the load bearing stratum below grade, it may be necessary to cut the final pier section to proper elevation. The last section of pier pipe shall be cut to the same elevation as the lowest point of the sides of the bracket for projects requiring lifts from zero up to 4". The pier pipe shall be cut very carefully to insure that the cut end is perpendicular to the axis of the pipe. The pier bracket is shipped with bracket lift rods sized for lifts up to 4". For larger lifts, longer bracket lift rods are required as is a short extension to fit between the Tieback Pier Extension Assembly and the Pier Cap. The length to cut the final pier section will vary depending upon the job site.

#### **5.06 Cutting External Sleeve Section to Length (Optional)**

The final piece of external sleeving shall be cut so that extends 6" above the top of the pier pipe in Section 5.05. When using the inertia sleeving, the top of the final section of inertia sleeve shall be cut to terminate 3-1/4" below the top of the pier pipe in Section 5.05.

#### **5.07 Installing the Tieback Pier Extension Assembly**

Once the final section of pier pipe and sleeving, if required, is cut to length; the Tieback Pier Extension Assembly is installed by inserting the coupling into the pier pipe. The slot in the pier extension assembly must be facing outward and centered, left to right within the pier bracket. (Note: The control sleeve supplied with the pier bracket is no longer required any longer.)

#### **5.08 Torque Anchor™ Termination**

Install the continuous threaded bar through the slots in the helical tieback pier extension assembly and thread the end into the previously installed tieback transition under the footing. Install the Tieback Bearing Plate over the threaded bar and hold in place by hand tightening the two 1/2" diameter nuts on the studs at the pier bracket. Install the bevel washer with the bevel toward the bearing plate. Install the large nut on the all thread bar and hand tighten it against the bevel washer. Install the lower face plate to the pier bracket with two 1/2" nuts and tighten. (Note: One face plate is not used in this application and may be discarded.)

#### **5.09 Load Transfer**

A pier cap, lift assembly and bracket lift rods shall be installed with nuts on each bracket. A 25-ton ram shall then be placed between each pier cap and lift assembly. Each ram shall be connected through a cut-off valve to one or more manifolds, gauges, and hydraulic hand pump systems. Transfer the structural load to the piers uniformly and evenly by activating many hydraulic rams simultaneously. The hydraulic hand pump is actuated and a force is applied against the top of the pier caps. As the load is transferred from the foundation to the piers; the interior and exterior of the structure must be carefully monitored to insure that the restoration occurs according to plan and the structure is stabilized or lifted to the design elevation. As each placement reaches the desired load and/or elevation, a cut-off valve for the ram at the pier is closed and the pressure recorded for that placement. The hex nuts at the top of the bracket rods located above the pier caps shall be advanced to the surface of the pier cap and secured to maintain final elevation.

The tieback nut shall then be tightened securely against the Tieback Bearing Plate or shall be tightened to the torque specified by the engineer to seat the tieback and to impose a preload on the tieback anchor. In critical applications, or when specified, the installer shall place a hollow plunger hydraulic cylinder and jack spacer over the all-thread bars from the tieback anchor and activate the cylinder to preload the system as specified. Once loaded, the nut on the all-thread bar and then the nuts on the Tieback Bearing Plate shall be secured.

Remove the lift assemblies, hydraulic rams, lifting hydraulics and hollow plunger hydraulic cylinders from each placement. Clean all hydraulics, replace dust caps on the hydraulic couplings and store the equipment in a clean, dry environment.

#### **5.10 Backfill and Cleanup**

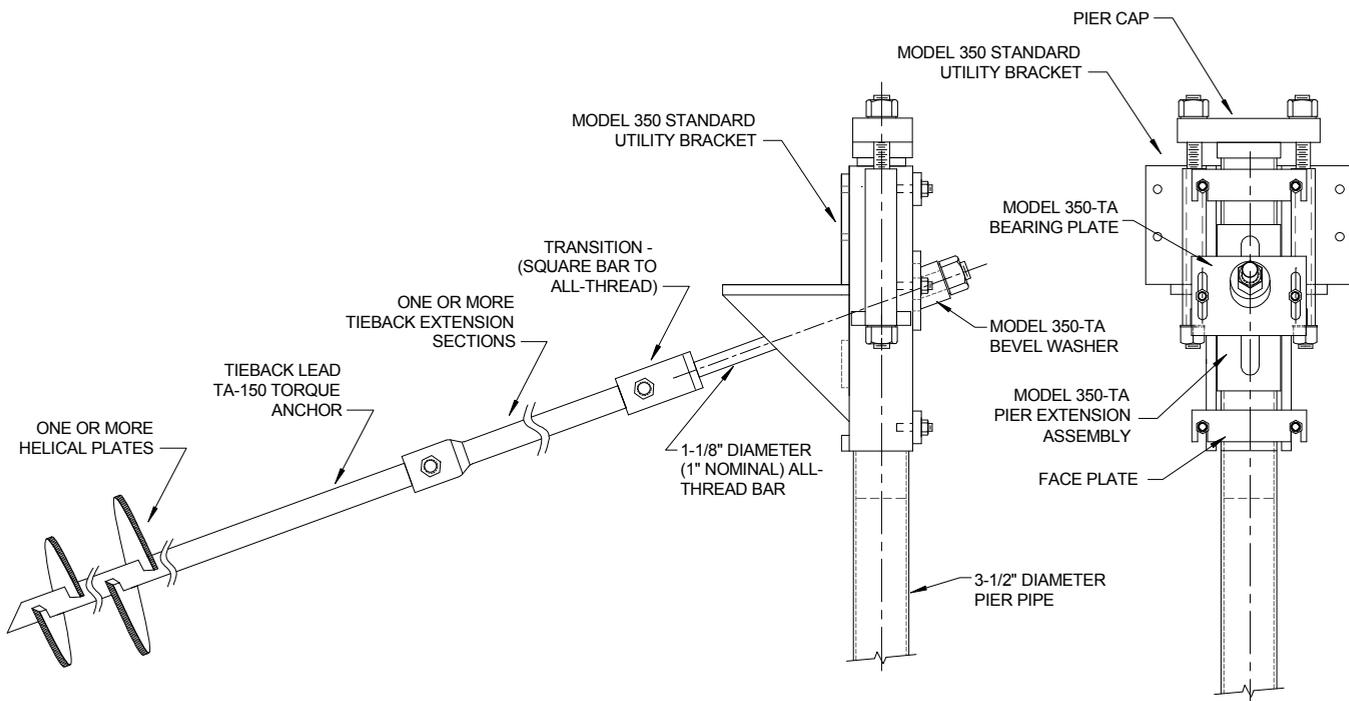
Remove all scrap and other construction debris from the site. Remove all tools and equipment, clean them and store them. The excavations shall now be backfilled using the soil that was removed and stored nearby. The backfill shall be placed into the holes in small lifts of 6" to 8" and then properly tamped to achieve maximum density. After the backfilling operation is complete, the soil at the perimeter must have a positive slope away from the perimeter of the foundation.

Dispose of all construction debris in a safe and legal manner.

**END OF SPECIFICATION**

## Model 350 ECP Steel Pier™, Model 350-TA Torque Anchor Adapter & TAF-150 Helical Torque Anchor™ Tieback Systems

- Model 350 Ultimate Capacity – 86,000 lb.
- Model 350 Max. Proof Test – 64,500 lb.
- 74 Square Inches Bearing Surface
- Installs From Outside or Inside Structure
- Friction Reduction Collar On Lead Pier Section
- 3-1/2” Diameter High Strength, Galvanized Tubular Pier Pipe
- Tubular Pier Pipe Installs To Rock or Verified Load Bearing Stratum
- Installs With Little or No Vibration
- 100% of Piers Proof Tested at Installation
- 1-1/2” Solid Square Shaft Helical Tieback Torque Anchor™ for Lateral Support
- Ultimate Tieback Capacity – 70,000 lb.
- Tieback Installation Angle – 15° to 20°
- Model 350-TA Assembly Required to Connect Bracket to Tieback Anchor
- Manufacturer’s Warranty



### Model 350 ECP Steel Pier™ System, ECP TA-150 Torque Anchor™ Tieback and Model 350-TA Tieback Adapter Assembly

Earth Contact Products, LLC reserves the right to change design features, specifications and products without notice, consistent with our efforts toward continuous product improvement. Please check with Earth Contact Products at 972 480-0007 or 913 393-0007 to verify that you are using the most recent specifications.

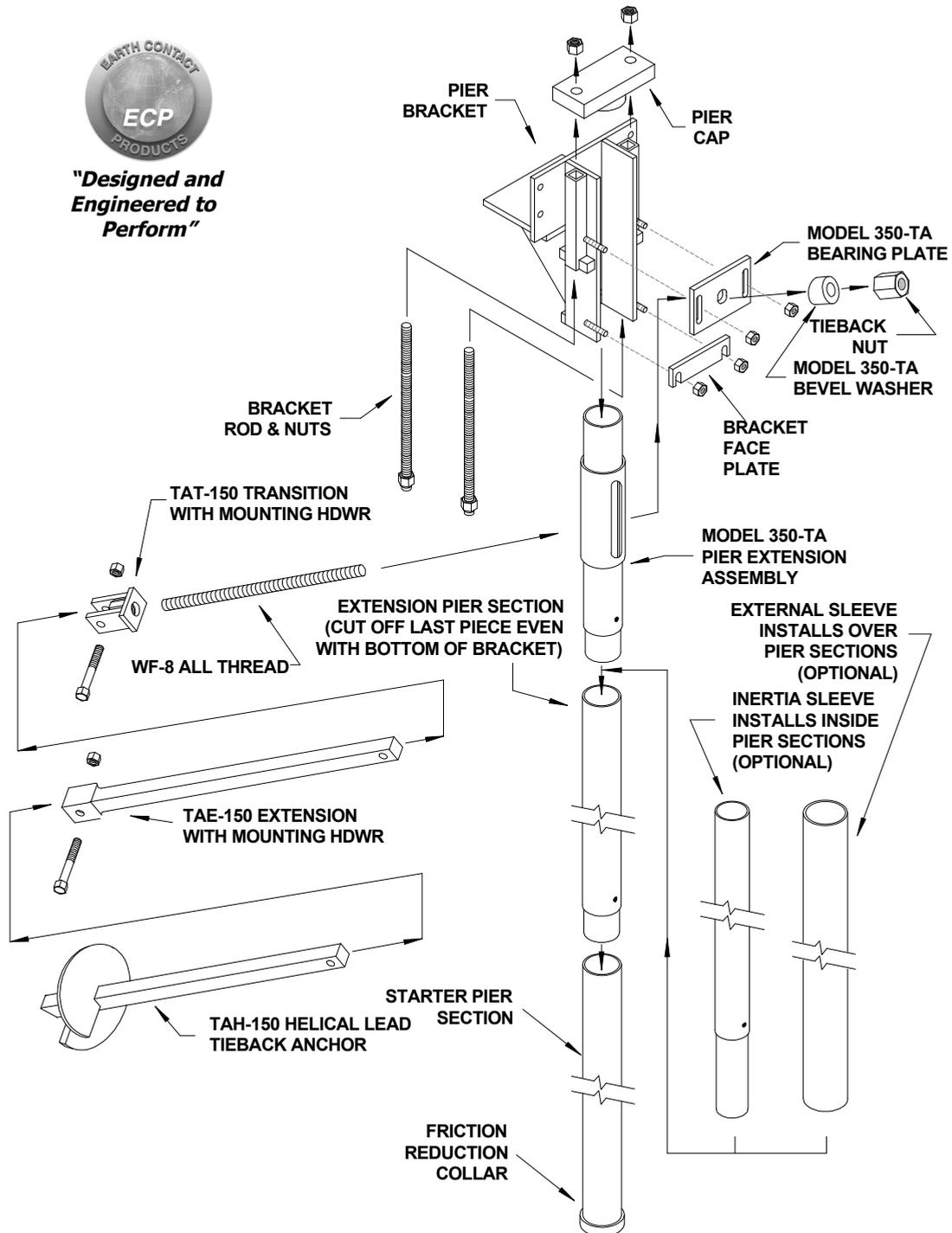


**"Designed and  
Engineered to  
Perform"**

# Assembly Configuration for the Model 350 ECP Steel Pier™, TAH-150 Helical Torque Anchor™ Tieback Systems & Model 350-TA Torque Anchor Adapter



**"Designed and  
Engineered to  
Perform"**



**ECP Steel Pier™  
Specifications**

*The capacity of the Model 350 ECP Steel Pier™ foundation support system is a function of the capacity of pier pipe and soil surrounding the pipe, capacity of the load bearing stratum, foundation bracket capacity, foundation strength and strength of the bracket to foundation connection. The capacity of the TA-150 Torque Anchor™ brand Helical Tieback system is directly related to the soil conditions at the site. Actual capacities could be lower than the rated ultimate capacity or of the Steel Pier™ System or the mechanical capacity Torque Anchor™ Tieback system after subjected to Factor of Safety of at least 2.0.*

