

# TYPICAL SPECIFICATION

## ECP Helical Torque Anchors™ New Construction Piles

### 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 7,000 ft-lb
- 1-3/4" square bar with a torque limit of 10,000 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, 2-7/8" and 3-1/2" 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 Grade 80 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 an all-thread bar or a 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 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 – HYD-801**

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 – HYD-2535**

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, 2-7/8" and 3-1/2" 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 an 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 minutes 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.

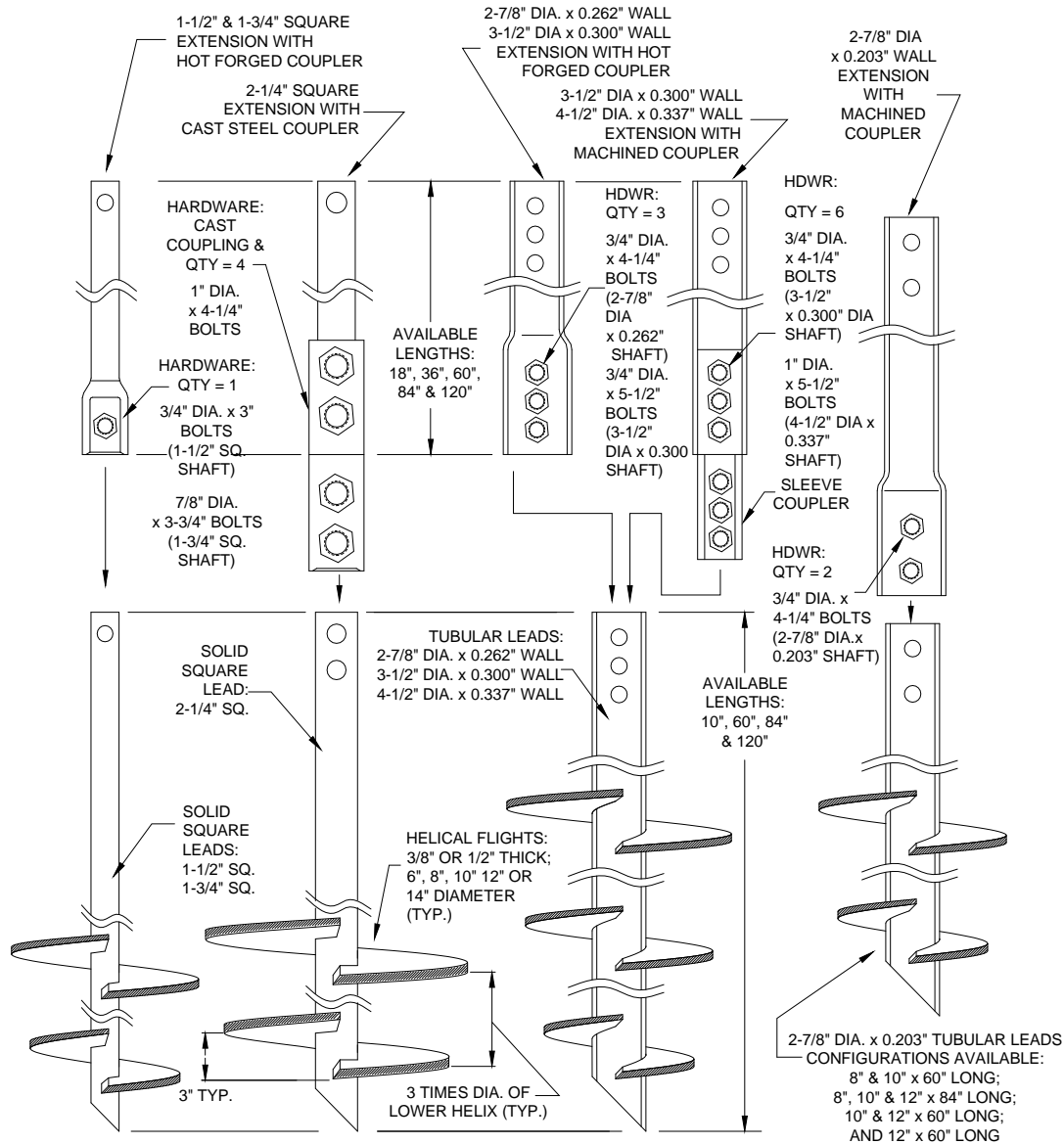
##### **4.062 Transition**

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.

