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 7,000 ft-lb
- 1-3/4" square bar with a torque limit of 10,000 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.

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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 3-1/2" diameter x 0.300 wall tubing may have this 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 4-1/2" diameter x 0.337 wall tubing shall use a separate mechanical coupler. Extensions fabricated from 3-1/2" diameter x 0.330 wall tubing may have this 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 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" 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.

2.022 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 standard continuously threaded bar shall have an approximate major nominal thread size of 1-1/8" to 1-1/2". Minimum ultimate strength shall be 79,000 pounds. Bar shall be supplied with a hex nut. Part Numbers: HAT-WF08 & HN-WF08-G (Williams R61-08 & R63-08 or equal)
- 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 for light duty applications. HAT-088-022G

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and HNCB-100.

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 15^0 and 30^0, 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-36.

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 12" x 18" formed from 10 gauge or 12" x 28" and formed from 70 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 1/4" thick 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 – 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^3 per stroke and above 400 psi, 0.15 in^3. HYD-801 (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. HYD-2535 (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.

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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 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 3-1/2" x 0.300 may have this feature.
- The 2-1/4" solid shaft and 4-1/2" diameter x 0.337 wall tubular products are connected with a separate coupler. The 3-1/2" diameter x 0.300 wall thickness tubular shaft may have this feature. 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

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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 rams 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

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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 loading shall be removed until the design load is reached and the tieback anchor nut shall be installed 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.

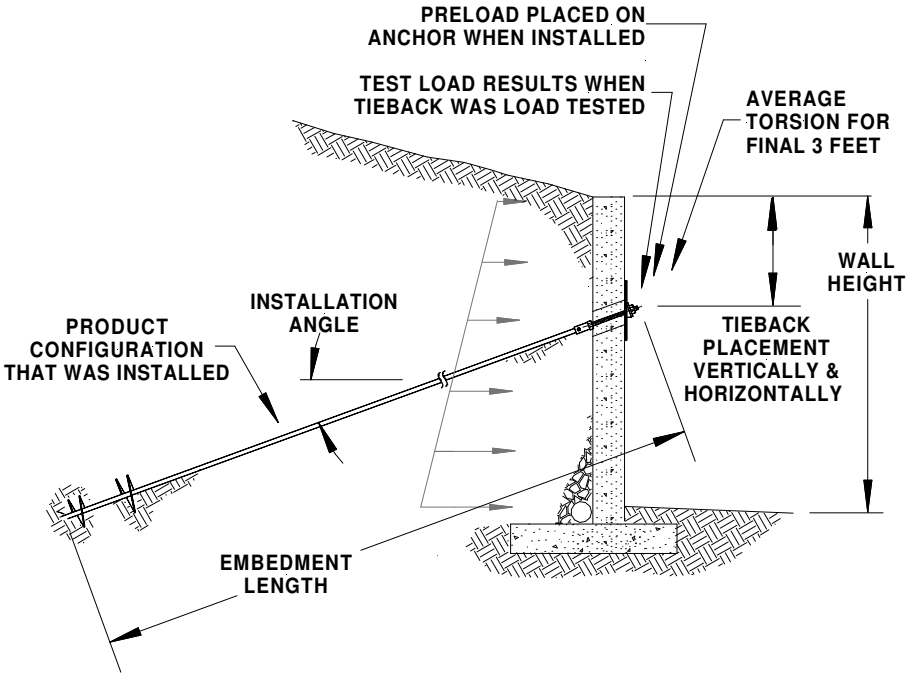
At the conclusion of the installation, the raw field data shall be converted into an installation report that includes the location of each placement, the installation angle, the installed length, the averaged torsion over the final three feet of installation, the working load placed on each placement 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 is 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 items shown on the sketch on all Torque Anchor™ tieback projects.

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