RCS Anchor and Shaft Torsion

RCS (Round Corner Square and Shaft Torsion

Installing RCS (Round Corner Square) Tension Anchor

Helical RCS (Round Corner Square) are used for compression and or tension anchor load applications. The mechanical rating of any helical shaft depends on the size, shape, material properties and engagement (coupling) configuration.

The shaft size selected for any application depends on a number of factors including: is only tension load required or also compression load, the insitu soil and site access. Once the shaft size is selected based on the required tension or compression loads, the shaft size must also consider the torque required to install to the depth and into the desired soil strata.

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RCS Anchor and Shaft Torsion

Typically the stresses from torque (rotational force) and crowd (down force) necessary to advance the helical pile/tension anchor are greater than imposed for the load application.

A benefit of a helical anchor is that torque is continuously monitored during installation. This is used to confirm the soil boring log and to assure that the helices are placed to the depth and soil strata to develop the required loads.

The selected shaft torque capacity must be sufficient to not only develop the required torque from the project engineering plan but must also sustain torque from variation in the soil, such as due to rocks, that may be encountered as the helices advance.

Typical calibrated hydraulic gauge and converted to torque used to measuring installing torque.

Load cell type torque measuring device.

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RCS Anchor and Shaft Torsion

Helical Shaft Rating

The torque rating of helical piles and tension anchors for either a RCS or pipe shaft is the shaft ultimate torque capacity. The shaft will "twist off" at the ultimate torque that exceeds the shaft material strength. The helical piles and tension anchors are designed with engagements so the shaft and not the coupling break when the ultimate rated capacity is exceeded.

Prior to reaching the ultimate torque rating of the shaft, the shaft will exhibit plastic deformation or shaft twist. This is normal when exceeding the material yield strength of the shaft and is an acceptable condition. The shaft and confirmed through extensive testing will develop the rated tension/compression load. The twist on the shaft will not affect the load bearing performance of the shaft.

The amount of twist at the ultimate torque capacity may range significantly depending on the specific shaft type and material -- from 1 to as much as 2.5 times per foot.

The torque at which the shaft will "twist" with permanent deformation visible may vary with the material properties of each heat lot. The normal variation in the material properties from heat lots typically results in a variation of+/- a few hundred ft-lbs in the torque where yield in torsion. The twist exhibited by the shaft at the ultimate torque will also vary with the material properties of the shaft. Installing torque must be measured with a calibrated continuous measuring devise. Using the"twist of the shaft" is not recommended and is not an acceptable substitute to a continuous torque measuring devise.

The shaft either remains intact during installation, irrespective of the degree of rotation or twist-of-the shaft, or shears off when the ultimate material strength is exceeded. The fiber stress is maximum at the outside of the shaft so when the ultimate material property is exceed the shaft breaks instantaneously – the shaft is either intact or not and clearly evident during installation.

A RCS shaft may twist off at any location between the forged upset socket and the next connection or at the shaft-to-helix interface.

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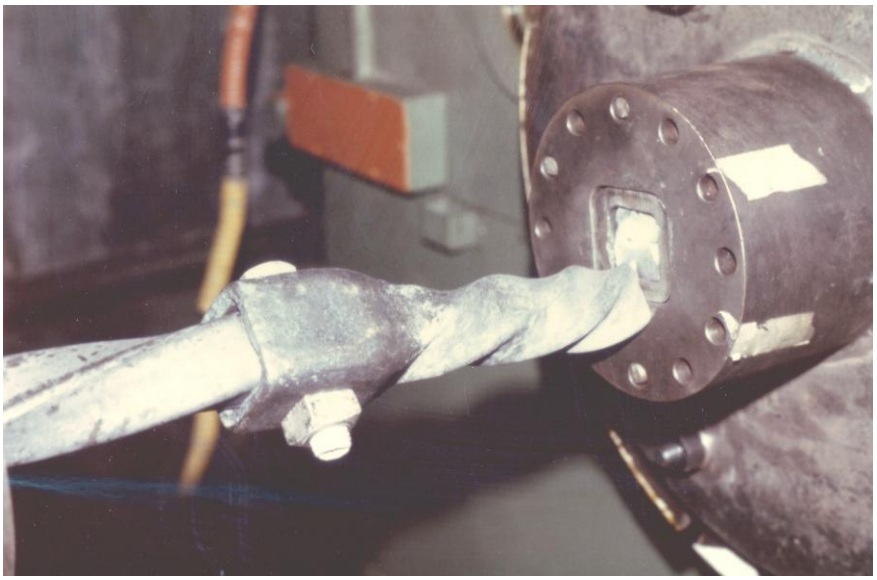
RCS Anchor and Shaft Torsion

A pipe shaft may twist off at any location between the welded male/female and the next connection or at the shaft-to-helix interface.

Torque testing with lead and extension in the laboratory



RCS (Round Corner Square) shaft helical pile/anchor undergoing torsion testing

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RCS Anchor and Shaft Torsion

RCS (Round Corner Square) Shafts

Typical RCS (Round Corner Square) shaft with plastic twist. Shaft engagement into upset socket and mounting hole not affected. Note: this is acceptable and shaft will meet the compression/tension rating.

Typically shaft twist is uniform throughout the entire individual shaft section. The observed twist may be different in adjoining sections if manufactured from different heat lots.

View of shaft at break point with only torque

Shaft break with both torque and bending

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RCS Anchor and Shaft Torsion

What if the shaft breaks during installation?

- If the soil is tougher to install and requires greater torque than expected, then select a higher torque rated anchor

- Another option is to select a smaller lead with less and or smaller diameter helices that will require less torque to install but may still meet the required load capacity

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