

# Helical Pile/Anchor and Shaft Torsion Considerations

## MacLean-Dixie RCS (Round Corner Square) and Pipe Piles and Shaft Torsion



Installing RCS (Round Corner Square) Shaft Foundation Pile/Anchor



Installing Pipe Shaft Foundation Pile/Anchor

Helical RCS (Round Corner Square) or Pipe shafts are used for compression and or tension 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.

## **Helical Pile/Anchor and Shaft Torsion Considerations**

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

A benefit of a helical pile/anchor is that torque is continuously monitored of the average installing torque 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 (PSI) and converted to torque used to measuring installing torque.

# **Helical Pile/Anchor and Shaft Torsion Considerations**

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## **Helical Shaft Rating**

The torque rating of MacLeanDixie helical piles and 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 MacLeanDixie helical piles and 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. MacLeanDixie shafts are tested to the ICC AC358 Acceptance Criteria for Helical Foundation Systems and Devises.

The torque at which the shaft will “twist” with permanent deformation visible may vary with the material properties of each heat lot. MacLeanDixie acquires steel to respective ASTM standards as required for each product and with material certifications to confirm it meets the specifications. 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.



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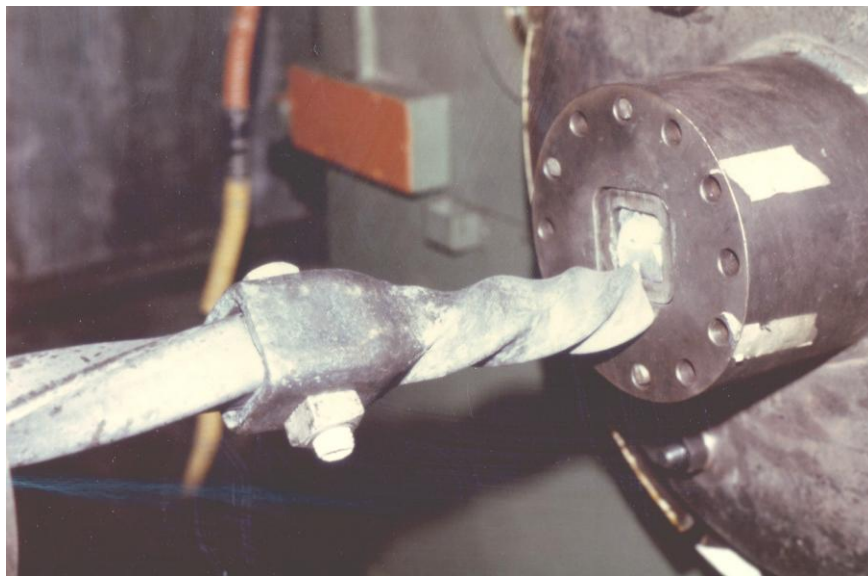
# Helical Pile/Anchor and Shaft Torsion Considerations

A RCS shaft may twist off at any location between the forged upset socket and the next connection but not at either the upset socket or the connecting hole.

A pipe shaft may twist off at any location between the welded male/female couplings but not the coupling or coupling connecting hole location.



Torque testing with lead and extension in the laboratory



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

# Helical Pile/Anchor and Shaft Torsion Considerations

## 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

# Helical Pile/Anchor and Shaft Torsion Considerations

## Pipe Pile Shafts



MacLeanDixie "Strength Squared" coupling system. Pipe buckles when ultimate torque is exceeded. Note: this is acceptable and shaft will meet the compression/tension rating.



Conventional Pipe Piles - Elongated/torn holes with round pipe pile coupling & bolts in shear. Pipe may buckle or holes may shear off

