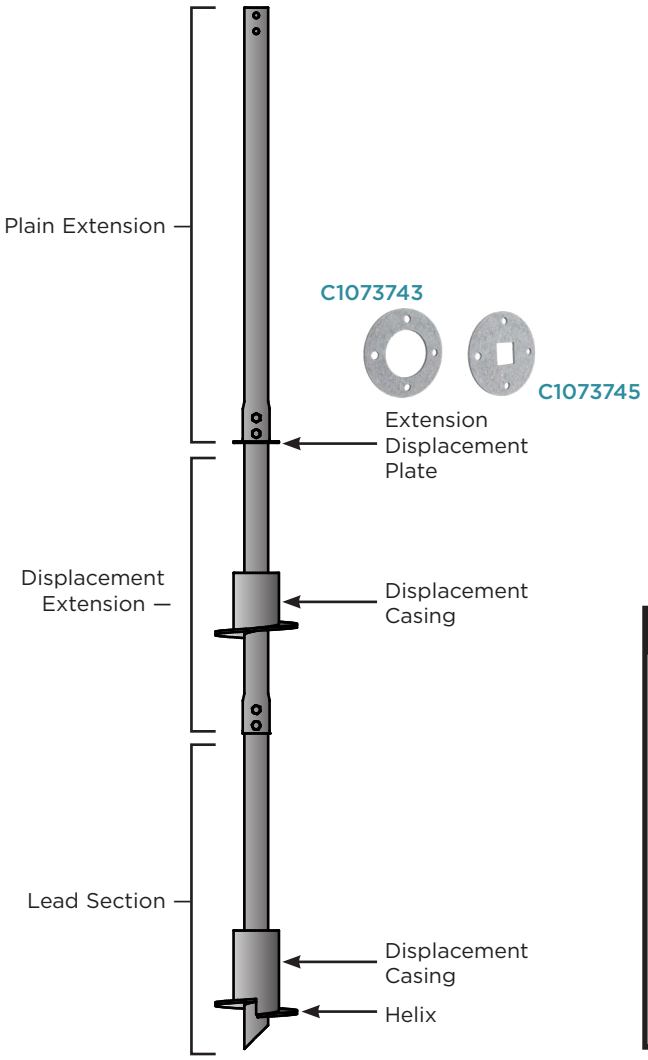
Installation Instructions: GroutForce™ Displacement Pile

These products must be installed by Chance Certified Installers trained to install Chance® products.

PRODUCT LINE

Catalog Number	Description	Shaft Diameter, type inch (mm)	Length feet (m)	Grout Column Diameter inch (mm)	Torsional Strength Rating * ft-lb (Nm)	Ultimate Compression Strength kip (kN)
C1073732	Lead Section, RS4500	4.5 (114), round	5 (1.5)	8.63 (219)	25,000 (33 895)	300 (1335)
C1073733	Extension Section, RS4500	4.5 (114), round	5 (1.5)	8.63 (219)	25,000 (33 895)	300 (1335)
C1073743 *	Extension Displacement Plate, RS4500	4.5 (114), round	-	8.63 (219)	-	-
C1073734	Lead Section, SS225	2.25 (57), square	5 (1.5)	8.63 (219)	21,000 (28 472)	450 (2002)
C1073735	Extension Section, SS225	2.25 (57), square	5 (1.5)	8.63 (219)	21,000 (28 472)	450 (2002)
C1073745 *	Extension Displacement Plate, SS225	2.25 (57), square	-	8.63 (219)	-	-
C1073738	Lead Section, RS6625	6.625 (168), round	5 (1.5)	12.75 (324)	40,000 (54 233)	500 (2224)
C1073739 †	Extension Section, RS6625	6.625 (168), round	5 (1.5)	12.75 (324)	40,000 (54 233)	500 (2224)

* To be used with any same-sized Chance plain extension.
† To be followed by Plain Extensions with built in displacement plates: C1073740 (5 ft), C1073741 (7 ft), C1073742 (10 ft), and/or C1073750 (20 ft)



⚠ WARNING

Read and understand this instruction sheet completely before installing a pile. These instructions are intended to illustrate the use of GroutForce displacement piles.

Installation tools covered in this instruction sheet must be used by competent personnel familiar with and following good work and safety practices.

Should additional information and details be desired or if specific situations arise which are not covered adequately herein, the user should refer to Chance directly. In some cases, Chance may make specific recommendations concerning installation torque and installation depth for a particular application.

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INSTALLATION TOOLING

All installation tooling shall be manufactured by Hubbell, Inc. and used in accordance with the manufacturer's written instructions.

- Kelly bar adapter
- Drive tool (square shaft or round shaft depending on product to be installed)
- Torque Indicator

⚠ WARNING

Installation tooling should be maintained in good working order and safe to operate at all times. Flange bolts and nuts should be regularly inspected for proper tightening torque. Bolts, connecting pins, and retainers should be periodically inspected for wear and/or damage and replaced with identical items provided by the manufacturer. Heed all warning labels. Worn or damaged tooling should be replaced.

Heavy suspended objects can fall and may cause property damage, severe injury, or death. Stay out from under the tooling string.

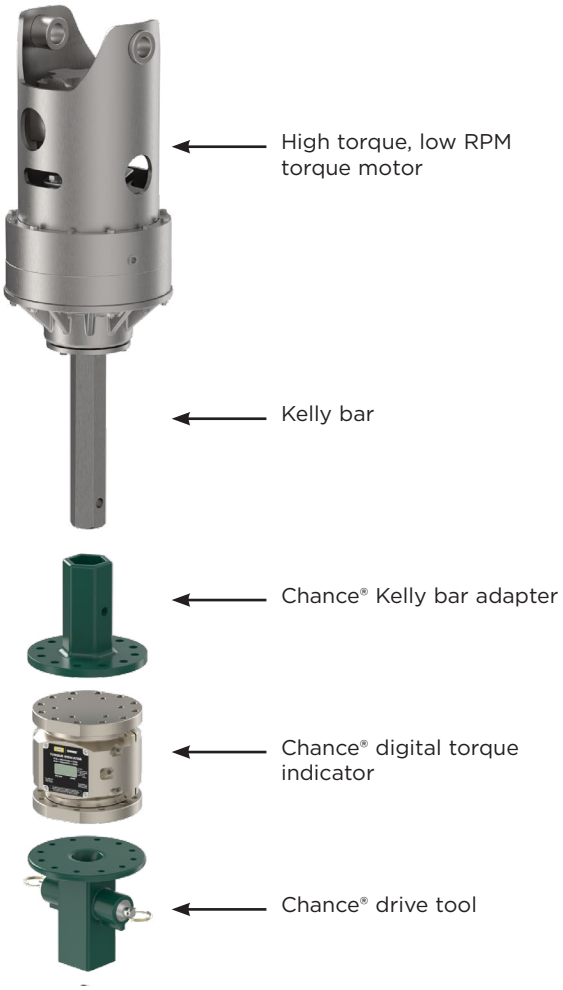
TORQUE INDICATOR

A torque indicator shall be used during GDP installation. The torque indicator can be an integral part of the installation equipment or externally mounted in-line with the installation tooling.

- Ensure torque indicator is calibrated per the manufacturer's instructions prior to installation.
- Torque monitoring is purely informational as a resource to the Engineer and Contractor. All design capacities are derived from engineering calculations and verified by load testing.
- Should be capable of continuous torque measurements in increments of 500 ft-lb or less throughout the installation.

TORQUE MOTOR

- Rotary type, hydraulic power driven torque motor
- High torque, low RPM torque motor
- Clockwise and counter-clockwise rotation capabilities
- Must be capable of continuous adjustment to revolutions per minute (RPM) during installation.
- Requires torque capacity 15% greater than the torsional strength rating of the central steel shaft to be installed.
- Do not use percussion drilling equipment.



EQUIPMENT

- Should be capable of applying adequate down pressure (crowd) and torque simultaneously to suit project soil conditions and load requirements.
- Equipment must be capable of continuous position adjustment to maintain proper alignment.

TOOLS

- Standard wrenches
- Spud tool/spud wrench
- Impact wrench and sockets
- Drill
- Level
- Inclinometer

⚠ WARNING

GDP installation can puncture underground utility service. Can cause property damage, severe injury, or death.

Locate and avoid all underground utility services before installation.

SITE CONDITIONS

Prior to installation, the Contractor shall inspect the work of all other trades and verify that all said work is completed to the point where GDP installation may commence without restriction.

1. Contractor must verify that all GDPs may be installed in accordance with all pertinent codes and regulations regarding such items as underground obstructions, right-of-way limitations, utilities, etc.

   In the event of a discrepancy, the Contractor shall notify the Owner. Do not proceed with installation in areas of discrepancies until said discrepancies have been resolved. All costs associated with unresolved discrepancies shall be the responsibility of the Owner.
2. Clearly mark installation locations
3. Attach the tooling string to the machine's Kelly bar per the manufacturer's instructions.

INSTALLATION STEPS

The Chance GroutForce Displacement Pile (GDP) installation technique shall be such that it is consistent with the geotechnical, logistical, environmental, and load carrying conditions of the project.

4. Ensure reservoir is properly seated and sealed and an adequate amount of grout is mixed before installation begins [See following section]
5. Position the lead displacement assembly at the location as shown on the project Plans. Battered GDP can be positioned perpendicular to the ground to assist in initial advancement into the soil before the required batter angle is established using a calibrated inclinometer.
6. Engage and advance GDP sections into the soil in a smooth, continuous manner at a rate of 8 to 20 RPM. Monitor and record installation torque through the installation process. Do not exceed the torsional strength rating of the central steel shaft during installation.
7. Apply sufficient down pressure to uniformly advance the GDP sections at 80% to 100% of the helix pitch per revolution (e.g., if the helix pitch is 3 inches, the advancement would be 2.5 to 3 inches per revolution). The rate of rotation and magnitude of down pressure may require adjustment for different soil conditions and depths.
8. Extension displacement assemblies and plain extension sections should be added to obtain the required minimum overall length as shown on the project Plans. Connect sections together using the provided coupling bolt(s) and nut(s) torqued to 40 ft-lb or hand tight + 1/4 turn.
9. Extension displacement plates are required at the connection of each plain extension section to maintain grout advancement and to centralize the pile shaft. Add the displacement plate before connecting the tooling string. It will fall to the upset end of the shaft and rise with the grout column.

GROUT

- Mix grout with equipment capable of providing a steady supply at the required level of production. The water–cement ratio for neat cement grouts is typically between 0.4 and 0.5. When using a pre-packaged grout, the recommended water-cement ratios listed in on the package should be followed.
- Typical water-cement ratio for pre-mixed Microsil grouts is 0.2 to 0.3. Over-watering will result in reduced compressive strengths, increased shrinkage, and reduced physical properties. Best results are obtained when the grout is mixed with colloidal or high shear mixers, providing complete wetting of cement particles.
- Place the grout using a gravity-fed reservoir consisting of a permanent or temporary casing or form capable of containing liquid grout, located at the surface. The reservoir must be appropriately sized (diameter and length) to accommodate soil conditions and grout column diameter. Immediately place the grout in the reservoir prior to advancement of the lead section into the soil. The volume of grout contained in the reservoir must be maintained at a level sufficient to maintain positive hydrostatic pressure on the grout column.
- Continue adding grout until the minimum grout column length has been achieved as shown on the project Plans. Volume measurements should be taken throughout the installation in order to determine the actual grout column diameter.
- Grout should be allowed to attain the minimum design strength prior to being loaded. The time to reach design strength will vary depending on grout manufacturer or the addition of high early strength additives. Grout mixes and/or additives shall be used in accordance with manufacturer’s written instructions.

TERMINATION CRITERIA

- The minimum overall length criteria as shown on the project Plans must be satisfied prior to terminating the GDP. If torsional strength rating of the central steel shaft and/or installation equipment has been reached prior to achieving the minimum overall length required, the Contractor has the following options:
  - » Terminate the installation at the depth obtained subject to the review and acceptance of the Owner, or:
  - » Remove the existing GDP and install a new one with fewer and/or smaller diameter displacement assemblies. The new configuration is subject to review and acceptance of the Owner.
- Do not re-use GDP material if it has been permanently twisted during a previous installation.
- If the minimum grout column diameter shown on the project Plans is not achieved along the minimum overall length, the Contractor has the following options:
  - » Remove the existing GDP and install a new one with additional and/or larger diameter displacement devices. The new helix configuration is subject to review and acceptance of the Owner.
  - » De-rate the load capacity and install additional pile(s). The de-rated capacity and additional pile location shall be subject to the review and acceptance of the Owner.
- If GDP is refused or deflected by a subsurface obstruction, the installation shall be terminated and the pile removed. Remove the obstruction and, if feasible, re-install. If obstruction can't be removed, GDP may be installed at an adjacent location, subject to review and acceptance of the Owner.

CONNECTING GDP TO THE STRUCTURE

Connect the GDP to the structure using an approved Chance steel adapter or properly designed pile cap capable of safely transferring the structural loads to the pile. This should be added immediately after installation is complete and the tooling string has been disconnected from the pile.

INSTALLATION RECORDS

Written installation records shall be maintained for each pile and should include, but are not limited to the following:

- Project name and/or location
- Names of Contractor and Contractor's foreman or representative who witnessed the installation
- Date and time of installation
- Location and reference number of piles
- Descriptions of lead section and extensions installed
- Overall depth of installation as referenced from bottom of grade beam or footing
- Torque readings for the last 3-feet (0.9 m) of installation at 1-foot (0.3 m) intervals if practical In lieu of this requirement, the termination torque shall be recorded as a minimum

GDP TESTING AND RECORDS

Testing is required only if specified on the project Plans or if deemed necessary by the Owner due to unusual subsurface conditions. If required, testing shall be performed in accordance with the test plan contained in the project Plans or in accordance with the test plan set forth by the Owner prior to the beginning of the test. The test plan shall include, but not be limited to, the following:

- Number and locations of tests, based on site and subsurface conditions
- Maximum load to be applied during the test
- Acceptance criteria including load versus displacement

The test equipment shall be capable of applying a compression or tension load equal to the maximum test load specified in the test plan. If the compression test requires additional piles for reaction, these piles shall be installed to the same torque requirements as the test pile. The pile shall be tested to the greater of the safety factored load or its ultimate capacity, defined as the maximum load the pile can resist at continuous creep conditions. Test records shall include the following:

- Items as outlined in "Installation Records"
- Magnitudes of applied loads and corresponding displacements