



Date: 2/23/2021

Number: ANC-4

MacLean Power Systems' Excalibur Pressure Grouted Displacement Piles

MacLean Power Systems (MPS) offers a full range of pressure grouted displacement piles, often referred to as drilled displacement micropiles (DDM), for high capacity deep foundation applications. These products have been safely and effectively used in a wide range of applications traditionally occupied by micropiles, augercast piles, driven piles, and similar foundation technologies.

The MPS Excalibur Displacement Pile (EDP) system offers the advantages of Displacement Piles with greater load support than other commonly available systems. EDP's can be safely and effectively installed in areas with limited access where specialized equipment for other deep foundation systems may be required and become less economical. Overhead access, limited site availability, low disturbance installations, and shorter overall pile lengths are all situations where the EDP can be a valuable tool for your project. Please see the below load capacity chart for commonly available pipe sizes.

By taking advantage of EDP's long lead and extension section lengths (up to 40') you can drastically reduce the pile's cost per foot (cost per kip). Reducing the number of pile sections/joints also brings down the overall material handling and jobsite labor hours. These advantages make MacLean EDP's an economic solution to many deep foundation applications.

Excalibur Pressure Grouted Displacement Pile Capacities Chart

| Pipe OD (in) | Wall Thickness (in) | Maximum Installation Torque (ft-lbs) | Grout Column Diameter* (in) | Estimated Grout Take (yd ³ per ft) | Ultimate Compression Capacity (kips) | Ultimate Tension Capacity (kips) |
|--------------|---------------------|--------------------------------------|-----------------------------|---|--------------------------------------|----------------------------------|
| 4.5 | 0.290 | 35,000 | 16 | 0.05 | 428 | 169 |
| 5.5 | 0.415 | 65,000 | 18 | 0.07 | 607 | 292 |
| 7 | 0.408 | 122,000 | 20 | 0.08 | 764 | 372 |
| 7.625 | 0.500 | 150,000 | 22 | 0.1 | 958 | 492 |
| 9.625 | 0.545 | 250,000 | 24 | 0.11 | 1,230 | 684 |

*Grout columns are custom sized to provide the most economical pile to resist the applied loads. Contact a MacLean representative to provide you with a pile recommendation.

EDP's can be utilized in a wide variety of soil conditions. They are fabricated of high strength steel and can withstand large amounts of torsional forces, enabling them to penetrate through tough, dense soils. By increasing the grout column diameter and diameter of the central steel shaft in the pile design, EDP's can generate tremendous axial and lateral resistances even in poor, low consistency soil conditions.

By incorporating easily accessible equipment, you are readily able to pressure grout through the ID of the pile during installation. The driver plate is used not only to help the pile advance through the soils and as an end bearing element, but also to displace the soils around the pile. As the soil is displaced, the pressurized grout fills that void and creates a grout column around the central steel shaft.

The benefits of utilizing a pressure grouted pile are two-fold: the pile is able to generate significant amounts of skin friction, particularly in areas with sand, gravel, and glacial till, and also improves the soils on site by creating a soil/grout zone. They can be used in areas with a pronounced bearing stratum by embedding into it to generate capacity through end bearing and skin friction. In areas without a pronounced bearing stratum, the piles are designed as a friction pile.



Pictured above, the toe of the pile is plugged by welding a steel plate to the ID of the pipe. The grout port, through which grout is delivered under pressure to fill the void created as the driver plate advances through the soil, can also be seen

This pile can be modeled as a micropile using FHWA Type B grout-to-ground bond strengths and allowable stresses. Pile capacities can be seen above, it should be noted that the grout column can be increased or decreased to meet your project's loading requirements. A review of the geotechnical data for the project should be done to determine the in-situ capacity of the pile.

A neat grout mix of Portland Cement and potable water may be used. Once the pile driver plate is in full contact with the ground, pressure grouting can begin and should continue as the pile is advanced through the soil. As the driver plate displaces the soil, the grout fills the void created and forms a column around the central steel shaft. Grout flow and delivery pressure should be monitored to ensure proper grout distribution is being achieved.



Regardless of your project's specific requirements, the representatives/engineers at MPS will work with you to provide an economical deep foundation solution to fit your needs.

Applications

The EDP has been used successfully in traditional Displacement Pile applications. It is a proven economical solution in the below job types where axial loads exceed the capacities of traditional piles. The larger cross-sectional area and higher-grade steel of the EDP offers much higher lateral and moment capacities along with minimal pile head deflection as compared to traditional Displacement Piles. These benefits, in conjunction with EDP's efficient installation, make it an ideal deep foundation solution.

Typical pressure grouted pile job site set up for grouted piles with threaded couplers:

Volumetric mix truck



Grout pump



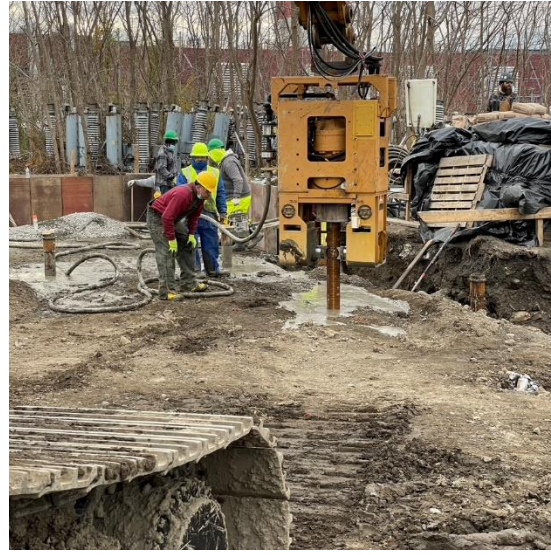
Pile installation and material handling equipment



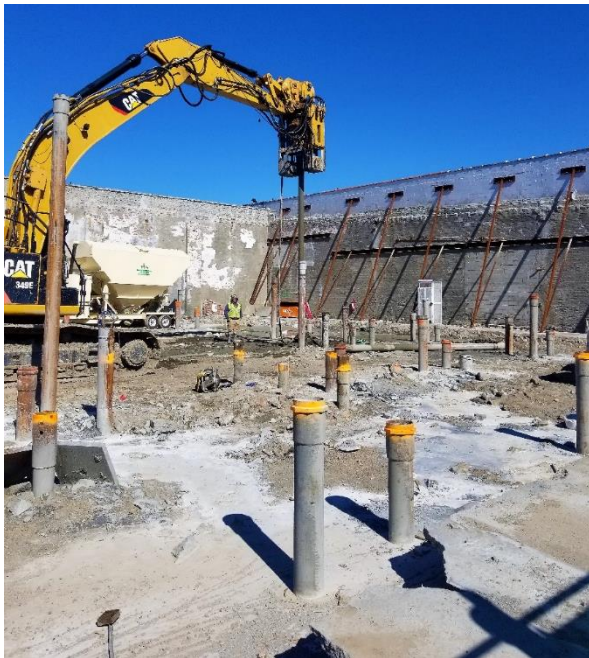
Drive head details for bolted coupler piles:



Pressure grouted piles being installed to support large storage tanks:



New build 7 story building development:



For more information on the products shown here please visit
macleancivilproducts.com/product/high-capacity