

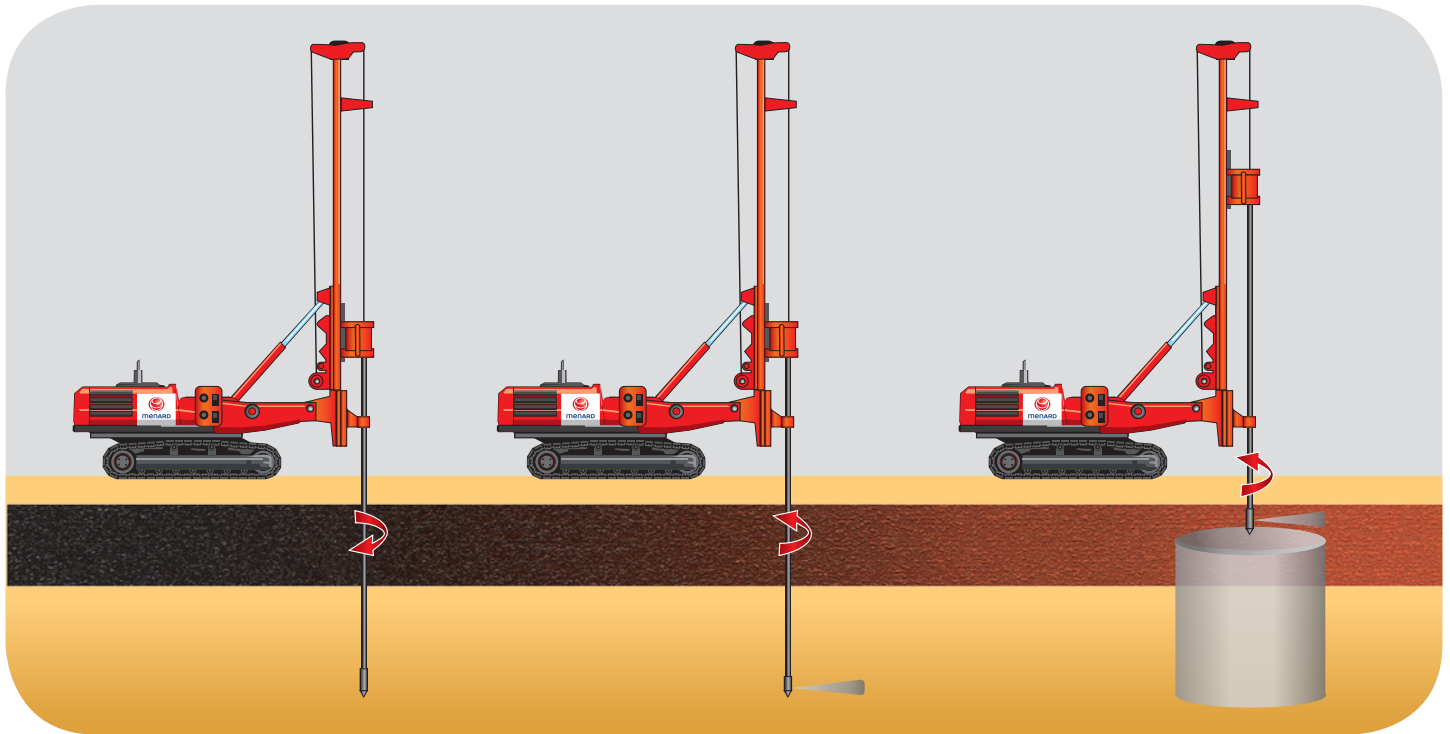
Jet Grouting



ground improvement specialists

Jet grouting method – is used to improve soil strength parameters and at the same time to create an impervious layer. This method involves a combination of the following three consecutive processes:

- break-up of the soil structure by a fluid injected into the soil under high pressure;
- extraction of the surplus spoils to the surface;
- mixing of the soil with cement grout, resulting in the cement-and-soil mixture.



Technology specification

The equipment is composed of a grout plant (cement silo, mixing plant, high pressure pump) joined by a flexible high pressure pipe to the drilling rig. The drilling rig is equipped with a special rod that is selected according to the properties of the soil subject to improvement and the expected characteristics of the constructed column (diameter, shape). The injection grout is usually prepared using Portland cement CEM 32.5 or CEM 42.5. The impervious layer can be further improved using bentonite (in case the strength parameters of soil-cement mixture are of secondary importance).

Construction of each column involves the following phases:

- a small diameter guide hole (approximately 10 cm) is drilled down to the design depth;
- grout is pumped through the rod at very high flow rate (200 to 400 L/min) and gets out through small diameter injection nozzles (1 to 10 mm in diameter) located at the tip of the drilling rod, thus breaking-up the soil structure and creating soil-cement slurry;
- column formation by slow withdrawal of the rod. The rod rotates during column formation and does not rotate during panel formation.

Spoils need to be regularly removed from the working platform during grouting works.

There are three Jet Grouting methods:

- single Jet Grouting

The following three different processes take place during grout injection - breaking down the soil phase, removal of spoils under high pressure and grout mixing with the soil.

- double Jet Grouting

In the double Jet Grouting, the air jet surrounds the grout jet in order to increase the efficiency of the injection process. Air-jetting also improves, thanks to an air-lifting effect, the extraction of the spoils along the drilling rod.

- triple Jet Grouting

In the triple Jet Grouting, the soil is loosened by water and air under high pressure. Cement grout is then injected through an independent nozzle into liquefied soil, easily penetrates into it and evenly mixes with the soil particles creating soil-cement slurry.

Applications

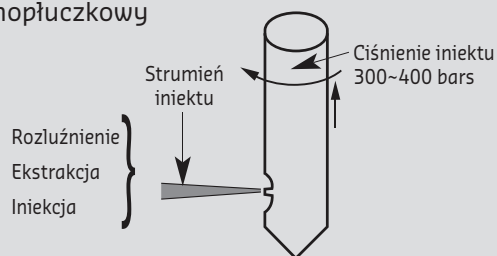
The characteristics of the Jet Grouting columns (column diameters, length of the panels, mixing degree, permeability, compression strength, etc.) depend on the process parameters (rod extraction speed, speed of rotation, pressure of the grout injection, density of the grout, etc.), as well as the soil conditions (type of soil, grain size distribution, compaction, etc.) and on the selected method of column construction (single, double or triple Jet Grouting). The method can be used to improve soft cohesive soil or loose sands of different fractions as well as organic soil, peat and aggragate mud when process parameters are selected properly. The strength of created columns, i.e. soil-cement mix, ranges from 2 to 30 MPa.

The Jet Grouting method can be used:

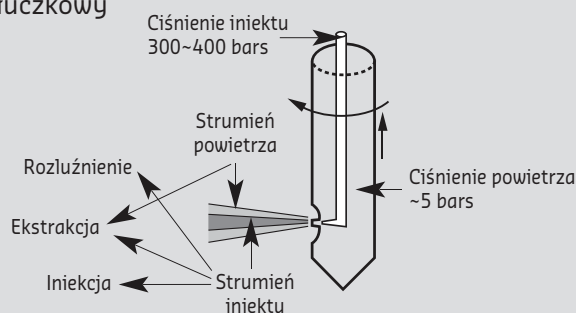
- as improvement of the subsoil subject to distributed load (floors of high bay warehouses, foundation slabs, embankments, quays, etc.) or subject to point loads (spot footings, bridge piers, etc.). In those cases, a load transfer platform (LTP) is usually required
- to form impervious cut-off wall/impervious bottom (plug) for deep excavations in cramped spaces
- to form retaining walls (column reinforcement is required)
- as an underpinning of existing foundations
- to form ground anchors and tunnel pre-arching structures
- in places with limited headroom (basements) or in cramped spaces (tight spacing, historic urban districts).

Systemy do wykonywania iniekcji strumieniowej

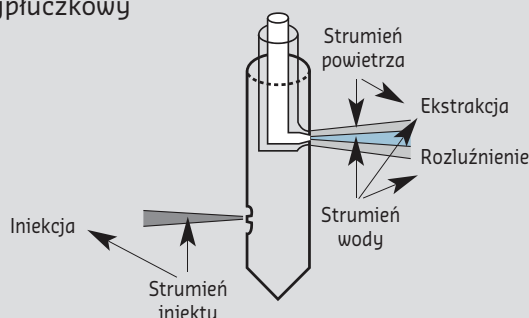
System jednopłuczkowy



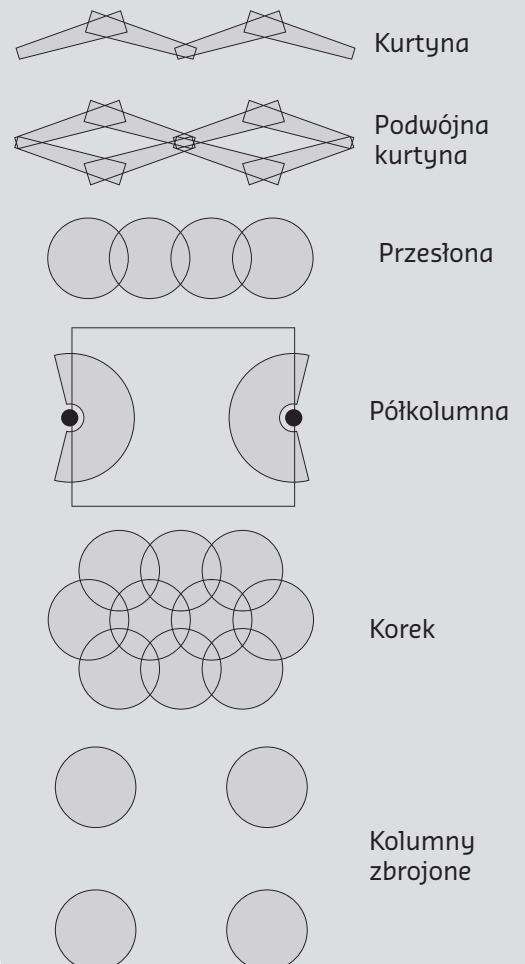
System dwupłuczkowy



System trójpłuczkowy



Formowane kształty kolumnami JG





Advantages:

- **Versatile application** – the application to almost any soil type including compressible, organic and man-made soils. Using this method, it is possible to construct foundation of underground structures in strongly waterlogged sandy soil.
- **Adjusted to the parameters of the structure** – provides possibility to improve strength indoors which allows for underpinning of existing buildings.
- **Good matching** – due to low stiffness to cross section ratio, foundation slabs and spot footing can be rested directly on the Jet Grouting columns right after its routine cleaning and alignment.
- **Unlimited distribution pattern** – provides possibility to form the columns in blocks (foundations of abutments), in groups (hall foundations) or in lines (excavation lining) and in the vicinity of the existing civil structures (no vibration and shock generation in the subsoil)..

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