

GFRP temporary ground anchor



Description

In the achievement of tunnel entrances pole bulkheads or diaphragm walls are built , they are anchored to soil by means of steel ground anchor.

During the excavation, some of these anchors involved in the excavation section will have to be subsequently removed or demolished.

In these cases, the use of steel is highly discouraged because of the safety problems and the high costs for demolition and removal.

Even the use of the GFRP passive nails, normally used for the consolidation of the excavation face, although they are provided with anchor head, they are underperforming due to the greater deformability of fiberglass than steel.

Otherwise, our RWB-star Anchor may be stressed before the full grouting, so holding the bulkheads deformation.

It is made of 8 star-shaped GFRP profiles, so as to maximize the anchor bond with the grouting mix.

The RWB-star Anchor provides a fixed anchor length and a free anchor length that will be stressed before the full grouting.

U n d e r g r o u n d & C i v i l W o r k s d i v i s i o n

This free length is contained in a corrugated high density polyethylene sheath that initially separates the fixed length from the free length.

Once the anchor is stressed, this active length will be also grouted completely in order to allow a progressive demolition without any risk .

The sealing between the free and the fixed length is done by means of a polyurethane foam pad.

Depending on the soil characteristic, the bond of the anchor with the surrounding soil will be achieved by low pressure grouting or with high pressure repeatable selective injections, carried out through manchette PVC pipes (TAM).

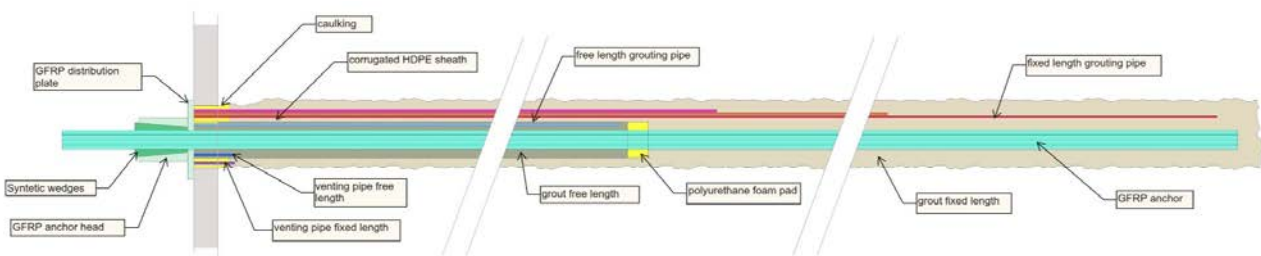
The entire anchor head and the locking wedge system is totally made of synthetic material, as well as the distribution plate.

The whole system is metals free, with the purpose of preventing damages in case of TBM excavation.

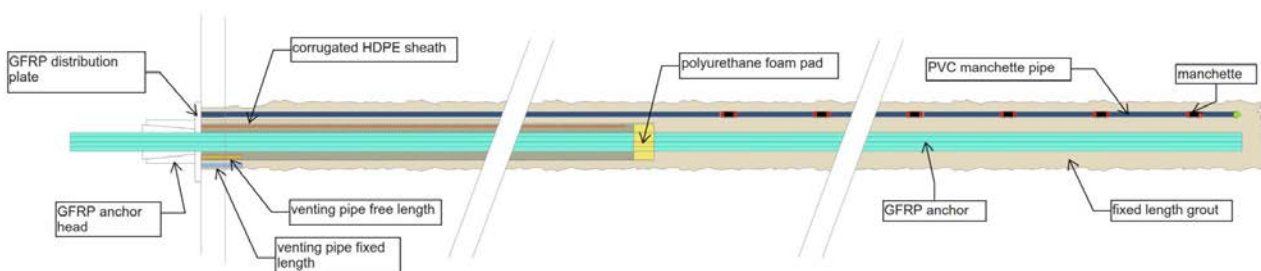
Moreover, the absence of metals guarantees excellent durability even in very aggressive environmental conditions such as the presence of chlorides or sulfates.

Basic Typology

- **Ground anchor for low pressure grouting by HDPE pipe**



- **Ground anchor with injection valve pipe for selective and repeated injections**



Technical features of the GFRP ground anchor

Geometrical characteristics	unit	Value
Maximum diameter	mm	100
Number of GFRP profiles	-	8
GFRP profiles dimensions	mm	27x7
Injection pipe	mm	20
Manchette Injection pipe	mm	27/34
Free lenght sheath	mm	100

Mechanical characteristics	unit	value
Working load	KN	350
Testing load	KN	420
Breaking load	KN	>525
Total resistant section	mm ²	1500
elastic modulus	GPa	>40
tensile strength (average value)	MPa	1000

Installation procedure for and low pressure grouting anchor

- Insert the anchor into the drilling
- Execute the caulking with cement mortar or polyurethane resins, after arranging the grouting and venting tubes.
- Perform foundation grouting by means of the foundation injection tube, checking the full filling of the drilling using the venting tube.
- Close the vent and pressurize the grout.
- As soon as the maturation of cementation is complete, stress the fiberglass profiles and lock the wedge system.
- Then grout the stressed length by the appropriate tube so checking the filling through the appropriate venting tube

Installation procedure for and high pressure selective grouting anchor

- Insert the anchor into the drilling.
- Execute the caulking with cement mortar or polyurethane resins after arranging the cementation and venting tubes and the valved PVC pipe.
- Carry out the cementation sheath by means of the bottom valve (operate by means of a double packer) checking the complete filling using the vent tube.
- Proceed with the internal flushing of the manchette injection pipe.
- Immediately after the partial hardening of the sheath to make the pressure injections with the injection volumes required by the project or until the expected reject pressure is reached (always proceed from the bottom valve).
- Perform further injection steps, if required by the project.
- Once the grouting has been completed cured, stress the fiberglass profiles and lock the wedge system.
- Then grout the free length by the appropriate tube so checking the filling through the appropriate venting tube.

Recommended stressing procedure

- Prepare and arrange the appropriate distribution fiberglass plate ensuring its equal and orthogonal positioning to the anchor drilling axis.
- Apply the GFRP anchor head furnished of the special synthetic blocking wedges.
- Place the jack with push-wedges on the anchor head, and fit the rear stressing head.
- Apply the alignment pull (approx. 30 KN) and observe the initial stretch.
- Stress the anchorage to the test load (1.2 times the expected tensioned load) by means of a series of successive increments of the applied load, with 5-minutes rest (4 or 5 increments equally spaced).
- Keep the test load for 15 minutes then reduce it to the alignment value and verify the perfect elastic behaviour of the system.
- Apply now the expected exercise load.
- Lock the synthetic wedges using the push-wedges cylinder.
- Release the load and disassemble the pull head.
- Carry out then cementation of the stressed section.

