

DESCRIPTION

This work consists of drilling the necessary holes and furnishing and installing rock bolts and appurtenances in accordance with the contract documents and as directed by the Engineer.

MATERIALS1. **Bolts**

Furnish bolts of at least Grade 1035 (ASTM-A722), 26 mm nominal diameter prestressing steel. Bolts must have rolled thread-like deformations over the entire length. Larger diameter bolts are acceptable if supplied at no additional cost to the State.

Basis of Acceptance: Manufacturer's certification of compliance with these specification requirements.

The Department reserves the right to sample and test delivered material.

2. **Appurtenances**

Furnish appurtenances as recommended by the bolt manufacturer for the size and grade bolt supplied, consisting of a steel bearing plate, a hardened washer, if required, and an anchor nut. Two beveled or wedge washers per bolt may be required, as ordered by the Engineer.

3. **Resin**

Furnish resin of the two-component type, and of two different setting times, specifically manufactured for rock bolting. Use only resin that is within the unexpired shelf life designated on the package by the manufacturer.

Furnish cartridges of the appropriate diameter as recommended by the manufacturer for the bolt/drill hole/cartridge diameter combination used. Furnish sufficient fast setting resin to fill 900 mm of annular space in the bottom of the hole, or as ordered by the Engineer. Greater amounts of fast setting resin will be necessary in some rock types to meet the pull test requirements. Furnish slower setting resin with a setting time of no less than fifteen minutes. Install enough slow setting resin in the remainder of the hole to fully encapsulate the bolt.

CONSTRUCTION DETAILS

Proceed with the installation of rock bolts from the top of slope downward. Drill bolt hole(s) into the rock at location(s) and angle(s) as ordered by the Engineer, to a depth equal to 150 mm less than the required bolt length. The bolt hole diameter shall be compatible with the bolt/drill hole/resin cartridge diameters, as recommended by the bolt manufacturer, but in no case shall the bolt hole diameter exceed the resin cartridge diameter by more than 6 mm. Install the bearing plate at 90 ± 15 degrees to the axis of the rock bolt and in intimate contact with the rock surface for its entire area. The method of leveling the rock surface shall be approved by the Engineer. Acceptable methods include, but are not limited to, the following:

1. Chipping the rock surface.
2. Applying a special mix supplied by the bolt manufacturer for leveling purposes.
3. Use of steel wedges in addition to a leveling mix.
4. A combination of chipping and leveling with or without wedges.

Clean out the bolt hole to its full depth with air or water. Place the appropriate amount of fast setting resin in the bottom of the hole and the appropriate amount of slower setting resin toward the top of the hole. Assemble the bolt with the appropriate appurtenances so that 100 mm of the bolt extends past the anchor nut. Insert the bolt into the hole and rotate at approximately 100 rpm while pushing the bolt down through

ITEM 203.1713 17 – RESIN ROCK BOLTS – TWENTY SIX MILLIMETER NOMINAL DIAMETER (GRADE 1035)

the resin cartridges to the bottom of the hole by a means approved by the Engineer. Rotate the bolt in this position for thirty to sixty seconds to insure mixing of the resins in the hole. Do not spin the bolt longer than the setting time of the fast set resin. Leave the assembly undisturbed in the hole for the time required for the fast setting resin to harden then tension the bolt prior to the set time for the slower setting resin.

Pull test the first bolt installed to 450 kN (80% of the ultimate strength of the bolt), or as ordered by the Engineer, by means of hollow-ram hydraulic jack, or by other methods approved by the Engineer. Support the base of the jack at right angles to the axis of the bolt. Conduct this test while tensioning the bolt and prior to installation of other bolts. Lock off the tension by tightening the anchor nut against the base plate. Tension the remaining bolts to 350 kN, or as ordered by the Engineer.

Additional pull tests may be required where different rock types or conditions are encountered, whenever a bolt fails a pull test (as described above) or can not be fully tensioned, or when resin bearing a different manufacturer's code number is being used for the first time.

If a failure of the bolt or anchorage occurs, a determination of the cause of failure will be made by a Departmental Engineering Geologist. Correct, at no cost to the State, failures due to causes other than failure of the rock being bolted, as ordered by the Engineer.

METHOD OF MEASUREMENT

The quantity to be paid is the number of meters of rock bolts satisfactorily installed in accordance with the contract documents and as directed by the Engineer.

BASIS OF PAYMENT

Include in the unit price bid the cost of furnishing all labor, materials, tools and equipment necessary to satisfactorily complete and test the work. No payment will be made for rock bolts which are not satisfactorily installed except those attributed to failure of the rock being bolted.