

# CT-Bolt™

## Rock support



### The advantages of the CT-Bolt™

Combines the benefits of immediate point anchor support and a post groutable fixture.

The polyethylene sleeve seals the bolt against corrosion when grouted.

Long term support for fully mechanised or hand installation.

[www.ct-bolt.com](http://www.ct-bolt.com)

[www.orsta.com](http://www.orsta.com)

# CT-bolt, the new generation of rock bolts.

## Quickly installed, easily grouted

The new CT-Bolt is in many ways a typical combination mechanical bolt, installed as a temporary rock support and later grouted to become permanent. But there are important differences. It's quick and easy to install, simple to grout even with varying consistency and the polyethylene sleeve seals the bolt against corrosion.

The bolt can be installed manually or fully mechanised with rock bolters, which have been developed for the CT-Bolt.

## Special hemispherical dome

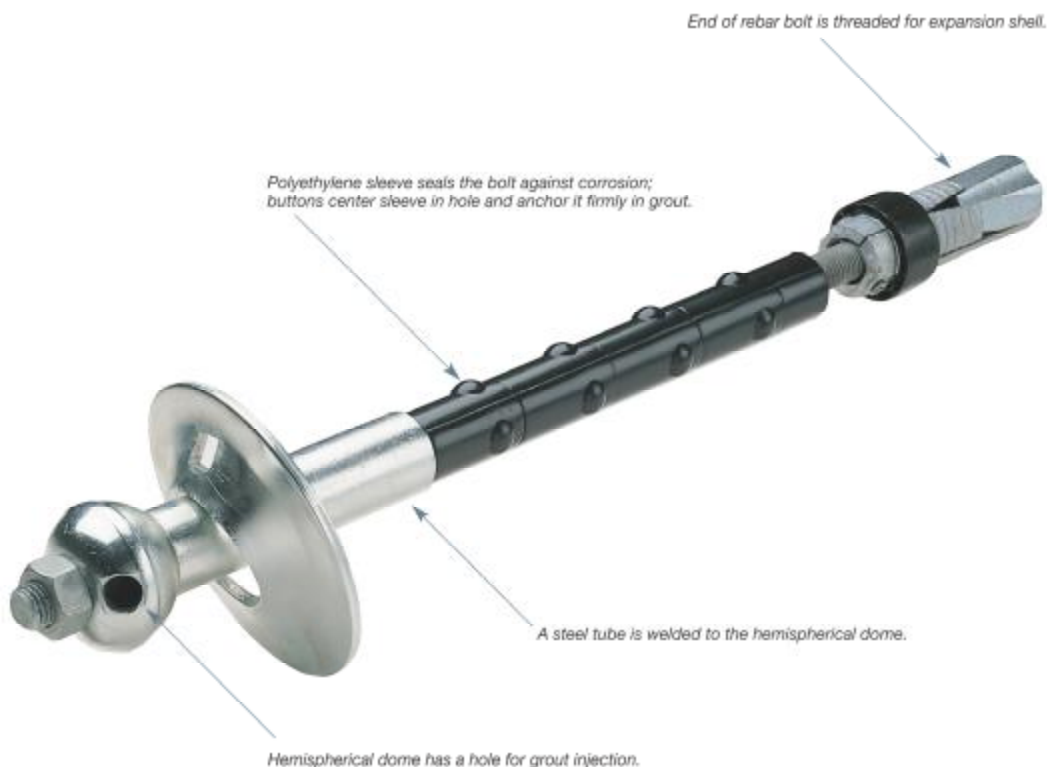
The CT-Bolt has a special hemispherical dome at the end, which serves both to hold the rock loading on the plate and as a grouting chamber. The grout is pumped into the hemispherical dome and flows through the polyethylene sleeve. At the end of the bolt, the grout flows out of the sleeve and spreads back between the sleeve and the rock.

## Unique corrosion protection

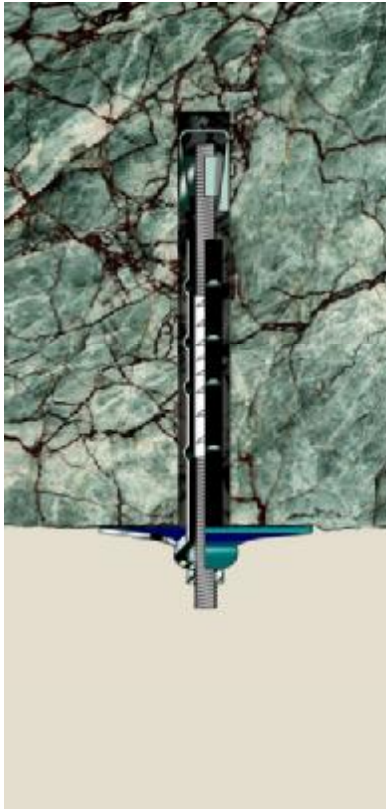
When the bolt is grouted, it can take loads along its full length as well as at the bearing plate. The polyethylene sleeve also seals the bolt against corrosion. The buttons on the sleeve transfer the load from the rock to the bolt and centre the bolt in the borehole.

The CT-Bolt is anchored with an expansion shell and is prestressed during installation. The load is maintained because the bearing plate needn't be removed for grouting.

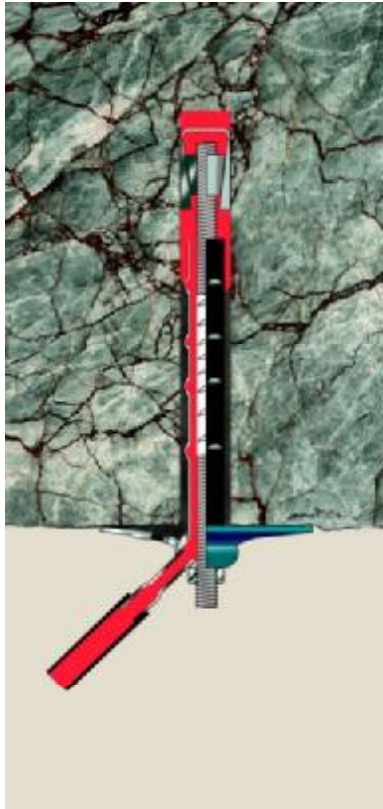
If the area has to be shotcreted before the bolt is grouted, it is possible to attach tubes to the hemispherical dome and the plate and grout the bolt after shotcreting. Many underground rock stabilisation jobs have proved the efficiency and reliability of the CT-Bolt since its first use in 1993. It has been specified on projects such as sub-sea tunnels, road and rail tunnels, sewer tunnels and mines.



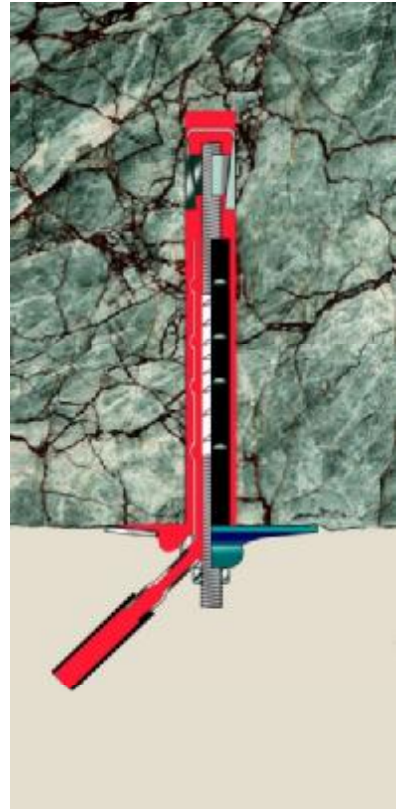
# Installation



The CT-Bolt is installed in a bore hole of 44-51mm diameter, using the expansion shell. The hole is drilled to at least the length of the bolt. The bolt is pressurised so the plate gives immediate support



To grout the bolt, use an injection nozzle on the grout hose. Insert the nozzle in the hole in the hemispherical dome and pump the grout. It flows up inside the polyethylene sleeve and back down between the sleeve and the drill hole.



When the grout flows out through the hole in the plate and sets, you have solid full-length anchorage.

The polyethylene sleeve seals the bolt against corrosion.

## Fully mechanised installation

TAMROCK has modified their Robolt rock bolters for fully mechanised installation of the CT-Bolt.

Total cycles time for a 2,4m CT-Bolt included grouting is about 3,5 minutes.

At the present time these rock bolters are being used at The M5 road project in Sydney and at Kemi Mine in Finland.



# Technical information

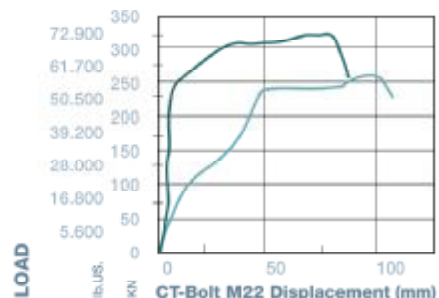
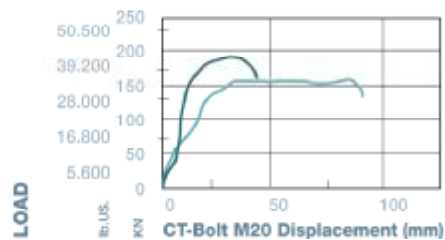
The charts at right show results of tensile tests by independent laboratories. They show displacement and load characteristics for Two bolt sizes on different applications, point-anchored and fully-grouted.

The CT-M20 has a yielding load of 140 kN (31400 lb.) and a failure load of 170kN (38100 lb.) after grout.

The CT-M22 has a yielding load of 230 kN (51600 lb.) and a failure load of 290kN (65000 lb.) after grout.

Bolt lengths range from 1,5m-6m

Fully grouted ●  
Point Anchored ●

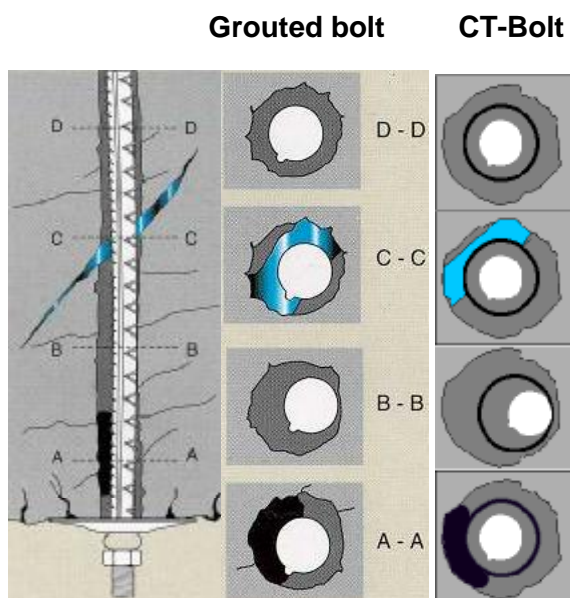


## Corrosion protection of rockbolts

For many years various methods of full column grouting have been considered as acceptable corrosion protection for rockbolts.

Overcored samples from fully grouted bolts have revealed varying quality of the grouting.

Section D-D: Fully grouted  
Section C-C: Loss of grout in wet area  
Section B-B: Eccentric bolt  
Section A-A: Air Pocket



## References.

Some of the projects that have used CT-Bolt™:

Australia, Cudgen Road tunnel  
Australia, M2 road tunnel, Sydney  
Australia, M5 Joint Venture road tunnel, Sydney  
Australia, Jindabyne valve House, h. power tunnel  
Australia, WMC Olympic Dam, underground mine  
Australia, Kanowna Belle, underground mine  
Australia, Newcrest Telfer, underground mine  
Costa Rica, San Jose, hydro power tunnel  
Finland, Kemi underground mine  
Iceland, Karahnjukar PowerStation  
Iceland, Faskrudsfiardargong, Road Tunnel  
Iceland, Hvalfjordur, sub sea tunnel  
Italy, Naturno, railway tunnel  
Italy, Foligno, road tunnel  
Italy-France, Mont Blanc, road tunnel  
Italy, Frejus railway tunnel  
Norway, OPS E39 Trøndelag road tunnels

Norway, Jong-Asker, railway tunnel  
Norway, Snøkvit LNG, sub sea tunnel  
Norway, Frøya sub sea tunnel  
Norway, Hitra sub sea tunnel  
Norway, Romeriksporten railway tunnel  
Norway, Mongstad North, gas caverns  
Portugal, Sines LPG rock cavern  
Singapore, rock caverns  
Sweden, Trollhattan railway tunnel  
Sweden, Botniabanen, railway tunnels  
Sweden, Limhamn rock cavern  
Sweden, Hallandåsen, railway tunnel  
Switzerland, Kirchenwald, highway tunnel  
Switzerland, Lötschberg Basis tunnel  
Turkey, Inmet underground mine  
USA, Chattahoochee sewer tunnel, Atlanta  
USA, Lake Mead water tunnel