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NC-Bolt

Combination bolt for rock support (rebar bolt)



Combination bolt

A combination bolt is installed for immediate support of rock, anchored by an expansion shell, to be fully grouted at a later stage, allowing it to be classified as permanent support. The advantage is that a single bolt is effective for immediate work protection at the face after torque tensioning, while later gaining additional corrosion protection by the grouting.

The combination bolt may be used for most ground conditions, but excluding ground subjected to strain bursting and very large contour convergence. The injected grout improves the corrosion protection provided by the plastic grout pipe and the Pc-Coat. Such bolts are therefore highly attractive for very corrosive environments like subsea tunnels. The end-anchorage with tensioning of the rebar, plastic grouting pipe and the cementitious mortar embedment creates a very stiff system offering extended durability.

Any tunnel may cross zones of variable need of corrosion protection for bolts, but to classify the exposure level may be difficult. One mitigation strategy may be to use the well protected Combination Bolt along all of the tunnel length.

The NC-Bolt may be used under most ground conditions, except when very high rock stresses may produce large radial deformations or strain bursting.

We produce two types of combination bolts - NC-Bolt (rebar bolt) and Pc-Bolt™ (tube bolt). Product data sheets and brochures for both bolt types can be downloaded from www.pretec.no.



Factory in Haining, Zhejiang, China
Total area: 20000m². Content: mechanical production, hot dip galvanizing and powder coating



NC-Bolts packed on pallet

Installation, equipment

Installation takes place in two steps:

- 1) Place the bolt in the hole and tension it by applying correct torque on the nut.
- 2) Grout injection for permanent anchoring and protection.



Immediate support by placement and tensioning at the tunnel face.



The grouting tool gets attached to the bolt head before start of the mortar pump. (Two alternative types of grouting tools are available)



Mortar gets pumped through the hole in the grouting head to fill the annular space from bottom of hole out to the spherical bearing plate.



In the bearing plate you can see the hole indicating completely filled borehole.

The pictures are freeze-frames from our animation film that can be found by searching for: "NC-Bolt" at www.youtube.com

Technical information



NC-Bolt ready for installation

Specifications

Specifications				Borehole	
Dimension	Material ¹⁾	Thread length	Weight	Diameter, mm	Depth ²⁾
M20x2,5	HRB500E	2xM20x150mm	2,47kg/m	Ø45-48	L+150mm
M22x2,5	HRB630	2xM22x150mm	2,98kg/m	Ø45-48	L+150mm
M33x3,5	HRB500E	2xM33x200mm	6,43kg/m	Ø64-68	L+150mm

Mechanical properties

Dimension	Tension area A_s Thread-shank	Yield stress R_{eh}	Tensile stress R_m	Ductility A_{gt}
M20x2,5	245-314 N/mm ²	Min. 500 N/mm ²	Min. 600 N/mm ²	Min. 8%
M22x2,5	303-380 N/mm ²	Min. 630 N/mm ²	Min. 790 N/mm ²	Min. 7,5%
M33x3,5	694-804 N/mm ²	Min. 500 N/mm ²	Min. 600 N/mm ²	Min. 8%

Minimum load capacity

Dimension	End anchored ³⁾		Fully grouted		Torque Nm	Pre-tension kN
	Yield kN	Failure kN	Yield kN	Failure kN		
M20x2,5	123	147	157	186	150-250	40-60
M22x2,5	191	239	239	300	150-250	40-60
M33x3,5	347	416	402	482	200-300	40-60

¹⁾ According to GB1499.2-2007

³⁾ Poor and soft rock quality may give lower values.

²⁾ L = bolt length

Test on site under actual conditions to correctly establish representative values.

Grout recommendations

Mix pure cement and water with a suitable water-reducing admixture. Typical water/cement-ratio is 0.3-0.4. Contact your concrete admixture supplier for selection of admixture product. Carry out pre-construction testing on Site to establish correct mortar consistency. For more detailed information, please see own brochure "Grout recommendations" on www.pretec.no.

To ensure proper and safe grouting, the safe Pretec grouting tool is recommended. Option for quick grouting is also available.



Stock program

Available in 3 different dimensions:
 M20 and M22 in lengths from 2400mm to 6000mm
 M33 from 3000mm to 12000mm (Option: delivered with couplers)



Accessories

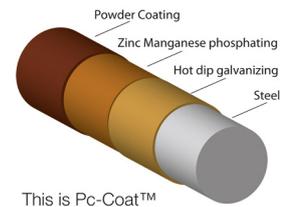
Spherical bearing plate with hole for evacuation of air. Suitable for angle deviation up to 30°. Bearing plate must be ordered additionally.

Expansion shell is mounted on the bolt from factory and is a part of the bolt. It is also available loose. Due to superior design, the expansion shell will provide immediate anchoring effect when the bolt has been installed and tensioned.



Corrosion protection / Pc-Coat™

Hot dip galvanizing is executed according to NS-EN-ISO 1461 and epoxy powder coating according to NS-EN 13438.



Please refer to product technical data sheet for Pc-Coat and relevant management, operations and maintenance documentation and Pc-Coat brochure which may be downloaded at www.pretec.no



Quality control

Our manufacturing plant Zhejiang Pretec Metal Products Co. Ltd. is certified according to ISO 9001 and EN 1090-1 with complete manufacturing control of all production steps. They are also environmentally certified according to ISO 14001.

Our CE product marking provides trace documentation from the steel mill to the final product, allowing Pretec to take full responsibility for providing the specified quality through the whole value chain.

We are continuously testing during manufacturing to ensure that our products will satisfy both the specifications and the expectations of the market, our customers and the construction site owner.

Certificates in compliance with EN 10204 3.1 are available for inspection. Approvals for bolts from the Norwegian Public Road Administration and Bane NOR (Norwegian Railway Authority) for use in Norwegian infrastructure tunnels are available on request.



Standard label marked with certificate number



Pretec China laboratory



Control of coating thickness

Advantages: The NC-Bolt

- Duplex corrosion protection: Hot dip galvanized and epoxy powder coated rebar bolt placed within a plastic grouting pipe and completely embedded in mortar, provides extended durability under all conditions.
- Highly efficient because it is suitable in most ground conditions and covers both immediate and permanent support in a single bolt.
- Durability testing of NC-Bolts shows that to improve on the Duplex system, stainless steel would be required for bolts and accessories.
- Bolts are delivered with zinc coated expansion shells mounted from factory. This ensures proper function of the threads and the coating prevents corrosion. Less work on site saves time and there are fewer parts to handle for stock management.
- Bolts are clamped in groups and loaded on pallets. This prevents transport damage and simplifies managing number of bolts in stock.
- Short distance from end of grouting pipe to expansion shell, ensures filling of borehole end, before mortar fills the rest of the hole.
- The bolt head design prevents leakage and risk of mortar spray against operators.
- Rebar anchorage tests show that the plastic grouting pipe bubble design provides excellent pull-out resistance for the rebar steel.



Norwegian Tunnelling Network (NTN) has issued a “Best Practice / the Norwegian way” document regarding installation of rock bolts:

www.norwegiantunnelling.com

Look under “Elements of Norwegian tunneling” and “Temporary and permanent rock bolts”.



Nc-bolts with mounted expansion shells

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