

# **ROCK REINFORCEMENT**

## 2 ROCK REINFORCEMENT

Our aim is to improve safety, increase productivity, save cost, time, and reduce risk in underground mining, tunnelling and construction of underground spaces.

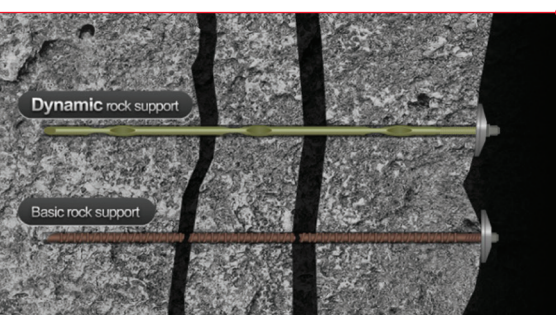
### RELIABLE DYNAMIC ROCK REINFORCEMENT

Underground mining is moving deeper and the construction of tunnels and underground spaces is subject to more challenging ground conditions. The risk of rock bursts and deformations is increasing, causing potentially unsafe conditions for people, equipment and the operation as a whole. Rock bursts and large rock deformations may also lead to closure of part or the entire mine or work site, consequently lowering revenues and impacting viability.

To manage these conditions, innovative and reliable rock reinforcement systems are critical to effective and modern underground operations. Such systems should not only be able to carry high loads, but also accommodate rock deformation by absorbing the energy released in the rock mass. Rock bolts are an essential part of these systems and have to be efficient and reliable, easily installed with standard equipment, and reduce the need for downstream rehabilitation.

Together with sprayed concrete, grouting and injection technologies and products, Normet offers the D-Bolt® system for active rock reinforcement. The D-Bolt represents a new generation energy-absorbing rock bolting system, specifically designed for efficient and reliable rock reinforcement, in both squeezing and burst-prone strata conditions. The D-Bolt's patented technology is based on a smooth steel bar with a number of anchor points along its length. It is anchored in a borehole with either cementitious grout or resin. The D-Bolt is only fixed with the grout in the anchor point positions, while the smooth sections between the anchor points can freely deform when subjected to rock dilation. The D-Bolt absorbs the rock dilation energy through fully mobilizing the strength and deformation capacities of the engineered bolt steel. The smooth sections of a D-Bolt independently provide reinforcement functions to the rock, and failure of one section would not affect the reinforcement function of other sections of the D-Bolt.

The D-Bolt is today used as an important rock reinforcement safety device at leading mines throughout the global mining community.



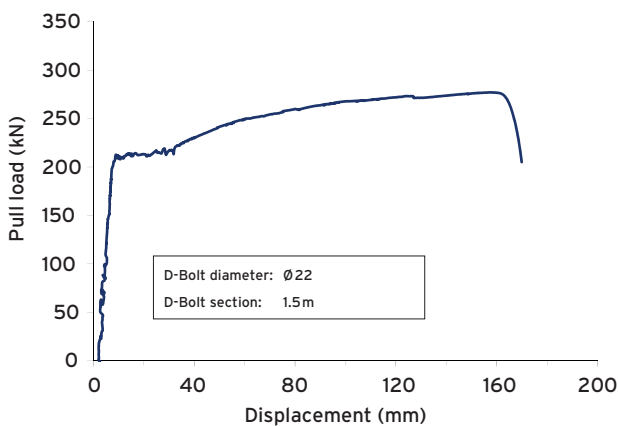
## THE D-BOLT

The D-Bolt technology is based on a smooth steel bar with a number of anchors along its length. It is anchored in a borehole with either cement grout or resin. The D-Bolt is only fixed with the grout in the anchors' positions, while the smooth sections between the anchors can freely deform when subjected to rock dilation.

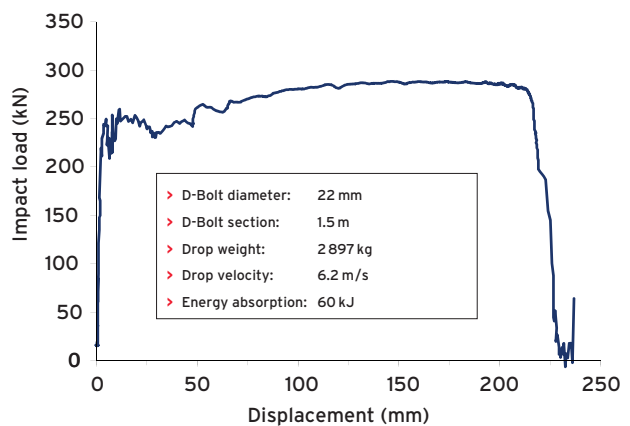
A D-Bolt reinforces the rock by constraining rock dilation between anchors. The anchors are loaded when the rock dilates and then the smooth sections between the anchors become stretched. The load in the smooth sections increases quickly with a small increase in the rock dilation until the yield load is reached. After that, the sections elongate plastically until failure. The D-Bolt absorbs the rock dilation energy through fully mobilising the strength and deformation capacities of the bolt material. The smooth sections of a D-Bolt independently provide reinforcement functions to the rock. Failure of one section would not affect the reinforcement function of other sections of the bolt.



### TYPICAL STATIC PERFORMANCE



### TYPICAL DYNAMIC PERFORMANCE

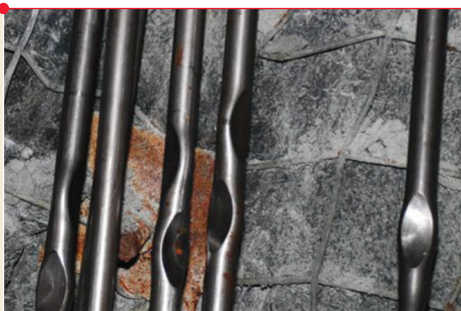


### BENEFITS OF THE D-BOLT

- > Increases mine safety.
- > Eliminates or reduces the effects of rock bursts.
- > Optimizes mine operations through reducing bolt failure.
- > Increases mine safety.
- > Extends mine lifecycle through superior reinforcement of troubled rock.
- > Installs easily with standard equipment and can be used as a standard bolt in a one pass system.

### PRODUCT RANGE:

- > Bolt diameters: 20 mm and 22 mm
- > Bolt lengths: 1.8 m, 2.1 m, 2.4 m, 2.7 m, 3.0 m (special lengths can be made)
- > Threads: M 24, R 24 (Ø 22 mm)  
M 22, 7/8" UNC 9 (Ø 20 mm)
- > Anchor type: Double oval shapes



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➤ ROCK REINFORCEMENT

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