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Terra-Barb Data Sheet

The *DD Grout Plugs* ***Terra-Barb*** is a simple mechanical plug for rifling protection in underground diamond drill holes. The ramped rubber rings are a one way brake, allowing the plug to go forward but not to reverse back. Two work together on each ramp as a simple spring loaded arrangement to provide forward resistance, to enable grouting behind the plug in addition to the substantial rifling resistance provided from in front of the plug.

The ***Terra-Barb*** can be used on its own for rifling protection, or in conjunction with a supporting grout column. The plug works immediately on installation. The plug is constructed from an engineering plastic designed to easily withstand the forces and pressures involved. The ***Terra-Barb*** will not corrode, and can be drilled through for hole extensions. The base of the plug is tapered to nestle into a drill bit, allowing it to be easily, simply and remotely pushed in to the collar with the diamond drill rig.

IMPORTANT: The ***Terra-Barb*** is made for use with standard size drill bits and reamers. Please contact us if oversize (OS) reamers are used.

Terra-Barb **Specifications**	**Magnitude**	**+/-**	**FoS**
Anchor strength in reverse direction (tonnes) HQ	12	2	200:1
Anchor strength in reverse direction (tonnes) NQ/NQ2	12	2	200:1
Anchor strength in reverse direction (tonnes) BQ/LTK60	10	2	300:1
Anchor strength in reverse direction (tonnes)AQ/LTK48	6	1	250:1
Continuous sliding resistance in reverse direction (% of anchor strength)	85	10	N/A
Water pressure rating (psi)[bar]	200 [14]		2:1
Forward sliding resistance (kg) approx.	200	50	nil
Recommended installation depth (m)	30		N/A

The ***Terra-Barb*** is pressure rated to 200 psi (14 Bar) with a 2:1 Factor of Safety for water control. This is subject to installation in competent ground, and is also subject to the grip of the rubber against the surrounding rock. As with rubber tyres, if the rock is soft or slippery, the rubber may not grip and in broken ground they may not seal. For higher water pressure applications, please see the ***Hydra-Barb*** specifications.

For a complete understanding of the protection the ***Terra-Barb*** affords against rifling, it is necessary to consider the typical maximum magnitude of airblasts from underground

blasting. Typically only a few holes are fired together on the same delay. The worst case of 300kg per delay within 10m of the plug is 17 psi overpressure highlighted below. For comparison, 300kg would be enough for an average decline face and is spread over 20 or so delay increments, however stoping rounds in larger mines may be to these levels. The following table provides an estimate of ovepressure (ie shockwave above atmospheric pressure) from unconfined blasting, with 300kg per delay at 10m highlighted; [i]

Airblast Overpressure in Underground Mines

Distance to collar plug (m)	Maximum charge per delay (kg)									
	25		50		100		200		300	
	kPa	*PSI*	kPa	*PSI*	kPa	*PSI*	kPa	*PSI*	kPa	*PSI*
10	42	*6*	56	*8*	74	*11*	97	*14*	114	*17*
20	18	*3*	24	*4*	32	*5*	42	*6*	50	*7*
50	6	*1*	8	*1*	11	*2*	14	*2*	17	*2*
100	3	*0*	4	*1*	5	*1*	6	*1*	7	*1*
150	2	*0*	2	*0*	3	*0*	4	*1*	4	*1*

To make sense of these numbers it is worth looking at potential risks to humans[ii] and to rated capacities of equipment. The following consequences and capacities apply.

Pressure (kPa)	Pressure (PSI)	Potential consequence / maximum or rated capacity
21	3	Serious injury common
34	5	Injuries are universal, fatalities likely
69	10	Most people are killed
103	15	Standard to which refuges are built
1,379	200	***Terra-Barb*** water pressure rated capacity at FoS 2:1
26,201	3,800	***Terra-Barb*** equivalent anchor strength being 12 tonnes +/- 2 tonnes.

The referenced tables above indicate that the ***Terra-Barb***, when installed into competent ground, is well beyond the strength required to protect from airblast and rifling. Further to this, the anchor strength of (HQ and NQ/NQ2) 12 tonnes and (BQ/LTK60) 10 tonnes +/-2t and (AQ/LTK48) 6 tonnes +/-1t will provide significant impact protection against debris or flyrock that might be ejected into the diamond drill hole from a connection to a blasting area.

For further information please contact;

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[i] The formula used is as follows;
P=185x(Distance/((explosive charge)^1/3)))^-1.2 (with no derating of Anfo to TNT equivalent)
Taken from "Constraints for tunnel construction in the urban environment and how to overcome them", David Lees, Planning for Urban Tunnels, AUCTA workshop at GEO Eng 2000, Melbourne.

[ii] Sourced from "Effects of blast pressures on structures and the human body", R. Karl Zipf, Jr, and Kenneth L. Cashdollar, available on the Centre for Disease Control NIOSH website.