HARD ROCK MINING

RESIN BOLT COMPARATIVE TESTING

R24 AND R27 SECURA BOLTS

INTRODUCTION

A variety of six (6) different rock-bolts with fitted nuts used extensively in hard rock mining were tested by a NATA accredited laboratory MTS[1/2/3]. The rock-bolts and nuts were tested for various strength and mechanical properties.

The samples were delivered to the testing facility differentiated only by a painted colour marker. All testing of the bolts referenced the following colour code I.D.

The white colour I.D refers to the Minova R24 Secura bolt and the orange colour I.D. refers to the Minova R27 Secura Bolt.

Red bars and nuts	
Blue bars and nuts	
White bars and nuts	**Minova R24 Secura Bolt**
Orange bars and nuts	**Minova R27 Secura Bolt**
Yellow bars and nuts	
Green bars and nuts	

[1] All the testing and results reported, were undertaken (independently) by a NATA accredited testing service, Melbourne Testing Services Pty. Ltd. (MTS) In collaboration with the Deakin University.

[2] While the report does not provide any specific conclusion, this flyer identifies the Minova R24 and R27 Secura Bolts and offers a performance comparison, based on our own interpretation of the tested data.

[3] Complete Report No. MT-19/0101-B, “Testing of Steel Rock-Bolt Bars and Retaining Nuts” is included in the pages following this bulletin.

MINOVA SECURA BOLT

The Secura Bolt® is a specifically designed solid reinforcing bar for use in strata reinforcement. The bolts include a unique paddle system to improve resin mixing and 27mm diameter deforms which provides higher bond strength in larger diameter boreholes. Secura paddles are formed using a unique shearing process which results in a more consistent resin mixing along the column length.

Advantages

- Proven historical performance
- Extensive quality-controlled manufacture
- Permanent primary support
- Multiple lengths, diameters, paddle configurations
- Consistent pin nut torque drive system
- High strength thread
- Proven resin mixing performance
- High load transfer

TENSILE STRENGTH TESTING

Five repeat test pieces for each variant bar type were accurately weighed and measured to determine the specific mass per metre and actual diameter. Five repeat test pieces for each variant bar type were loaded in tension until rupture of the bar occurred. Testing was conducted in accordance with AS 1391-2007.

Bolt Tensile Response

Bolt by Colour I.D.	Tensile Strength (MPa)	Maximum Force (KN)
White Bolt (Minova R24 Secura)	**847**	**325**
Orange Bolt (Minova R27 Secura)	**833**	**351**
Red Bolt	691	303
Blue Bolt	744	324
Yellow Bolt	646	212
Green Bolt	680	298

SHEAR STRENGTH TESTING

Five repeat test pieces for each variant bar type was prepared and then fitted to a hardened steel, double shear plain loading tool. Shear force was then applied to the tool's plate until the peak force was attained and shear failure of the test pieces occurred.

Bolt Shear Response

Bolt by Colour I.D.	Single Shear Strength (MPa)	Single Shear Force (KN)
White Bolt (Minova R24 Secura)	**630**	**242**
Orange Bolt (Minova R27 Secura)	**624**	**263**
Red Bolt	487	214
Blue Bolt	536	233
Yellow Bolt	504	166
Green Bolt	515	225

TORSIONAL RESPONSE TESTING

Shear Pin

One single test bar for each variant type / colour was tested. A length of bar incorporation the threaded end and nut was secured to a fixed torque plate assemble. Rotational torque was applied in an anti-clockwise direction until the peak torque was achieved and failure of the shear pin or end cap had occurred.

After completion of the shear pin tests the nuts were welded to the rock-bolts to facilitate testing of the bar for torsional strength. Rotational torque was applied in an anti-clockwise direction until the peak torque was achieved and torsional rupture of the bar occurred.

Torsional Bar Strength

Bolt by Colour I.D.	Mode of Failure	Torsional Strength (Nm)
White Bolt (Minova R24 Secura)	Torsional rupture of bar	**1222**
Orange Bolt (Minova R27 Secura)	Torsional rupture of bar	**1755**
Red Bolt	Torsional rupture of bar	1534
Blue Bolt	Torsional rupture of bar	1534
Yellow Bolt	Torsional rupture of bar	975
Green Bolt	Torsional rupture of bar	1152

TENSILE STRENGTH THREADED SECTION & NUT PULL-OFF TESTS

Repeat tests were conducted for each variant bar and nut type. Sample lengths of bar were cut with nuts threaded onto the end of the bar in the as delivered condition. Special loading washers were fitted over the bar to provide a secure reaction against the loading nose of the nut. The test pieces were then fitted into the tensile testing machine and loaded in tension until the peak load and failure of the bar or threaded connection occurred.

Nut / Thread Tensile Response

Bolt by Colour I.D.		Mode of Failure	Maximum Force (kN)
White Bolt (Minova R24 Secura)		Tensile rupture of bar	**310**
Orange Bolt (Minova R27 Secura)		Tensile rupture of bar	**352**
Red Bolt		Tensile rupture of bar	302
Blue Bolt		Thread stripped	308
Yellow Bolt		Thread stripped	201
Green Bolt		Tensile rupture of bar	269

TECHNICAL SUPPORT

We provide technical advisory service by a team of specialists in the field. The service includes on site assistance and advice on evaluation trials and laboratory work. All technical data sheets can be found on www.minovalgobal.com

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