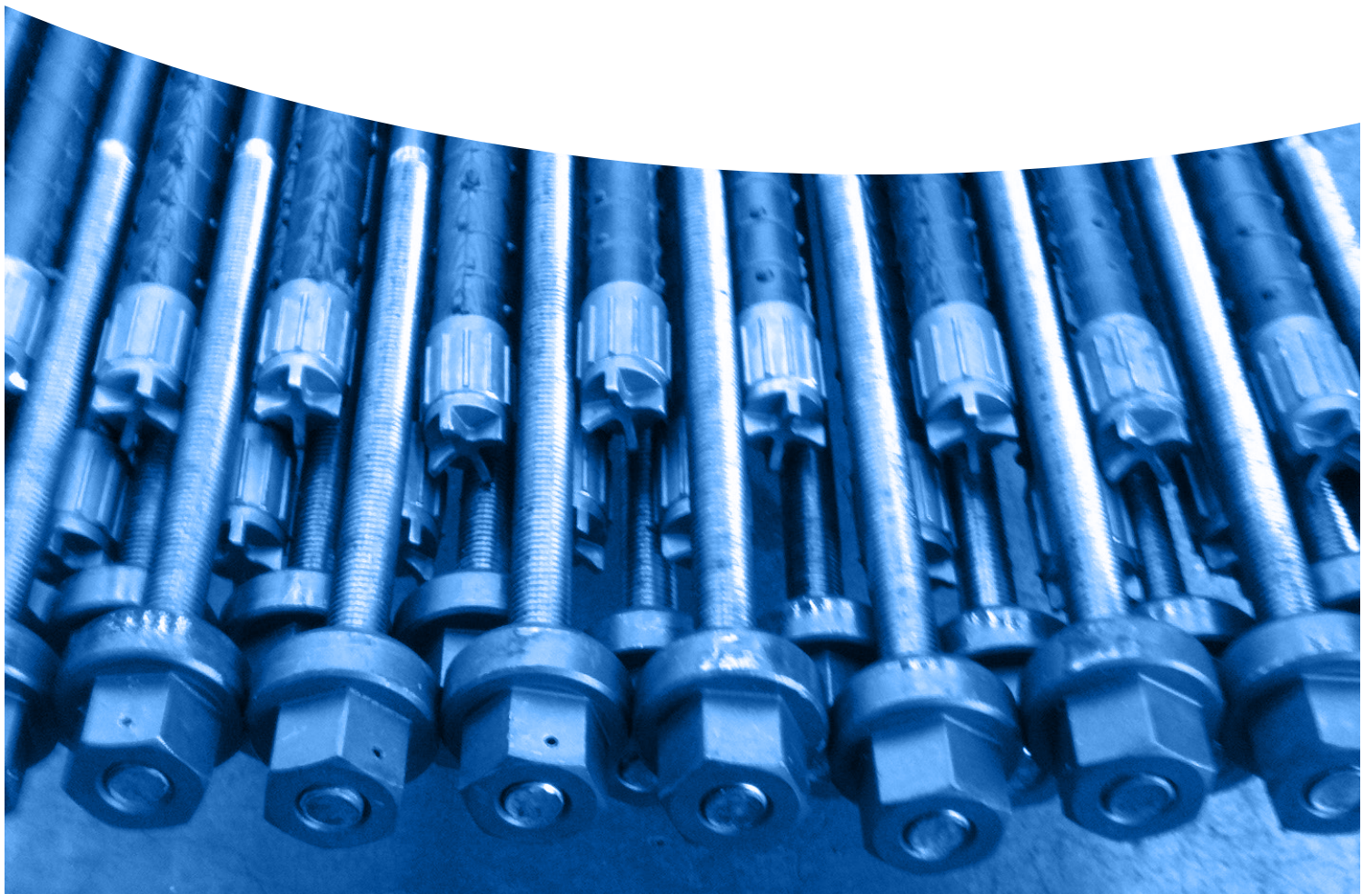




DYNAMIC & HIGH CAPACITY SURFACE SUPPORT CATALOGUE





For more than 20 years, our mission has been ground support products. Today, JENNMAR Australia makes a broad range of reliable products, from rock bolts and plates, to cable bolts and cuttable support, to resin and cement anchoring. We're proud to make products that make the industries we serve safer and more efficient.

Adding to this wide range of products are DYNAMIC and HIGH CAPACITY SURFACE SUPPORT products, thoroughly tested in-house and in leading research facilities. JENNMAR now offer the largest range of products designed to suit the most challenging dynamic and quazi-static geotechnical domains. The demanding conditions where deep and highly stressed mines now operate, demand JENNMAR manufactured products.

JENNMAR's success and growth in Australia has come about through the dedication of its people and the commitment to all facets of customers' requirements including the efficient manufacture and supply of quality products, the reliable provision of support services and ongoing new product development.

At JENNMAR and its related companies, we consider safety to be a core company value. The nature of the products and services we provide are designed to enhance the safety of people working in the mining, tunnelling and civil construction industries. Safety starts with our people and transfers through our products and services to our end use customers.

ACCREDITATIONS

Jennmar Australia is certified as compliant with the following standards:



Quality
ISO 9001

AS/NZS ISO 9001:2008
Quality Management System



ISO 14001

AS/NZS ISO 14001:2004
Environmental Management
System

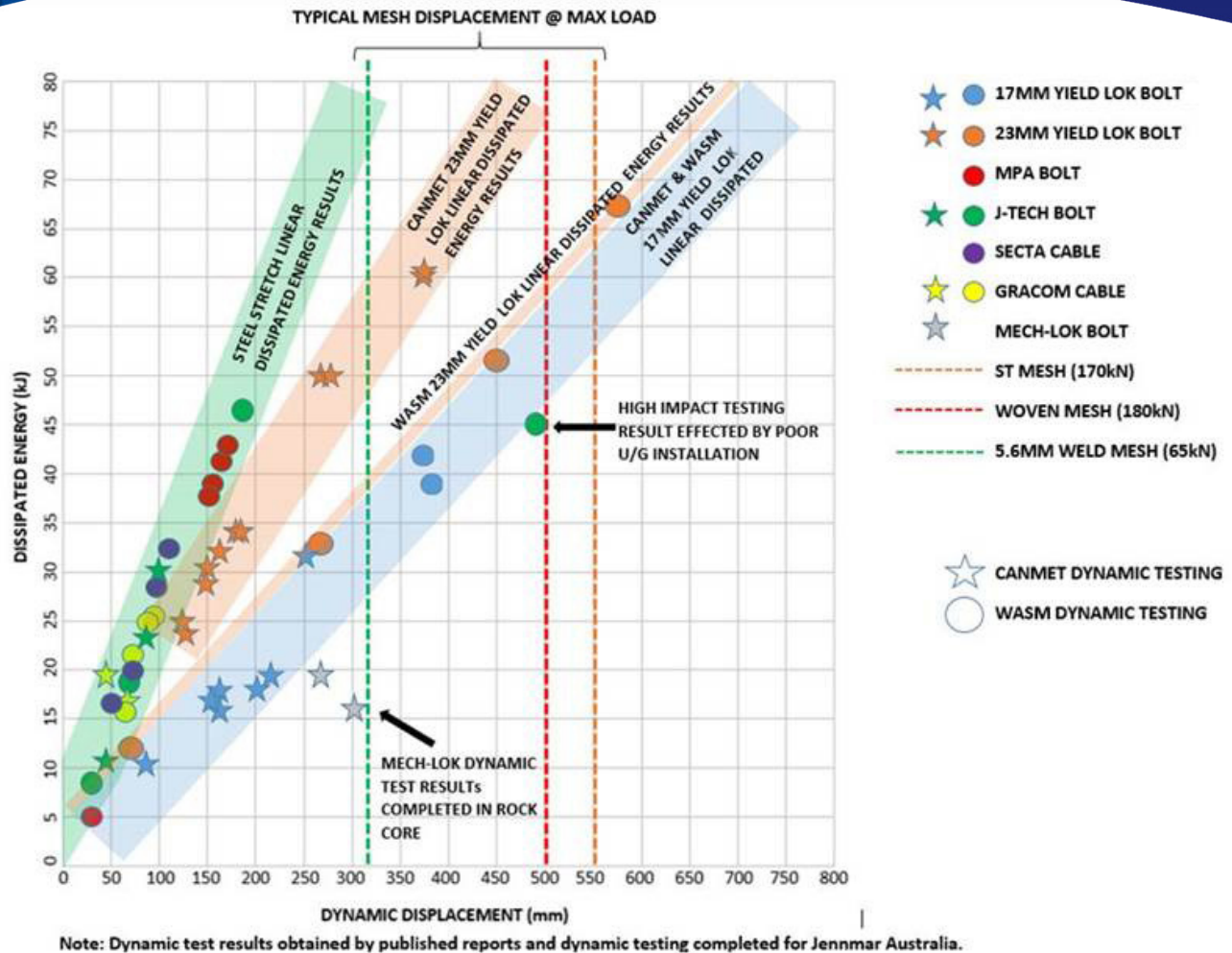


Health & Safety
AS 4801

AS/NZS 4801:2001
Occupational Health and
Safety Management System



Dynamic Testing



Rock bursts are one of the greatest challenges to ground control in the mining industry. The general principle of ground control in rock burst prone conditions is to transfer the dynamic energy of a rock burst event to the yielding support system to facilitate absorption and controlled deformation of the rock mass while containing materials, or helping the rock mass to support itself. JENNMAR research and development has focused on well engineered products where understanding the interaction of the reinforcement element failure mode within the rock mass and the element's mechanistic response in static and dynamic environments is paramount.

The Dynamic Testing chart shows testing completed at both CANMET and WASM dynamic test facilities. Results are obtained from published reports, papers and dynamic testing completed for JENNMAR. Each JENNMAR dynamic product has completed reinforcement dynamic capacity testing and is plotted to explain dissipated energy and displacement demand. JENNMAR provide a product offering for varying design requirements with stiffer products with minimal available displacement and products with larger displacement that perform well in squeezing ground conditions.

Surface support capacity is a critical link in rock reinforcement system performance. JENNMAR has devoted significant energy in developing high capacity systems designed to fit within the design criterion of our dynamic rock and cable bolts. The typical displacement at maximum capacity of the ST and Woven Mesh are shown in conjunction with the industry standard 5.6mm weld mesh.

Static Testing



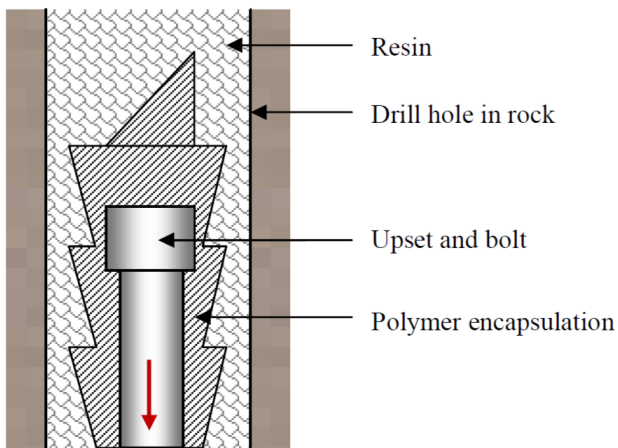
Steel wire weld mesh is a common industry standard surface support used in underground mining, traditionally installed with mining drills during the bolting cycle. As underground mining depth and stress increase, mining methods and their sequences at these depths place challenges on conventional surface support options. These challenges have provided a need for high capacity surface support options that improve development efficiency, reduce the need for secondary ground support installation and are easily installed with current mining equipment. A 5m² mesh testing machine has been built, suspending a 14,500kg concrete/steel slab, designed with multiple hold down points to test varying bolting patterns. Mesh load and displacement can be accurately measured using a data acquisition system which pushes against the restrained mesh module with an available 1000kN load and 1200mm displacement capacity.

JENNMAR has focused on the successful development of two high capacity surface support mesh products, the ST and Woven Mesh modules. Significant testing using our in-house test facility has achieved the successful development of economical, high capacity surface support products plotted on the JENNMAR Dynamic Testing Chart.

Yield-Lok Bolt 17mm

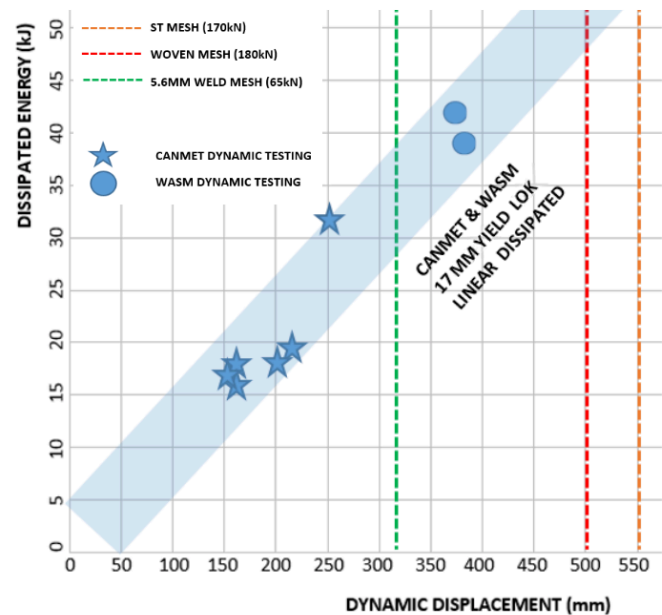


The patented 17mm Yield-Lok Bolt was developed to allow for easy installation when using small machines and hand held bolters. Thoroughly dynamic tested, the 17mm Yield-Lok bolt is a proven performer.



Features:

- Yielding not effected by resin/grout properties, hole diameter or encapsulation length
- Bolt Upset provides consistent and repeatable results, plowing through and engineered polymer
- High shear stiffness and strength
- Suitable for Hand Held Mining installations



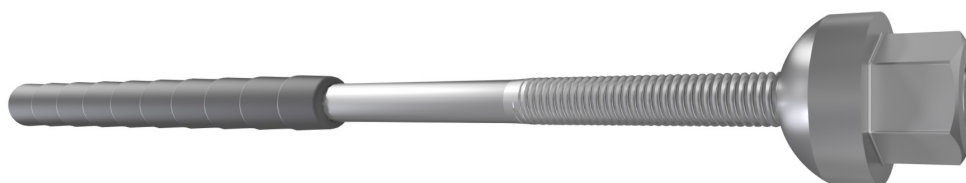
Note: Dynamic test results obtained by published reports and dynamic testing completed for Jennmar Australia.

Technical Data – 17mm Yield-Lok

Bar Diameter (mm)	17			
Bar Straightness to AS	1442 - 1991			
Cross Sectional Area (mm ²)	235			
Mass Per Metre (kg/m)	2.1			
Drill Hole Size (mm)	34 - 40			
Standard Elongation min.	8%			
	Properties Minimum		Properties Typical	
	MPa	kN	MPa	kN
Yield Strength of Steel	517	120	633	147
Tensile Strength of Steel	688	160	844	196
Shear Strength (0.7 x UTS)		112	-	137

Rolled Thread ¾" Left Hand Thread Automotive Standard

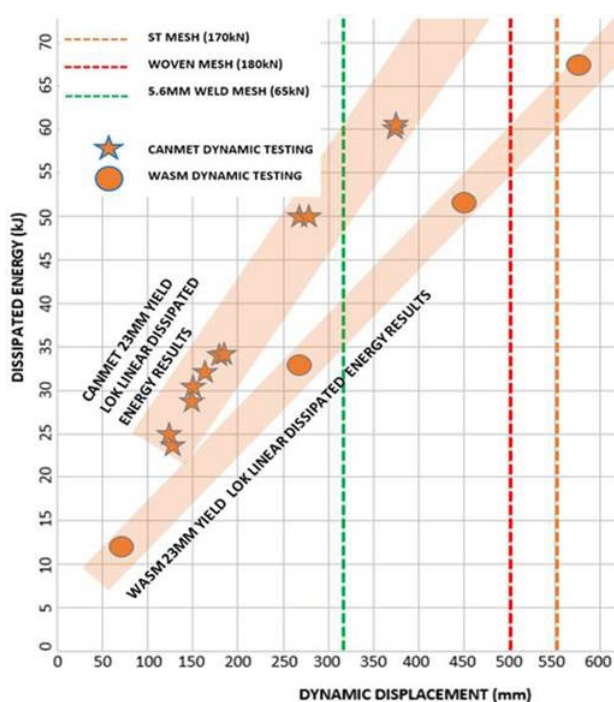
Yield-Lok Bolt 23mm



The patented 23mm Yield-Lok Bolt is a proven performer in dynamic and squeezing ground conditions. The engineered yielding mechanism provides ever consistent and repeatable test results. With significant volumes of testing completed, results in the Yield-Lok chart below showing a very linear demand response.

Features:

- Yielding not effected by resin/grout properties, hole diameter or encapsulation length
- Bolt Upset provides consistent and repeatable results, ploughing through an engineered polymer
- High shear stiffness and strength
- Bolt performance can be changed to suit varying geotechnical domains by increasing PE coating stiffness which reduces displacement for given input energy



Note: Dynamic test results obtained by published reports and dynamic testing completed for Jennmar Australia.



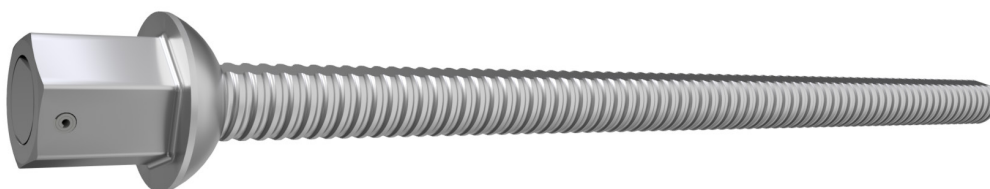
Yield-Lok displacement in full resin column grouted encapsulation

Technical Data – 23mm Yield-Lok

Cross Sectional Area (mm ²)	405			
Mass Per Metre (kg/m)	3.15			
Drill Hole Size (mm)	36 - 40			
	Properties Minimum		Properties Typical	
	MPa	kN	MPa	kN
Yield Strength of Steel	517	200	633	246
Tensile Strength of Steel	688	267	844	328
Shear Strength (0.7 x UTS)		172	-	230
Standard Elongation min.	Min	7%	Typ	9%
Bar Diameter	Core	23	Major	31

Rolled Thread ¾" Left Hand Thread Automotive Standard

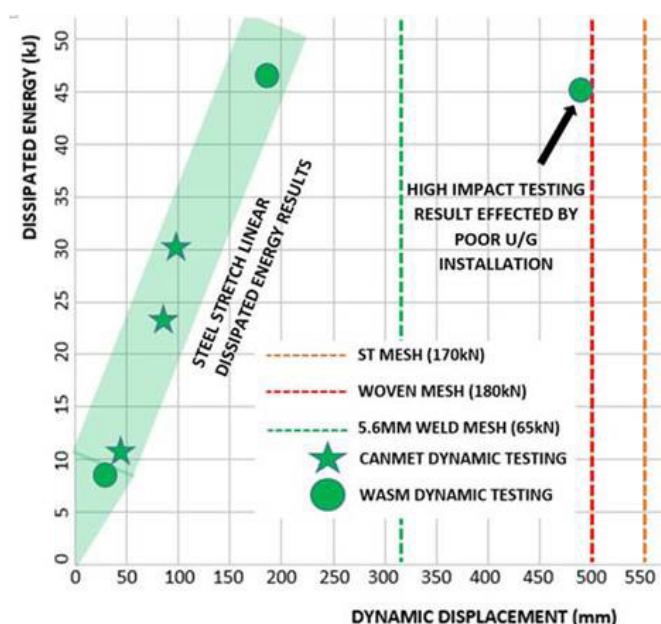
J-Tech 25mm All Thread Bar



The J-Tech bolt is JENNMAR'S standard bolt supply in hard rock mining. Its superior design performs exceptionally in static and dynamic conditions. The smaller thread pitch and flats along the length of the bar allow for resin column shear at high/dynamic loads and maintain a high static capacity in normal mining demand.

Features:

- Patented Resin Shredder* actively promotes shredding of the resin components
- Varying resin shredder sizes available for use with larger drill bits or where bore holes have excessive blowout
- Resin shredder* centralises the bolt within the bore hole and allows use in larger diameter holes e.g. 35mm
- Paddle resin mixing device actively promotes resin mixing and anchorage in smaller hole diameters
- Finer 6mm pitch thread achieves higher tension for a given torque
- Dynamic testing conducted without bolt failure to 47kJ absorbed energy



Note: Dynamic test results obtained by published reports and dynamic testing completed for Jennmar Australia.

Technical Data — J-Tech 25mm Threaded Bar

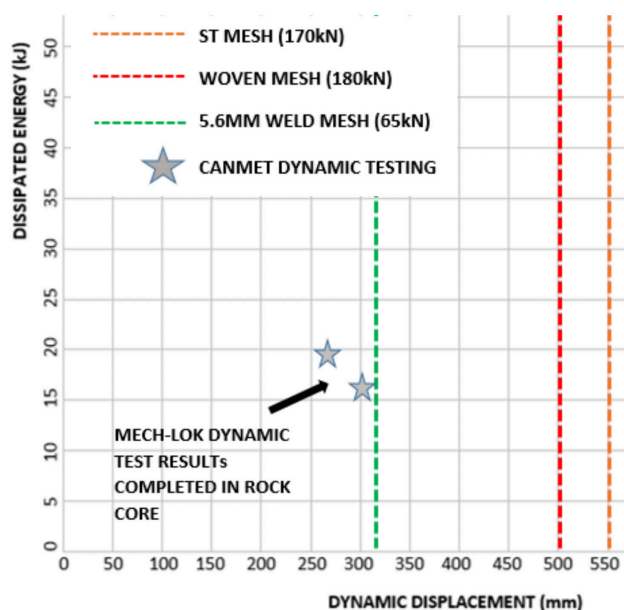
Description	25mm Bar Properties Minimum		25mm Bar Properties Typical	
	MPa	kN	MPa	kN
Yield Strength of steel	500	215	565	245
Tensile Strength of steel	600	260	685	294
Standard Elongation	Min	15%	Typ	20%
Shear Strength (0.7 x UTS)	--	182	-	201
Bar Diameter (mm)	Core - 23mm		Major - 25mm	
Bar Straightness to AS	1442 - 1991			
Cross sectional area (mm²)	433			
Mass per metre (kg/m)	3.4			
Drill Hole size Shredder (mm)	36-40			
Drill Hole size Paddle (mm)	32-38			

Various torque rated shear pin break-out nuts available for use on J-Tech 25mm bolts *Patent Pending Resin Shredder

Mech Lok Bolt



The patented Mech-Lok bolt with Energy Absorbing Ring is designed to be easily installed in poor ground conditions, but maximise load capacity.

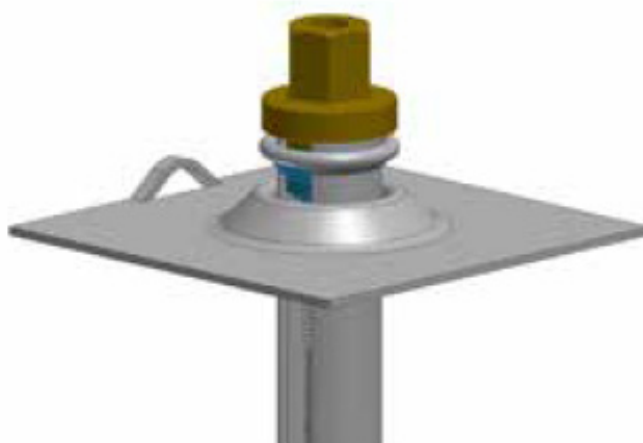


Note: Dynamic test results obtained by published reports and dynamic testing completed for Jennmar Australia.



Features:

- Dynamic tested at CANMET to 17kJ without failure
- Easy installation in very poor ground
- Increased system capacity compared to standard 47mm Friction Loks
- Improved load transfer due to combination of the Friction Lok and mechanical anchor bolt working together
- Improved corrosion performance compared to standard Friction Loks
- Improved shear performance of installed system
- Energy absorbing ring included with bolts to prevent the bar from ejecting in failure mode

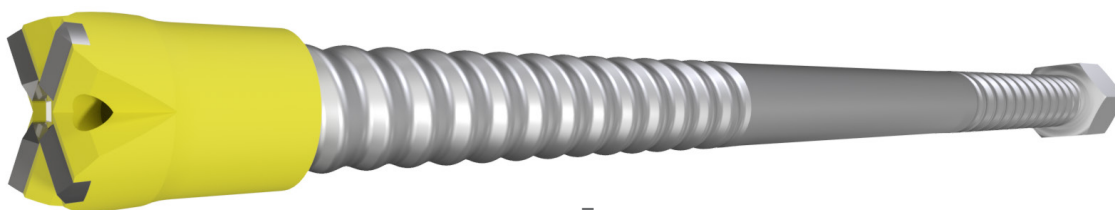


Technical Data – Mech Lok Bolt

Grade Description	M24 Bar Properties Minimum		M24 Bar Properties Typical	
	MPa	kN	MPa	kN
Yield Strength of steel	500	171	550	190
Tensile Strength of steel	660	250	700	265
Standard Elongation	Min	15%	Typ	27%
Shear Strength (0.7 x UTS)	185		223	

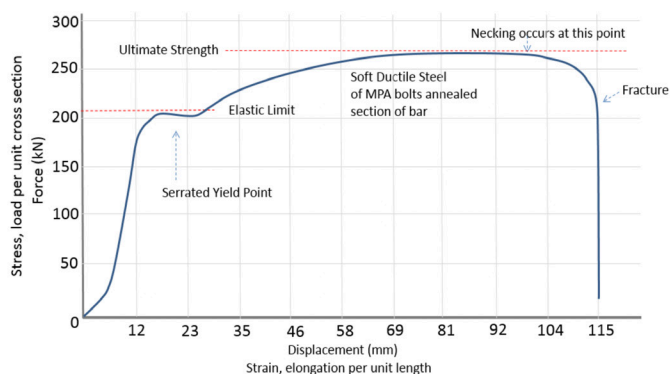
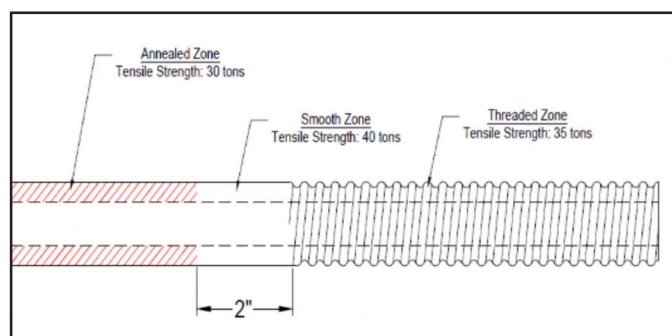
Grade Description	47mm Friction Lok Properties Minimum		47mm Friction Lok Properties Typical	
	MPa	kN	MPa	kN
Yield Strength of steel	345	120	445	160
Tensile Strength of steel	460	165	510	200
Standard Elongation	Min	15%	Typ	27%
Shear Strength (0.7 x UTS)	185		223	
Cross Sectional Area (mm²)	355			
Mass Per Metre (kg/m)	6.01			
Drill Hole Size (mm)	42.1 - 45			

MPA Bolt



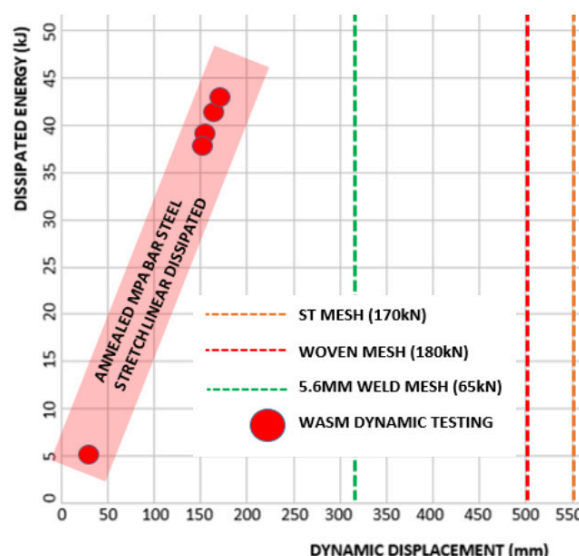
Features:

The patented MPA bolt improves the normally stiff R32 self-drilling bolt by providing a smooth section of bar. The smooth bar is then annealed to improve ductility for demanding dynamic conditions.



MPA Quazi-static testing using J-Lok P resin injection full anchorage

- Self-Drilling hollow bolt with annealed smooth section to increase elongation, suitable for seismic and squeezing ground conditions
- When used with 42mm JENNMAR drill bits, faster drilling is achieved
- When used with the J-Lok P system, drilling and resin injection anchoring is achievable
- Also available in Galvanised and PE coated



Note: Dynamic test results obtained by published reports and dynamic testing completed for Jennmar Australia.

Technical Data – Technical specifications of the variuos sections of the bar.

Standard Length	2.4m (94") and 3.0m (118")
Type	Dynamic Self Drilling Hollow Core
Inner Diameter	17mm (0.67")
Smooth Zone	
Diameter	30.2mm (1.190")
Yield Strength Nominal	25 tonne
Tensile Strength Nominal	30 tonne
Minimum Elongation	6"(20% typical)
Threaded Zone	
Diameter	31.34mm (1.234")
Tensile Strength Nominal	35 tonne
Minimum Elongation	<5%

Technical Data – Components available separately or supplied assembled.

R32 Nut Left Hand Thread	46mmAF with 180/210ft/lb. pin
Sacrificial Bit	Custom Hardened Steel of Carbide Buttons
Plate	Curr contract supplied 150x150x8mm
Coating	Galvanized or PE Coated

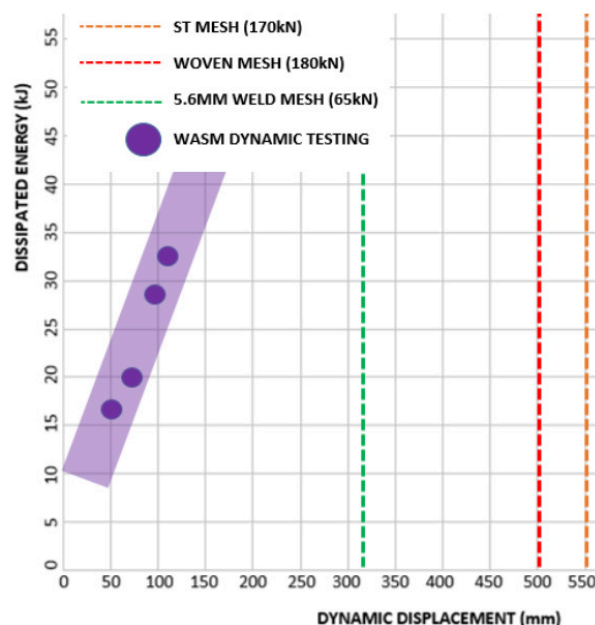
Secta® Dynamic Cable Reel & Bolt



The patented SECTA Cable is a high capacity, single strand dynamic cable bolt which can be mechanically installed from Cable Bolting machines. Used with a Yield Tube, the SECTA cable's dissipated energy improves, shown by higher energy absorption and displacement in the dynamic testing chart.

Features:

- Dynamic Tested at WASM to 40kJ input energy
- Dynamic tested to 50kJ at WASM using a single Yield Tube
- Available in plain or bulbed cable reels or single strand pre-cut supply
- Lowest cost to capacity cable bolt configurations for the hard rock mining industry
- Typically fitted with fish-hooks to hold the cables inside the drill holes or cable reels for mechanical bolt installation
- Cable truss configurations are available for high capacity pillar support



Note: Dynamic test results obtained by published reports and dynamic testing completed for Jennmar Australia.

Technical Data – Secta® Dynamic Cable Reel & Bolt

Grade Description	17.8 Cable Properties Minimum		17.8 Cable Properties Typical	
	MPa	kN	MPa	kN
Yield Strength of steel	-	280	-	330
Tensile Strength of steel	-	350	-	370
Standard Elongation	Min - 3.5%		Typ - 6%	
Cross sectional area (mm²)	208.4			
Mass per metre (kg/m)	1.652			
Drill Hole size (mm)	35-51			

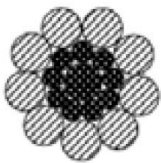
GRACOM® Dynamic Cable Reel & Bolt



The patented GRACOM® Cable allows a higher capacity, single strand dynamic cable option to be mechanically installed from Cable Bolting machines. Used with a Yield Tube, the GRACOM® cable's dissipated energy improves shown by higher energy absorption and displacement in the dynamic testing chart.

GRACOM : Graded Composite Hybrid Strand



Grade composite cable showing High Tensile and Mild Steel wires



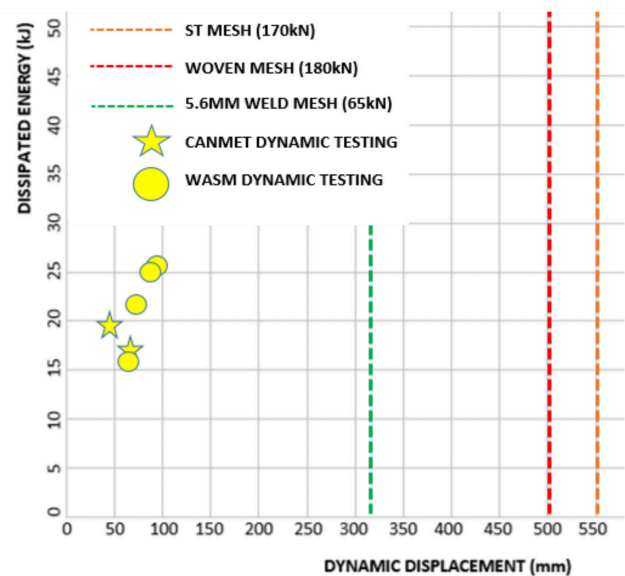
-  Ultra High Tensile Wire
-  Ultra Low Yield Wire

19-wires strand 17.8



Features:

- Dynamic tested at WASM to 40kJ input
- Dynamic tested to 50kJ at WASM using a single Yield Tube
- Available in plain cable reels or single strand pre-cut supply
- The grade composition concept allows the mild steel wires to provide longitudinal deformation and maintaining capacity and energy dissipation capacity



Note: Dynamic test results obtained by published reports and dynamic testing completed for Jennmar Australia.

Technical Data – GRACOM® Dynamic Cable

Grade Description	GRACOM® Cable Properties Minimum		GRACOM® Cable Properties Typical	
	MPa	kN	MPa	kN
Yield Strength of steel	-	280	-	330
Tensile Strength of steel	-	350	-	370
Standard Elongation	Min - 3.5%		Typ - 6%	
Cross sectional area (mm ²)	208.4			
Mass per metre (kg/m)	1.652			
Drill Hole size (mm)	35-51			

Yield Tube

The patented Yield Tube provides proven dynamic and quazi-static capacity when used with cable and rockbolts. High and consistent collapse loads and easy installation, make the Yield Tube a great "simple go to" solution.

Features:

- Yield Tube available for 15.2mm, 17.8mm and 21.8mm cables and JENNMAR cable bolts
- Dynamic tested with cables, confirmed to increase dynamic capacity by 10kJ
- Supplied separately and easily installed, without changing current installation processes
- Allows improved application in squeezing ground
- Anti-corrosion coating available on request



Testing:



17.8mm Single Yield Tube before dynamic testing



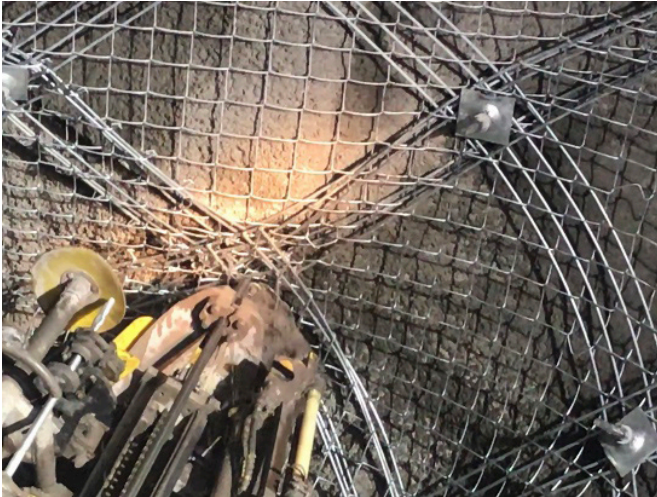
17.8mm Single Yield Tube after dynamic testing. Yield tube increased energy dissipation by 10kJ

ST Mesh

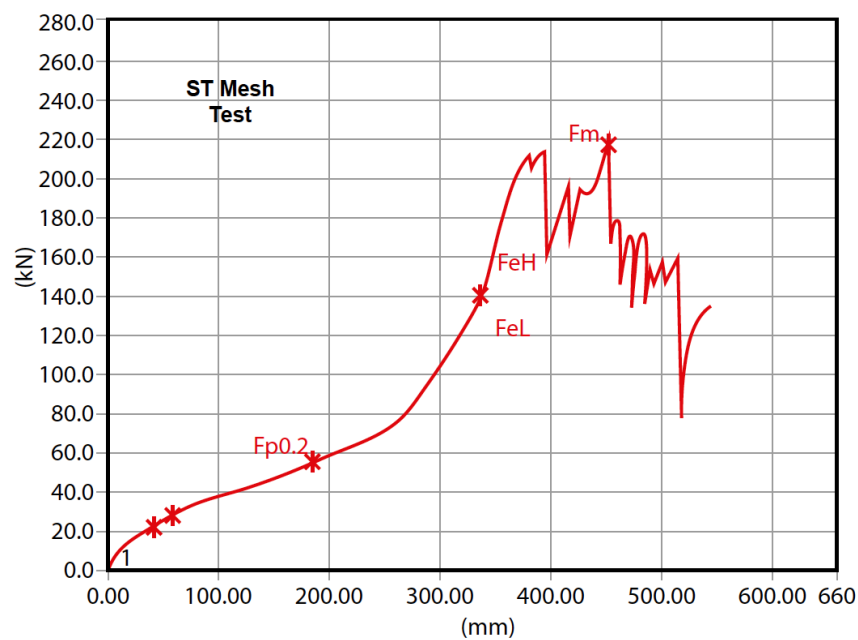
ST Mesh is a lighter designed mesh module, improving manual handling and installed easily with existing mining equipment. The module conforms well to rock undulation and provides superior support in extreme mining conditions.

Features:

- Cost efficient and high capacity mesh module
- Displacement minimised to below 400mm when nearing ultimate loads using 2m x 2m bolt spacing
- Load capacity Typically 210kN
- Load capacity Minimum 190kN
- 2200mm x 2200mm module weight = 40kg, making manual handling underground easier



ST Mesh Test Results:



ST Mesh test result achieving 217kN. The displacement at maximum load is 455mm, although loads at 380mm are near to the maximum load capacity

Woven Mesh

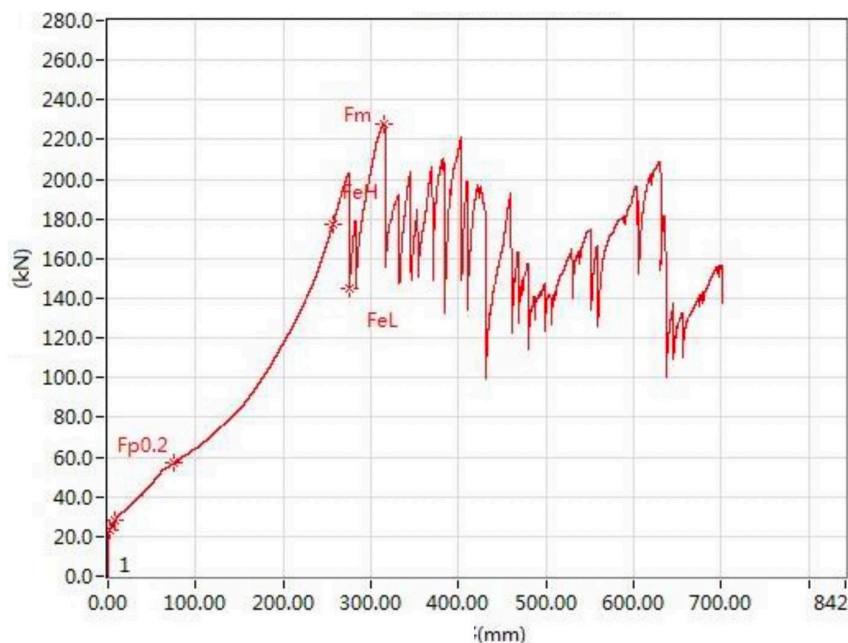
Woven Mesh is designed to be manual handled and installed easily with existing mining equipment. The module conforms well to rock undulation and product produces superior support in extreme mining conditions.

Features:

- Cost efficient and extremely high capacity mesh
- Displacement minimised to below 350mm when nearing ultimate loads using 2m x 2m bolt spacing
- Load capacity Typically 230kN
- Load capacity Minimum 200kN
- In-house mesh testing machine utilised for quality control processes
- 2200mm x 2200mm module weight = 65.1kg



Woven Mesh Test Results:



Woven Mesh test result achieving 227kN. The displacement at maximum load is reducing to 320mm, whilst maintaining residual high loading capacity throughout the 700mm test range



Head Office and Plant

40-44 Anzac Avenue
Smeaton Grange NSW 2567
Ph: +61 2 4648 7500
Fax: +61 2 4648 7555

Queensland Plant

48-50 Southgate Drive
Paget QLD 4740
Ph: +61 7 4952 8700
Fax: +61 7 4952 8777

Perth Plant

84 Furniss Rd
LANDSDALE WA 6065
Ph: +61 8 9408 9900
Fax: +61 8 9408 9999

WWW.JENNMAR.COM.AU

