

ROCK AND ROOF BOLTS

PRODUCT GROUP	PRODUCT	PRODUCT CODE PREFIX	DATA SHEET
CHEMICAL OR RESIN ANCHOR BOLTS (CEMENTITIOUS)	24mm LHA Bar	AS, AH, AX4	A1.1
	24mm LHA Bar, Extra High Strength, High Ribbed	AXR4	A1.2
	28mm LHA Bar, Extra High Strength, High Ribbed	AXL8	A1.3
	24mm LHA Bar, Headed Standard Strength	ES, EH, EX4	A1.4
	24mm AVH Bar, High Strength	AVH4	A1.5
	20/24mm Solid Deformed Bar, Standard Strength	CS4	A1.6
	24mm LHA Bar Slimline Coupled Bolt	CXR	A1.7
	20mm Threadbar, Standard Strength	TB2	A1.8
	16/20mm Wriggle Bolt, Standard Strength	WS6/2	A1.9
	Posimix Bolt	-	A1.10
	HI-TEN Strand Bolt	AFC4	A1.11
	Post Groutable HI-TEN Strand Bolt	PFC4	A1.12
	26mm Flexibolt	AFB4	A1.13
	MP Bolt	-	A1.14
Tiger Bolt	TTB	A1.15	
EXPANSION SHELL BOLTS	16/20mm Round Bar, Headed, Standard Strength	ES6/2	A2.1
	16/20mm Round Bar, Double Ended, Standard Strength	DS6/2	A2.2
	22.7mm Solid Universal Bolt, Standard Strength	US4	A2.3
SLOT & WEDGE BOLT	24mm Solid Deformed Bar, Standard Strength	SS4	A3.1
FRICTION BOLT	Friction Bolt	FB33/39/47	A4.1
CABLE BOLTS	Plain Cable Bolt, Single & Double Strand	CB	A5.1
	Minicage Cable Bolt, Single & Double Strand	CB	A5.2
CUTTABLE BOLT	20mm Fibreglass Dowel	AROA	A6.1

PHYSICAL PROPERTIES

Mass Per Metre	2.92kg
Bar Core Diameter	21.7mm
Cross Sectional Area of Bar	370mm ²
Major Bar Diameter	23.2mm
Bar straightness to AS 1442-1991	
Rolled Thread M24x3.0mm Pitch	

Standard Strength Bolt	Minimum		Typical	
Yield Strength	250MPa	95kN	300MPa	110kN
Ultimate Tensile Strength	410MPa	150kN	475MPa	175kN
Calculated Shear Strength	100kN		115kN	
Standard Elongation	22%		35%	
Uniform Elongation	12%			
High Strength Bolt	Minimum		Typical	
Yield Strength	375MPa	140kN	400MPa	150kN
Ultimate Tensile Strength	570MPa	210kN	680MPa	250kN
Calculated Shear Strength	140kN		170kN	
Standard Elongation	17%		22%	
Uniform Elongation	10%			
Extra High Strength Bolt	Minimum		Typical	
Yield Strength	600MPa	220kN	650MPa	240kN
Ultimate Tensile Strength	850MPa	310kN	920MPa	340kN
Calculated Shear Strength	205kN		225kN	
Standard Elongation	13%		15%	
Uniform Elongation	8%			

GENERAL FEATURES

- Manufactured from a special hot rolled deformed bar designed by DSI ARNALL and commonly known as “Left Hand Anchor Bar”, this bolt features a rib pattern which actively assists with mixing the chemical anchors during installation.
- The deformed bar rib pattern improves load transfer properties.
- The rolled thread strength nominally equals the column strength of the bar.
- The 24mm chemical anchor bolt is designed to be used with chemical anchors (refer to Section F), but can be effectively used with cementitious grouts.
- Corrosion protection may be provided by hot dip galvanizing (refer to Section G). Alternative coatings are available by negotiation.
- Australian Patent Number 536627 is applicable to the bar design of this bolt.



- 27-28mm hole diameters are preferred. If larger diameter holes are to be used refer to “Posimix” bolts on page A1.10.
- Hole depth is critical. Hole depth should be shorter than the bolt to allow for the height of the washer and nut.
- After insertion of the chemical anchors the bolt is rotated through the anchors while being pushed to the back of the hole.
- It is important to follow the chemical manufacturer’s recommended mixing and hold times as printed on the chemical anchor cartons. DO NOT OVER MIX.
- For further details of installation technique refer to DSI Arnall’s “Practical Guide to Rock Bolting”.

STANDARD LENGTHS & PACKAGING

- Standard bolt lengths range from 600 to 3000mm in 300mm increments.
- Non-standard requirements are available by negotiation.
- Bolts are packaged in bundles with threads protected by heavy duty polyethylene bags.
- Bolt fittings, such as nuts, anti-friction washers and domed balls, are supplied fitted to rock bolts in the configuration requested.

NOTES

- Only DSI Arnall rock bolt components should be used to enable the full performance of the bolt system to be obtained.
- DSI Arnall Mining Products Division is Quality Assured to AS 9002, License No. 406.

24mm CHEMICAL HIGH RIBBED ANCHOR BOLT**PHYSICAL PROPERTIES**

	Minimum		Typical	
	Yield Strength	600MPa	220kN	650MPa
Ultimate Tensile Strength	850MPa	310kN	920MPa	340kN
Calculated Shear Strength	205kN		225kN	
Standard Elongation	13%		15%	
Uniform Elongation			8%	
Mass Per Metre			2.97kg	
Bar Core Diameter			21.7mm	
Major Bar Diameter			24.7mm	
Bar straightness to AS 1442-1991				
Cross Sectional Area			551mm ²	
Rolled Thread M24x3.0mm Pitch				

GENERAL FEATURES

- Manufactured from a special hot rolled deformed bar designed by DSI Arnall and commonly known as “Left Hand Anchor Bar”, this bolt features a rib pattern which actively assists with mixing the chemical anchors during installation.
- The bolt rib pattern design has modified physical characteristics to maximise load transfer from the rock to the bolt, with higher transverse ribs together with lower profile longitudinal ribs.
- The rolled thread strength nominally equals the column strength of the bar.
- The 24mm chemical anchor bolt is designed to be used with chemical anchors (refer to Section F), but can be effectively used with cementitious grouts.
- Corrosion protection may be provided by hot dip galvanizing (refer to Section G) due to the steel’s homogenous microstructure it is not effected by hot dipped galvanizing temperatures. Alternative coatings are available by negotiation.

- 28mm hole diameters are preferred. If larger diameter holes are to be used refer to “Posimix” bolts on data sheet A1.10.
- Hole depth is critical. Hole depth should be shorter than the bolt to allow for the height of the washer and nut.
- After insertion of the chemical anchors the bolt is rotated through the anchors while being pushed to the back of the hole.
- It is important to follow the chemical manufacturer’s recommended mixing and hold times as printed on the chemical anchor cartons. **DO NOT OVER MIX.**
- For further details of installation procedures refer to DSI Arnall’s “Practical Guide to Rock Bolting.”

STANDARD LENGTHS & PACKAGING

- Standard bolt lengths range from 600 to 3000mm in 300mm increments.
- Non-standard requirements are available by negotiation.
- Bolts are packaged in bundles with threads protected by heavy duty polyethylene bags.
- Extra high strength bolts are identified by a RED band around the centre of major bundles.
- Bolt fittings, such as nuts, anti-friction washers and domed balls, are supplied fitted to rock bolts in the configuration requested.

NOTES

- Only DSI Arnall rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- DSI Arnall Head Mining Products Division is Quality Assured to AS 9002, License No. 406.

**PHYSICAL PROPERTIES**

	Minimum		Typical	
	Yield Strength	600MPa	310kN	650MPa
Ultimate Tensile Strength	850MPa	440kN	920MPa	500kN
Calculated Shear Strength	290kN		320kN	
Standard Elongation	13%		16%	
Uniform Elongation			8%	
Mass Per Metre			4.3kg	
Bar Core Diameter			25.8mm	
Major Bar Diameter			28.8mm	
Bar straightness to AS 1442-1991				
Cross Sectional Area			551mm ²	
Rolled Thread M24x3.0mm Pitch				

GENERAL FEATURES

- Manufactured from a special hot rolled deformed bar designed by DSI Arnall and commonly known as “Left Hand Anchor Bar”, this bolt features a rib pattern which actively assists with mixing the chemical anchors during installation.
- The bolt rib pattern design has modified physical characteristics to maximise load transfer from the rock to the bolt, with higher transverse ribs together with lower profile longitudinal ribs.
- The rolled thread strength nominally equals the column strength of the bar.
- The 28mm chemical anchor bolt is designed to be used with chemical anchors (refer to Section F), but can be effectively used with cementitious grouts.
- Corrosion protection may be provided by hot dip galvanizing (refer to Section G) due to the steel’s homogenous microstructure. It is not effected by hot dipped galvanizing temperatures. Alternative coatings are available by negotiation.

INSTALLATION GUIDE LINES

- 32-33mm hole diameters are preferred. If larger diameter holes are to be used refer to “Posimix” bolts on page A1.10.
- Hole depth is critical. Hole depth should be shorter than the bolt to allow for the height of the washer and nut.
- After insertion of the chemical anchors the bolt is rotated through the anchors while being pushed to the back of the hole.
- It is important to follow the chemical manufacturer’s recommended mixing and hold times as printed on the chemical anchor cartons. **DO NOT OVER MIX.**
- For further details of installation procedures refer to DSI Arnall’s “Practical Guide to Rock Bolting.”

STANDARD LENGTHS & PACKAGING

- Standard bolt lengths range from 600 to 3000mm in 300mm increments.
- Non-standard requirements are available by negotiation.
- Bolts are packaged in bundles with threads protected by heavy duty polyethylene bags.
- Extra high strength bolts are identified by a RED band around the centre of major bundles.
- Bolt fittings, such as nuts, anti-friction washers and domed balls, are supplied fitted to rock bolts in the configuration requested.

NOTES

- Minimal order quantities may apply to this product.
- Only DSI Arnall rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- DSI Arnall Mining Products Division is Quality Assured to AS 9002, License No. 406.

24mm CHEMICAL ANCHOR BOLT WITH FORGED INTEGRAL HEAD

A1.4

PHYSICAL PROPERTIES

Mass Per Metre	2.92kg
Bar Core Diameter	21.7mm
Cross Sectional Area of Bar	370mm ²
Major Bar Diameter	23.2mm
Bar straightness to AS 1442-1991	
Rolled Thread M24x3.0mm Pitch	

Standard Strength Bolt	Minimum		Typical	
Yield Strength	250MPa	95kN	300MPa	110kN
Ultimate Tensile Strength	410MPa	150kN	475MPa	175kN
Calculated Shear Strength	100kN		115kN	
Standard Elongation	22%		35%	
Uniform Elongation	12%			
High Strength Bolt	Minimum		Typical	
Yield Strength	375MPa	140kN	400MPa	150kN
Ultimate Tensile Strength	570MPa	210kN	680MPa	250kN
Calculated Shear Strength	140kN		170kN	
Standard Elongation	17%		22%	
Uniform Elongation	10%			
Extra High Strength Bolt	Minimum		Typical	
Yield Strength	600MPa	220kN	650MPa	240kN
Ultimate Tensile Strength	850MPa	310kN	920MPa	340kN
Calculated Shear Strength	205kN		225kN	
Standard Elongation	13%		15%	
Uniform Elongation	8%			

GENERAL FEATURES

- Manufactured from a special hot rolled deformed bar designed by DSI Arnall and commonly known as “Left Hand Anchor Bar”, this bolt features a rib pattern which actively assists with mixing the chemical anchors during installation.
- The deformed bar rib pattern improves load transfer properties.
- The 24mm chemical anchor bolts have a hot forged integral head, 30mm square, and are used in areas where headroom is low or when bolt tails are undesirable. For this reason, flat plates are generally used with headed bolts and are un-tensionable.
- The 24mm chemical anchor bolt is designed to be used with chemical anchors (refer to Section F), but can be effectively used with cementitious grouts.
- In some circumstances these bolts may be used with an expansion shell by the addition of a M24x3.0mm thread on the up hole end of the bolt.
- Corrosion protection may be provided by hot dip galvanizing (refer to Section G). Alternative coatings are available by negotiation.
- Australian Patent Number 536627 is applicable to the bar design of this bolt.



- 27-28mm hole diameters are preferred. If larger diameter holes are to be used refer to “Posimix” bolts on page A1.10.
- Hole depth is critical. Hole depth should be slightly longer than the bolt length to ensure that the bolt plate and bolt head are tight to the roof after installation.
- After insertion of the chemical anchors the bolt is rotated through the anchors while being pushed to the back of the hole.
- It is important to follow the chemical manufacturer’s recommended mixing and hold times as printed on the chemical anchor cartons. DO NOT OVER MIX.
- For further details of installation procedures refer to DSI Arnall’s “Practical Guide to Rock Bolting.”

STANDARD LENGTHS & PACKAGING

- Standard bolt lengths range from 600 to 3000mm in 300mm increments.
- Non-standard requirements are available by negotiation.
- Bolts are packaged in bundles.

NOTES

- Only DSI Arnall rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- DSI Arnall Mining Products Division is Quality Assured to AS 9002, License No. 406.

24mm VIDEX CHEMICAL ANCHOR BOLT

DATA SHEET
A1.5



PHYSICAL PROPERTIES

	Minimum		Typical	
	Yield Strength	745MPa	250kN	775MPa
Ultimate Tensile Strength	890MPa	300kN	935MPa	315kN
Calculated Shear Strength	200kN		210kN	
Standard Elongation	12%		14%	
Uniform Elongation			3%	
Mass Per Metre			2.64kg	
Nominal Bar Core Diameter			20.7mm	
Major Bar Diameter			22.5mm	
Bar Straightness to AS 1442-1991				
Cross Sectional Area			370mm ²	
Rolled Thread M24x3.0mm Pitch				

GENERAL FEATURES

- Manufactured from round bar the Videx bolt is cold worked to provide an improved form of left hand deformations and increased yield strength.
- The Videx bolt rib pattern actively assists with mixing the chemical anchors during installation.
- The rolled thread strength nominally equals the column strength of the bar.
- The Videx bolt provides stiffer mechanical characteristics than the equivalent High Strength Bolt.
- The 24mm Videx bolt is designed to be used with chemical anchors (refer to Section F), but can be effectively used with cementitious grouts.
- Corrosion protection may be provided by hot dip galvanizing (refer to Section G). Alternative coatings are available by negotiation.

- 26-27mm hole diameters are preferred. If larger diameter holes are to be used refer to “Posimix” bolts on page A1.10.
- Hole depth is critical. Hole depth should be shorter than the bolt to allow for the height of the washer and nut.
- After insertion of the chemical anchors the bolt is rotated through the anchors while being pushed to the back of the hole.
- It is important to follow the chemical manufacturer’s recommended mixing and hold times as printed on the chemical anchor cartons. **DO NOT OVER MIX.**
- For further details of installation procedures refer to DSI Arnall’s “Practical Guide to Rock Bolting.”

STANDARD LENGTHS & PACKAGING

- Standard bolt lengths range from 600 to 3000mm in 300mm increments.
- Bolts are packaged in bundles with threads protected by heavy duty polyethylene bags.
- Bolt fittings, such as nuts, anti-friction washers and domed balls, are supplied fitted to rock bolts in the configuration requested.

NOTES

- Only DSI Arnall rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- DSI Arnall Mining Products Division is Quality Assured to AS 9002, License No. 406.

20 & 24mm SOLID DEFORMED BOLT



PHYSICAL PROPERTIES

20mm Bolt	Minimum		Typical	
Yield Strength	250MPa	75kN	335MPa	100kN
Ultimate Tensile Strength	390MPa	115kN	470MPa	140kN
Calculated Shear Strength	75kN		95kN	
Standard Elongation	22%		35%	
Tensile Strength of Threaded End			120kN	
Uniform Elongation			19%	
Mass Per Metre			2.46kg	
Bar Core Diameter			19.5mm	
Cross Sectional Area of Bar			300mm ²	
Major Bar Diameter			23.0mm	
Bar Straightness to AS 1442-1991				
Rolled Thread M20x2.5mm Pitch				
24mm Bolt	Minimum		Typical	
Yield Strength	400MPa	165kN	460MPa	190kN
Ultimate Tensile Strength	440MPa	180kN	550MPa	230kN
Calculated Shear Strength	120kN		150kN	
Standard Elongation	16%		25%	
Uniform Elongation			15%	
Tensile Strength of Threaded End			190kN	
Mass Per Metre			3.55kg	
Bar Core Diameter			23.0mm	
Cross Sectional Area of Bar			415mm ²	
Major Bar Diameter			27.0mm	
Bar straightness to AS 1442-1991				
Rolled Thread M24x3.0mm Pitch				

GENERAL FEATURES

- The Solid Deformed Bolt is manufactured from hot rolled reinforcing bar having rib deformations generally in a “herringbone” form.
- The 24mm Solid Deformed Bolt can be used in applications where the small diameter hole recommended for other 24mm chemical bolts cannot be drilled.
- The Solid Deformed Bolt has a standard thread roll formed at one end.
- The solid deformed bolt is usually fully encapsulated with chemical anchors (refer to Section F), but can be effectively used with cementitious grouts.
- The solid deformed bolt is commonly used in civil tunnelling applications.
- Corrosion protection may be provided by hot dip galvanizing. (refer to Section G). Alternative coatings are available by negotiation.

- 30-32mm hole diameters are preferred. If larger diameter holes are to be used refer to “Posimix” bolts on page A1.10.
- Hole depth is critical. Hole depth should be shorter than the bolt to allow for the height of the washer and nut.
- After insertion of the chemical anchors the bolt is rotated through the anchors while being pushed to the back of the hole.
- It is important to follow the chemical manufacturer’s recommended mixing and hold times as printed on the chemical anchor cartons. **DO NOT OVER MIX.**
- For further details of installation procedures refer to DSI Arnall’s “Practical Guide to Rock Bolting.”

STANDARD LENGTHS & PACKAGING

- Standard bolt lengths range from 600 to 3000mm in 300mm increments.
- Non-standard requirements are available by negotiation.
- Bolts are packaged in bundles with threads protected by heavy duty polyethylene bags.
- Bolt fittings, such as nuts, anti-friction washers and domed balls, are supplied fitted to rock bolts in the configuration requested.

NOTES

- Only DSI Arnall rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- DSI Arnall Mining Products Division is Quality Assured to AS 9002, License No. 406.

**24mm CHEMICAL HIGH RIBBED
SLIMLINE COUPLED BOLT****PHYSICAL PROPERTIES**

	Minimum		Typical	
	Yield Strength	600MPa	220kN	650MPa
Ultimate Tensile Strength	850MPa	310kN	920MPa	340kN
Calculated Shear Strength	205kN		225kN	
Standard Elongation	13%		15%	
Uniform Elongation			8%	
Mass Per Metre			2.97kg	
Bar Core Diameter			21.7mm	
Major Bar Diameter			24.7mm	
Bar straightness to AS 1442-1991				
Cross Sectional Area			551mm ²	
Rolled Thread M24x3.0mm Pitch (Nut End)				

GENERAL FEATURES

- Manufactured from a special hot rolled deformed bar designed by DSI Arnall and commonly known as “Left Hand Anchor Bar”, this bolt features a rib pattern which actively assists with mixing the chemical anchors during installation.
- The bolt rib pattern design has modified physical characteristics to maximise load transfer from the rock to the bolt, with higher transverse ribs together with lower profile longitudinal ribs.
- The rolled thread and coupled section strength nominally equals the column strength of the bar.
- Negligible difference in diameter of coupler and bolt which allows the coupled bolt to be installed in a 28mm diameter hole.
- Full encapsulation can be achieved with resin.
- More than two segments can be joined together, allowing for greater overall bolt length.
- The 24mm chemical anchor bolt is designed to be used with chemical anchors (refer to Section F), but can be effectively used with cementitious grouts.
- Corrosion protection may be provided by hot dip galvanizing (refer to Section G) due to the steel’s homogenous microstructure it is not effected by hot dipped galvanizing temperatures. Alternative coatings are available by negotiation.

- Bolt designed to be installed in 28mm diameter hole.
- Hole depth is critical. Hole depth should be shorter than the bolt to allow for the height of the washer and nut.
- After insertion of the chemical anchors the bolt section with coupler is inserted, then the bolt with the tapered thread is connected into the coupler. Once bolt sections are connected the bolt is rotated through the anchors while being pushed to the back of the hole. If more than two bolt sections are to be connected a special adaptor is available to allow insertion of first two segments through the resin.
- It is important to follow the chemical manufacturer's recommended mixing and hold times as printed on the chemical anchor cartons. **DO NOT OVER MIX.**
- For further details of installation procedures refer to DSI Arnall's "Practical Guide to Rock Bolting."

STANDARD LENGTHS & PACKAGING

- Standard coupled bolt lengths range from 3000mm to 6000mm.
- Non-standard requirements are available by negotiation.
- Bolts are packaged in bundles with threads protected by heavy duty polyethylene bags.
- Bolt fittings, such as couplers, nuts, anti-friction washers and domed balls, are supplied fitted to rock bolts in the configuration requested.

NOTES

- Only DSI Arnall rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- DSI Arnall Mining Products Division is Quality Assured to AS 9002, License No. 406.



PHYSICAL PROPERTIES

	Minimum		Typical	
Yield Strength	500MPa	160kN	550MPa	170kN
Ultimate Tensile Strength	600MPa	185kN	650MPa	200kN
Calculated Shear Strength	120kN		130kN	
Standard Elongation	16%		19%	
Uniform Elongation			12%	
Mass Per Metre			2.47kg	
Bar Diameter			20.0mm	
Cross Sectional Area of Bar			310mm ²	
Major Bar Diameter			22.1mm max.	
Bar Straightness to AS 1442-1991				

GENERAL FEATURES

- This bolt is hot rolled with deformations that form a coarse left hand thread (10mm pitch) over its entire length.
- The thread bar form provides good load transfer properties.
- The continuous thread provides a high flexibility in “fragile” ground and blasting conditions as the bolt can be readily re-tensioned.
- The thread bar bolt is normally used with chemical anchors (refer to Section F), but can be effectively used with cementitious grouts.
- Corrosion protection may be provided by hot dip galvanizing (refer to Section G). Alternative coatings are available by negotiation.

- 26-27mm hole diameters are preferred. If larger diameter holes are to be used refer to “Posimix” bolts on page A1.10.
- Hole depth is critical. Hole depth should be shorter than the bolt to allow for the height of the washer and nut.
- After insertion of the chemical anchors the bolt is rotated through the anchors while being pushed to the back of the hole.
- It is important to follow the chemical manufacturer’s recommended mixing and hold times as printed on the chemical anchor cartons. **DO NOT OVER MIX.**
- For further details regarding installation procedures refer to DSI Arnall’s “Practical Guide to Rock Bolting”.

STANDARD LENGTHS & PACKAGING

- Standard bolt lengths range from 600 to 3000mm in 300mm increments.
- Non-standard requirements are available by negotiation.
- Bolts are packaged in bundles.
- Bolt fittings, such as nuts, anti-friction washers and dome balls, are normally supplied separate with thread bar bolts.

NOTES

- Only DSI Arnall rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- DSI Arnall Mining Products Division is Quality Assured to AS 9002, License No. 406.



PHYSICAL PROPERTIES

16mm Bolt	Minimum		Typical	
Yield Strength	400MPa	65kN	460MPa	75kN
Ultimate Tensile Strength	590MPa	95kN	645MPa	105kN
Calculated Shear Strength	60kN		70kN	
Standard Elongation	17%		22%	
Uniform Elongation			12%	
Mass Per Metre			1.21kg	
Bar Diameter			14.4mm	
Cross Sectional Area of Bar			160mm ²	
Bar Straightness to AS 1332-1991				
Rolled Thread M16x2.0 Pitch				
20mm Bolt	Minimum		Typical	
Yield Strength	375MPa	95kN	440MPa	110kN
Ultimate Tensile Strength	540MPa	135kN	680MPa	170kN
Calculated Shear Strength	90kN		110kN	
Standard Elongation	19%		22%	
Uniform Elongation			12%	
Mass Per Metre			1.99kg	
Bar Diameter			18.0mm	
Cross Sectional Area of Bar			250mm ²	
Bar Straightness to AS 1332-1992				
Rolled Thread M20x2.5 Pitch				

GENERAL FEATURES

- These bolts are manufactured from round bar with “wriggles” on the up hole end which allows a small diameter bolt to mix chemical anchors in standard diameter holes.
- The wriggle bolt is an economic alternate when the tensile strength of larger bolts is not required.
- The rolled thread strength nominally equals the column strength of the bar.
- The wriggle bolt is designed to be used with chemical anchors (refer to Section F), but can be effectively used with cementitious grouts.
- The wriggle bolt has been found to be effective in coal rib stabilization and mesh retention on rock embankments.
- The nut fitted to wriggle bolts has similar across flats dimensions as nuts fitted to 24mm bolts to utilize standard roof bolt spanners.
- Corrosion protection may be provided by hot dip galvanizing (refer to Section G). Alternative coatings are available by negotiation.

- 26-28mm hole diameters are preferred for 16mm wriggle bolt and 27-29mm for 20mm wriggle bolt.
- Hole depth is critical. Hole depth should be shorter than the bolt to allow for the height of the washer and nut.
- After insertion of the chemical anchors the bolt is rotated through the anchors while being pushed to the back of the hole. Care should be exercised to ensure the bolt is held axially during installation.
- It is important to follow the chemical manufacturer's recommended mixing and hold times as printed on the chemical anchor cartons. DO NOT OVER MIX.
- For further details regarding installation procedures refer to DSI Arnall's "Practical Guide to Rock Bolting."

STANDARD LENGTHS & PACKAGING

- Standard bolt lengths range from 600 to 3000mm in 300mm increments.
- Non-standard requirements are available by negotiation.
- Bolts are packaged in bundles with threads protected by heavy duty polyethylene bags.
- Bolt fittings, such as nut and anti-friction washer, are normally supplied fitted to wriggle bolts in the configuration as requested.

NOTES

- Only DSI Arnall rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- DSI Arnall Mining Products Division is Quality Assured to AS 9002, License No. 406.



GENERAL FEATURES

- Manufacture of the “posimix” bolt is the addition of a specially designed spring wire attached to the up hole end of many of DSI Arnall rock bolts.
- The “posimix” bolting system was designed to assist in the installation of rock bolts with chemical anchors in larger diameter holes (31-38mm) by providing:-
 - substantially enhanced mixing of the chemical anchors,
 - load transfer capabilities are maximised,
 - the ability to be installed with a face jumbo as well as hand held machines.
- The “posimix” device centralises the bolt in the hole allowing an even distribution of the chemical anchor around the bolt. It also acts as an Archimedes screw pump forcing the chemical towards the back of the hole, assisting in mixing whilst consolidating the anchor for improved load transfer properties.
- In addition to improved mixing properties the “posimix” device also tends to pump the plastic skin of the chemical anchor to the back of the hole which eliminates the ‘gloving’ effect.
- All DSI Arnall conventional chemical bolts can be manufactured as “posimix” bolts and supplied to suit either left or right hand bolt rotation.
- Recommended hole size is 31 to 38mm diameter.
- Corrosion protection may be provided by hot dip galvanizing (refer to Section G). Alternate coatings are available by negotiation.
- Australian Patent Application Number 48547/97 is applicable to the design of DSI Arnall “posimix” bolts and components.

- The rock bolt hole is drilled as per mine support designs.
- Hole depth is critical. Hole depth should be shorter than the bolt to allow for the height of the washer and nut.
- After insertion of the chemical anchors the bolt is rotated through the anchors while being pushed to the back of the hole. In the case of full encapsulation, anchors of different setting times are often used and the higher speed anchor is to be inserted first followed by the slower speed anchors.
- It is important to follow the chemical manufacturer's recommended mixing and hold times as printed on the chemical anchor cartons. DO NOT OVER MIX.

STANDARD LENGTHS & PACKAGING

- Standard bolt lengths range from 1500 to 3000mm in 300mm increments.
- Non-standard lengths are available by negotiation.
- Bolts are packaged in bundles with threads protected by heavy duty polyethylene bags.
- Bolt fittings, such as nuts, anti-friction washers and dome balls, are supplied fitted to rock bolts in the configuration requested.

NOTES

- Only DSI Arnall rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- Assistance should be sort from DSI Arnall Technical Services Engineer's in selection of the correct "posimix" bolt for the application together with its product code.
- DSI Arnall Mining Products Division is Quality Assured to AS 9002, License No. 406.

HI-TEN STRAND BOLT

HIGH PRE-TENSION

A1.11



PHYSICAL PROPERTIES

	Minimum	Typical
Yield Strength	480kN	500kN
Ultimate Tensile Strength	550kN	580kN
Uniform Elongation	3-4%	
Mass Per Metre	2.87kg	
Cable (Strand) Diameter	23.5mm	

GENERAL FEATURES

- The DSI Arnall HI-TEN Strand Bolt is a cable designed to be installed as a long rock bolt which is capable of being post-tensioned at the face, or out-bye, to loads of up to 25 tonnes using the DSI Arnall Tensioner Unit.
- The HI-TEN Strand Bolt is manufactured from 21 wire strand having a 12mm square, for mixing chemical anchors, welded to one end of the strand.
- The HI-TEN Strand Bolt has a special collar and segmented wedge, which can sustain collar loads of between 42 and 45 tonnes.
- The HI-TEN Strand Bolt is designed for high pre-tensioning using a point anchor system. Full encapsulation up to 8.0m is obtainable depending on installation equipment available.
- If full encapsulation is required, extra slow speed chemical anchors of 20 minutes set time are available. Refer to Section F for chemical anchor details.
- The HI-TEN Strand Bolt can also be effectively used with cementitious grouts.
- The HI-TEN Strand Bolt concept allows a longer than seam height bolt to be installed at up to 30° from the vertical at the face, or out-bye, to supplement existing strata reinforcement. Compatible domed plates are available to be used with the HI-TEN Strand Bolt.
- The HI-TEN Strand Bolt system is patent pending.

- 28mm hole diameters are preferred.
- Hole depth is critical. Hole depth should be approximately 155mm shorter than the bolt length. This allows for sufficient tail to fit accessories, roof plate, collar/wedges & Tensioner Unit.
- After insertion of the chemical anchors the bolt is rotated through the anchors while pushing the bolt, fully, to the back of the hole.
- It is important to follow the chemical manufacturers recommended mixing and hold times as printed on the chemical anchor cartons. DO NOT OVER MIX.
- The tensioner unit is connected to the HI-TEN Strand Bolt and tension applied.
- For further details refer to DSI Arnall's Tensioner Unit user instruction guide.

STANDARD LENGTHS & PACKAGING

- Standard HI-TEN Strand Bolts lengths range from 4100 to 8100mm.
- Collar/wedge assemblies are supplied separately to the bolt.
- Non-standard requirements are available by negotiation.
- 4100 to 8100mm long HI-TEN Strand Bolts are strapped in bundles of 50 and supplied on steel trays.
- Assistance should be sought from DSI Arnall's Technical Service Engineers in selection of the correct HI-TEN Strand Bolt fittings for the application and correct product codes.

NOTES

- Only DSI Arnall rock bolt components should be used to enable the full performance of the bolt system to be obtained.
- Stiffening tubes to assist in installation are also available.
- DSI Arnall Mining Products Division is quality assured to AS 9002, License No. 406.

POST GROUTABLE HI-TEN STRAND BOLT HIGH PRE-TENSION



PHYSICAL PROPERTIES

	Minimum	Typical
Yield Strength	480kN	500kN
Ultimate Tensile Strength	550kN	580kN
Uniform Elongation		3-4%
Mass Per Metre (Strand)		2.87kg
Diameter (Strand)		23.5mm

GENERAL FEATURES

- The Post Groutable HI-TEN is a high tensile and shear load capacity strand bolt. It is a cable designed to be installed as a long rock bolt which is capable of being post-tensioned at the face, or out-bye, to loads of up to 25 tonnes using the DSI Arnall Tensioner Unit.
- The Post Groutable HI-TEN Strand Bolt is manufactured from 21 wire strands having a 12mm square, for mixing chemical anchors, welded to one end of the strand and is available in any length up to 10 metres.
- The Post Groutable HI-TEN Strand Bolt has a special collar and segmented wedge, which can sustain collar loads of between 42 and 45 tonnes.
- The Post Groutable HI-TEN Strand Bolt concept allows a longer than seam height bolt to be installed at up to 30° from the vertical at the face, or out-bye, to supplement existing strata reinforcement. Compatible domed plates are available to be used with the Post Groutable HI-TEN Strand Bolt.
- The bolt can be post grouted immediately or at any time later using standard grouting equipment.
- Provides very efficient anchorage at the very top end of the bolt using a unique combination of a spiral resin mixer and a bulb. The bulb is always fully filled with 100% mixed resin.
- Anchorage strength of the resin grouted top end of the bolt exceeds bolt tensile strength in typical rock conditions.
- The Post Groutable HI-TEN Strand Bolt system is patent pending.

- Drill 52-55mm diameter hole for the length of the bolt.
- Insert resin. Each cartridge should be pushed to the back of the hole using a resin inserter.
- Install the Post Groutable HI-TEN Bolt in the same way the standard HI-TEN Bolt is installed, ie push and spin into the resin.
- Loosely assemble the plate with a grout hole and the collar and wedges onto the bolt.
- Push grout tube through the grout hole in the plate to the back of the hole.
- Pre-tension the bolt to the required load.
- Pump thixotropic grout.

STANDARD LENGTHS & PACKAGING

- Post Groutable HI-TEN Strand Bolt typical lengths range from 4100 to 8100mm.
- Collar/wedge assemblies are supplied separately to the bolt.
- Non-standard requirements are available by negotiation.
- 4100 to 8100mm long HI-TEN Strand Bolts are strapped in bundles of 50 and supplied on steel trays.
- Assistance should be sought from DSI Arnall's Technical Service Engineers in selection of the correct HI-TEN Strand Bolt fittings for the application and correct product codes.

NOTES

- Only DSI Arnall rock bolt components should be used to enable the full performance of the bolt system to be obtained.
- Stiffening tubes to assist in installation are also available.
- DSI Arnall Mining Products Division is quality assured to AS 9002, License No. 406.



PHYSICAL PROPERTIES

	Minimum	Typical
Yield Strength	480kN	500kN
Ultimate Tensile Strength	550kN	580kN
Uniform Elongation		3-4%
Mass Per Metre		2.87kg
Cable (Strand) Diameter		23.5mm
Rolled Thread M24x3.0mm Pitch		

GENERAL FEATURES

- The Flexibolt is manufactured from 21 wire strand and has a rolled thread on one end to which a collar, cone and OZ nut is fitted for installation and tensioning purposes. The collar and cone combination is capable of sustaining collar loads up to 42 tonnes.
- The Flexibolt is designed to be used with chemical anchors with full encapsulation up to 8 metres when a bolting rig that feeds the cable into the hole is used. With hand held machines, or rigs without a powered feeding system, over 2.0 metres encapsulation can be obtained.
- If full encapsulation is required, extra slow speed chemical anchors of 20 minutes set time are available. Refer to Section F for details of chemical anchors.
- The Flexibolt concept allows a longer than seam height bolt to be installed at up to 30° from the vertical at the face, or out-by, to supplement existing strata reinforcement. Compatible domed plates are available for use with the Flexibolt.
- The DSI Arnall Flexibolt can be initially tensioned up to 5 tonnes using the "rim cone" system. Australian Patent Number 45588/96 is applicable to DSI Arnall rim cone. For high pretension refer Data Sheet A1-11 HI-TEN Strand Bolt.
- The DSI Arnall Flexibolt is manufactured and distributed under license from JJP Geotechnical Engineering Pty. Ltd. Australian patent number 668515 is applicable.

- 28mm hole diameters are preferred.
- Hole depth is critical. Bolt should bottom in the hole leaving approximately 100mm protruding (including fittings).
- After insertion of the chemical anchors the bolt is rotated through the anchors while pushing the bolt to the back of the hole.
- It is important to follow the chemical manufacturer's recommended mixing and hold times as printed on the chemical anchor cartons. **DO NOT OVER MIX.**
- For further details of installation procedures refer to DSI Arnall's "Guide to Flexibolt Installation."

STANDARD LENGTHS & PACKAGING

- Standard Flexibolt lengths range from 2100 to 8100mm.
- Non-standard requirements are available by negotiation.
- 2100mm long Flexibolts are strapped in bundles.
- 4100 and 8100mm long Flexibolts are strapped in bundles of 50 and supplied on steel trays.

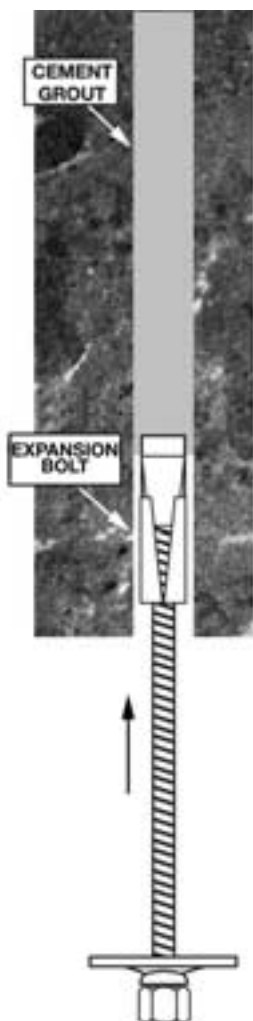
NOTES

- Only DSI Arnall rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- Assistance should be sought from DSI Arnall's Technical Services Engineer's in selection of the correct Flexibolt fittings for the application and correct product codes.
- Stiffening tubes to assist in installation are also available.
- DSI Arnall Mining Products Division is quality assured to AS 9002, License No. 406.

MECHANICAL PREGROUTABLE BOLT (MP BOLT) **A1.14**

PHYSICAL PROPERTIES

	Minimum		Typical	
Yield Strength	500MPa	160kN	550MPa	170kN
Ultimate Tensile Strength	600MPa	185kN	650MPa	200kN
Calculated Shear Strength	120kN		130kN	
Standard Elongation	16%		19%	
Uniform Elongation			12%	
Mass Per Metre			2.47kg	
Bar Diameter			20.0mm	
Cross Sectional Area of Bar			310mm ²	
Major Bar Diameter			22.1mm max.	
Bar Straightness to AS 1442-1991				



GENERAL FEATURES

- The MP Bolt consists of a bar thread, specially designed expansion shell and drive nut.
- The MP Bolt Expansion Shell (patent pending) has been designed to reduce the grout resistance upon bolt installation.
- The MP Bolt provides immediate rock reinforcement through mechanical anchorage while the grout cures.
- The MP Bolt bar is hot rolled with deformations that form a course left hand thread (10mm pitch) over its entire length.
- Single pass bolt installation.
- The thread bar form provides good load transfer properties.
- Corrosion protection provided by full column grout.
- Provides immediate support.
- Drive nut ensures reliable setting of the Expansion Shell and provides a bolt tail for subsequent meshing.
- Additional corrosion protection may be provided by hot dip galvanizing. (Refer Section G).

- 35mm hole diameter are preferred.
- The drilled hole length must be longer than the bolt by approximately 50mm.
- Appropriate components are fitted to the bolt. The Expansion Shell is screwed onto the bolt until the bolt thread just protrudes through the Expansion Shell plug.
- The hole is pregrouted by retracting the hose from the toe to the collar.
- The bolt is inserted through the grout.
- After placing the bolt in the hole to its full length, the bolt is rotated to set the expansion shell and apply tension.

STANDARD LENGTHS AND PACKAGING

- Standard bolt lengths range from 600 to 5000mm in increments of 300mm.
- Non-standard requirements are available by negotiation.
- Bolts are packaged in bundles with threads protected by heavy duty polyethylene bags.
- Bolt fittings, such as nuts, ant-friction washers and dome balls, are supplied fitted to rock bolts in the configuration requested.

NOTES

- Only DSI Arnall rock bolt components should be used to enable the full performance of the bolt system to be obtained.
- DSI Arnall Mining Products Division is quality assured to AS 9002, License No. 406.

EXPANSION SHELL BOLT WITH FORGED INTEGRAL HEAD



PHYSICAL PROPERTIES

16mm Bolt	Minimum		Typical	
Yield Strength	400MPa	65kN	460MPa	75kN
Ultimate Tensile Strength	590MPa	95kN	645MPa	105kN
Calculated Shear Strength	60kN		70kN	
Standard Elongation	17%		22%	
Uniform Elongation			12%	
Mass Per Metre			1.21kg	
Bar Diameter			14.4mm	
Cross Sectional Area of Bar			160mm ²	
Bar Straightness to AS 1332-1992				
Rolled Thread M16x2mm Pitch				
20mm Bolt	Minimum		Typical	
Yield Strength	375MPa	95kN	440MPa	110kN
Ultimate Tensile Strength	540MPa	135kN	680MPa	170kN
Calculated Shear Strength	90kN		110kN	
Standard Elongation	19%		22%	
Uniform Elongation			12%	
Mass Per Metre			1.99kg	
Bar Diameter			18.0mm	
Cross Sectional Area of Bar			250mm ²	
Bar straightness to AS 1332-1992				
Rolled Thread M20x2.5 Pitch				

GENERAL FEATURES

- Manufactured from round bar with a hot forged integral head on one end and a rolled thread on the other end.
- Expansion shell bolts are compatible with DSI Arnall expansion shells. Refer to Section B4.9 for details of the expansion shell range.
- Expansion shell bolts, with integral head, are suitable for use in areas where headroom is low or when long bolt tails are undesirable.
- The rolled thread strength is nominally equal to the column strength of the bar.
- For longer term installations these bolts can be grouted with cementitious grouts.
- Corrosion protection may be provided by hot dip galvanizing (refer to Section G). Alternative coatings are available by negotiation.

- It is imperative that the bolt hole diameter suits the expansion shell to be used.
- The length of the hole must be longer than the bolt by approximately 50mm.
- The expansion shell, separately supplied, is screwed onto the bolt until the bolt thread just protrudes through the expansion shell plug.
- After placing the bolt in the hole to its full length the bolt head is rotated to set the shell and tension the bolt.

STANDARD LENGTHS & PACKAGING

- Standard bolt lengths range from 900 to 2400mm in 300mm increments.
- Non-standard lengths are available by negotiation.
- Bolts are packaged in bundles with threads protected by heavy duty polyethylene bags.

NOTES

- Only DSI Arnall rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- DSI Arnall Mining Products Division is quality assured to AS 9002, License No. 406.

EXPANSION SHELL BOLT (ROUND BAR) OR DOUBLE ENDED BOLT



PHYSICAL PROPERTIES

16mm Bolt	Minimum		Typical	
Yield Strength	400MPa	65kN	460MPa	75kN
Ultimate Tensile Strength	590MPa	95kN	645MPa	105kN
Calculated Shear Strength	60kN		70kN	
Standard Elongation	17%		22%	
Uniform Elongation			12%	
Mass Per Metre			1.21kg	
Bar Diameter			14.4mm	
Cross Sectional Area of Bar			160mm ²	
Bar Straightness to AS 1332-1992				
Rolled Thread (both ends) M16x2.0mm Pitch				
20mm Bolt	Minimum		Typical	
Yield Strength	375MPa	95kN	440MPa	110kN
Ultimate Tensile Strength	540MPa	135kN	680MPa	170kN
Calculated Shear Strength	90kN		110kN	
Standard Elongation	19%		22%	
Uniform Elongation			12%	
Mass Per Metre			1.99kg	
Bar Diameter			18.0mm	
Cross Sectional area of Bar			250mm ²	
Bar Straightness to AS 1442-1992				
Rolled Thread (both ends) M20x2.5mm Pitch				

GENERAL FEATURES

- Double ended bolts are generally used with expansion shells and post grouted with cementitious grouts.
- The double ended bolt utilises, and is compatible with, DSI Arnall's expansion shells which provides:-
 1. An up the hole point anchor.
 2. Centralisation of the bolt on the up hole end.
 3. Allows the bolt to be pre-tensioned.
 Refer to Section B4.9 for details of the expansion shell range.
- A drive nut is fitted to allow initial setting of the expansion shell.
- The thread's strength is nominally equal to the column strength of the bar.
- Corrosion protection may be provided by hot dip galvanizing (refer to Section G). Alternative coatings are available by negotiation.
- Double ended bolts are often used as tie rods with rib supports (arches) and supplied with two plain nuts.

- It is imperative that the hole diameter suits the expansion shell to be used.
- The drilled hole length must be longer than the bolt by approximately 50mm.
- Appropriate components are fitted to the bolt. The expansion shell is screwed onto the bolt until the bolt thread just protrudes through the expansion shell plug.
- After placing the bolt in the hole to its full length, the bolt nut is rotated to set the shell and tension the bolt.

STANDARD LENGTHS & PACKAGING

- Standard bolt lengths range from 600 to 2400mm in increments of 300mm.
- Non-standard requirements are available by negotiation.
- Bolts are packaged in bundles with threads protected by heavy duty polyethylene bags.
- Bolt fittings, such as nuts, anti-friction washers and dome balls, are supplied fitted to rock bolts in the configuration requested.

NOTES

- Only DSI Arnall rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- DSI Arnall Mining Products Division is quality assured to AS 9002, License No. 406.



PHYSICAL PROPERTIES

	Minimum		Typical	
Yield Strength	520MPa	180kN	580MPa	200kN
Ultimate Tensile Strength	800MPa	280kN	900MPa	310kN
Calculated Shear Strength	195kN		200kN	
Standard Elongation	12%		15%	
Uniform Elongation			6%	
Mass Per Metre			2.88kg	
Cross Sectional Area of Bar			345mm ²	
Major Bar Diameter			22.7	
Bar Straightness to AS 1332-1992				
Rolled Thread R22.7x8.05 Pitch				

GENERAL FEATURES

- The solid universal bolt is manufactured by DSI from round bar to form a left hand rolled rope type thread, nominally 8mm pitch, formed over its entire length. The thread form provides good load transfer properties with cementitious or resin grouts.
- The solid universal bolt is usually fitted with an expansion shell and installed with a Face Jumbo which allows the bolt to be a highly tensioned point anchor bolt.
- The continuous thread provides high flexibility in “fragile” ground and blasting conditions as it can be readily re-tensioned.
- A design safety feature of the solid universal bolt is that the nut will strip at 24 tonnes which is well above the bolt yield strength but below its UTS.
- Plate loads of up to 12 tonnes can be obtained at installation.
- Corrosion protection may be provided by hot dip galvanizing (refer to Section G). Alternative coatings are available by negotiation.
- The solid universal bolt can be fitted with the Posimix Attachment (refer to A1.10) for use with resin capsule.

- It is imperative that the hole diameter suits the expansion shell to be used.
- Hole depth should be longer than the bolt by approximately 150mm.
- Appropriate components are fitted to the bolt. The expansion shell is screwed onto the bolt until the bolt thread just protrudes through the expansion shell plug.
- The bolt is inserted in the hole using feed only, then the expansion shell and nut is initially tightened using left hand rotation only. To set the expansion shell, after initially tightening the nut, the percussion and rotation are turned on full together. At this time the insert in the drive nut will break out and the nut will rotate up the bolt. This combined action further sets the shell into the rock and tightens the bolt.

STANDARD LENGTHS & PACKAGING

- Standard bolt lengths range from 1200 to 4000mm in 300mm increments.
- Non-standard lengths are available by negotiation.
- Bolts are packaged in bundles with threads protected by heavy duty polyethylene bags.
- Bolt fittings, such as nuts, anti-friction washers & dome balls, are supplied fitted to rock bolts in the configuration requested.

NOTES

- Only DSI Arnall rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- DSI Arnall Mining Products Division is Quality Assured to AS 9002, License No. 406.



PHYSICAL PROPERTIES

	Minimum		Typical	
Yield Strength	400MPa	150kN	460MPa	170kN
Ultimate Tensile Strength	440MPa	160kN	550MPa	200kN
Calculated Shear Strength	120kN		150kN	
Standard Elongation	16%		25%	
Uniform Elongation			15%	
Tensile Strength of the Threaded End			190 kN UTS	
Mass Per Metre			3.46kg	
Bar Core Diameter			23.0mm	
Cross Sectional Area of Bar			415mm ²	
Major Bar Diameter			27.0mm	
Bar Straightness to AS 1442-1991				
Rolled Thread M24x3.0mm Pitch				

GENERAL FEATURES

- This slot and wedge bolt is manufactured from hot rolled reinforcing bar which has rib deformation generally in a “herringbone” form. It has a 150mm long slot cut into the up hole end of the bolt and M24x3mm pitch rolled thread on the other end.
- The 150mm long slot is designed to accept a steel wedge which acts as a mechanical type point anchor. Refer to Data Sheet B4.8 for details of steel wedges.
- The solid deformed slot and wedge bolt parent bar is reduced in diameter to allow forming of the M24 rolled thread. The threaded section of the bolt accordingly has reduced physical properties to that of the parent bar.
- The 24mm solid deformed slot and wedge bolt can be pre or post grouted if required with cementitious grouts.
- Corrosion protection may be provided by hot dip galvanizing (refer to Section G). Alternative coatings are available by negotiation.

- 34mm hole diameters are preferred. Larger diameters than these can be used but anchorage capacity may be reduced. Holes larger than 36mm and smaller than 32mm are not recommended.
- Hole depth is critical and should be approximately 50mm shorter than the bolt.
- The wedge is assembled into the slot, just sufficient to support the wedge, for entry into the bolt hole. The nut is also rotated along the bolt thread to leave approximately 50mm of thread exposed.
- The bolt with the wedge is entered into the hole and the nut end of the bolt is fitted into a special spanner contained in a rotary percussive rock drill.
- Using both the thrust of the machine and full impact the bolt is driven onto the wedge to set the bolt. The spanner is then changed and the nut rotated to tighten the bolt.

STANDARD LENGTHS & PACKAGING

- Standard bolt lengths range from 600 to 3000mm in 300mm increments.
- Non-standard lengths are available by negotiation.
- Bolts are packaged in bundles with threads protected by heavy duty polyethylene bags.
- Bolt fittings, such as nuts, anti-friction washers and dome balls, are supplied fitted to rock in the configuration requested.

NOTES

- Only DSI Arnall rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- DSI Arnall Mining Products Division is Quality Assured to AS 9002, License No. 406.



PHYSICAL PROPERTIES

33mm Bolt	Minimum		Typical	
Yield Strength	415MPa	80kN	510MPa	100kN
Ultimate Tensile Strength of Tube	510MPa	100kN	610MPa	120kN
Friction Bolt Diameter	33mm			
Hole Diameter Range	30mm min./32mm max.			
Mass per Metre	1.53kg			
Cross Sectional Area	204mm ²			
39mm Bolt	Minimum		Typical	
Yield Strength	415MPa	90kN	510MPa	115kN
Ultimate Tensile Strength of Tube	510MPa	115kN	600MPa	135kN
Friction Bolt Diameter	39mm			
Hole Diameter Range	35mm min./38mm max.			
Mass per Metre	1.77kg			
Cross Sectional Area	225mm ²			
47mm Bolt	Minimum		Typical	
Yield Strength	345MPa	120kN	445MPa	160kN
Ultimate Tensile Strength of Tube	460MPa	165kN	510MPa	180kN
Friction Bolt Diameter	47mm			
Hole Diameter Range	43mm min./45.5mm max.			
Mass per Metre	2.79kg			
Cross Sectional Area	355mm ²			

GENERAL FEATURES

- The DSI Arnall Friction Bolt is manufactured from high strength steel tube which has a slot along its entire length. A ring, or collar, is welded on the outer end to hold a domed plate to the rock surface.
- The 33mm & 39mm Friction Bolt is suitable for installation with hand held rock drills (stoppers/drifters). The 47mm Friction Bolt is **NOT** suitable for installation with hand held rock drills (stoppers/drifters).
- Friction bolts can be load tested by fitting a special ring to the bolt prior to its installation. Pull tests can then be conducted with a hollow ram hydraulic jack.
- Further corrosion protection can be provided by hot dip galvanizing, (refer to Section G).

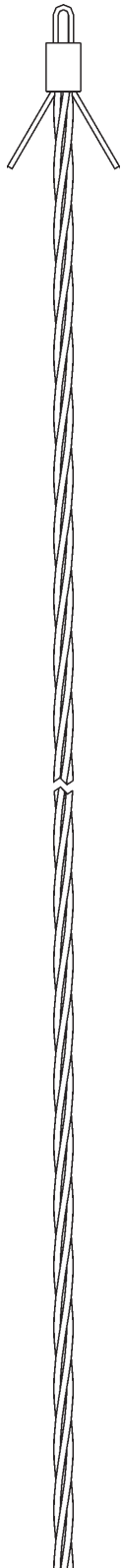
- The hole length should be longer than the bolt, nominally 150mm, to allow for any rock fretting during installation.
- The friction bolt is inserted into the hole. The driving dolly is fitted into the rock drill's chuck and then the bolt (with accessories) is placed onto the dolly.
- Using full percussion and thrust the bolt is fully driven into the hole until the domed plate is firmly against the rock surface. Care should be taken to ensure the rock drill's feed/thrust is in the same orientation as the hole or the bolt may be bent during installation.

STANDARD LENGTHS & PACKAGING

- Standard bolt lengths include 450mm long and from 600mm to 2400mm in 300mm increments.
- Non-standard lengths are available on application.
- Friction Bolts are supplied in standard packs of 150 bolts (39mm & 47mm) and 300 bolts (33mm).

NOTES

- Only DSI Arnall rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- DSI Arnall Mining Products Division is Quality Assured to AS 9002, License No. 406.



PHYSICAL PROPERTIES (Single Strand Only)

15.2mm Strand	Minimum	Typical
Yield Load at 0.2% Elongation	212kN	250kN
Ultimate Tensile Strength	250kN	265kN
Elongation on 600mm Gauge Length	3.5%	6.5%
Uniform Elongation		4%
Mass per Metre		1.13kg
Nominal Strand Diameter		15.2mm
Cross Sectional Steel Area in Cable		143mm ²

GENERAL FEATURES

- Plain cable bolts are manufactured from stress relieved, low relaxation, high strength 15.2mm diameter 7 wire steel strand and are commonly used as long tendons in strata reinforcement.
- Plain cable bolts are supplied in various lengths to customers requirements.
- Load capacity can be enhanced by simply doubling up from single strand, to double, or treble as the need arises.
- Can be used with cementitious grouts as well as polyester resin when early support is required.
- For up hole applications plain cable bolts are fitted with a spring wire “fish hook” to hold the cable bolt up the hole prior to grouting. Multiple strand cables are usually supplied swaged on the up hole end.
- Surface confinement is usually provided by flat or domed plates and barrel and wedge anchors. For accessories refer to appropriate pages for slotted or multiple hole plates, barrel and wedge anchors, cable bolt spacers, grout tube and air bleed tube.

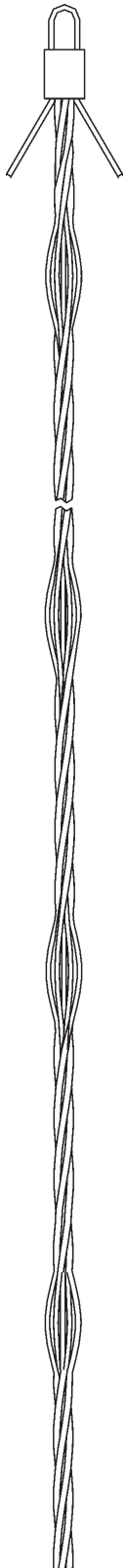
- In metal mine or civil application the diameter of the hole is governed by the type of drill string available and the length of hole to be drilled. For coal mining application refer to Minicage form data sheet.
- Holes are drilled to approximately 200mm shorter than the bolt length. If bolts are to be tensioned a tail of between 200 to 500mm is required, dependent on the type of tensioning unit to be used.
- Plain cable bolts are prepared for installation by attaching a breather tube to the full length of the bolt. An excess of breather tube, approximately 2 metres, to protrude from the hole mouth. These cables can also be installed using an alternate “retreat” grouting method by withdrawing the grout tube from the hole.
- Approximately 1 metre of grout tube is attached to the bottom of the cable with sufficient tail provided to connect to the pump.
- The cable bolt is inserted into the hole and the hole mouth sealed to eliminate loss of grout when pumping.
- Connect the grout tube to the pump. The air bleed (breather) tube is placed into a container of water and pumping commenced. Air bubbles will exhaust from the hole whilst pumping and be visible in the water container. When the hole is full of grout these air bubbles will cease to flow.
- After the grout has cured the cable bolt can be tensioned provided sufficient free length of cable is available. Note that HDP tubes are often used to provide a de-bonded section to allow tensioning.

STANDARD LENGTHS & PACKAGING

- Standard bolt lengths range from 3000 to 20000mm in 300mm increments.
- Non-standard requirements are available by negotiation.
- Plain cable bolts are normally supplied in straight lengths up to 6 metres and bundled. Cables over this length are usually coiled.

NOTES

- Only DSI Arnall rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- DSI Arnall Mining Products Division is Quality Assured to AS 9002, License No. 406.



PHYSICAL PROPERTIES Single Strand Only

MINICAGE	Minimum	Typical
Yield Load at 0.2% Elongation	212kN	250kN
Ultimate Tensile Strength	250kN	265kN
Elongation on 600mm Gauge Length	3.5%	6.5%
Uniform Elongation		4%
Mass per Metre		1.13kg
Nominal Strand Diameter		15.2mm
Cross Sectional Steel Area in Cable		143mm ²

GENERAL FEATURES

- Manufactured from stress relieved, low relaxation, high strength 15.2mm diameter 7 wire steel strand, the “minicage” cage cable bolt is formed by bulbing the strand into small cages, typically 26 to 28mm diameter, and up to 6 “minicages” per metre.
- The “minicage” cable bolt cages can be modified, in cage frequency and diameter, so that geotechnical engineers are able to design specific reinforcement products to suit ground conditions being encountered. In some cases de-bonding tube can be added to the lower section of the bolt to allow for pre-tensioning.
- The “minicage” cable bolt is supplied in either single, double or in combination forms. Single minicage plus single plain cable. They are supplied in nominated lengths for grouting into holes from 35mm to 105mm diameter.
- Can be used with cementitious grouts as well as polyester resin when early support is required.
- For up hole applications, cable bolts are fitted with a spring wire “fish hook” to hold the cable bolt up the hole.
- Surface confinement is provided by flat or domed plates and barrel and wedge anchors. Please refer to appropriate pages for slotted or multiple hole plates, barrel and wedge anchors, grout and air bleed tubes.

- In coal mining applications the preferred hole diameters are 35/36mm for single “minicage” cable bolts and 50mm for double “minicage” cable bolts.
- Holes are drilled approximately 200mm shorter than the bolt length. If the bolts are to be tensioned a tail of between 200 to 500mm is required dependent on the type of tensioning unit to be used.
- The “minicage” cable bolt is prepared by attaching a breather tube to the full length of the bolt. Allow an excess of breather tube, say 2 metres, to protrude from the hole mouth.
- Similarly attach approximately 1 metre grout tube to the bottom of the cable with sufficient tail to connect to the pump.
- The “minicage” cable bolt is inserted into the hole & the hole mouth sealed to eliminate lose of grout when pumping.
- Connect the grout tube to the pump. The air bleed (breather) tube is placed into a container of water and pumping commenced. Air bubbles will exhaust from the breather tube while pumping and be visible in the water container. When the hole is full of grout these air bubbles will cease to flow.
- After the grout has cured the bolt can be tensioned if a de-bonding tube has been fitted.

STANDARD LENGTHS & PACKAGING

- Standard bolt lengths range from 3000 to 30000mm in 300mm increments.
- Non-standard requirements are available by negotiation.
- “Minicage” cable bolts are normally supplied in straight lengths up to 6 metres and bundled. Cables over this length are usually coiled.

NOTES

- Only DSI Arnall rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- DSI Arnall Mining Products Division is Quality Assured to AS 9002, License No. 406.

DYNAMIC CABLE BOLT

A5.3

PHYSICAL PROPERTIES

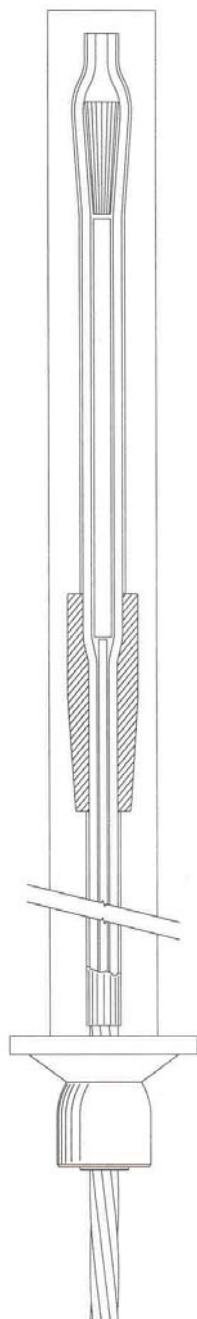
Static Yield Force Capacity	150kN (min)	to	180kN (max)
Dynamic Yield Force Capacity	80 kN (min)	to	120kN (max)
Displacement Capacity	Up to 300mm		Larger capacity may be specified.
Ultimate Force Capacity	250kN at ultimate displacement.		
Energy Absorption Capacity	At 300mm displacement >30kJ		Larger capacity may be specified.
Dome Plate	150x150x8mm		

GENERAL FEATURES

- 15.2mm diameter Compact strand manufactured to AS 1311
- Yielding anchor assembled under factory conditions.
- Quality Control measurements during yielding anchor assembly.
- Strand supplied ready to install in borehole with:-
 - PVC de-bonding sleeves
 - Domed bearing plate
 - Spherical base barrel an 3 part wedge anchor
- Strand may be installed with alternate cement grouting procedures:-
 - Collar to Toe (pre-placed strand with breather tube method and collar packing)
 - Toe to Collar (pre-placed Strand Grout – tube withdrawal during pumping)
 - Toe to Collar (pre-fill borehole and push strand)
- Typical hole diameter: 45-51mm
- Standard equipment and procedures used for barrel and wedge installation and for strand tensioning

NOTES:

- Manufactured by Garford Pty Ltd in conjunction with DSI.
- DSI Arnall Mining Products Division is quality assured to ISO 9001:2000, Registration No.QAC/R61/0315



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DYWIDAG-SYSTEMS
INTERNATIONAL



20mm FIBREGLASS DOWEL

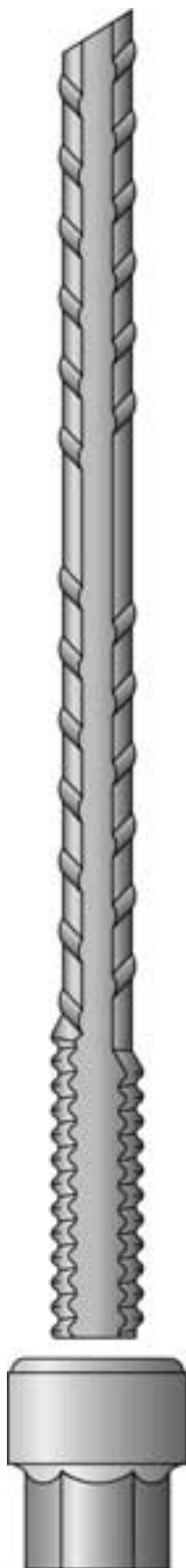
FULLY FORMED, THREADED & RIBBED FRP DOWELS

PHYSICAL PROPERTIES

	TYPICAL		
	15 tonne dowel	20 tonne dowel	30 tonne dowel
Ultimate Tensile Strength	150kN	200kN	300kN
Nut/Thread Tensile Strength	50kN	55kN	55kN
Single shear Strength	45kN	50kN	60kN
Nut Breakout Torque	38-41Nm		
Mass Per Metre	645g		
Nominal Bolt Diameter	20mm		
Nominal Cross Sectional Area of Bolt	310mm ²		
Major Bar Dimension	25mm		
Specific Gravity in grams/cm ³	1.7-1.8	1.8-1.9	2.1-2.2

GENERAL FEATURES

- The 20mm dowels are pull formed (matched die) fibreglass construction and are ribbed over its full length to provide maximum load transfer.
- Thread form is of a sinusoidal type, nominally 150mm long and 25mm diameter, and is fitted with an integral drive nut with radial face.
- All 20mm fibreglass dowels are designed to be used with chemical anchors and be fully encapsulated.
Only the 20 and 30 tonne capacity fibre glass dowels should be used with cementitious grouts.
- Bolts over 2400mm in length are available in all dowel types by negotiation.
- Australian Patent Numbers 631881 and 65494 are applicable to these bolts.



- 26-27mm hole diameters are preferred. Holes over 28mm diameter are not recommended.
- Hole depth is critical. Hole depth should be shorter than the bolt to allow for the height of the washer and nut.
- After insertion of the chemical anchors, the bolt is rotated through the anchor(s) while being pushed to the back of the hole.
- It is important to follow the chemical manufacturer's recommended mixing and hold times as printed on the chemical anchor cartons. DO NOT OVER MIX.
- For further details regarding installation procedures refer to DSI Arnall's "Practical Guide to Rock Bolting".

STANDARD LENGTHS & PACKAGING

- Standard bolt lengths range from 1200 to 1800mm in 300mm increments. Other lengths are available by negotiation.
- 1200mm long dowels are packed in 10's then palletized in lots of 1000.
- 1500 and 1800mm long dowels are packed in 10's then palletized in lots of 500.

NOTES

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