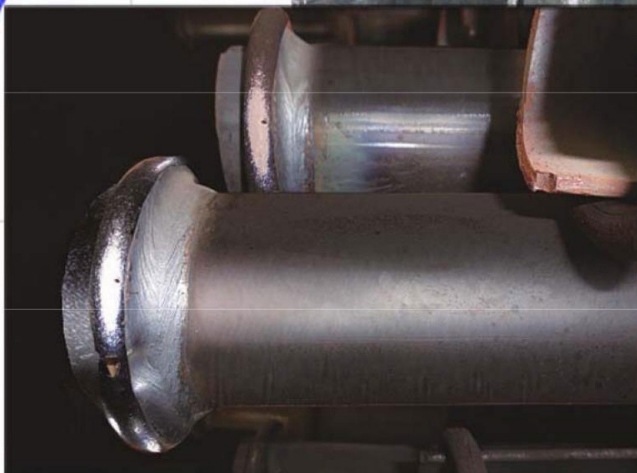


FRICTION BOLTS STABILIZERS

*Instant underground support
system for Mining and
Tunnel Industry*



KEMAICO ROCK TOOLS INC.

Friction Bolts (Stabilizers)

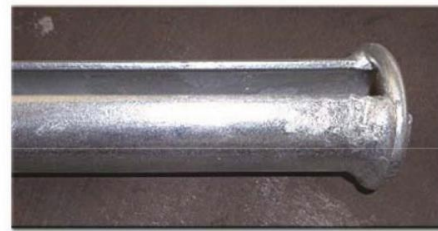
Friction Bolt (Stabilizers), as one of the main ground support bolt, are considered as the simplest and most cost effective form which has been used by metalliferous mining and tunnel industry for decades.



The maxdrill Friction Bolt (Stabilizers) are made by high tensile steel strip, which is roll-formed into a longitudinal slot C shape tube along its entire length. A steel ring is full welded on the end of the tube by automatic welding device, which is to hold the plates to the rock surface.

The tubular C shape of the bolt generates a load transfer from the steel to the rock when installed into a slightly smaller diameter hole, and results in a frictional resistance pull-out load of the tube from the hole, and creating a full length radial pressure to the hole by increasing the contact surface of the steel to the rock due to its tubular shape, and when install onto the plate, it establishes a compressive force against the rock. When additional load bearing capacity is required, friction bolt can be grouted by cement grouts.

A pull collar fixing at the ring end enables load testing during the bolt installation. The tapered end of friction bolt can be easily inserted into the drilled holes. Friction bolt can be installed with either hand held or mechanized equipment, such as a jackdrill, a stopper, a roof bolting jumbo, or any other type of drill.



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Our Bolts (Stabilizers)

- ✦ Made by High Tensile Steel
- ✦ Full range of accessories available
- ✦ Available in Hot Dip Galvanized or Untreated Steel
- ✦ Provide instant Full Length Ground Support

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Friction Bolts (Stabilizers) Range

The Friction Bolts (Stabilizers) are manufactured in 33, 39 and 47mm diameters with different length available. Length typically range from 600mm to 3000mm in 300mm increments. Other length is also available on request. TRM Friction Bolts are available in Galvanized or untreated steel in pack of 150 or 300 (only for 33mm Bolts)

2

33mm Friction Bolt (Stabilizers)

It is mainly used to establish ground support when hand-held mining operations are required.



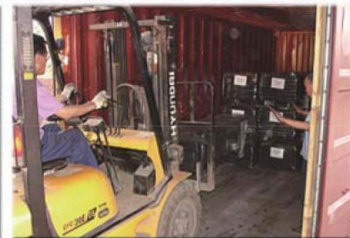
39mm Friction Bolt (Stabilizers)

It is primarily used for securing strata mesh by installing into existing 47mm friction bolts in conjunction with a smaller plate. Longer lengths are also used as primary ground support when drilling small diameter holes.



47mm Friction Bolt (Stabilizers)

It is mainly used as a primary support in mechanised jumbo development and production mining.





Friction Bolts (Stabilizers) Utility Hanger



The Friction bolt utility hangers available in all Models and up to 900mm. They're not for ground support, but they offer the same installation advantages as friction bolt Stabilisers. They come in the same tube diameters, and use the same bearing plates. They are used to support cables, ductwork, pipes and Mine Mesh. Lightweight items such as ventilation tubing may be hung from the loop on the bearing plate.

The Friction bolt utility hangers can also make screen and mesh installation much easier, faster and safer. After your opening is secured with standard Friction Bolt Stabilisers, install the mesh all at once by driving friction bolt Utility hangers inside the stabiliser tubes. No new holes are needed. There's no awkward handling of mesh at the end of a long bolt, or under unsupported ground. Screen or Mesh conforms to the rock more tightly.

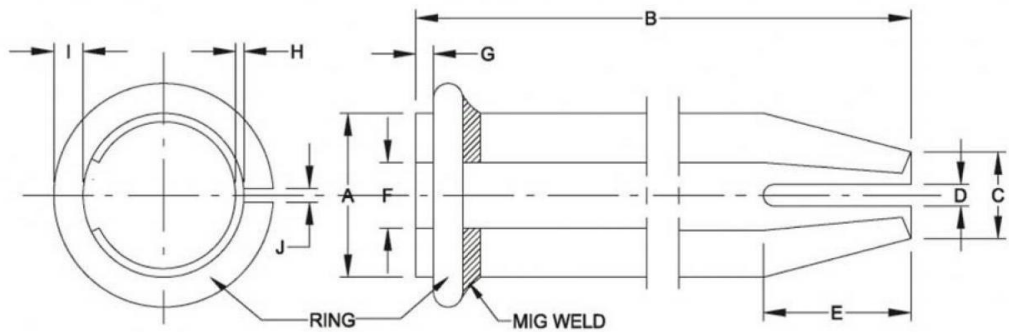
Friction Bolts (Stabilizers) Widely use

- Mine roof and ribs
- Pillars
- Water tunnels
- Shaft walls
- Wage tunnels
- Underground storage caverns
- Road tunnels
- Pipe and ventilation ducts
- Conveyor Belts
- Roller wires
- Surface excavation slopes
- Highway cuts





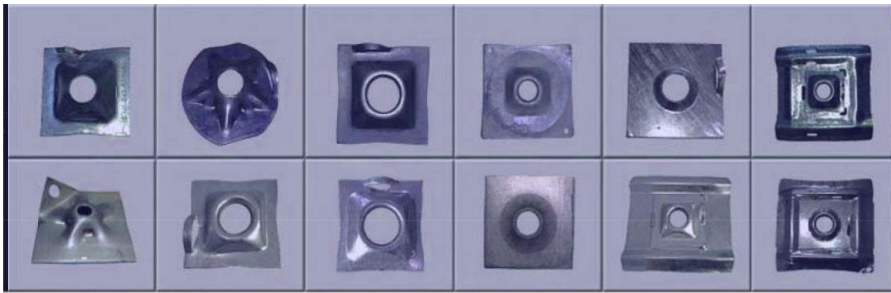
Friction Bolts (Stabilizers) Properties



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Dimensions		FB-33	FB-39	FB-47
Bolt Diameter	A	33mm	39mm	47mm
Bolt Length	B	600-3000mm	600-3000mm	600-3000mm
Taper End Diameter	C	28mm	30mm	38mm
Taper Slot Wide	D	2mm	2mm	2mm
Taper Length	E	60mm	65mm	65mm
Bolt Slot Wide	F	12mm	17mm	25mm
Ring Location	G	3mm	3mm	8mm
Material Gauge	H	2.0-2.5mm	2.0-2.5mm	2.5-3.2mm
Ring Wire Gauge	I	6mm	6mm	8mm
Ring Open Gap	J	5.0-6.0mm	5.0-6.0mm	6.0-7.0mm
Physical Properties				
Yield Strength		Min.345 Mpa (70KN) Typical 445 Mpa (95KN)	Min.345 Mpa (85KN) Typical 445 Mpa (110KN)	Min.345 Mpa (120KN) Typical 445 Mpa (150KN)
Tube Ultimate Tensile Strength		Min.470 Mpa (100KN) Typical 530 Mpa (115KN)	Min.470 Mpa (115KN) Typical 530 Mpa (130KN)	Min.470 Mpa(160KN) Typical 530 Mpa (180KN)
Mass per Meter		1.67Kgs	1.92Kgs	2.71Kgs
Cross Section Area		212mm ²	245mm ²	345mm ²
Hole Diameter Range		30-32mm	35-38mm	43-45.5mm
Technical Data				
Recommended Norminal Bit Size		31-33mm	35-38mm	41-45mm
Typical Breaking Capacity		107KN	124KN	178KN
Minimum Breaking Capacity		71KN	89KN	133KN
Recommended Initial Anchorage		3-6Tons (27-53KN)	3-6Tons (27-53KN)	6-10Tons (53-89KN)
Ultimate Axial Strain		Typical 21% (Thickness<16mm)		

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Bolt Accessories

DOME PLATE

Plate Code	Dimension mm	Thickness mm	Hole Dia. mm	Weight Kgs
MDDP125-4-33	125x125	4	36	0.42
MDDP125-4-39	125x125	4	42	0.40
MDDP125-4-47	125x125	4	49	0.38
MDDP150-4-33	150x150	4	36	0.72
MDDP150-4-39	150x150	4	42	0.70
MDDP150-4-47	150x150	4	49	0.68
MDDP150-6-33	150x150	6	36	1.08
MDDP150-6-39	150x150	6	42	1.05
MDDP150-6-47	150x150	6	49	1.02
MDDP200-4-39	200x200	4	42	1.25

- Domed plates are compatible with friction bolts, They are complementary products and assists in overcoming the problem of minor surface angularity
- Different shaped plates offered (OEM service offered)
- Corrosion protection may be provided by hot dip galvanizing

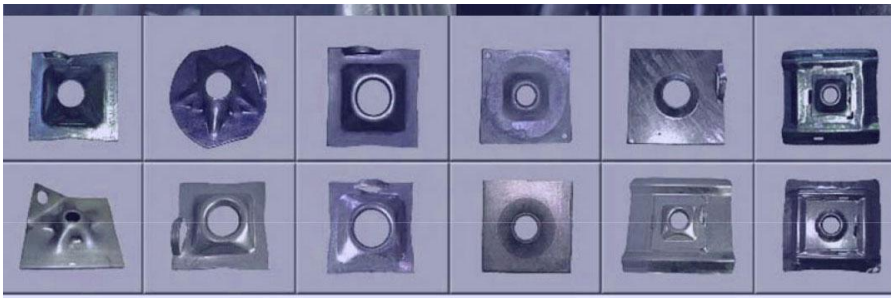


COMBI & DUO PLATE

Plate Code	Base Plate mm	Top Plate mm	Hole Dia. mm	Surface Finish
MDCDP-150-19P	280x400x1.9	150x150x4/125x125x4	36,42,49	Pre-Galv.
MDCDP-150-19G	280x400x1.9	150x150x4/125x125x4	36,42,49	Hot Dip Galv.
MDCDP-150-19U	280x400x1.9	150x150x4/125x125x4	36,42,49	Untreated
MDCDP-150-16P	280x300x1.6	150x150x4/125x125x4	36,42,49	Pre-Galv.
MDCDP-150-16G	280x300x1.6	150x150x4/125x125x4	36,42,49	Hot Dip Galv.
MDCDP-150-16U	280x300x1.6	150x150x4/125x125x4	36,42,49	Untreated
MDCDP-150-15P	280x300x1.5	150x150x4/125x125x4	36,42,49	Pre-Galv.
MDCDP-150-15G	280x300x1.5	150x150x4/125x125x4	36,42,49	Hot Dip Galv.
MDCDP-150-15U	280x300x1.5	150x150x4/125x125x4	36,42,49	Untreated

- Incorporate a plate washer attached to a standard strata plate to give a superior product with enhanced performance.
- Designed with a profile that gives greater strength by strategically pressing the vees, placing the perimeter of plate in tension.
- Has "user friendly" rounded corners
- Allows faster installation by eliminating the handling of two separate components
- Can be facilitate flat and domed plates (up to 150mm square) to increase rock surface coverage area
- Can be utilised with lighter domed or flat plates to provide an economic advantage over heavier Is suitable for direct placement onto the rock surface or used against welded mesh
- Are supplied with a slot for suspension of light services and some domed plates include a services support lug





Bolt Accessories

STRATA PLATE

Plate Code	Dimension mm	Thickness mm	Hole Dia. mm	Weight (Blk/Galv.)Kgs
MDDP300-19U/G	300x280	1.9	50	1.35/1.40
MDDP400-19U/G	400x280	1.9	50	1.80/1.85

- The strata plate is a light-weight plate with a large surface area.
- It is used as an intermediate plate to increase the surface coverage of a bolt.
- The plate feature both longitudinal and transverse V-shaped deformations for adding strength and greater ability to conform to irregularities in the rock surface.
- The deformed design renders a greater strength, placing the perimeter of the plate in tension.
- User friendly rounded corners.
- Can be used with both flat and domed plates (up to 150mm)
- The plate are can be placed directly to the rock surface or used with welded Steel Mesh.
- The plates are supplied with slots for supporting of light service lines.
- Corrosion protection may be provided by using pre-galvanized material.



MESH PALTE

Plate Code	Dimension mm	Thickness mm	Hole Dia. mm	Weight (Blk/Galv.)Kgs
MDMP200-4U/G	200x200	4.0	36,42,49	1.30/1.40

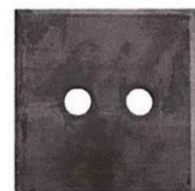
- Used with installation of different stabilizers
- With bent up edges so that they do not cut the mesh
- Corrosion protection may be provided by hot dip galvanizing



BEARING PLATE

Plate Code	Dimension mm	Thickness mm	Hole Dia. mm	Weight Kgs
MDBP125-6	125x125	6	22	0.72
MDBP150-6	150x150	6	22	1.02
MDBP150-8	150x150	8	22	1.38
MDBP150-10	150x150	10	22	1.72
MDBP150-12	150x150	12	22	2.00
MDBP200-12	200x200	12	22	3.60
MDBP300-12	300x300	12	22	8.20
MDBP300-16	300x300	16	22	11.20
MDBP400-18	400x400	18	22	22.50
MDBP400-20	400x400	20	22	25.00

- Bearing Plate is for general use as bearing plate or washers in mining
- Additional plate sizes & thickness (up to 20mm) can be manufactured to individual specifications as required (OEM service offered)
- Bent Corner, grout slots & Keyholes available



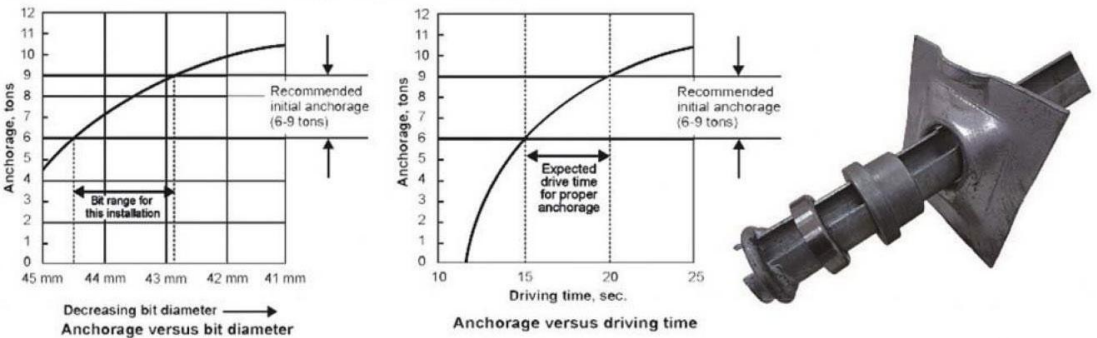


Pull Testing and Load Testing

Bit selection and Pull test

To select the correct drill bit diameter for meeting the recommended initial anchorage, drill several holes with bit diameters ranging. Drill each at least 5cm longer than the bolt length. Number each hole and record the bit size. In soft ground, a bit may drill a hole larger than its diameter. In hard abrasive ground, the hole may be the same diameter as the bit. Drive into each hole a friction bolt fitted with a pull collar. Record the driving time for each stabilizer. After insertion, observe the amount of slot closure inside each stabilizer. Once the bolt has slipped in the hole, pressurize the tester pump until the bolt slips again. The same pull load should cause subsequent slippage.

After the above pull tests are completed, draw two graphs:

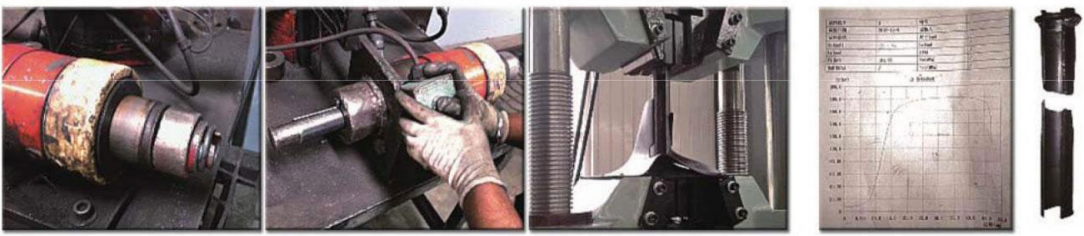


Use the first graph to determine the correct bit size for your particular ground condition. As the bit wears, the hole will become smaller and friction will increase until the bit is replaced or the drill can't drive the bolt completely.

Use the second graph to establish correct driving time required for this ground and bolt length. With a given bit, drill, bolt length, rock characteristic and constant pressure, insertion time will be proportional to initial anchorage.

It's important to establish this data for use in later spot checks, to assure that proper installation techniques are still being used. To determine anchorage, perform a pull test. Align the pull tester with the stabiliser, and pressurize it until the stabiliser slips in the hole

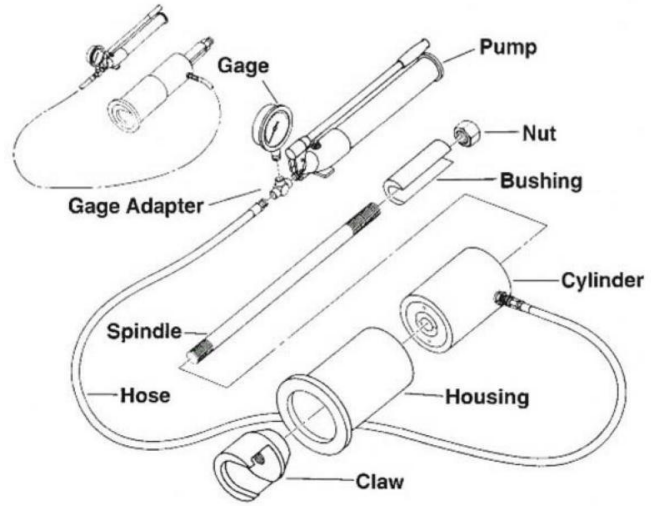
Rupture strength load testing





Pull Tester Equipment

The pull tester consists of two assemblies: the hydraulic portion which includes the cylinder, gage, pump, hose and adapter; and the mechanical portion which includes the claw housing, U-shaped bushing, Spindle and nut. With the bushing removed, the claw can be slid over the pull collar which has been installed with the stabilizer. When the housing and cylinder are raised, the bushing can be inserted between the nut and the cylinder, the nut then tightened to take up slack. The pump is then actuated to raise cylinder pressure, pulling the stabilizer slightly out of the hole through the bearing plate. Maximum gage reading at slip indicates the holding force.



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Other Accessories

Kemaico also manufactures and supplies a comprehensive range of accessories together with friction bolt, such as driver tools, welding ring, Pull Collar, Support Ring, Bolts and Nuts, Screw Bar etc. It is recommended that friction bolt be used associated with Kemaico products.





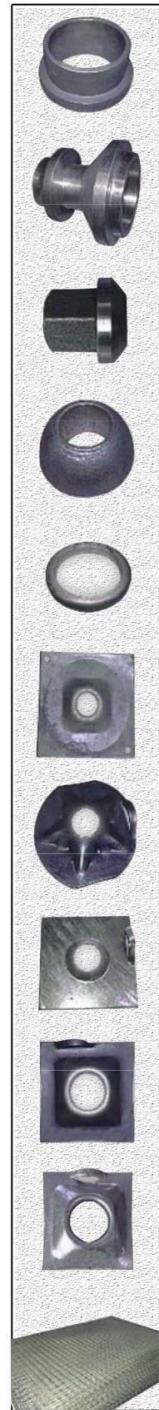
Installation and Advantages

Installation Guidelines :

- Drill holes at proper diameter and depth. Holes diameters is determined by on-site testing. Holes length should be longer than the bolt, normally 150mm, to allow for any rock fretting during installation.
- Insert the bolt into the hole. Put driving tool into rock drill's chuck, place the bolt and plate onto the tool
- Using full percussion and thrust the bolt is fully driven into the hole until the 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.

Advantages :

- Simple System: All you need for the system is a bolt, bearing plate and drive tool.
- Conforms to ground shifts, grips even tighter: After installation bolt grips more tightly. Days or weeks later, when the average conventional bolt becomes ineffective and needs retorquing, a typical bolt is tighter than ever. It never needs tightening.
- Full length support: Bolt grips the rock over its full contact length. The bolt and plate exert pressure against the rock immediately upon installation.
- Fast, easy installation reduces bolting cost: Can be installed quickly using a jackdrill, a stoper, a roof-bolting jumbo or any other type of drill.





Installation Quality Guidelines

The following are items to be aware of when using/installing friction bolts:

- **Type of Ground** - The nature of the ground must be evaluated. Soft strata requires a longer anchorage length to be effective. Soft ground results in larger hole sizes for a given bit size (due to bit rattling and reaming)
- **Scaling** - The ground should be thoroughly scaled (i.e. barred down) before drilling and bolting. Periodic re-scaling may be required while drilling.
- **Strength and Yield Capacity of Bolt** - The mechanical properties of the bolt should be appropriate for the ground conditions, bolt length and bolting pattern. Pull tests should be performed to determine initial anchorage of the friction bolts.
- **Proper Grade Plates** - Thin or weak plates will deform at low bolt tension. The bolt could also rip through the plate during installation or by bolt loading.
- **Hole Condition** - The hole should be cleaned and examined to ensure the friction bolt will insert smoothly. Variation in hole diameters (due to differing strengths of rock strata or excessively fragmented ground) can yield variations in anchorage capacities at various elevations.
- **Hole Length** - If holes are drilled too short then the bolt will stick out of the hole and the plate will not make contact with the rock surface. Damage to the bolt will result if an attempt is made to drive the bolt further than the hole length will permit. The hole should thus be a few inches deeper than the bolt length being used.
- **Oversize Holes** - The hole size required for the friction bolt is the most crucial aspect of the installation. The holding power of the bolt relies on the fact that the hole is smaller than the diameter of the bolt. The larger the hole relative to the bolt diameter, the less the holding force (at least initially). Oversized holes can be caused by using the wrong bit size, leaving the drill running while flushing the hole, soft ground (faults, gouge, etc.) and bent steel.
- **Undersize Holes** - If the hole size is too small relative to the friction size then it becomes extremely difficult to install the bolt. The bolt can be damaged i.e. kinked or bent when installed. Undersized holes are usually caused by worn bits and/or wrong bit sizes being used. If integral steel is used with a stoper or jackleg, the hole diameter decreases with each change of steel (normal practice requires smaller bits be used as one drills deeper into the hole). With each reduction in hole diameter the anchorage capacity increases. Integral steel often results in crooked holes and should be avoided whenever possible.





Installation Quality Guidelines (continued)

- **Drive Times** - For a typical 5 or 6 foot friction bolt, a stoper or jackleg will drive the bolt into the hole in 8 to 15 seconds. This drive time corresponds to proper initial anchorages of the stabilizer. Faster drive times should serve as a warning that the hole size is too large and thus the initial anchorage of the bolt will be too low. Longer drive times indicate smaller holes sizes probably caused by bit wear.
- **Bit Selection** - Button bits are commonly up to 2.5mm larger than their slated size. A 37mm button bit may in reality be 39.5mm in diameter when new. This is too large for an 39mm friction. Button bits do wear quickly however, increasing anchorage capacity and increasing drive times. Cross or "X" bits, on the other hand, are sized true to stamped size usually within 0.8mm. They hold their gauge very well but tend to drill slower than button bits. They are preferable to button bits for friction installation where possible.
- **Perpendicular Installation** - Bolts should be installed as near perpendicular to the rock surface as possible. This ensures the welded ring is in contact with the plate all round. Bolts not perpendicular to the plate and rock surface will result in the ring being loaded at a point which may cause early failure. Unlike other rock bolts, spherical seat washers are not available to correct for angularity with frictional stabilizers.
- **Installation Driver Tools** - Driver tools must transfer percussive energy to the bolt during installing, not rotational energy. This is opposite to most other forms of ground support. The shank end of the driver must be the proper length to contact the drill piston in stopers and jacklegs (i.e. 4 1/4" long for 7/8" hex drill steel). The shank end on the drivers is round so as to not engage the rotation of the drill. The driver tools must have the proper end shape to fit into the friction without binding and causing damage to bolt during installation.
- **Education** - Proper education of mining personnel and supervisors is mandatory. As manpower turnover is relatively frequent in bolting crews, education must be continuous. An informed workforce will save money in the long run.
- **Monitoring** - Installation must be monitored to ensure proper procedures and quality are maintained. Pull-test measurements should be routinely conducted on friction stabilizers to check initial anchorage values.

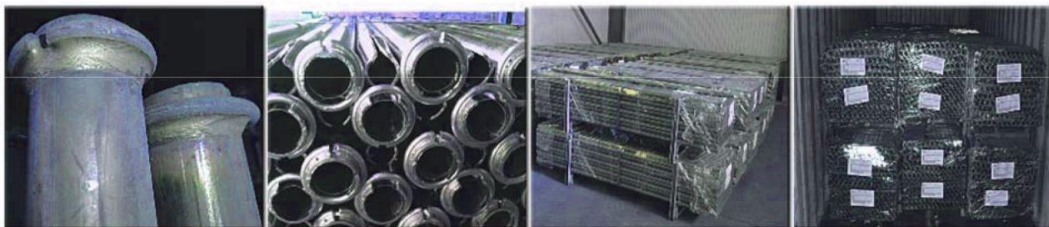




Bolt Codes Weights and Packs

Bolt Code	Bolt Description	Diameter (mm)	Length (mm)	Surface Finish	Weight (Kgs)	Pack QTY (Pcs)	Ring Color ID
MDFB33-06	Friction Bolt 33x600	33	600	Untreated	1.00	300	-
MDFB33-09	Friction Bolt 33x900	33	900	Untreated	1.50	300	-
MDFB33-12	Friction Bolt 33x1200	33	1200	Untreated	2.00	300	-
MDFB33-15	Friction Bolt 33x1500	33	1500	Untreated	2.50	300	-
MDFB33-18	Friction Bolt 33x1800	33	1800	Untreated	3.00	300	-
MDFB33-06G	Friction Bolt 33x600HDG	33	600	Hot Dip Galv.	1.05	300	-
MDFB33-09G	Friction Bolt 33x900HDG	33	900	Hot Dip Galv.	1.58	300	-
MDFB33-12G	Friction Bolt 33x1200HDG	33	1200	Hot Dip Galv.	2.10	300	-
MDFB33-15G	Friction Bolt 33x1500HDG	33	1500	Hot Dip Galv.	2.63	300	-
MDFB33-18G	Friction Bolt 33x1800HDG	33	1800	Hot Dip Galv.	3.15	300	-
MDFB39-06	Friction Bolt 39x600	39	600	Untreated	1.20	150	-
MDFB39-09	Friction Bolt 39x900	39	900	Untreated	1.70	150	-
MDFB39-12	Friction Bolt 39x1200	39	1200	Untreated	2.40	150	-
MDFB39-24	Friction Bolt 39x2400	39	2400	Untreated	4.30	150	-
MDFB39-06G	Friction Bolt 39x600HDG	39	600	Hot Dip Galv.	1.26	150	-
MDFB39-09G	Friction Bolt 39x900HDG	39	900	Hot Dip Galv.	1.80	150	-
MDFB39-12G	Friction Bolt 39x1200HDG	39	1200	Hot Dip Galv.	2.50	150	-
MDFB39-24G	Friction Bolt 39x2400HDG	39	2400	Hot Dip Galv.	4.50	150	-
MDFB47-09	Friction Bolt 47x900	47	900	Untreated	2.50	150	-
MDFB47-18	Friction Bolt 47x1800	47	1800	Untreated	5.10	150	-
MDFB47-21	Friction Bolt 47x2100	47	2100	Untreated	6.10	150	-
MDFB47-24	Friction Bolt 47x2400	47	2400	Untreated	6.70	150	-
MDFB47-30	Friction Bolt 47x3000	47	3000	Untreated	8.60	150	-
MDFB47-09G	Friction Bolt 47x900HDG	47	900	Hot Dip Galv.	2.60	150	-
MDFB47-18G	Friction Bolt 47x1800HDG	47	1800	Hot Dip Galv.	5.50	150	-
MDFB47-21G	Friction Bolt 47x2100HDG	47	2100	Hot Dip Galv.	6.40	150	-
MDFB47-24G	Friction Bolt 47x2400HDG	47	2400	Hot Dip Galv.	7.05	150	-
MDFB47-30G	Friction Bolt 47x3000HDG	47	3000	Hot Dip Galv.	9.00	150	-

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