FRAZER & JONES

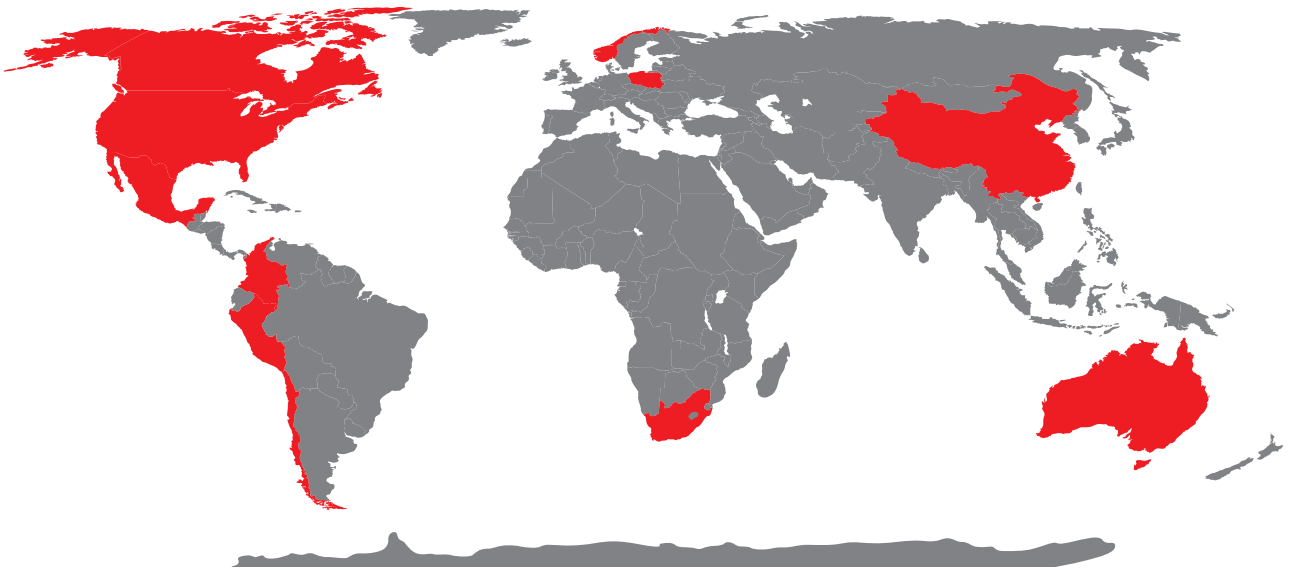
ISO 9000 CERTIFIED

## Mining & Ground Control

# ANCHOR PRODUCTS

# Our Company

The Frazer & Jones story began nearly 175 years ago, producing and supplying malleable iron products in North America. Now, almost two centuries later, we are proud to extend our reach over seas to more than ten countries in six continents.



Since then, we've been developing and perfecting modern malleable iron roof anchors, filling technological voids along the way for the mining industry. We understand how important it is to not only deliver a quality product but also one that improves working conditions for underground miners, protecting them each and every day.

Our commitment to invest in people, technology, research and development has been evident since our inception. We will strive to continue to deliver that same dedication while we grow, change and expand as the demands of the mining industry evolve.

FRAZER & JONES

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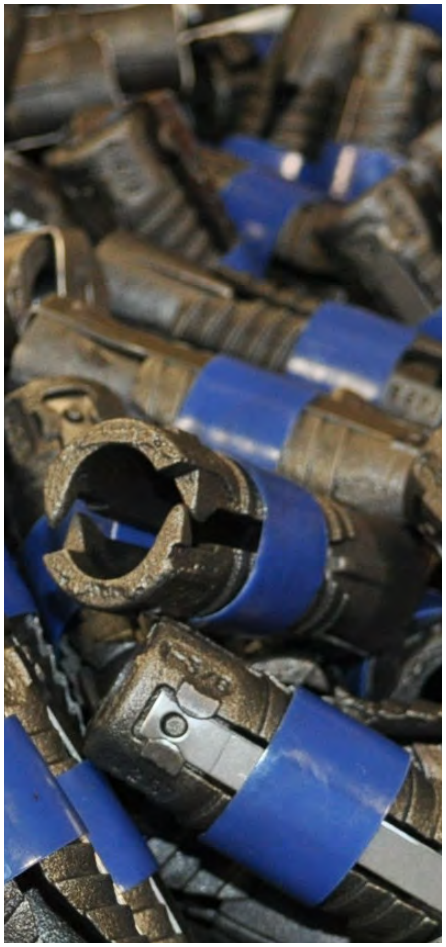
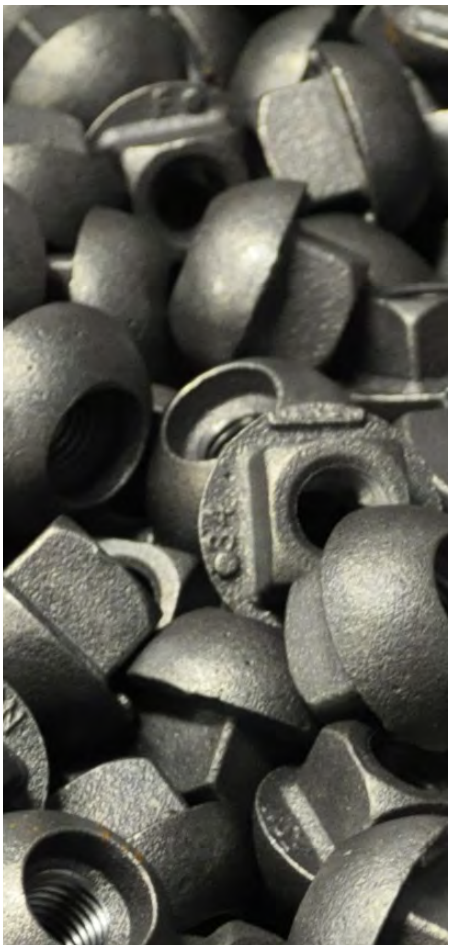




## From above ground to under ground, we support the future.

In 1952, Frazer & Jones began its journey as a ground control product supplier in the mining industry. Since then, we have grown to support tunneling and civil needs with safety and efficiency as our top priorities in design and functionality.

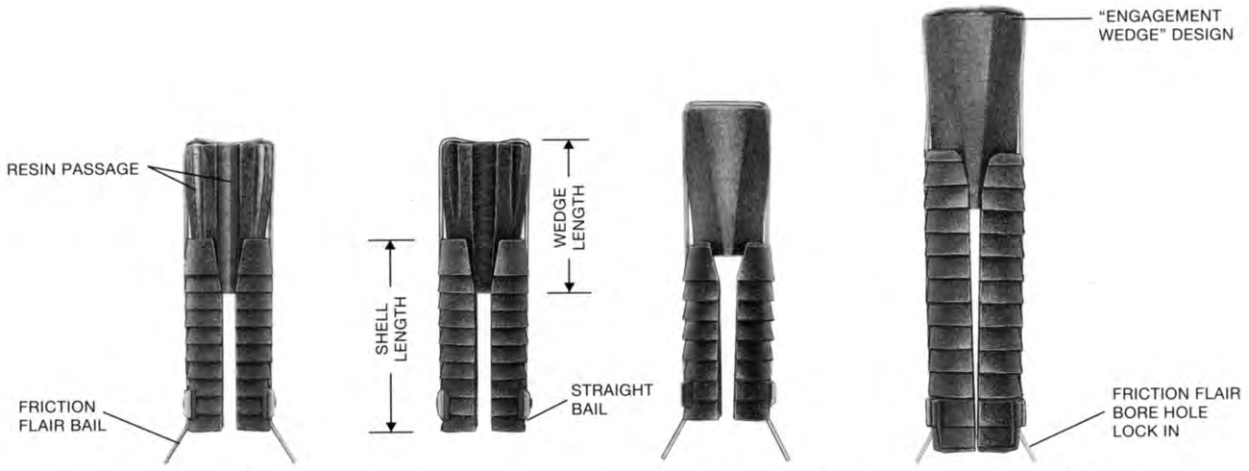
Over the years, the industry has come to trust Frazer & Jones as the source for dependable quality ground control products with the most budget-conscious pricing. Not only do we pride ourselves in our final product, but we also strive to create substantial value along with several other benefits:

- Excellent production quality standards
- Largest industry selection of assembly styles, virtually able to fit any anchoring need
- An ongoing research and development program dedicated to product improvement and innovation
- Custom engineering of special shells for your unique anchoring needs
- Extensive laboratory pre-testing of all anchor styles
- Comprehensive underground field service designed to reduce non-productive installation time and boost overall mining productivity
- American Standard UNC, Metric, Lag and Special/Custom Threads
- All products comply with ASTM F-432 and CAN/CSA-M430

When your order arrives, it's important that everything is prepped and ready to go, without any secondary labor. The following is a list of value-added services we offer our customers:

- Galvanizing
- Plating
- Custom packaging
- Custom anchor design
- Custom assembly

# New Technology: Friction Flair Rock Anchors

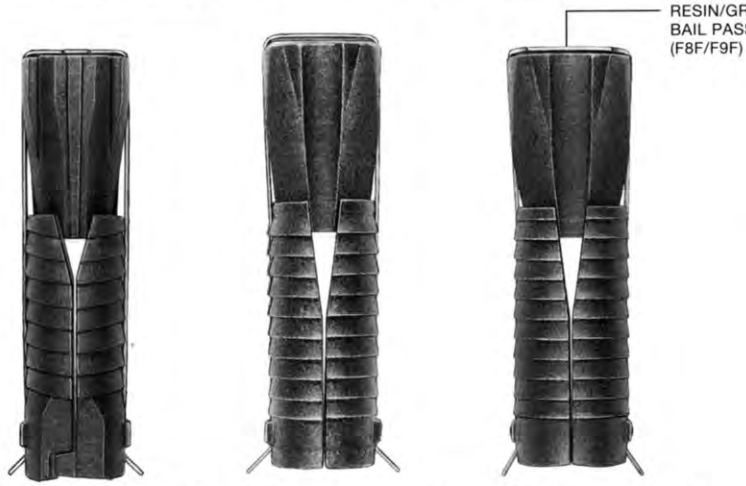



**F1FR®** Reccommended for resin. Available with straight or friction flair bail.

**F1F®** Recommended for general use. Available with straight or friction flair bail.

**F3F®** Recommended for general use. Available with straight or friction flair bail.

**FLF®** Recommended for soft or friable strata. Available with friction flair and popout bail features.




**F5F®** Recommended for general use. Available with straight or friction flair bail.

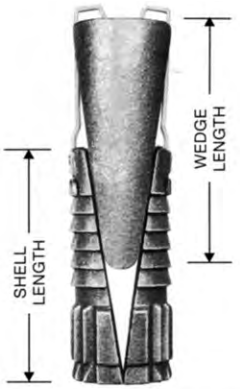
**F8F®** Recommended for general use. Available with straight or friction flair bail.

**F9F®** Recommended for general use. Available with straight or friction flair bail.

| Style | Thread Size UNC or (metric) | Drill Hole Size in. (mm) | Shell Length In. | Wedge Length In. | Non-Seizure Load Lbs. |
|---|---|---|---|---|---|
| **F1FR*** | 5/8 (M16) | 1-1/32 (26) & 1-1/16 (27) | 2-1/8 | 1-5/8 | 18000 |
| **F1F*** | 5/8 (M16) | 1-1/32 (26) & 1-1/16 (27) | 2-1/8 | 1-5/8 | 18000 |
| **F3F*** | 5/8 (M16) | 1-3/16 (30) & 1-1/4 (32) | 2-1/8 | 1-3/4 | 22500 |
| **FLF*** | 5/8 (M16) | 1-1/4 (32) | 3-1/4 | 2-1/8 | 18000 |
| **F5F*** | 5/8 (M16) | 1-3/8 (35) | 2-7/8 | 2 | 22500 |
| **F5F*** | 3/4 (M20) | 1-3/8 (35) | 2-7/8 | 2 | 30000 |
| **F8F*** | 3/4 (M20) | 1-5/8 (41) | 3-1/4 | 2-1/4 | 30000 |
| **F8F*** | 7/8 (M22) | 1-5/8 (41) | 3-1/4 | 2-1/4 | 39500 |
| **F9F*** | 3/4 (M20) | 1-3/4 (44) | 3-1/4 | 2-1/4 | 30000 |
| **F9F*** | 7/8 (M22) | 1-3/4 (44) | 3-1/4 | 2-1/4 | 40000 |
| **F9F*** | 1 (M24) | 1-3/4 (44) | 3-1/4 | 2-1/4 | 40000 |

® Registered trademark  * Patented item

# 2 Leaf Bail Type Assemblies




**D1L** Recommended for general use.

**D2®** Recommended for general use.

**D5®** Recommended for general use.

**D5-1** Recommended for general use.

**D10L®** For use in extremely soft anchorage using a standard bolt thread length.


**D20®** For heavy duty and construction uses.

**D33®** For heavy duty and construction uses.

| Style | Thread Size UNC or (metric) | Drill Hole Size in. (mm) | Shell Length In. | Wedge Length In. | Non-Seizure Load Lbs. |
|---|---|---|---|---|---|
| **D1L** | 5/8 (M16) | 1-3/8 (35) & 1-1/2 (38) | 3 | 3-1/8 | 22500 |
| **D1L** | 3/4 (M20) | 1-3/8 (35) & 1-1/2 (38) | 3 | 3-1/8 | 30000 |
| **D2+** | 1/2 (M12) | 1-3/8 (35) | 2-1/2 | 3-1/8 | 13500 |
| **D2+** | 5/8 (M16) | 1-3/8 (35) | 2-1/2 | 3-1/8 | 22500 |
| **D2+** | 3/4 (M20) | 1-3/8 (35) | 2-1/2 | 3-1/8 | 25000 |
| **D5**+** | 5/8 (M16) | 1-5/8 (41) | 3 | 3-1/8 | 22500 |
| **D5**+** | 3/4 (M20) | 1-5/8 (41) | 3 | 3-1/8 | 30000 |
| **D5**+** | 7/8 | 1-5/8 (41) | 3 | 3-1/8 | 39500 |
| **D5-1+** | 5/8 (M16) | 1-3/4 (44) | 3 | 3-1/8 | 22500 |
| **D5-1+** | 3/4 (M20) | 1-3/4 (44) | 3 | 3-1/8 | 30000 |
| **D5-1+** | 7/8 (M22) | 1-3/4 (44) | 3 | 3-1/8 | 38000 |
| **D5-1+** | 1 (24) | 1-3/4 (44) | 3 | 3-1/8 | 36500 |
| **D10L** | 5/8 (M16) | 1-3/8 (35) & 1-1/2 (38) | 5 | 4-3/8 | 22500 |
| **D10L** | 3/4 (M20) | 1-3/8 (35) & 1-1/2 (38) | 5 | 4-3/8 | 30000 |
| **D20** | 5/8 (M16) | 2 (51) | 4 | 3-7/8 | 22500 |
| **D20** | 3/4 (M20) | 2 (51) | 4 | 3-7/8 | 40000 |
| **D20** | 7/8 (M22) | 2 (51) | 4 | 3-7/8 | 50000 |
| **D20** | 1 (M24) | 2 (51) | 4 | 3-7/8 | 50000 |
| **D20** | 1-1/8 (M27) | 2 (51) | 4 | 3-7/8 | 40000 |
| **D33** | 1-1/8 (M27) | 2-1/2 (63) | 4 | 3-7/8 | 70500 |
| **D33** | 1-1/4 (M30) | 2-1/2 (63) | 4 | 3-7/8 | 70500 |
| **D33** | 1-3/8 (M33) | 2-1/2 (63) | 4 | 3-7/8 | 70000 |

+ Also available in lag threads ® Registered trademark ** Customer owned product

# Slotted 2 Leaf Bail Type Assemblies

**F1¼B** Recommended for general use. Available with straight top or popout bail.


**FL1¼®** Recommended for general use. Available with straight top or popout bail, or grout through hole in bail.

**F2B®** Recommended for general use.

**F1⅜B** Recommended for general use.

| Style | Thread Size UNC or (metric) | Drill Hole Size in. (mm) | Shell Length In. | Wedge Length In. | Non-Seizure Load Lbs. |
|---|---|---|---|---|---|
| **F1-1/4B** | 5/8 (M16) | 1-1/4 (32) | 3-1/4 | 1-3/4 | 22500 |
| **F1-1/4B** | 3/4 (M20) | 1-1/4 (32) | 3-1/4 | 1-3/4 | 30000 |
| **FL1-1/4*** | 5/8 (M16) | 1-1/4 (32) | 3-1/4 | 2-1/8 | 22500 |
| **F2B** | 5/8 (M16) | 1-3/8 (35) | 2-7/8 | 1-3/8 | 17000 |
| **F2B** | 3/4 (M20) | 1-3/8 (35) | 2-7/8 | 1-3/8 | 30000 |
| **F1-3/8B** | 5/8 (M16) | 1-3/8 (35) | 2-7/8 | 1-3/8 | 17000 |
| **F1-3/8B** | 3/4 (M20) | 1-3/8 (35) | 2-7/8 | 1-3/8 | 30000 |

# 3 Leaf Bail Type Assemblies

**EF3**
Recommended for general use. Available with spring tensioner and popout bail top.

**FSL**
Recommended for general use. Available with spring tensioner and popout bail top.

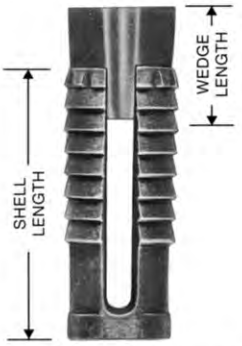
| Style | Thread Size UNC or (metric) | Drill Hole Size in. (mm) | Shell Length In. | Wedge Length In. | Non-Seizure Load Lbs. |
|---|---|---|---|---|---|
| **EF3** | 5/8 (M16) | 1-1/4 (32) – 1-3/8 (35) | 2-5/8 | 1-3/8 | 22500 |
| **FSL** | 5/8 (M16) | 1-1/4 (32) – 1-1/2 (35) | 2-5/8 | 1-3/8 | 22500 |

® Registered trademark  * Patented item

# Standard 4 Leaf Type Assemblies

**B1H** Recommended for resin encapsulation anchorage. Requires support nut during installation.

**F1¼ Standard** Recommended for general use. Requires support nut during installation.




**D8S®** Recommended for general use. Requires support nut during installation. Also available with 1⅜ long D8 wedge.

**D8LP** Recommended for soft rock and high torque installations. Requires support nut during installation.

**D9** Recommended for resin encapsulation anchorage. Requires support nut during installation.

**D15** Recommended for genera use. Requires support nut for installation.

| Style | Thread Size UNC or (metric) | Drill Hole Size in. (mm) | Shell Length In. | Wedge Length In. | Non-Seizure Load Lbs. |
|---|---|---|---|---|---|
| **B1H* **** | 5/8 (M16) | 1-1/32 (26) | 2-3/8 | 1-3/16 | 22500 |
| **F1-1/4STD** | 5/8 (M16) | 1-1/4 (32) | 3-1/2 | 1-3/4 | 22500 |
| **F1-1/4STD** | 3/4 (M20) | 1-1/4 (32) | 3-1/2 | 1-3/4 | 30000 |
| **D8S** | 5/8 (M16) | 1-3/8 (35) | 3-1/8 | 1-1/4 | 17000 |
| **D8S** | 3/4 (M20) | 1-3/8 (35) | 3-1/8 | 1-1/4 | 30000 |
| **D8** | 3/4 (M20) | 1-3/8 (35) | 3-1/8 | 3-3/8 | 30000 |
| **D8LP**** | 5/8 (M16) | 1-3/8 (35) | 3-1/8 | 1-13/16 | 22500 |
| **D8LP**** | 3/4 (M20) | 1-3/8 (35) | 3-1/8 | 1-13/16 | 30000 |
| **D9*** | 7/8 (M22) | 1-3/8 (35) | 3-1/4 | 2 | 38000 |
| **D15** | 3/4 (M20) | 1-1/2 (38) | 3-7/8 | 2 | 30000 |
| **D15** | 7/8 (M22) | 1-1/2 (38) | 3-7/8 | 2 | 38000 |
| **D15** | 1 (M24) | 1-1/2 (38) | 3-7/8 | 2 | 40000 |

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# Tension & Torque Nuts

**FJT 1& 2**
**Dome Nut**
Recommended for normal resistance torque mixing applications.

**FJT 3 & 4**
**Hex Dome Nut**
Recommended for high resistance torque mixing applications.

**FJT 5**
**Dome Nut**
Recommended for normal resistance torque mixing applications.

**FJT 8**
**Split Dome Nut**
Recommended for low resistance torque mixing applications.

**1-1/8**
**Square Nut**
General use.

Top View Bottom View

**FSN**
Used to induce and maintain bolt tension w/spherical flange for anchoring upon irregular surfaces. Can be used in shear-pin & reverse-spin torque applications.

**F&J Flange Nut**
Generally used to induce and maintain bolt tension often used in shear-pin & reverse-spin torque applications.

| Style (Part No.) | Nut Type | Thread Sizes UNC or (metric) | Wrench Size In. | Flange Dia. In. | Mixing Torque[1] (Ft. Lbs.) | Ultimate Load Lbs. |
|---|---|---|---|---|---|---|
| **FJT1*** | Sq. Head Dome Nut, Lg. Flange | 5/8 (M16) | 1-1/8 Sq. | 1-3/4 | 55 | 35000 |
| **FJT1*** | Sq. Head Dome Nut, Lg. Flange | 3/4 (M20) | 1-1/8 Sq. | 1-3/4 | 80 | 50000 |
| **FJT2*** | Sq. Head Dome Nut, Lg. Flange | 7/8 (M22) | 1-3/8 Sq. | 1-3/4 | 90 | 65000 |
| **FJT3*** | Hex Head Dome Nut | 3/4 (M20) | 1-7/16 Hex | 1-3/4 | 150 | 50000 |
| **FJT3*** | Hex Head Dome Nut | 7/8 (M22) | 1-7/16 Hex | 1-3/4 | 150 | 65000 |
| **FJT4*** | Hex Head Dome Nut | 1 (M24) | 1-5/8 Hex | 1-3/4 | 200 | 80000 |
| **FJT5*** | Sq. Head Dome Nut, Sm. Flange | 5/8 (M16) | 1-1/8 Sq. | 1-7/16 | 55 | 35000 |
| **FJT5*** | Sq. Head Dome Nut, Sm. Flange | 3/4 (M20) | 1-1/8 Sq. | 1-7/16 | 80 | 50000 |
| **FJT8*** | Sq. Head Split Dome Nut | 3/4 (M20) | 1-1/8 Sq. | 1-3/4 | 35-55 | 50000 |
| **F&J Flange Nut** | Sq. Head, Large Flange | 5/8 (M16) | 1-1/8 Sq. | 1-3/4 | — | 35000 |
| **F&J Flange Nut** | Sq. Head, Large Flange | 3/4 (M20) | 1-1/8 Sq. | 1-3/4 | — | 50000 |
| **F&J Flange Nut** | Sq. Head, Large Flange | 7/8 (M22) | 1-1/8 Sq. | 1-3/4 | — | 65000 |
| **1-1/8 Square Nut** | Square | 5/8 (M16) | 1-1/8 Sq. | None | — | 35000 |
| **1-1/8 Square Nut** | Square | 3/4 (M20) | 1-1/8 Sq. | None | — | 45000 |
| **1-1/8 Square Nut** | Square | 7/8 (M22) | 1-1/8 Sq. | None | — | 60000 |
| **FSN** | Spherical Tension Nut | 5/8 (M16) | 1-1/8 Sq. | 2 O.D. X 3/4 H Spherical Seat | — | 35000 |
| **FSN** | Spherical Tension Nut | 3/4 (M20) | 1-1/8 Sq. | 2 O.D. X 3/4 H Spherical Seat | — | 50000 |
| **FSN** | Spherical Tension Nut | 7/8 (M22) | 1-1/8 Sq. | 2 O.D. X 3/4 H Spherical Seat | — | 65000 |
| **FSN** | Spherical Tension Nut | 1 (M24) | 1-1/8 Sq. | 2 O.D. X 3/4 H Spherical Seat | — | 80000 |

* Patented item

# Spherical Seats

FSW & FSW-1

FSW-2 & 4

FSW-2-1/4

Recommended for use as bolt head support when anchoring in an irregular mine roof surface.

**FSW-HD**

Recommended for demanding conditions requiring heavy duty roof plates.

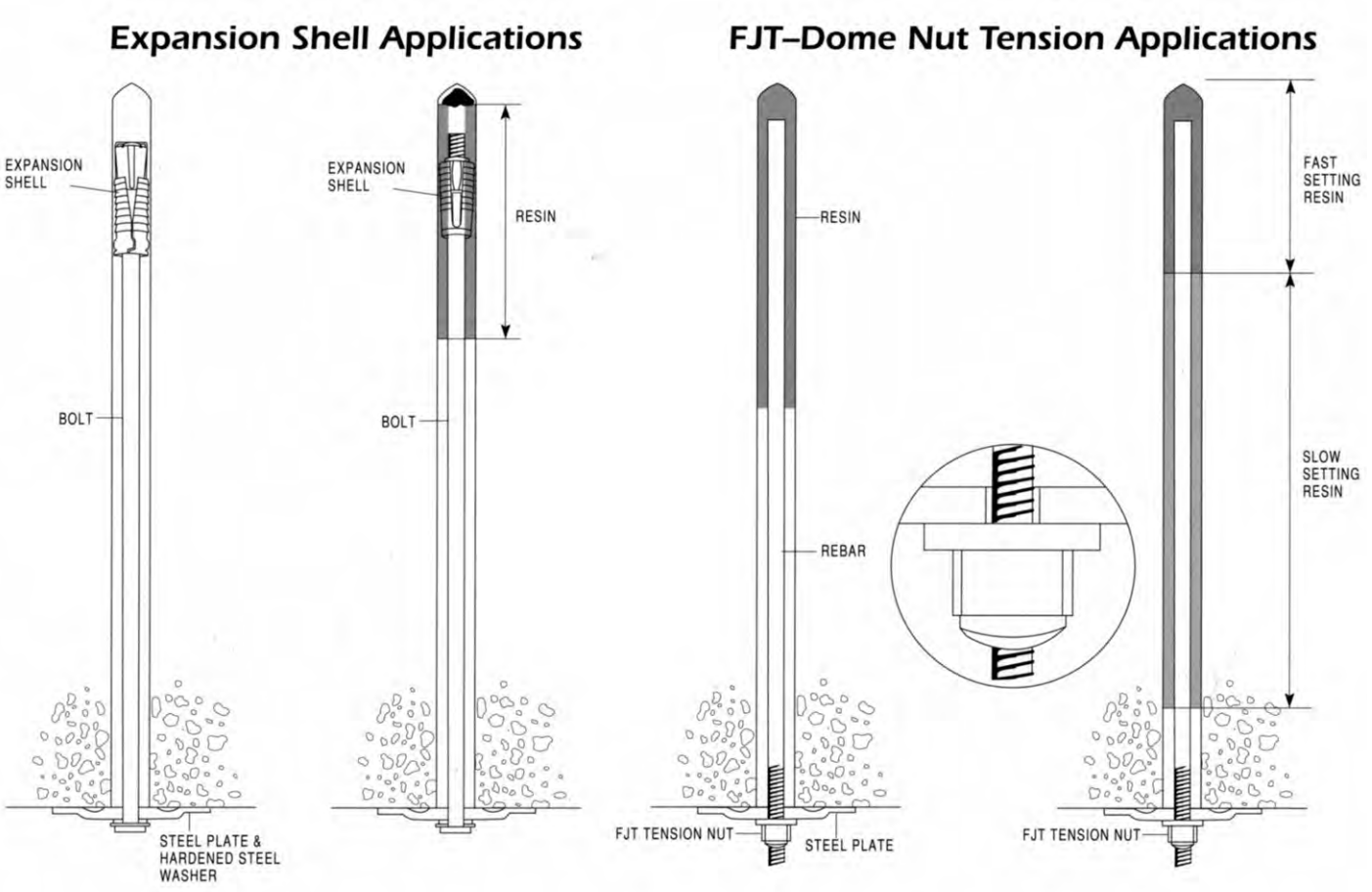
Top View

Bottom View

**FSW-3**

Recommended for use with threaded both ends (TBE) bolt and support nut when anchoring in an irregular mine roof surface.

| Style (Part No.) | Spherical Seat Part Name | Accepts Bolt Thread Size UNC or (metric) | Dimensions In. |
|---|---|---|---|
| **FSW** | Standard Spherical Seat | 5/8 (M16) and 3/4 (M20) | 2 O.D. X 1/2 H X 15/16 I.D. |
| **FSW-1** | Standard Spherical Seat | 7/8 (M22) and 1(M24) | 2 O.D. X 1/2 H X 1-1/16 I.D. |
| **FSW-2** | Standard Spherical Seat | 5/8 (M16) | 2 O.D. X 3/4 H X 11/16 I.D. |
| **FSW-2-1/4** | Large Diameter Spherical Seat | 1-1/4 (M30) | 2-1/4 O.D. X 1/2 H X 1-9/32 I.D. |
| **FSW-4** | Standard Spherical Seat | 3/4 (M20) | 2 O.D. X 13/16 H X 13/16 I.D. |
| **FSW-3*** | Standard Spherical Seat with support nut recess | 5/8 (M16) | 2 O.D. X 3/4 H X 11/16 I.D. |
| **FSW-HD** | Heavy Duty Spherical Seat | 1 (M24) | 2 O.D. X 3/4 H X 1-1/32 I.D. |




## Non-Seizure Load

*THE LOAD AT WHICH THE MINE ROOF SUPPORT ANCHOR CAN BE TAKEN TO, WHILE IN COMPRESSION, WITHOUT THREAD SEIZURE.*

Non-Seizure load specifications should not be exceeded at installation; nor should bolt yield be exceeded at installation.

## Anchor Zone

*THE AREA OF THE DRILLED BORE HOLE THAT THE MINE ROOF SUPPORT ANCHOR WILL COME IN CONTACT WITH AND RELY ON TO SUPPORT THE MECHANICAL TENSIONING SYSTEM.*

Mine roof support anchors require competent rock strata in the anchor zone. The suitability of the rock anchor zone and specific mine roof support anchor to be used is best determined by actual testing at the mine site.

## Resin and Grouted Encapsulated Anchors

*MINE ROOF SUPPORT ANCHORS USED IN CONJUNCTION WITH RESIN OR GROUT.*

Although some anchors have been designed for specific resin and grout encapsulation applications, field experience has determined that virtually all anchors can be encapsulated. The suitability of combining mine roof support anchors with resin is best determined by actual testing at the mine site.

# Troubleshooting

*The installation and reliability of mine roof support anchors and tension nuts can be enhanced with an understanding of the most common problems encountered during and after installation. The following is a trouble shooting guide for those installation problems most often encountered.*

## Mine Roof Support Anchors

### Anchor does not go in bore hole

- Drill bit undersized
- Anchor pre-expanded

### Anchor goes into expansion but bolt does not put roof in compression

- Depth of bore hole too short

### Plug/wedge pulls through shell

- Strata conditions too soft
- Oversized bore hole; wrong size roof support anchor

### Threads strip

- Major diameter of bolt threads undersized
- Minor diameter of plug/wedge threads oversized
- Plug/wedge material properties too soft
- Insufficient thread engagement

### Support nut failure

- Support nut shear resistance too low
- Bolt threads undersized
- Support nut running off bolt thread
- Support nut upside down

### Bolt springs back when checking torque

- Thread zone between bolt and anchor seized
- Threaded bolt end hitting end of bore hole
- Bolt loaded higher than torque test

### Anchor spins in bore hole

- Strata too soft to take anchorage
- Strata too friable to take anchorage
- Bore hole depth too short
- Bore hole oversized
- Bolt thread runout
- Anchor and bolt thread pitch diameters not compatible
- Support nut prematurely fails (see support nut under problem column)
- Anchor style too rigid for strata conditions
- Dirt in exposed bolt threads causing seizure
- Tube/sleeve/band not removed from expansion unit
- Bolt cuts through bail or pierces bail pop put before satisfactory anchorage takes place
- Resin acting as a lubricant
- Resin cartridge material encapsulates mechanical anchor (gloving condition)

### Anchor goes only part way into bore hole or bolt bends on insertion

- Bore hole not straight
- Bore hole depth too short
- Bendable bolt not straightened sufficiently
- Bore hole undersized
- Inserting anchor too fast for bore hold condition
- Insufficient resin passage between anchor and bore hole
- Resin cartridge not being pierced on insertion
- Anchor pre-expanded

### Torque loss (bleed off)

- Excess flashing on bolt head
- Hitting head of bolt with hammer or object
- Installed on wood header board
- Blasting/shooting roof crushing (soft or irregular roof line)
- Wet condition in bore hole
- Undersized bore hole in very hard rock
- Plug/wedge unable to sufficiently engage in shell
- Excessive thrust on bolter
- Severe installation angle
- Bolt hole drilled same length as bolt used (topping off)

## Mine Roof Tension & Torque Nuts

### Bore hole depth too short

- Threaded bolt end not seated against inner surface of dome prior to installation

### Dome nut shear mechanism (dome) prematurely fail

- Major diameter on bolt thread undersized
- Bore hole not straight
- Bendable rebar not straightened sufficiently
- Mixing too much resin in initial surge
- Resin mix time too fast
- Dome I.D. too large

### Installed torque too low

- Bore hole depth too short
- Bolt thread runout
- Resin problem

### Threads strip

- Major diameter of bolt threads undersized
- Minor diameter of dome nut threads oversized
- Insufficient thread engagement

### Dome nut destructs at high loads

- Roof plate load rating insufficient
- Plate is flexing, transferring load to periphery of dome nut
- Load exceeds product specification
- Roof plate hole diameter too large

### Dome nut shear mechanism (dome) does not shear

- Insufficient torque on installation equipment
- Resin either over-mixed or under-mixed (rebar rotates with dome nut)

Since 1952 Frazer & Jones has been the source for
dependable quality mine roof support products

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