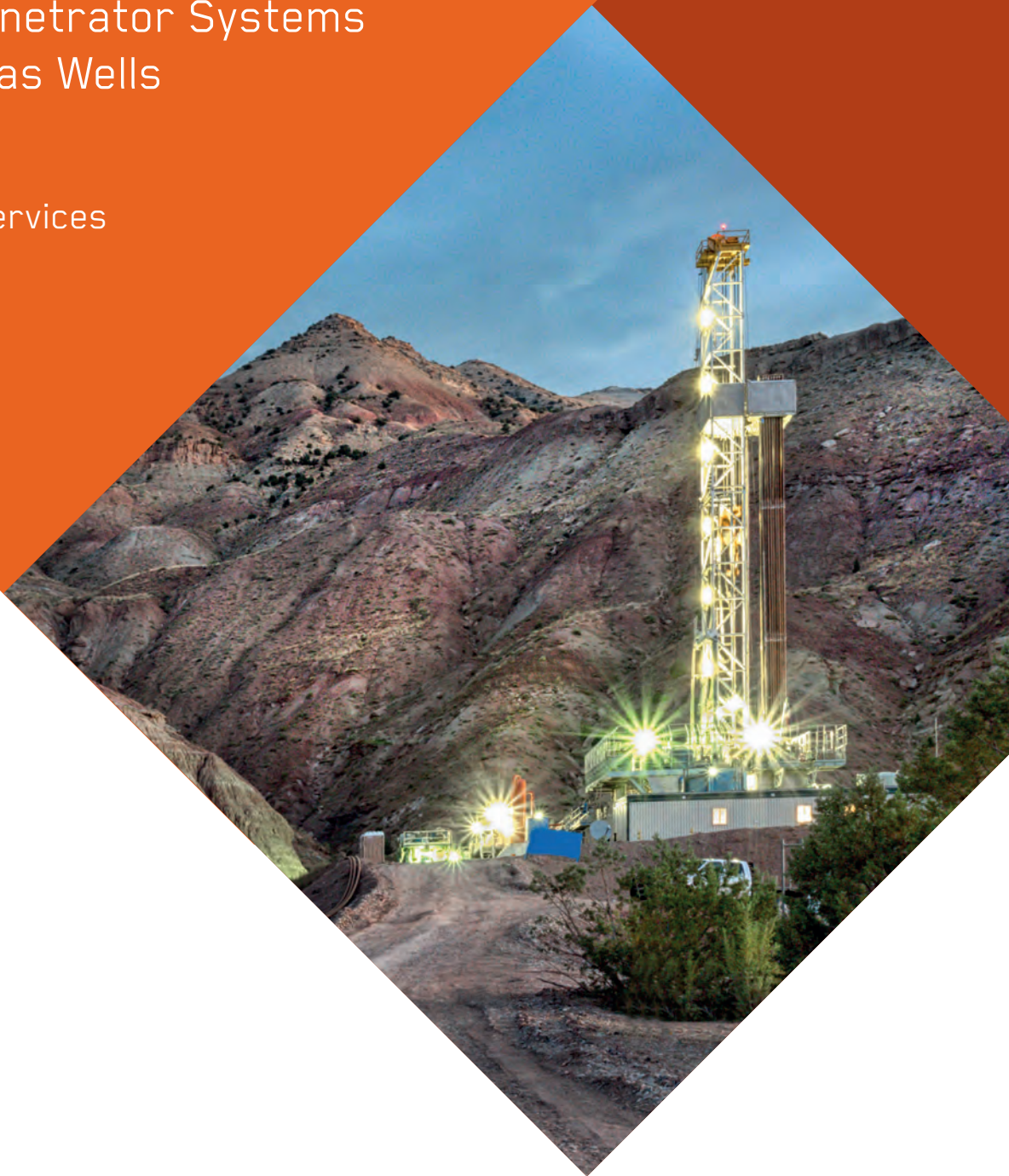


**biw** connector  
systems

# Electrical Penetrator Systems for Oil and Gas Wells

Products and Services



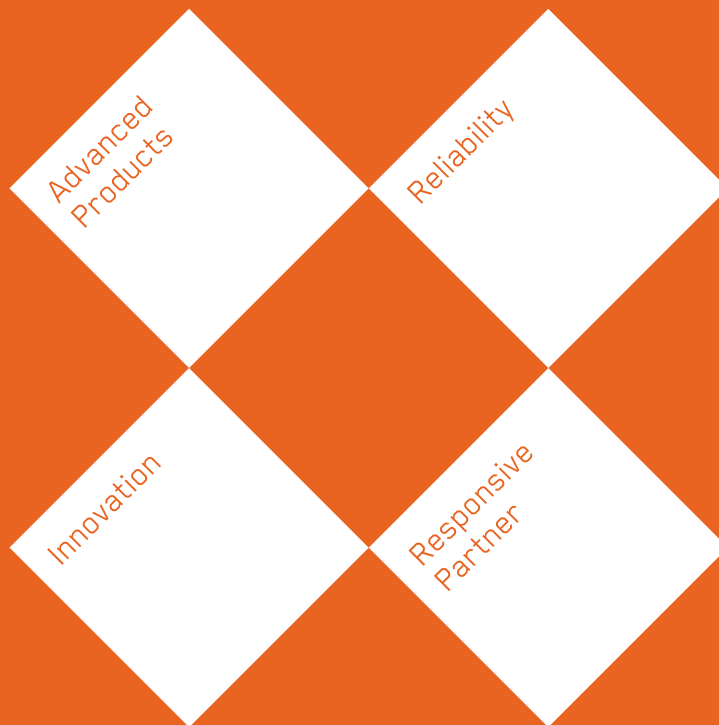
**ITT**



For more than four decades, BIW Connector Systems has been the industry-leading supplier of electrical penetrator systems used by the upstream oil and gas market. Applications include safety barriers for electric submersible pump (ESP) systems, oil reservoir monitoring instruments, downhole heaters and ESP isolation systems. We operate on a global basis serving customers in every major oil center in the world.

At BIW Connector Systems, our commitment to designing and delivering quality products, solutions and services is unwavering. We also certify our products through recognized test laboratories to worldwide specifications for hazardous location environments, including the National Electric Codes of the USA and Canada, ATEX and IEC, among others. BIW Connector Systems is certified to ISO9001:2015.

In 2001, BIW Connector Systems became part of ITT Inc., a diversified leading manufacturer of highly engineered critical components and customized technology solutions for the transportation, industrial, and oil and gas markets. Together, ITT and BIW Connector Systems foster a culture of innovation, resourcefulness and continuous improvement that helps us solve our customers' most pressing business challenges.



## Advanced Products

BIW Connector Systems supplies the oil and gas industry with a breadth and depth of innovative products and breakthrough solutions. Our state-of-the-art engineering, testing and production capabilities, combined with high-performance elastomeric, thermoplastic and pressure-balanced technologies, allow us to deliver robust products that perform continuously and reliably in the harshest environments.

## Reliability

Product reliability is critical in the upstream oil and gas production market. If any part of the production string fails, the well goes down and valuable revenue opportunity is lost. BIW Connector Systems invests significant resources in design and testing to ensure our products withstand the extreme, harsh environment of a production well.

## Responsive Partner

Our customers need partners and suppliers that move at the speed of their business. That's where BIW Connector Systems comes in. When an oil well is down, we help you quickly get it back into service. When deliveries need to arrive sooner, our infrastructure is nimble and flexible enough to accommodate. And when there are last minute design changes, we have both the expertise and production facilities to execute. At BIW Connector Systems, we move at the speed of business—and then some.

## Innovation

When quality design and engineering are at the core of your DNA, innovation, performance and reliability become the standard. At BIW Connector Systems, we carefully balance the development of new solutions and technology with improvements to existing products, ensuring that our customers receive value at every touch point.

Looking for a specific product? Not sure what product you need?  
See our Product Index on pp 22-23.

# Wellhead Applications

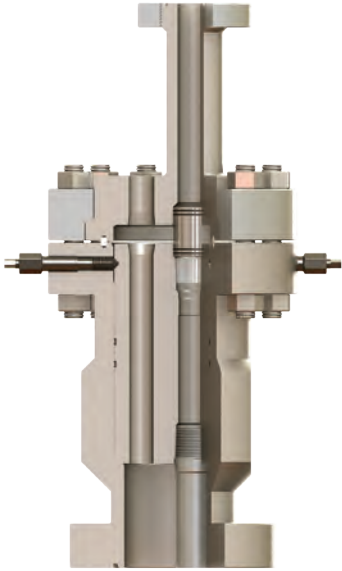
## Electrical Penetrators for Wellheads

A wellhead provides the most critical safety barrier between the oil well and the surrounding environment. The electrical wellhead penetrator is designed to safely deliver electrical energy through this critical barrier to operate electric submersible pumps deep in the well. Requirements for relatively high voltage and current, together with wide variation in operational temperatures of wellhead systems, add significant challenges.

Length variations and physical characteristics of the wellhead penetrator are the result of differences in wellhead designs and the need to seal against wellhead sealing structures, the tubing hanger and the top flange or “bonnet.” General configurations of wellhead penetrators can be divided into three groups. The shortest penetrators are used in wellheads that do not employ a top flange. Medium sized penetrators are used in wellheads that have top flanges, and the longest penetrators are used in wellhead with long tubing hangers and/or large top flange structures.

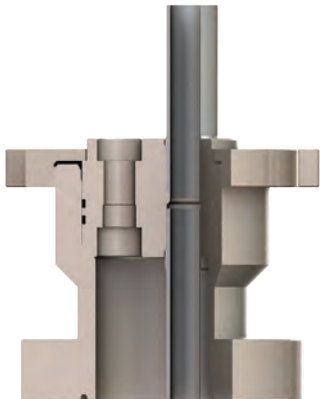
BIW’s wellhead penetrator systems have provided important sealing protection for the oil and gas industry over the last four decades. Our products are installed in thousands of wellheads around the globe and have a proven track record in meeting the requirements of each application.

BIW Connector Systems’ wellhead penetrators deliver high power through the critical safety barrier between the oil well and its surrounding environment.



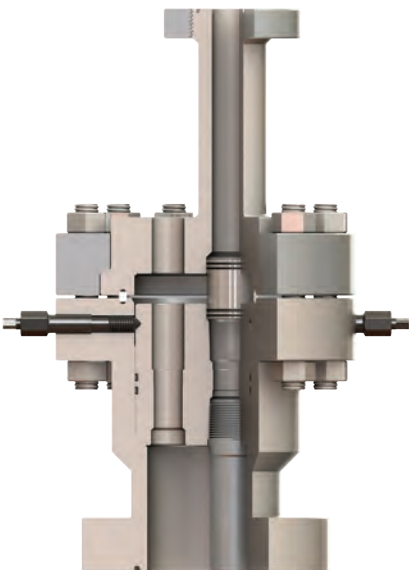
### Wellheads with Bonnet

A bonnet or adapter flange is used in high pressure applications. These applications are rated for 5000 psi or greater and all off-shore installations will include a bonnet. BIW's penetrator systems for this application are designed to work in the harshest environments, and in most cases, the system is made up of three pieces: surface connector, penetrator/mandrel and lower connector. These three pieces provide the complete pressure block insuring the integrity of the wellhead.



### Wellheads without Bonnet

Wellheads that do not have a bonnet are typically used in lower pressure applications and are sometimes referred to as non-API or independent wellheads. These wellheads are typically rated for 3000 psi or lower. BIW has designed 1, 2, and 3-piece penetrator systems that all provide a complete safety block while delivering reliable power. These systems are a safe and reliable replacement for cable packoffs.



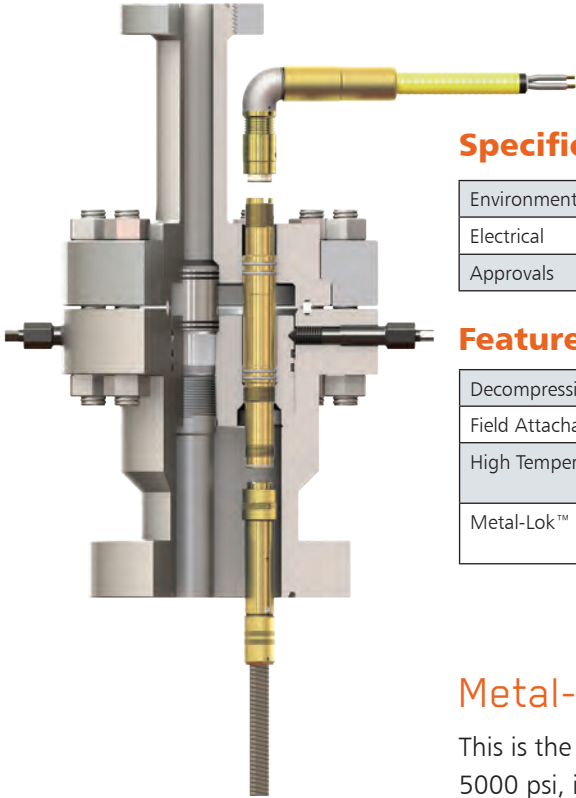
### Wellheads with Long Hanger

Long hangers are typically used when the wellhead has extended length. These wellheads usually require special penetrator systems that have a small penetrator bore profile. BIW's solutions to these types of wellheads are 2-piece systems that consist of a surface connector and mandrel/lower connector made up as 1-piece. These systems are easy to install and provide the same safety and reliable power as all of BIW's other systems.

# Wellhead Penetrator Systems

## Metal-Lok™ High Temperature (HT) - Gen 3

The Metal-Lok HT Wellhead Penetrator System is rated 450°F (232°C) and 3000 psi and is suitable for some of the most challenging downhole conditions. This product has been subjected to BIW Connector Systems' qualification regimen, proving its robustness and reliability. This product is provided with a field attachable lower, which eliminates the need for a rig splice, making installation both quick and easy. It is designed to be used in higher temperature well applications on wellheads with bonnets. The Second Generation product features new, high technology elastomers and components.



Metal-Lok Ultra in wellhead with bonnet

### Specifications

Environmental	450°F (232°C), 3000 psi
Electrical	5000 VAC, 140 to 160 Amperes
Approvals	CSA approved for Class 1, Division 1, Groups C and D Hazardous Locations

### Features

Decompression-Resistant	Increased product lifetime and reliability downhole
Field Attachable	Eliminates need for a rig splice and is highly adaptable to your ESP cables
High Temperature Materials	Suitable for use in applications with a maximum conductor temperature of 450°F (232°C)
Metal-Lok™ Keying	Prevents damage that could result from inadvertent turning or mishandling of the surface connector

## Metal-Lok™ Hi Amp - Second Generation

This is the workhorse of the Metal-Lok family. Rated and tested to 300°F (149°C) and 5000 psi, it covers the majority of ESP well applications and is designed and tested to handle harsh environments. The use of PEEK and the minimal use of elastomers make it highly resistant to downhole pressure decompression. This product has been subjected to BIW's qualification regimen, proving its robustness and reliability. This system is designed to work in wellheads with or without bonnets. The Second Generation product features new, high technology elastomers and components.

### Specifications

Environmental	300°F (149°C), 5000 psi
Electrical	5000 VAC, 140 to 215 Amperes
Approvals	CSA approved for Class 1, Division 1, Groups C and D Hazardous Locations. IEC and ATEX Certification Exd IIB T4 G

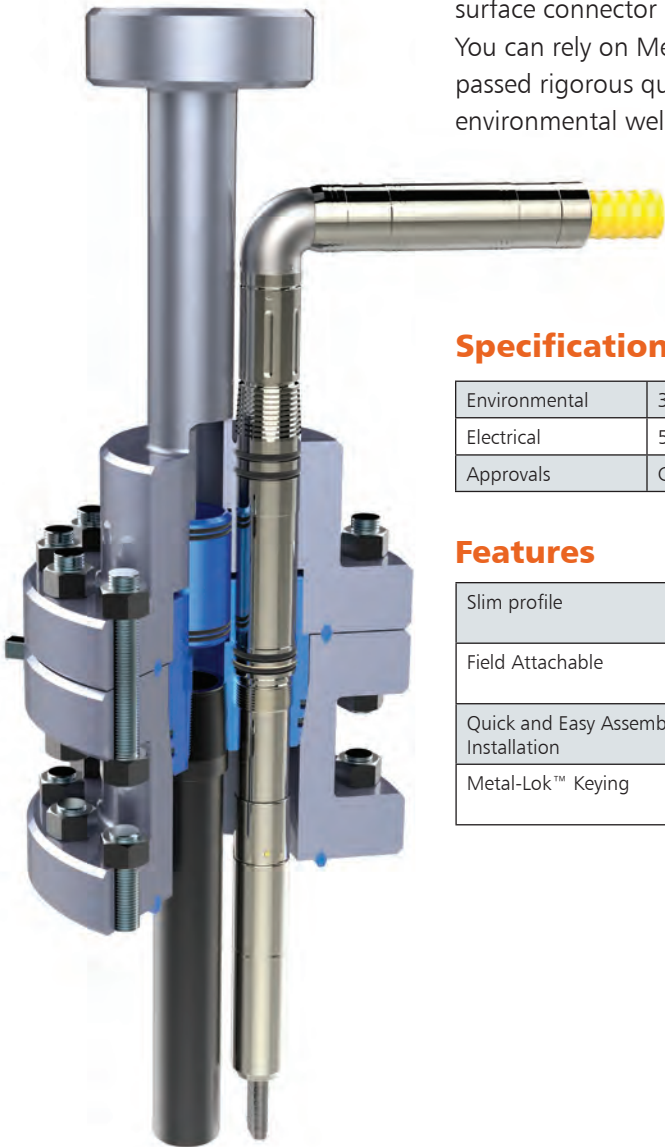
### Features

Decompression-Resistant	Decompression-resistant
Field Attachable Lower	Eliminates need for a rig splice and is highly adaptable to your ESP cables
Metal-Lok™ Keying	Prevents damage that could result from inadvertent turning or mishandling of the surface connector



## Metal-Lok™ Slimline - Gen 3

The Metal-Lok Slimline is a versatile new product in the BIW line. It is designed to fit into a smaller sealing bore, as small as 2.25", and is suitable for 300°F, 5000 psi service. The system comes with BIW's innovative Crimp-free contact, completely eliminating the need for crimp tools. This new contact withstands a minimum of 1000 pounds of pull force, making it stronger than most crimped contacts. The crimp-free contacts will reduce the installation complexity, saving precious rig time. The product also includes a new sealing design that requires just one kit for each cable size, eliminating the need for cable-specific sealing elements and reducing stocking inventory and confusion. BIW's innovative Quick-Thread™ technology at the surface connector requires only a little more than one turn for complete engagement. You can rely on Metal-Lok Slimline, like you do all BIW products, because it has passed rigorous qualification testing at temperature, pressure and decompression in environmental well fluids and gas while under electrical monitoring.



### Specifications

Environmental	350°F (176°C), 5000 psi
Electrical	5000 VAC, 180 Amperes
Approvals	CSA approved for Class 1, Division 1, Groups C and D Hazardous Locations

### Features

Slim profile	Fits in tight annular spaces and in smaller bore tubing hangers (2.25" diameter). Short Surface and Lower Connectors.
Field Attachable	Field attachable design eliminates a downhole splice and is highly adaptable to all ESP cables
Quick and Easy Assembly/Installation	Connector is preassembled making it the quickest installation offered by BIW
Metal-Lok™ Keying	Prevents damage that could result from inadvertent rotation or mishandling of the surface connector

Metal-Lok Slimline with BIW's Quick-Thread™ Technology

# Wellhead Penetrator Systems

## Metal-Lok™ Ultra with k-PaC™ Technology - Gen 3

This system features a new high temperature feedthru and lower connector design that is suitable for use to 500°F (260°C) and pressures of up to 3000 psi. The downhole field attachable connector features BIW Connector Systems' groundbreaking k-PaC Technology, a pressure-balanced design that compensates for normally destructive thermal expansion pressure variation and operates over a wide temperature range. Metal-Lok Ultra was designed to withstand extended exposure to steam, multiple temperature cycles and SAGD wells.

### Specifications

Environmental	500°F (260°C), 3000 psi
Electrical	5000 VAC, 140 Amperes
Approvals	CSA Approval for Hazardous Location Installation, Class 1, Division 1 Groups C and D

### Features

Decompression-Resistant	Increased product lifetime and reliability downhole
Field Attachable	Field attachable lower requires no splice and is highly adaptable to your ESP cables
High Temperature	Innovative k-PaC Technology enables applications with an ambient temperature of up to 500° F (260°C)
Metal-Lok™ Keying	Metal-Lok Keying positively prevents damage that could result from inadvertent turning or mishandling of the surface connector

## EFT®

EFT penetrator products have been safely sealing and passing power through 5000 psi-rated wellheads for more than 20 years. With more than 10,000 installations, the EFT Wellhead Penetrator System has proven that it is a mainstay in the ESP market. The surface and lower connector can be provided in a field attachable kit and configured to your cable preference, making it a quick, flexible and cost-effective option. These systems can also be provided with cable pigtailed and are designed to work in systems with or without bonnets.

### Specifications

Environmental	300°F (149°C), 5000 psi
Electrical	5000 VAC, 180 Amperes
Approvals	Some versions available for Class 1, Division 1 Hazardous locations

### Features

Thousands Installed	Making it one of the most proven penetrator systems on the market
Field Attachable	Field attachable lower connector eliminates downhole splice and streamlines installation
Standard Sizes	Enables quick lead-time and repeatable performance
Three-Piece Versatility	Versatile 3-piece system makes installation and work-overs a breeze, saving rig time



Metal-Lok Ultra Penetrator System with k-PaC Technology





3-Piece Rubber Molded Feedthru System

## Rubber Molded 3-Piece and Rubber Molded 2-Piece (FTLM)

BIW Connector Systems' Vulcanized Elastomer Electric Penetrator designs have long been recognized for superior performance. These products are manufactured using a variety of metallurgies. Internal pressure blocking elements are made from high performance epoxy resins and include vulcanized elastomer seals. Throughout the years, these products have been meticulously improved. Modern epoxy resins retain their mechanical properties at very high temperatures and elastomers offer superb electrical and sealing characteristics.

Today's products are optimized for long life and utmost safety, with approvals for use in hazardous locations from ATEX, IEC, CSA and Factory Mutual. We offer more than 2,000 part numbers, a product range unmatched by all other suppliers combined. Our vulcanized elastomer solutions are just one of several technologies that meet your needs for safe, reliable, and easy-to-use penetrator systems.

Most surface connectors are supplied with coupling rings retained by ball bearings. This retention method ensures longer life, better resistance to corrosion, and easier engagement.

Many surface connectors are also supplied with replaceable sealing elements. These new seals consist of O-rings that are easily replaced with a special tool.



### Specifications

Environmental	300°F (149°C), 5000 psi
Electrical	5000 VAC, up to 215 Amperes
Approvals	Systems available with CSA and FM for Class 1, Division 1 Hazardous Locations; ATEX for Hazardous Locations; IEC for Hazardous Locations

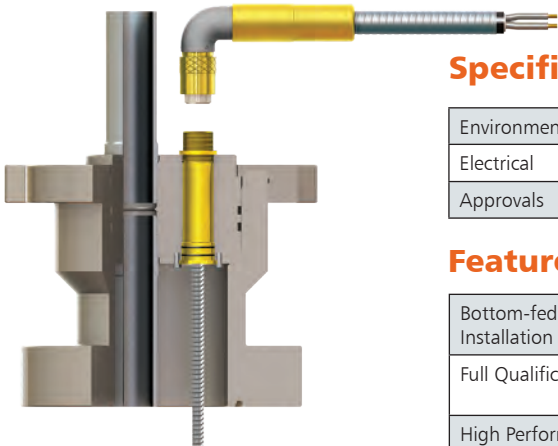
### Features

2- and 3-Piece Penetrator Systems	Separable Surface Connectors allow for fast and easy installation
Ball Bearing Coupling Ring on Surface Connectors	Ball Bearing Coupling Ring on Surface Connectors provide the same reliability, and makes installation easier
Field Attachable, Factory Molded	Field Attachable and Factory Molded Lower Connectors provide flexibility to meet your installation needs
Lip Seal Design	The Lip Seal Design to provides a secondary seal from ingress, increasing reliability
Replaceable Sealing Elements on Surface Connectors	Replaceable sealing elements on surface connectors allow for re-use on used connectors, saving both time and money

# Wellhead Penetrator Systems

## E-Zee Feed<sup>®</sup> and 5000 psi E-Zee Feed<sup>®</sup> - Gen 3

The E-ZEE Feed Wellhead Penetrator System is designed for easy conversion from cable pack-off with minimal wellhead modifications. It is supplied as a field attachable kit. This two-piece, "stab-in" design reduces cable handling issues by permitting fast coupling of the surface cable to the penetrator, making it is easy to install or to pull during workovers. The E-Zee Feed comes in both 3000 psi and 5000 psi versions to accommodate most wellhead pressure ratings. The E-Zee Feed is available for applications requiring certification for hazardous locations and for applications where this is not required.



E-ZEE Feed Field Attachable Wellhead Feedtrhu System now available in 3000 and 5000 psi

### Specifications

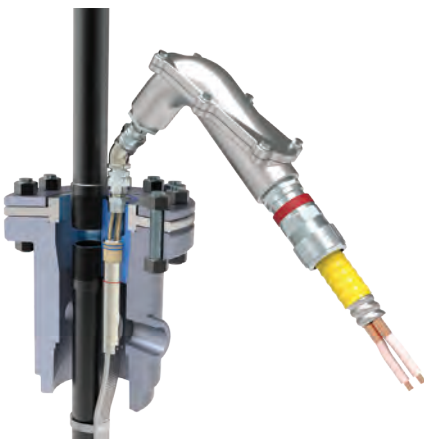
Environmental	Proof Tested to 13,500 psi, 300°F (149°C), 3000 and 5000 psi
Electrical	5000 VAC, 215 Amperes
Approvals	CSA approved for Class 1, Division 1, Groups C and D Hazardous Locations

### Features

Bottom-fed Field Attachable Installation	Bottom-fed installation, coupled with field attachable design, provide the easiest, quickest and most reliable installation
Full Qualification	Proven reliability by passing BIW's rigorous qualification testing and numerous successful field installations
High Performance Materials	High strength, high temperature insulators provide safety and reliability

## Uni-Lok<sup>™</sup> Wellhead Penetrator - Gen 3

The Uni-Lok Wellhead Penetrator System is designed to provide the quickest and easiest pass-through of ESP power at a very competitive price. Unlike other products, the Uni-Lok system offers a complete verified pressure block inside the tubing hanger ensuring that downhole fluids stay downhole. This field attachable system is designed as a single plug-and-play pressure barrier that fits into sealing bores as small as 1.75" and to have the flexibility to fit/re-use any existing surface cable infrastructure. It has passed BIW's rigorous testing protocol and is available for applications requiring certification for hazardous locations and for applications where this is not required.



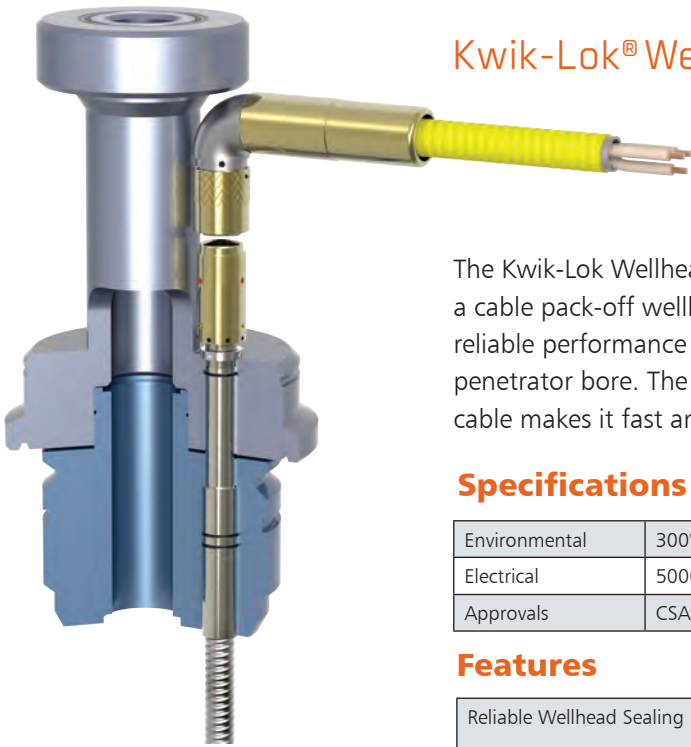
Uni-Lok Wellhead Penetrator System

### Specifications

Environmental	300°F (149°C), 3000 and 5000 psi
Electrical	5000 VAC, 160 Amperes
Approvals	Pending CSA Class 1, Division 1, ATEX and IEC Hazardous Locations

### Features

Slim profile	Fits in tight annular spaces and in smaller bore tubing hanger (1.75") that fits nearly all tubing hangers
Field Attachable	Field attachable design eliminates a downhole splice and is highly adaptable to all ESP cables
Well Control	Provides a complete pressure block in the tubing hanger, guaranteeing that well fluids and gases stay downhole
Versatility	Designed to re-use existing surface installation or be installed onto existing surface cable



## Kwik-Lok® Wellhead Penetrator Systems

The Kwik-Lok Wellhead Penetrator System offers a safe, explosion-proof option to a cable pack-off wellhead penetration. This robust design and construction ensures reliable performance and long run life. The slim feedthru OD needs only a small penetrator bore. The bottom fed, stab-in feedthru design with downhole molded cable makes it fast and easy to install.

### Specifications

Environmental	300°F (149°C), 3000 and 5000 psi
Electrical	5000 VAC, 140 Amperes
Approvals	CSA approved for Class I, Division 1, Groups C and D Hazardous Location installation

### Features

Reliable Wellhead Sealing	Complete cable termination below the wellhead, which results in a reliable wellhead seal. Well fluids stay downhole, no need to vent
Slim Design	Slim design is great for use in small well casings. Requires seal bore of only 1.75" diameter.



## Safe-T-Lok®

The Safe-T-Lok Wellhead Penetrator System is a one-piece design that is a safe, reliable and an inexpensive replacement for cable packoffs. Unlike packoffs, the Safe-T-Lok provides a complete pressure block. This is done through a mandrel design with factory cable molded on both ends. The Safe-T-Lok requires splicing below the tubing hanger and is intended for use with independent wellheads, suitable for 3000 psi service.

### Specifications

Environmental	300°F (149°C), 3000 psi
Electrical	5000 VAC, 140 Amperes

### Features

Safe-T-Lok Feedthrus & Tubing Hangers	Safe-T-Lok feedthrus are suitable for use with "independent wellheads" if they are equipped with tubing hangers. Alternative configurations are available for different tubing hangers.
Compatible with most ESP Cable Sizes	Compatible ESP Cable Sizes: AWG4 Flat; AWG2 Round, AWG4 Round
Slim Design	Fits into wellheads too small for any other type of feedthru systems

# Wellhead Penetrator Systems

## Tri-Lok® 3-Bore

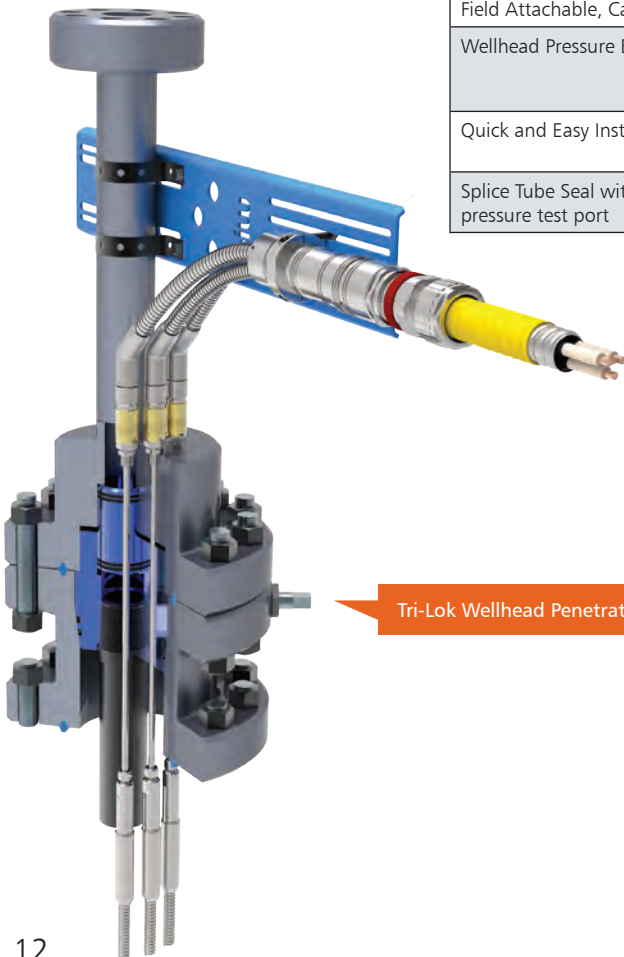
The Tri-Lok 3-Bore Wellhead Penetrator Systems are designed to provide safe and reliable ESP power transfer through wellheads with minimal space. The design of these systems are ideal for concentric wellheads, with or without bonnets, where there is not enough room for a standard mandrel system. The Tri-Lok system also provides the ultimate safety providing a complete pressure block and cable termination in the wellhead. The Tri-Lok 3-Bore Wellhead Penetrator System now comes with an improved surface connector, making it the most flexible and easiest to install 3-Bore product on the market. The new BIW Quick-Thread Technology connection eliminates tedious wrench turns, and the flexible leads make installation easy even in the tightest of locations. It can also be retrofitted to keep the surface cable in place. The new higher rating of 180 Amperes enables the use of this product with larger motors. The surface connector is available in field attachable or cable-molded configurations and is ATEX approved for hazardous locations. Connects to existing approved surface cables.

## Specifications

Environmental	350°F (176°C), 5000 psi
Electrical	5000 VAC, 205 Amperes
Approvals	CSA Class1, Division 2, ATEX and IEC for Hazardous Locations

## Features

Flexible Surface Connector	Multiple surface mounting configurations, which provides the flexibility to fit most wellheads, even those where space is limited
Field Attachable, Cable Molded	Flexibility to meet your specific installation
Wellhead Pressure Block & Seal	The complete pressure block and seal at wellhead keeps the well fluids in the well, which provides the ultimate safety and peace of mind without requiring a vent
Quick and Easy Installation	New patent pending quick-connection/disconnection technology that greatly reduces the installation time
Splice Tube Seal with optional pressure test port	Optional Pressure Test Port permits testing of Splice Tube primary seal



Tri-Lok Wellhead Penetrator with BIW's Quick-Thread™ Technology

# Tru-Lok™ 3-Bore with Junction Box Surface Connection



## Tru-Lok™ 3-Bore

The Tru-Lok 3-Bore Wellhead penetrator is the most cost effective system available for situations where wellheads are too small for a single, three-phase penetrator, or where the wellhead design is concentric. Below the tubing hanger, the system is identical to the Tri-Lok.

## Re-use of Pre-existing Surface Cable

Above the top flange, the tubing encased conductors enter a junction box, where the conductors are spliced to the surface cable. Connection to the surface cable within the junction box is field attachable. This offers the benefit of using existing surface cable, which may already have been installed at the well site, saving the cost of running new surface cable.

## Hazardous Location Approvals

The Tru-Lok Wellhead Penetrator System may be installed in locations where certifications for Hazardous Locations are required. For locations where North America certifications are desired, the system can be supplied with National Electric Code approvals under either Class I Division 1, or Class 1 Division 2. For locations where CE marking is required, ATEX Hazardous Location approval is offered. IEC certification for Hazardous Locations is also offered.

## Slim-Lok Version for Small Casing Size

Both Tri-Lok and Tru-Lok Penetrator Systems are offered as the Slim-Lok version, suitable for casing sizes as small as 5 1/2-inches, and are suitable for 160A service. The option to pressure test the Splice Tubes is available for this small size.

## Specifications

Environmental	Standard - 5000 psi at 350°F High Temp - 3000 psi at 450°F High Pressure - 7000 psi at 350°F
Electrical	5000 VAC, 180 Amperes
Approvals	CSA Approved for Class 1 Div 1 and Class I Div 2 ATEX Approved; IEC Approved

## Features

Junction Box Termination to Surface Cable	Allows the use of pre-existing Surface Cables at the well site
True Pressure Block, with Metal-to-Metal Sealing	The Tru-Lok system provides for a true and verified pressure block under the tubing hanger. Eliminates requirements for installing epoxy blocks in the Surface Cables, and vents are never required at the junction box
PEEK® Insulated AWG 4 Steel Clad Power Conductors	High Performance PEEK-insulated power conductors ensure reliable performance, with current ratings up to 180 Amperes
Splice Tube Seal with optional pressure test port	Optional Pressure Test Port permits testing of Splice Tube primary seal

# Packer Applications

## Packer Penetrator Systems

BIW Connector Systems offers electrical penetrator solutions for mudline packers, deep-set packers, and ESP Pods. Packer penetrators are different from wellhead penetrators, since they are designed to withstand pressure from both sides. All packer penetrator systems are designed for repeated pressure cycling. Systems include the following:

**Penetrators for Dual String Packers**, where the penetrator is installed directly into the secondary bore, sometimes by the manufacturer of the packer.

**Penetrators with Cross-over Adapters**, where the secondary bore is large enough only for the ESP cable, but not for hardware installation. Using a Cross-over Adapter, the pressure-blocking penetrator may be installed above or below the Packer.

**3-Bore Packer Systems**, where the casing size is too small to accommodate a conventional penetrator, with or without over adapters. Penetrations through the packers are made with Tubing Encased Cable conductors. These are secured to the Packer with metal-to-metal sealing.



## Molded Cable Packer Penetrators

Molded Cable Packer Penetrator Systems are widely used in both mudline applications and deep-set applications. Molded Cable Penetrators are supplied with factory installed both above and below the penetrators. Cable splicing is a widely available skill, and penetrators with cable may be preferred for remote installations that may not have technical support available for field attachable solutions.

When used with deep-set packers, these penetrators are often supplied with motor lead extension cables and pothead connectors. In these cases, the penetrators are mounted below the packer, and there is no need for a field splice to the MLE below the packer.

## Specifications

Environmental	300°F (149°C), 5000 psi
Electrical	5000VAC, up to 160 Amperes
Insulators	Penetrator - 28-inches
Metallurgy	4130 Alloy Steel, 410 Corrosion Resistant Steel, Monel 400

## Features

Crossover Adapters	Ease of installation - not necessary to rotate penetrators during installation
Test Ports	Permits hydraulic testing of O-ring seals
Adjustment Slots	Ease of installation - helps to manage cable slack
Wide thread selection	Crossover Adapter are supplied with both pin and box threads in the following sizes: 1.90NU-10RD • 2 3/8 EU10 RD • 2 3/8 EU8 RD • 2 7/8 EU10 RD



## Tri-Lok® 3-Bore

Packer installations can boost ESP performance in many wells, including those with casing diameters of 7-inches or less. For these wells, it is necessary to use the smallest possible diameters for electrical penetrations in the packer. The Tri-Lok 3-Bore Packer Penetrator System meets this need. High performance electrical conductors are encased in 3/8-inch Duplex tubing and the three tubes penetrate the packer. Below the packer, three mechanical splice tubes are used to connect the Duplex-encased conductors to the Motor Lead Extension cable. Similar splice tubes are used above the packer to connect the ESP cable above. Slim-Lok version for small casing sizes is also available.

### Tri-Lok SP Packer Penetrators - Standard Specification

#### Specifications

Environmental	350°F (176°C), 5000 psi
Electrical	5000VAC, up to 180 Amperes
Insulators	PEEK
Metallurgy	Tubing and Hardware – 316 Corrosion Resistant Steel

#### Features

Tubing Encased Cable	3/8-inch Steel Tubing fits into all ESP Packers, even when Packer bores are not straight
120-inch Steel Tubes	For use with any Packer design. Tubing is trimmed to required size at installation
Metal-to-Metal Seals	Used between Tubing-encased cable and Packer, and at Splice Tubes
Splice Tube Technology	Field Proven and easy to install; includes Crimp-free™ electrical contacts

### Tri-Lok SPTHT Packer Penetrators - High Temperature

#### Specifications

Environmental	450°F (232°C), 3000 psi
Electrical	5000VAC, up to 180 Amperes
Insulators	PEEK
Metallurgy	Tubing and Hardware – 316 Corrosion Resistant Steel

**Features** Same as SPT above.

### Tri-Lok SPTH Packer Penetrators - High Pressure

#### Specifications

Environmental	350°F (176°C), 7500 psi. Tested to 18,500 psi Hydrostatic Pressure
Electrical	5000VAC, up to 180 Amperes
Insulators	PEEK
Metallurgy	Tubing and Hardware – 316 Corrosion Resistant Steel

**Features** Same as SPT above, except that 3 conductor tubes are braised to a single penetration fitting. Specially sized adapter fittings may be installed for cable slack management.

### Tri-Lok SPTM Packer Penetrators for Metal-Clad MLE

#### Specifications

Environmental	300°F (149°C), 5000 psi
Electrical	5000VAC, up to 180 Amperes
Insulators	PEEK
Metallurgy	Tubing and Hardware – 316 Corrosion Resistant Steel

**Features** Same as SPT above, except that 3 MLE conductor tubes are secured to the packer with a 3:1 cross-over adapter. A single set of splice tubes connects MLE conductors to ESP Cable conductors.



# Mechanical Splices

## Presta™ GS Splice - Gen 3

The Presta GS Mechanical Slice system is designed to make uniform, reliable splices quickly, with minimal training. Using the Presta GS Splice requires only easy cable preparation. The prepared cable ends are then inserted into the individual Slice Tubes, where they are permanently retained. The Presta GS Splice replaces taped splices, and allows splices to be completed in 45 to 60 minutes.

Presta GS Splice Kits are available for the following cable types:

- AWG 1 - Round and Flat Lead Sheathed Cables
- AWG 2 - Round and Flat Lead Sheathed Cables
- AWG 4 - Round and Flat Lead Sheathed Cables

Splice Kits for flat cables include cable breakouts. Cable conductors are protected with flexible armor. Completed Splice Tubes are designed to be banded to tubing. For small casing sizes, individual splices may be staggered for minimal interference

### Specifications

Environmental	300°F (149°C), 5000 psi
Electrical	5000VAC, up to 160 Amperes
Insulators and Seals	PEEK and High Performance Elastomer
Metallurgy	Tubing and Hardware – 316 Corrosion Resistant Steel with Aluminum End Caps
Size	Splice Tubes 7.75-inch Length and 3 x 1.1-inch Diameter Tubes. Overall Splice Length is 21.25-inches.

### Features

Plug & Play Assembly	Field Attachable. Requires on that cable ends must be prepared and inserted into the pre-fabricated Splice Tubes.
Boot Seal Technology	Field Proven Sealing Technology with minimal cable preparation

Easy strip-and-click assembly



# Instrumentation Feedthru Systems



## Products for permanent downhole gauges

Permanent downhole gauges (PDG) have an important role for optimizing oil production. PDGs are always installed using metal-tubing encased cable, using both the conventional 1-conductor, and the newer 7-conductor cable types. BIW Connector Systems offers a variety of products to make the installation of these systems safer and easier. The safest installations of PDG cables require the use of a pressure-proof electrical penetration system. If an accidental breach of the PDG cable should occur downhole, the tubing encapsulated cable could provide a conduit for hazardous fluids. When a penetrator is used, this risk is averted.

## PDG Penetrators for 7-conductor cables and 1-conductor cables

These penetrators are designed to be installed either atop the wellhead bonnet or on the side of the wellhead bowl. Pressure proof sealing is provided by electrical contacts in a glass-to-metal sealed barrier. These systems have removable surface connectors for easy work-over. Our products have ATEX approvals for installation in hazardous locations.

## PDG Penetrators for 1-conductor cables for tubing hanger installations

These penetrators are long electrical connectors, designed to seal both to the tubing hanger and the top flange. Pressure-proof sealing is provided either with glass-to-metal barriers or by elastomer/epoxy resin barriers. Surface connectors are removable, and may be either 1- or 2-conductor. Connection to the PDG cable is by field attachable lower connectors, with verifiable metal-to-metal sealing. The feedthru and surface connectors of these systems have Class 1 Division 1 approvals for installation in Hazardous Locations.

## Splices for 1-conductor PDG cables

Splices are used to join single conductor PDG cables downhole. Splices attach to cable ends using verifiable metal-to-metal seals. Each splice includes a pressure block element within the splice, to prevent fluid migration past the splice junction, should the PDG cables become breached.

## PDG Instrument Penetrations for 1-conductor Cables

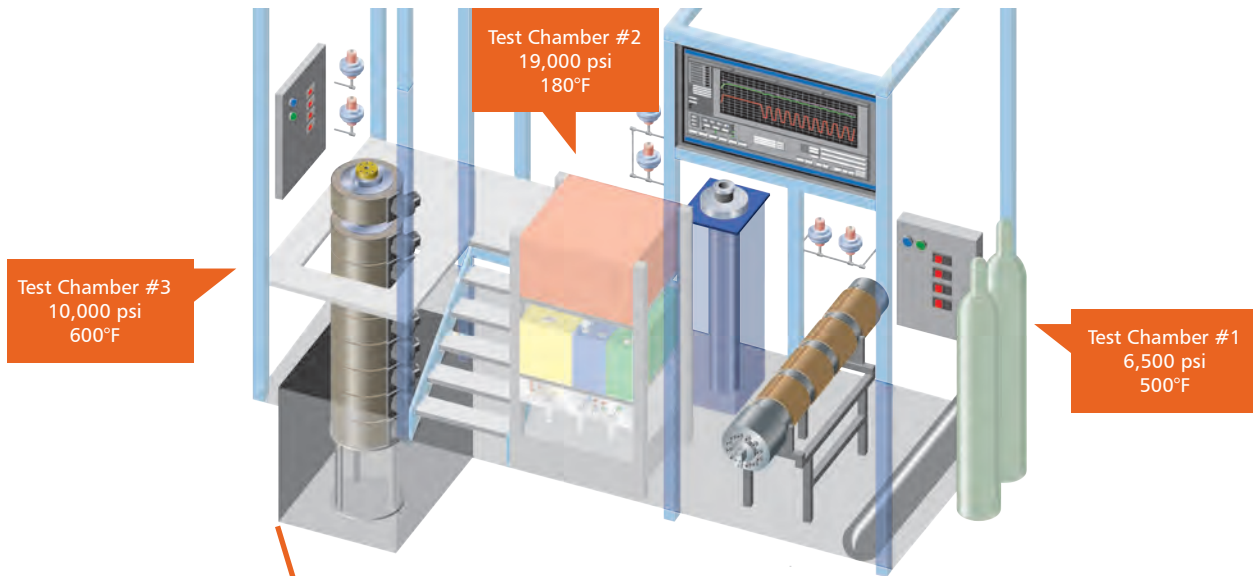
Instrument Penetrations are used to protect costly instruments from fluid ingress should the PDG cables become breached. The instrument penetrator has a glass-to-metal sealed electrical contact that is designed for welding to the instrument. Connection to the PDG cable is made using Field Attachable downhole connectors with verifiable metal-to-metal seals.

## Specifications for Penetrator Products

	7-Wire Wellhead Penetrator	1-Wire Wellhead Penetrator	1-Wire Tubing Hanger Penetrator	1-Wire Instrument Penetrator	1-Wire PDG Cable Splice
<b>Pressure Rating</b>	5000 psi	Up to 10,000 psi	5000 psi	Up to 10,000 psi	5000 psi
<b>Temperature Rating</b>	350°F (177°C)	300°F (149°C)	300°F (149°C)	392°F (200°C)	300°F (149°C)
<b>Voltage/Current</b>	240VAC / 1A	600VAC / 15A	600VAC / 15A	600VAC / 15A	600VAC / 15A
<b>Verifiable Seal</b>	Yes	No	No	No	Yes

# Design Approach

Product reliability is critical in the upstream oil and gas production market. If any part of the production string fails, the well goes down and valuable revenue opportunity is lost. BIW Connector Systems invests heavily in design and testing to ensure our products can withstand the extreme, harsh environment of a production well.



BIW Connector Systems' reliability and long product lifetimes are realized via a three-fold engineering strategy. The first is to **test exhaustively**. The second is to conduct extensive **forensic analysis** on all field returns to identify root cause. Finally, we maintain an **electronic Knowledge Database** of all technical data to practice "Informed Design."





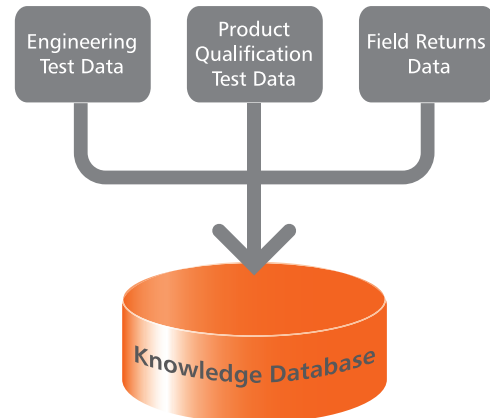
## Test

Environmental testing that closely replicates downhole conditions is essential to prove product reliability. BIW Connector Systems offers multiple test chambers capable of up to 650°F/20,000 psi with temperature and pressure cycling, and electrically monitors every qualification test to ensure operation in all conditions.



## Forensic Analysis

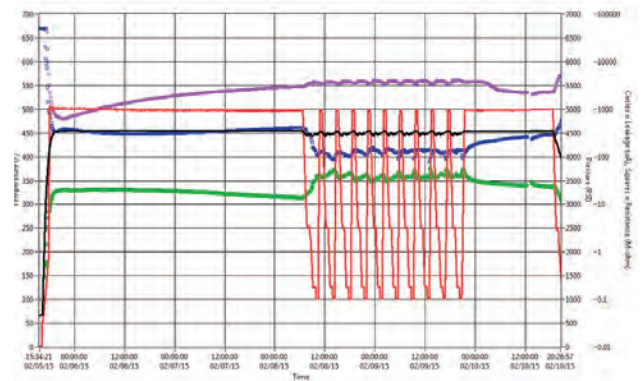
We analyze every returned product to determine root cause, and then upload findings to our Knowledge Database.



The BIW Connector Systems Engineering Knowledge Database systematically captures all test, qualification and in-service field return data into a single searchable storehouse of information, which informs each new design.

## Informed Design

We have experienced oilfield product designers with the best tools and technology. In addition, we have invested in a significant material science lab and created a common electronic Knowledge Database that is mined for information from past designs, engineering tests and forensic analysis. We apply all this learning to every design.



Every product qualification is continuously monitored for electrical performance throughout the test.

# Specialized Application Products

BIW Connector Systems designs and manufactures a wide range of products to support specialized requirements. The following are examples of these products:



## Side Entry Feedthru Systems

Side entry penetrator systems are designed to enter the wellhead on the side instead of through the bonnet. This configuration has many advantages, including shorter work-over times and the ability to easily test an ESP while a BOP is still in place during work-over. Our side entry systems have three components: (1) a Horizontal Feedthru, which enters through the side of the wellhead and tubing hanger and engages with (2) the Vertical Feedthru, and (3) a conventional downhole connector that is used to connect the Vertical Feedthru to the ESP cable.



## 8KV Power Feedthru Systems

With ever-longer cable runs and high power motors, BIW meets the need for 8KV Power Penetrator Systems.

## Penetration Systems for Geothermal Wells

Electric submersible pumps in geothermal wells have many special requirements. BIW supplies equipment specifically designed to fit geothermal wells.







### Penetrators for systems with Alternative Work-over Methods

The elimination of rig-based workovers has become a reality for many systems, especially with smaller ESPs. Rigless work-over systems rely on a variety of technologies, some of which are still emerging. BIW is a leader in the supply of penetrator systems for systems that do not require a traditional work-over rig, whether these systems utilize coiled production tubing, cable deployed ESPs or another technology.

BIW supplies systems for **downhole heaters**. Small, low-powered heaters may be used to hold paraffins in suspension. Some high-power heaters are used for downhole separation of crude oil components.

We also supply systems for **gas well de-watering**. It has been possible to significantly increase the productivity of gas wells through the process of de-watering wells, sometimes with the use of multi-phase ESPs.



### Crossover Adapters and Y-Adapters

Dual ESP completions often require specialized packer feedthru methods. Using a Y-Adapter, an operator can supply power to two ESPs using a convention packer design, with two packer feedthrus installed using a Y-adapter system.

When there is a need for multiple injection and control lines to the ESP, the design of a specialized crossover adapter will allow these lines to pass through the bore together with ESP cable.



# BIW Connector Systems | Product Index

Quickly find your product by application

Product	Application	Pressure Rating (PSI)	Temp Rating
<b>Metal-Lok™ Hi Amp</b>	Wellhead Penetrator	5000 psi	300°F (149°C)
<b>Metal-Lok™ High Temperature (HT)</b>	Wellhead Penetrator	3000/5000 psi	450°F (232°C)
<b>Metal-Lok™ Slimline</b>	Wellhead Penetrator	5000 psi	350°F (176°C)
<b>Metal-Lok™ Ultra</b>	Wellhead Penetrator	3000 psi	500°F (260°C)
<b>EFT®</b>	Wellhead Penetrator	5000 psi	300°F (149°C)
<b>Rubber Molded</b>	Wellhead Penetrator	5000 psi	300°F (149°C)
<b>E-ZEE Feed®</b>	Wellhead Penetrator	3000/5000 psi	300°F (149°C)
<b>Uni-Lok™</b>	Wellhead Penetrator	3000/5000 psi	300°F (149°C)
<b>Kwik-Lok®</b>	Wellhead Penetrator	3000/5000 psi	300°F (149°C)
<b>Safe-T-Lok®</b>	Wellhead Penetrator	3000 psi	300°F (149°C)
<b>Tri-Lok®</b>	Wellhead Penetrator	7000 psi	350°F (176°C)
<b>Tru-Lok™</b>	Wellhead Penetrator	7000 psi	350°F (176°C)
<b>Slim-Lok™</b>	Wellhead Penetrator	5000 psi	350°F (176°C)

<b>Rubber Molded</b>	Packer Penetrator	5000 psi	300°F (149°C)
<b>Tri-Lok® SPT</b>	Packer Penetrator	5000 psi	350°F (176°C)
<b>Tri-Lok® SPTHT</b>	Packer Penetrator	3000 psi	450°F (232°C)
<b>Tri-Lok® SPTH</b>	Packer Penetrator	7500 psi	350°F (176°C)
<b>Tri-Lok® SPTM</b>	Packer Penetrator for Metal-clad MLE	5000 psi	350°F (176°C)
<b>Slim-Lok™ SLP</b>	Packer Penetrator	5000 psi	350°F (176°C)

<b>I-Wire</b>	I-Wire Penetrator	5000 psi	300°F (149°C)
<b>Downhole Heater</b>	Wellhead Penetrator	5000 psi	300°F (149°C)
<b>Presta® GS</b>	Mechanical Splice	5000 psi	300°F (149°C)

Voltage /Amperage	Number of Pieces	Bores	Cable Termination Type	Hazardous Location Certification	Page
5000VAC / 215A	3	1	Field Attachable	C1D1, ATEX	6
5000VAC / 160A	3	1	Field Attachable	C1D1, ATEX, IEC	6
5000VAC / 180A	3	1	Field Attachable	C1D1, C1D2, ATEX	7
5000VAC / 140A	3	1	Field Attachable	C1D1	8
5000VAC / 180A	3	1	Field Attachable or Factory Molded	C1D1	8
5000VAC / 215A	2 or 3	1	Field Attachable	C1D1, ATEX, CEPEL, IEC	9
5000VAC / 215A	2	1	Field Attachable	C1D1	10
5000VAC / 160A	2	1	Field Attachable	C1D1, C1D2, ATEX	10
5000VAC / 160A	2	1	Factory Molded	C1D1	11
5000VAC / 140A	1	1	Factory Molded	CEPEL	11
5000VAC / 205A	2	3	Field Attachable or Factory Molded	C1D2, ATEX	12
5000VAC / 180A	2	3	Field Attachable	C1D1, C1D2, ATEX, IEC	13
5000VAC / 160A	2	3	Field Attachable	ATEX	13

5000VAC / 160A	1, 2 or 3	1	Factory Molded	N/A	14
5000VAC / 180A	1	3 or 1	Field Attachable	N/A	15
5000VAC / 180A	1	3 or 1	Field Attachable	N/A	15
5000VAC / 180A	1	1	Field Attachable	N/A	15
5000VAC / 180A	1	1	Field Attachable	N/A	15
5000VAC / 160A	1	1	Field Attachable	N/A	15

600VAC / 15A	3	1	Field Attachable	ATEX	17
5000VAC / 285A	3	1	Factory Molded	C1D1	17
5000VAC / 160A	1	N/A	Field Attachable	N/A	16

**Connect with your ITT BIW Connector Systems representative today  
or visit us at ITTBIW.com**

#### **Why ITT**

ITT is a focused multi-industrial company that designs and manufactures highly engineered critical components and customized technology solutions. ITT's Cannon brand is a leading global manufacturer of connector products serving international customers in aerospace, defense, medical, industrial and transportation end markets. ITT's Connector business, which also includes the Veam and BIW Connector Systems brand, manufactures and supplies a variety of connectors and interconnects that make it possible to transfer data, signal and power in an increasingly connected world. ITT is headquartered in Stamford, Connecticut, with employees in more than 35 countries. For more information, visit ITT.com.

#### **About BIW Connector Systems**

For more than 40 years, ITT BIW Connector Systems has connected the world to energy sources in some of the harshest environments, helping energy companies meet the growing demand of their global customers. ITT BIW Connector System's products provide reliable electrical penetration through well barriers and ensure the highest performance and safe operation of submerged electrical pumps. Visit ITTBIW.com



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