



Electrical Penetrator Systems for Oil and Gas Wells

Products and Services



ITT

ENGINEERED FOR LIFE



For more than four decades, BIW Connector Systems has been the industry-leading supplier of electrical penetrator systems used by the petroleum industry. 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 U.S. and Canada, ATEX and IEC, among others. BIW Connector Systems is certified to ISO9001:2008.

In 2011, BIW Connector Systems became part of ITT Interconnect Solutions, a world leader in the design and manufacture of highly engineered connector solutions for harsh conditions and ruggedized environments. Together, ITT and BIW Connector Systems foster a culture of innovation, resourcefulness and continuous improvement that help us solve our customers' most pressing business challenges today and in the future.



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 technology, 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 can move at the speed of business. That's where BIW Connector Systems comes in. When an oil well is down, we get it quickly 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 18-19.

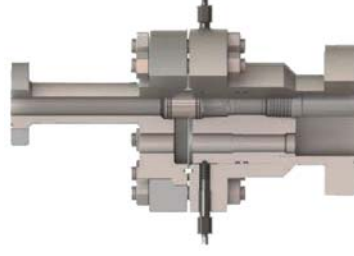
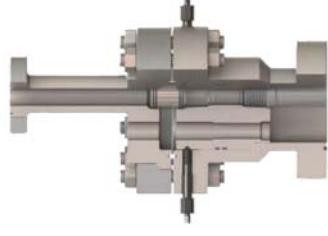
Wellhead Applications

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.



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 system's 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 and 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 one piece. These systems are easy to install and provide the same safety and reliable power as all of BIW's other systems.

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

Wellhead Penetrator Systems

Metal-Lok™ High Temperature

The Metal-Lok High Temperature 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.

Specifications

Environmental	450°F (232°C), 3000 psi
Electrical	5000 VAC, 20 to 120Hz, 140 Amperes
Approvals	CSA approved for Class 1, Division 1, TCode T4A, Groups C and D Hazardous Locations, ATEX & IEC Ex d IIBT4 Gb

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™

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 decomposition. 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.

Specifications

Environmental	300°F (149°C), 5000 psi
Electrical	5000 VAC, 20 to 120Hz, 160 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 Ultra Penetrator System with k-PaC Technology

Metal-Lok™ Ultra with k-PaC™ Technology

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. This 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 and multiple temperature cycles. This product is the solution to your 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 Hazardous Locations

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™

Safely sealing and passing power through 5000 psi-rated wellheads for over 20 years. With over 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 pigtails and are designed to work in systems with or without bonnets.

Specifications

Environmental	300°F (149°C), 5000 psi
Electrical	5000 VAC, 20 to 120Hz, 180 Amperes
Approvals	CSA Approval for, Class 1, Division 1, Groups C and D, 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

Wellhead Penetrator Systems

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 Feedthru 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 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, 20 to 120Hz up to 215 Amperes
Approvals	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 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

3-Piece Rubber Molded Feedthru System



E-ZEE Feed®

The E-ZEE Feed Wellhead Penetrator System is designed with a small profile allowing 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 problems by permitting fast coupling of surface cable to penetrator, making it is easy and fast to install or to pull during workovers. The E-ZEE Feed is intended to be used on wellheads with a pressure rating of 3000 psi or lower.

Specifications

Environmental	300°F (149°C), 3000 psi
Electrical	5000 VAC, 20 to 120Hz 160 Amperes
Approvals	CSA approved for Class I, Division 1, Groups C and D Hazardous Location installation

Features

Bottom-Fed Installation	Bottom-fed installation, coupled with field attachable design, provide the easiest, quickest and most reliable installation
Field Attachable	Field attachable design eliminates a downhole splice
Full Qualification	Proven reliability by passing BIW's rigorous qualification testing and numerous successful field installations
Geothermal Wells	Suitable for geothermal wells
High Performance Materials	High strength, high temperature insulators provide safety and reliability

Kwik-Lok™

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 psi
Electrical	5000 VAC, 20 to 120Hz 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

Wellhead Penetrator Systems

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 pack-offs. Unlike pack-offs, 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, 20 to 120Hz 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 to small for any other type of feedthru systems

Tri-Lok® 3-Bore

The Tri-Lok 3-Bore Wellhead Penetrator Systems are designed to provide safe and reliable power transfer through wellheads with minimal space. The designs 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 through a complete pressure block and cable termination in the wellhead. The system also includes a flexible and easy-to-install surface connector that mates with all of the Tri-Lok penetrators, which are available in either cable-molded or field-attachable configurations.



Specifications

Environmental	300°F (149°C), 5000 psi
Electrical	5000 VAC, 20 to 120Hz 140 Amperes
Approvals	Approved for Class 1, Division 1, Groups C and D Hazardous Locations; ATEX for Hazardous Locations

Features

Field Attachable & Cable Molded Flexible Surface Connector	Flexibility to meet your specific installation Multiple surface mounting configurations, which provides the flexibility to fit most wellheads, even those where space is limited
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

Packer Applications

Packer Penetrator Systems

BIW Connector Systems offers electrical power penetrator solutions for all types of downhole pressure barriers, including mudline packers, deep-set packers and electric submersible pump pods. Packer penetrators are specifically engineered to withstand pressure from both sides. All packer penetrator systems are designed to withstand repeated pressure cycles, and qualification testing for these devices includes a severe regimen of pressure cycling.

Packer Penetrators for Dual-String Retrievable Packers

When used with dual-string retrievable packers, penetrators are installed directly into the packer. Field attachable connectors or downhole connectors with cables are used to make the electrical connection between ESP cable above and below the packer.

Packer Penetrator Systems with Cross-over Adapters

In many wells, there is not sufficient space for a twin-seal packer. Often, cross-over adapter solutions are used to provide reliable sealing at the packer, but with the pressure barrier device ("penetrator") actually located below or above the packer itself.

Field Attachable Packer Penetrator Systems

Using PEEK technology, we offer field attachable packer systems. These systems can be easily installed above or below the packer, without requiring a cable splice. Systems are exceptionally robust, and they are suitable for temperatures up to 450°F.

3-Bore Packer Penetrator Systems

With enhanced production methods, it may be desirable to use a packer in wells with just 7-inch casings – or even smaller. In those cases, BIW Connector Systems can offer a Tri-Lok 3-Bore packer feedthru, where steel-encased power conductors pass through the wellhead with positive seals to ESP cables located above and below the packers.



High Performance Packer Penetrator Systems

Most packer penetrator systems are intended for 5000 psi maximum pressure, at a temperature of 300°F. However, there are installations which require higher performance. Downhole conditions with temperatures in excess of 300°F, sour wells with high concentrations of corrosive gases and production techniques that result in high numbers of pressure decompression cycles are examples. BIW's k-PaC Technology was developed specifically for these harsh conditions.

Packer and POD Penetrator Systems

Molded Cable

Molded Cable Packer Penetrator Systems are widely used in both mudline applications and deep-set applications. Molded Cable Penetrators are supplied with cable factory installed both above and below the penetrator. 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 160A
Maximum Length	Penetrator - 28-inches
Metallurgy	4130 Alloy Steel, 316 Corrosion Resistant Steel, Monel 400

Features

Cross-over Adapters	Ease of installation - not necessary to rotate penetrators during installation
Test Ports	Permits hydraulic testing of O-ring Seals
Adjustment Slot	Ease of installation — helps to manage cable slack
Wide thread selection	Cross-over Adapters are supplied with both pin and box threads in the following sizes: 1.90NU-10RD • 2.3/8 EU 8 RD and 2.3/8 EU10 RD • 2.7/8 EU 8 RD • 2.7/8 EU10 RD

HEZF Field Attachable

The HEZF Field Attachable Packer Penetrator System is intended for convenient installation above or below the packer. The systems consists of three major components: Packer Penetrator, Field Attachable, 2) Downhole Power Connector, Field Attachable; and 3) Cross-over Adapter.

Installation consists of separately installing the ESP cable end and the Motor Lead Extension cable end to the Packer Penetrator assembly and to the Field Attachable Power Connector, respectively. The system can be ordered for installation above or below the packer, depending on local preference.

Specifications

Environmental	350°F (177°C), 5000 psi
Electrical	5000VAC, up to 140A
Metallurgy	4130 Alloy Steel, 316 Corrosion Resistant Steel, 410 Corrosion Resistant Steel, Monel 400

Features

Cross-over Adapters	Ease of installation
Adjustment Nut	Ease of installation — helps to manage cable slack
Wide thread selection	Cross-over Adapters are supplied with both pin and box threads in the following sizes: 1.90NU-10RD • 2.3/8 EU 8 RD and 2.3/8 EU10 RD • 2.7/8 EU 8 RD



Left:
Tri-Lok 3-Bore Packer Penetrator
Right:
Tri-Lok Ultra Packer Penetrator

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 penetrators 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.

Specifications

Environmental	300°F (149°C), 5000 psi
Electrical	5000VAC, up to 140A
Insulators	PEEK
Metallurgy	Tubing — Duplex 2205; Hardware-316 Corrosion Resistant Steel

Features

Tubing Encased Cable	3/8-inch Duplex Tubing fits into all ESP packers, even when bores in the packer are not straight
75-inch Duplex Tubes	For use with a variety of packers. Tubing is trimmed to the required size at time of installation.
Metal-to-metal seals	Reliable sealing to the packer
Splice Tube Technology	Easy, reliable sealing to ESP cable above and below the Packer

Tri-Lok® Ultra

The Tri-Lok Ultra Packer Penetrator System is designed for high performance applications where long life is a requirement. Pressure blocking is achieved using redundant electrical power contacts brazed into ceramic blocks. Connections to cables are made using patented pressure-balanced technology. This unique system applies virtually no mechanical stress on ESP cable insulation and barriers over a wide range of pressure and temperature.

Tri-Lok Ultra Penetrators are designed for 400°F (204°C) service at pressures up to 7500 psi (absolute or differential). The system is designed to withstand harsh and repetitive pressure cycles.

The system is delivered pre-assembled. On-site work requires minimal cable preparation and inserting cable ends into the packer penetrator.

Specifications

Environmental	400°F (204°C), 7500 psi
Electrical	5000VAC, up to 180A
Insulators	Ceramic, PEEK and VDM-1000
Metallurgy	17-4 Corrosion Resistant Steel, 410 Corrosion Resistant Steel, 316 Corrosion Resistant Steel

Features

Ceramic Pressure Block	Withstands extremely high pressures, with no harmful effects from high temperature exposure
Metal-to-metal seals	Reliable sealing to the packer with pressure test ports
Pressure Balanced Cable termination	Pressure cycling and the presence of gas do not harm the cable termination. Suitable for round cables, flat cables, lead-sheathed cables and tube encapsulated MLEs

Mechanical Splices

Presta™ Splice with k-PaC™ Technology

The Presta® Extreme Service Mechanical Splice is designed to allow difficult splices to be made easily, quickly, and uniformly by rig personnel with minimal training. Using the Presta splice requires only easy cable preparation. The prepared cable ends are then inserted into the Presta splice, where they are permanently retained. Presta replaces complex taped splices, and allows severe service splices to be made up in 60 to 90 minutes.

The Presta Splice with k-PaC Technology are designed for Deep Water Offshore applications rated for 350°F and 7500 psi and for Extreme Service applications rated for 400°F and 5000 psi. Both have performance headroom for even more severe applications.

Specifications

Environmental	400°F (204°C), 7500 psi
Test Temperature	500°F (260°C)
Test Pressures	20,000 psi at 200°F (93°C), 5500 psi at 550°F (288°C)
Electrical	5000VAC, up to 160A
Electrical Test Value	30KVAC for 4 hours
Dielectric Leakage Current	Less than 1 micro-ampere at 24KVDC
Insulators	PEK and VDM-1000™
Metallurgy	17-4 Corrosion Resistant Steel, 410 Corrosion Resistant Steel, 316 Corrosion Resistant Steel

Features

Plug & Play Assembly	Field Attachable Picker Penetrator requires only that cable ends must be prepared and inserted into the pre-fabricated device.
Pressure Balanced Cable Termination	Pressure cycling and the presence of gas do not harm the cable termination. Suitable for round cables, flat cables, lead-sheathed cables and tube encapsulated MLEs.

Presta Splice Global Service

The Presta Global Service Mechanical Splice is designed to make uniform, reliable splices quickly and with minimal training. Using the Presta splice requires only easy cable preparation. The prepared cable ends are then inserted into the Presta splice, where they are permanently retained. Presta replaces taped splices, and allows splices to be made up in 45-60 minutes.

Specifications

Environmental	300°F (149°C), 5000 psi
Electrical	5000VAC, up to 160A
Dielectric Leakage Current	Less than 1 micro-ampere at 24KVDC
Insulators	PEK, Alias
Metallurgy	Alloy Steel and 316 Corrosion Resistant Steel

Features

Plug & Play Assembly	Field Attachable Picker Penetrator requires only that cable ends must be prepared and inserted into the pre-fabricated device.
Boot Seal Technology	Reliable sealing with minimal cable preparation.

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. BW 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 gases and 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
Pressure Rating	5000 psi	Up to 10,000 psi	5000 psi	Up to 10,000 psi	5000 psi
Temperature Rating	350°F (177°C)	300°F (149°C)	300°F (149°C)	392°F (200°C)	300°F (149°C)
Voltage/Current	240VAC / 1A	600VAC / 15A	600VAC / 15A	600VAC / 15A	600VAC / 15A
Verifiable Seal	Yes	No	No	No	Yes

Specialized Application Products

BIW Connector Systems produces many products to support specialized requirements in the energy industry. 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) Horizontal Feedthru, which enters through the side of the wellhead and tubing hanger and engages with (2) the Vertical Feedthru. (3) A conventional downhole connector is used to connect the Vertical Feedthru to the ESP cable.



Pothole Connectors and Motor Housing Penetrators. Large geothermal ESPs and specialized ESPs for gas wells may require specialized motor lead systems. BIW Connector Systems supplies connectors for these applications.

Penetrations Systems for Cable Deployed ESP and Electro-thermic Heating. These systems often have unique wellhead designs and special considerations for delivering power. BIW Connector Systems supplies field installable feedthru systems and penetrators with flexible high voltage power conductors to make installation easy.



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.



Cross-overs 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. Similarly, when there is a need for multiple injection and control lines to the ESP, the design of a specialized cross-over adapter will allow these lines to be passed through the bore together with ESP cable.

Design Approach



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."

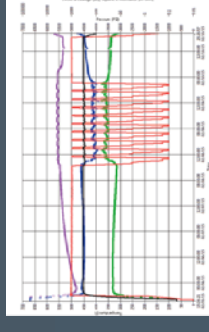
Test

Environmental testing that closely replicates the downhole conditions are essential to prove product reliability. BIW Connector Systems has multiple test chambers capable of up to 650°F/10,000 psi with temperature and pressure cycling.



Forensic Analysis

We analyze every returned product to root cause. This information is then fully documented and uploaded to our Knowledge Database.



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 each and every design.

Product Index

Quickly find your product by application.

Product	Application	Pressure Rating (PSI)	Temp Rating	Voltage /Amperage	Number of Pieces	Bores	Cable Termination Type	Page
EFT	Wellhead Penetrator	5000 psi	300°F (149°C)	5000VAC/180A	3	1	Field Attachable or Factory Build	7
E-ZEE Feed	Wellhead Penetrator	3000 psi	300°F (149°C)	5000VAC/160A	2	1	Field Attachable	9
Rubber Molded	Wellhead Penetrator	5000 psi	300°F (149°C)	5000VAC/215A	2 or 3	1	Field Attachable or Factory Molded	8
Kwik-Lok	Wellhead Penetrator	3000 psi	300°F (149°C)	5000VAC/140A	2	1	Factory Molded	9
Safe-T-Lok	Wellhead Penetrator	3000 psi	300°F (149°C)	5000VAC/140A	1	1	Factory Molded	10
Metal-Lok	Wellhead Penetrator	5000 psi	300°F (149°C)	5000VAC/160A	3	1	Field Attachable	6
Metal-Lok HT	Wellhead Penetrator	3000/5000 psi	450°F (232°C)	5000VAC/160A	3	1	Field Attachable	6
Metal-Lok Ultra	Wellhead Penetrator	3000 psi	500°F (260°C)	5000VAC/140A	3	1	Field Attachable	7
Tri-Lok	Wellhead Penetrator	5000 psi	300°F (149°C)	5000VAC/140A	2	3	Field Attachable or Factory Molded	10
I-Wire	Instrumentation Penetrator	5000 psi	300°F (149°C)	600VAC/15A	3	1	Field Attachable	15
Heaters	Instrumentation Penetrator	5000 psi	300°F (149°C)	5000VAC/250A	3	1	Factory Molded	15
Rubber Molded	Packer Penetrators	5000 psi	300°F (149°C)	5000VAC/215A	1, 2, or 3	1	Factory Molded	12
HEZF	Packer Penetrators	5000 psi	350°F (177°C)	5000VAC/140A	2	1	Field Attachable	12
Tri-Lok	Packer Penetrators	5000 psi	300°F (149°C)	5000VAC/180A	1	3	Field Attachable	13
Splice-Lok	Mechanical Splices	5000 psi	350°F (177°C)	5000VAC/160 A	1	N/A	Field Attachable	14
Presta	Mechanical Splices	10000 psi	500°F (260°C)	5000VAC/160 A	1	N/A	Field Attachable	14