Inflatable Packers International

MINING & GEOTECHNICAL CATALOGUE

February 2016

Introduction

IPI is a world leader in equipment for in-situ characterization of permeability and rock stress (hydraulic fracturing and jacking), and provides a wide range of custom and standard packer-based products for the mining and geotechnical industries. IPI provides technical support and training with our qualified staff of engineers and technicians to assist our customers. IPI technology has been applied at diverse sites around the globe, including: mine site hydrogeological characterization for major and minor projects; ice drilling in Antarctica; CBM (Coal permeability) projects; CO_2 sequestration; nuclear waste site characterization; dam monitoring and numerous other projects.

Canadian Arctic
(SRK Ltd)

Sahara Desert,
Mauritania
(Aqua Lithos llc)

Peruvian Andes
(Aqua Lithos llc)

Atacama Desert,
Chile
(Geotech Drilling
Services)

Papua New Guinea
(Klohn Crippen Berger)

Ghana
(IPI)

Mongolia
(IPI)

Pilbara, Australia
(Northern Drilling Services)

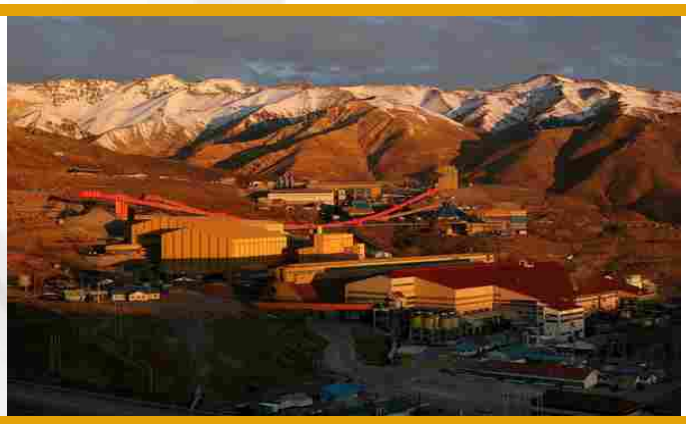
Argentine-Chilean border
@4200m (IPI LA)

Bowen Basin, Australia
(SRK Ltd)

Illinois, USA
(IPI llc)

Mining and Geotechnical Equipment

From the early days of IPI, established in 1999, we have been privileged to have supplied our equipment to some of the world's most prestigious mining and geotechnical projects and have continued our association with many of these to this day. We're also privileged to work with some of the world's leading mining and geotechnical consultants including Golder Associates, Klohn Crippen Berger, Knight Piesold, Schlumberger Water Services and SRK.



El Teniente, Chile
World's largest underground copper mine.

The Andean hard rock mining industry are advanced users of inflatable packer technology for wireline permeability testing, hydraulic fracturing for rock burst mitigation and block caving pre-conditioning as well as for In Situ Recovery.

Various Major Tunnel and Dam Projects, worldwide

Clients use a range of IPI products from OEM or standard inflatable packers for their own tools to IPI's own wireline permeability testing tools, including versions with balanced piston setting tools and optional impression packers, for a wide range of geotechnical tests.

Several nuclear waste disposal sites, worldwide

Work is either undertaken by specialist consultancies or government sector agencies. For the sensitivity of data required, IPI has provided specialist tools with advanced Data Acquisition Systems and high pressure specialist testing rods.

Oyo Tolgoi Copper Mine
Gobi Desert, Mongolia

One of the early users of SWiPS®, IPI has gone on to develop market leading permeability testing tools that now dominate the hard rock mining and coal bed methane industries, as well as used for such as CO_2 sequestration and salt dome testing. All the world's major mining companies use IPI equipment.

IPI – our vision is to be the world's first choice inflatable packer company.

Founded in 1999 in Perth, Western Australia, by Clem Rowe to design and manufacture inflatable packer based down-hole tools for the international marketplace, IPI has since developed a world-wide presence. IPI delivers world-class service in striving to achieve its vision with which many clients, most of whom are service companies or consulting engineers, would confirm. IPI is primarily a manufacturer but can provide on-site services if required, especially for training purposes. In May 2015 the IPI Perth facility achieved third party accreditation of its Quality Management System as complying with ISO 9001:2008.

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SWiPS® Standard Wireline Packer System

The IPI SWiPS® is designed for permeability testing in NQ, HQ and PQ wireline core holes. The packers are hydraulically inflated through the drill string, eliminating the need for high-pressure gas bottles and inflation lines. This system is potentially adaptable to suit other core systems.

APPLICATIONS:

Permeability testing for:

- Mine design and dewatering
- Coal bed methane exploration
- In situ mining

FEATURES:

- Completely hydraulic - needs no nitrogen gas or inflation lines
- Water inflation enables a higher sealing pressure
- Effective to depths over 1,000m in angle and vertical holes
- Works with standard Boart Longyear™ or equivalent systems
- Compatible with orientation devices
- Configurable as single or straddle packer system
- Deflate and retrieve with wireline and standard overshot
- Rental systems available
- Flow meter skids available
- Pump-down versions for shallow angle and horizontal use
- Stainless steel option for brine and other aggressive borehole conditions
- Sizes to suit NQ, HQ and PQ size core barrels.
- Types of Testing
  - Permeability
  - Lugeon Tests
  - Falling Head
  - Air Lift

OPERATION: EASY AS 1-2-3

STEP 1

Remove inner barrel, then run SWiPS® in and latch into core barrel.

STEP 2

Inflate SWiPS® by filling and pressurizing the drill string and conduct permeability test

STEP 3

Latch on to tool using a standard overshot, deflate packers by pulling up slightly. Once deflated, retrieve SWiPS® to surface, replace inner barrel, and resume drilling.

1 2 3

ACCESSORIES:

- Non-rotating C-Plate and hauling sub for tool assembly over rods
- Flow meter assembly with pressure gauge and optional data logger
- Extension subs for 3m/10', 6m/20' and 12m/40' core barrels
- PQ 70 adaptation kit to enable HQ SWiPS® to be run in PQ size Core Barrel using 70mm Packer Elements
- Downhole memory gauge carriers

SWIPS® technical specifications:

NOMINAL SIZE	NQ [75.7mm]	HQ [96.0mm]	PQ70 [122.6mm]	PQ [122.6mm]
CENTRE TUBE ID	13.9mm [0.55"]	18.9mm [0.74"]	18.9mm (0.74")	32.5mm [1.3"]
MAXIMUM WORKING PRESSURE	100 bar [1450 psi]	100 bar [1450 psi]	100 bar [1450 psi]	100 bar [1450 psi]
PACKER ELEMENT LENGTH	1000mm [39.4"]	1000mm [39.4"]	1000mm [39.4"]	1000mm [39.4"]
OD - DEFLATED	42 mm [1.65"]	60 mm [2.36"]	70mm [2.76"]	80 mm [3.15"]

STX-60

The STX-60 is the smallest diameter version of IPI's ST range. It employs a multi-cycle, four stage valving mechanism that allows fluid communication to either the packers, annulus, test interval or provides complete shut in. What makes the STX unique is that it can be run:

- As a wireline tool in conjunction with a 3m or longer mineral wireline coring system;
- Or, on rods/tubing – including coiled tubing.

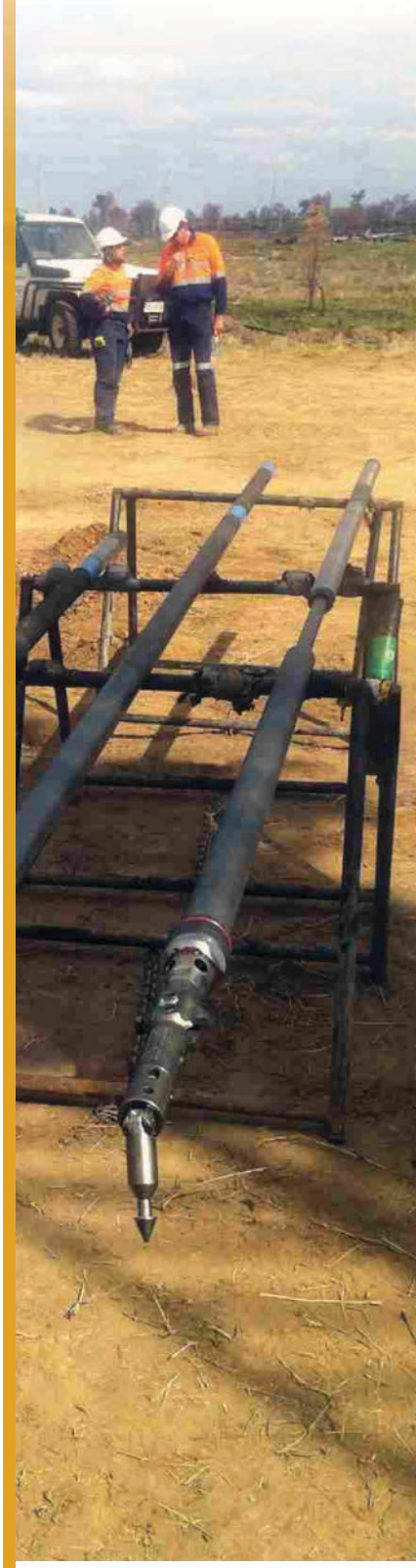
As with all other setting tools in IPI's range, shifting between different stages is accomplished by axial movement only – no rotation is required. The multi-stage functionality enables multiple tests in a single run without pulling out of hole.

APPLICATIONS:

- Permeability testing
- Hydrojacking
- Hydraulic fracturing
- Rock stress testing
- Selective stimulation
- Casing integrity testing
- Caprock integrity testing

FEATURES:

- Run in on either wireline or on rods/tubing
- Ease of use - no control lines, no rod rotation, no down hole pumps required
- Inflationbypass design -no 'squeeze' pressure while inflating the straddle packers
- Zero displacement valve design - maintains accurate shut-in pressures after the tool is shifted from injection/inflow to shut-in. Prevents spiking the formation when shifting from shut-in to test zone, which can cause jacking/fracking.
- Balanced valve piston - the tool is in equilibrium
- Ability to circulate while shut-in
- Ability to blow down the fluid in the drill pipe/tubing whilst in circulating stage by using compressed air/nitrogen, to facilitate DST or slug withdrawal testing
- All inlet/outlet ports are protected by filter screens to prevent ingress of solids
- Emergency deflation - can be activated by over-pull in the event that the packers will not deflate by normal means
- Cased and open hole application



COMPATIBLE PACKER SYSTEMS

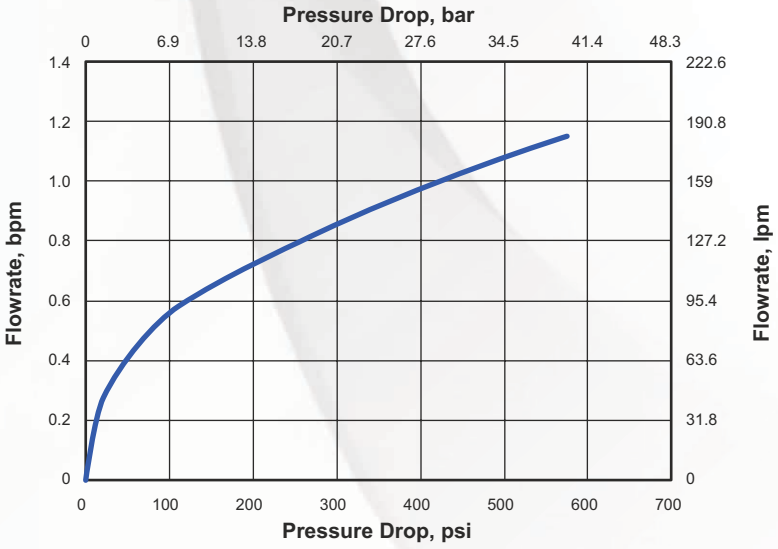
PACKER SIZE		WIRELINE		TUBING	
mm	inch	Hole Size	Max. Pressure	Hole Size	Max. Pressure
Ø57	Ø2 ¼	HQ (Ø96mm)	2500 psi	Ø76mm	5000 psi
				Ø96mm	2500 psi
Ø60	Ø2 ⅜	HQ (Ø96mm)	1500 psi	Ø76mm	2500 psi
				Ø96mm	2000 psi
Ø67	Ø2 ⅝	PQ (Ø122mm)	2500 psi	Ø96mm	5000 psi
				Ø140mm	1700 psi
Ø70	Ø2 ¾	PQ (Ø122mm)	1500 psi	Ø96mm	2000 psi
				Ø122mm	1500 psi
Ø86	Ø3 ⅜	N/A	N/A	Ø96mm	5000 psi
				Ø152mm	2000 psi

SPECIFICATIONS

Minimum Tool Diameter	60mm
Run in Mineral Wireline Coring System	HQ or PQ Size
Run in on Tubing/Pipe	NQ, HQ & PQ
Max. Pressure Rating	5000 psi (34.5 MPa)
Max. Temperature Rating **	70° C (158° F)
Max. Pull (Emergency Deflate)	4.4 T (9700 lb)
Max. Axial load (1.6 safety factor)	13.5 T (29,762 lb)

**Maximum temperature rating on a standard tool.
Tools requiring higher temperatures can be supplied, as well as change over kits to existing tools to a maximum temperature of 130°C/266°F.

PRESSURE vs. FLOW



STX-60 ON WIRELINE

STX-60 ON TUBING

SINGLE PACKER SYSTEM

STRADDLE PACKER SYSTEM

ST Well Test Tools

IPI's ST range of multi-cycle inflatable packer systems features a four-stage operational mechanism that enables packer inflation, annular circulation, interval testing, and complete shut-in isolation. The ST range can be configured as a single packer or a dual packer straddle assembly; its multi-cycle functionality allows for multiple formation evaluation tests or stimulation cycles to be performed on different zones within a single trip.

Its design features a volume-compensated balanced piston that prevents inner-component movement from inducing pressure fluctuations within isolated test zones and allows to accurately record initial shut-in pressure while preventing unintentional formation fractures. This innovation makes the ST range the optimal inflatable packer solution for formation evaluation and well stimulation in open hole or cased hole applications.

APPLICATIONS:

- Coalbed methane DST, IFO and DFIT testing
- Formation evaluation in oil & gas, geotechnical, or water wells
- Casing patch leak-off testing
- Well stimulation (acid treatment)
- Caprock integrity analysis

FEATURES:

- Simple and reliable operation only requires axial movement and hydraulic pressure (control lines, rotation, or downhole pumps are not required)
- Innovative design eliminates squeeze pressure during packer inflation
- Improved shut-in pressure accuracy due to zero-displacement valve design
- Low-pressure-loss tool chassis
- Ability to circulate while in the shut-in stage enables air/nitrogen induced hydrostatic head reduction for DST or swabbing applications
- Filter screen protected flow path prevents solid/debris clogging
- Backup pull-release emergency deflation mechanism available
- Ideal for cased and open hole applications
- Available upgrades for real-time downhole measurement systems
- Adaptor sub extensions available for longer straddle intervals
- Three different chassis sizes available for adaptability with an extensive range of packer types and sizes

COMPATIBLE PACKER SYSTEMS

Packer Size		Compatible ST Tool	Hole Size		Max. Pressure
mm	inch		mm	inch	
Ø57	Ø2 ¼	ST60	76	3.0	5000 psi
			96	3.8	2500 psi
Ø67	Ø2 ⅝	ST60	96	3.8	5000 psi
			140	5.5	1700 psi
Ø86	Ø3 ⅜	ST86	115	4.5	5000 psi
			152	6	2000 psi
Ø114	Ø4 ½	ST86 & ST114	140	5.5	5000 psi
			200	7.9	2000 psi
Ø127	Ø5	ST86 & ST114	170	6.7	5000 psi
			250	9.8	1600 psi
Ø140	Ø5 ½	ST86 & ST114	180	7	5000 psi
			260	10.2	2800 psi
Ø178	Ø7	ST114	210	8.3	5000 psi
			300	11.8	2150 psi
Ø190	Ø7 ½	ST114	228	9	5000 psi
			310	12.2	2100 psi
Ø280	Ø11	ST114	310	12.2	5000 psi
			394	15.5	2000 psi

SPECIFICATIONS

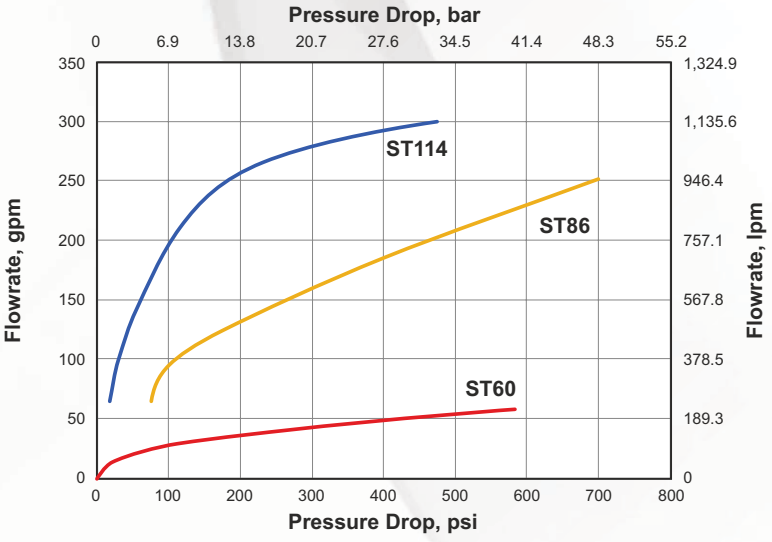
Tool Type	ST60	ST86	ST114 *
Minimum Tool Diameter	60 mm	86 mm	114 mm
Run on API Drill Pipe/Tubing	2 ⅜ inch	2 ⅞ inch	4 ½ inch
Max. Pressure Rating	5000 psi (34.5 MPa)	5000 psi (34.5 MPa)	5000 psi (34.5 MPa)
Max. Temperature Rating **	80° C (176° F)	80° C (176° F)	80° C (176° F)
Max. Pull (Emergency Deflate)	4.4 T (9,700 lb)	13.2 T (29,100 lb)	26.4 T (58,202 lb)
Max. Axial Load (1.6 safety factor)	13.5 T (29,762 lb)	48 T (105,821 lb)	87 T (191,802 lb)

* ST114 High pressure version available (up to 10,000 psi)

** Maximum temperature rating on a standard tool

Tools requiring higher temperatures can be supplied, as well as change over kits to existing tools to a maximum temperature of 150° C / 302° F.

PRESSURE vs. FLOW



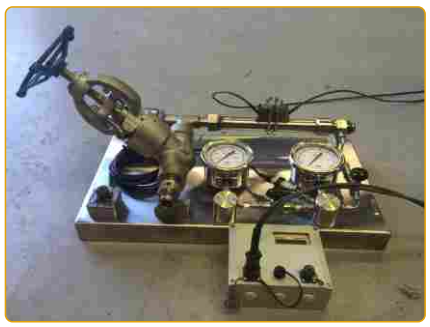
ST114

STRADDLE PACKER SYSTEM

SINGLE PACKER SYSTEM

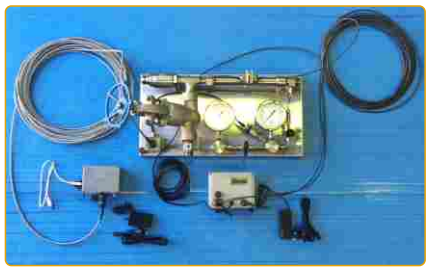
Portable Flow Meter Skids

IPI manufactures a range of portable flow meter skids for use with high-pressure IPI downhole tools, eg. SWiPS® STX 60, ST Range, etc



APPLICATIONS:

- Permeability tests
- Injection test
- Withdrawal tests
- Hydrojacking
- Minifrac to 5000 psi



FEATURES:

- Built-in strainer to protect flowmeter
- 1" JIC male connections
- Easy-to-use flow control globe valve
- All stainless steel construction
- Waterproof “Pelican“ storage & shipping case
- Robust high & low pressure analog gauges with optional electronic transducer on data logging models
- User friendly logging software (data logging models only)
- Twin meter boards also availailable, custom skids available

Model	Max. Pressure rating		Flow meter type	Pressure measurement	Flow rate measurement range		Data logging capability
	psi	bar			L/min	US GPM	
FM-800 Manual	800	55	Turbine	Dual direct drive gauges	0.5 - 83	No	No
FM-5000 Electronic	5000	345	Ultrasonic	Dual direct drive gauges + Strain bridge transducer	0.26 - 661.7	Yes	Yes

Slim Hole Formation Tester

The IPI Slim Hole Formation Tester produces detailed evaluation of formations in boreholes as small as 3" [76mm]. The straddle section has a flush outside diameter to minimize running risk. Real time data acquisition enables quality assurance and evaluation on site, and yields high-quality data necessary for modern well test evaluation methods.

APPLICATIONS:

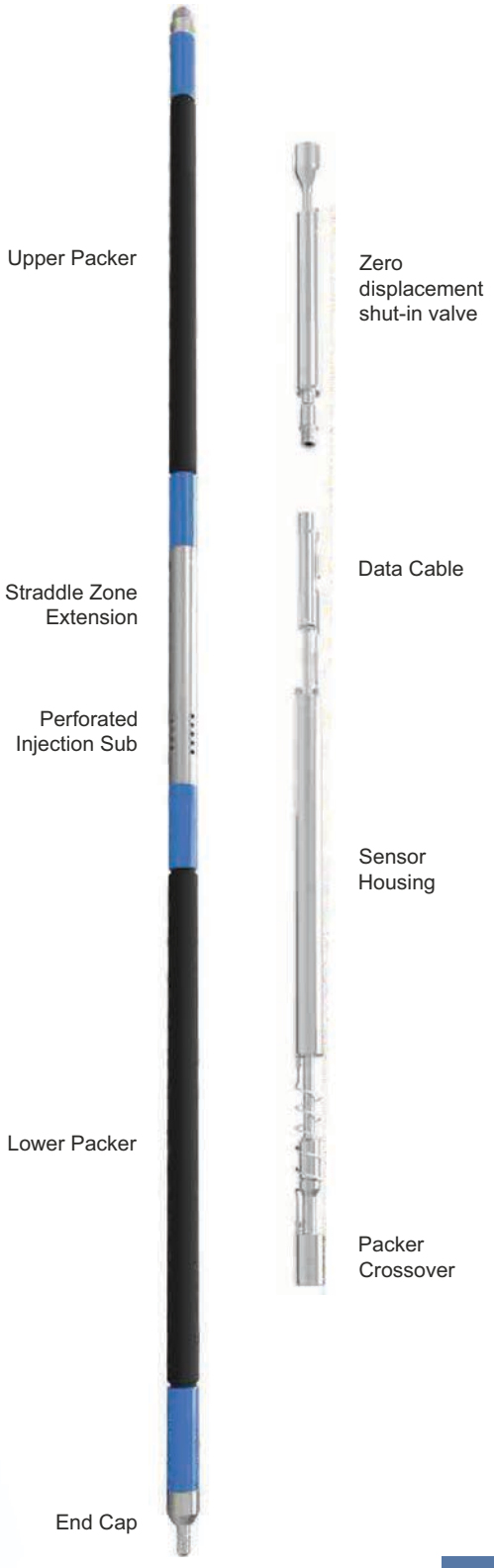
- Nuclear waste site characterization
- Oil shale exploration
- Aquifer testing
- Tight formation evaluation

FEATURES:

- Robust straddle packer system with flush OD straddle section
- Zero-displacement downhole shut-in valve
- Real-time Data Acquisition System (DAS for downhole and surface instruments)
- Can be run with IPI O-Rod with O-ring seal and easy-mate threads
- Standard diameters of 60mm [2 3/8"] and 70mm [2 3/4"]; other diameters available upon request

SYSTEM OPTIONS:

- In-line submersible pump
- Safety joint
- Encapsulated flatpack control line
- Motorised spooling unit
- Pulse generator
- Piezoelectric or quartz pressure transducers



DuraFRAC® HP Straddle

Designed specifically to suit pre-conditioning for rock burst mitigation and for block caving via very high pressure hydraulic fracturing. IPI packers deflate faster and recover to their original diameter better than any packers on the market, enabling them to be run with lower annular clearances.

APPLICATIONS:

- Hydraulic pre-conditioning for block caving
- Rock burst mitigation
- Other Hydraulic fracturing

FEATURES:

- Exceptional packer durability
- Use in any hole orientation (i.e down-hole, up-hole or horizontally)
- Injection zones as short as 350mm
- Standard diameters for NQ (76mm) and HQ (96mm) size holes.
- Pressure rating up to 12,000 psi (850 bar)
- Option of “XHP” packer elements
- Available in both carbon steel and stainless steel
- Lead-in wiper to minimize rock particle puncture when used up-hole
- Bypass feature to equalise pressure below and above the injection zone
- BQ rod connection and 1/4” tube inflation connection as standard.

AUXILIARY EQUIPMENT:

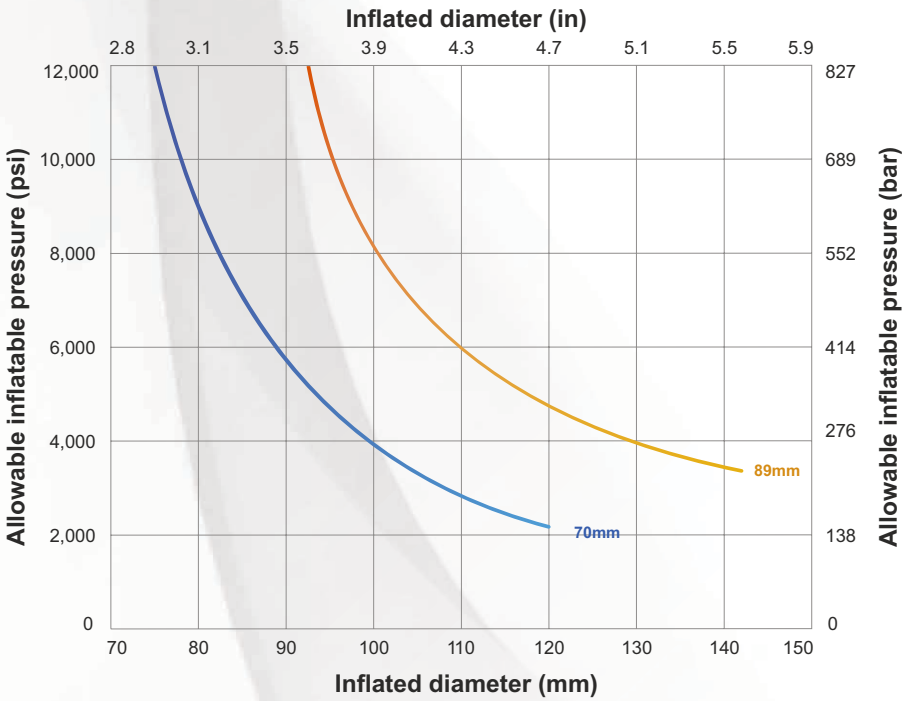
- Setting tools available to avoid use of external inflation lines
- Deflation dump valve
- Use in conjunction with impression packers to analyze formation fractures
- Downhole pressure sensors and housings
- Single or dual wall push rods

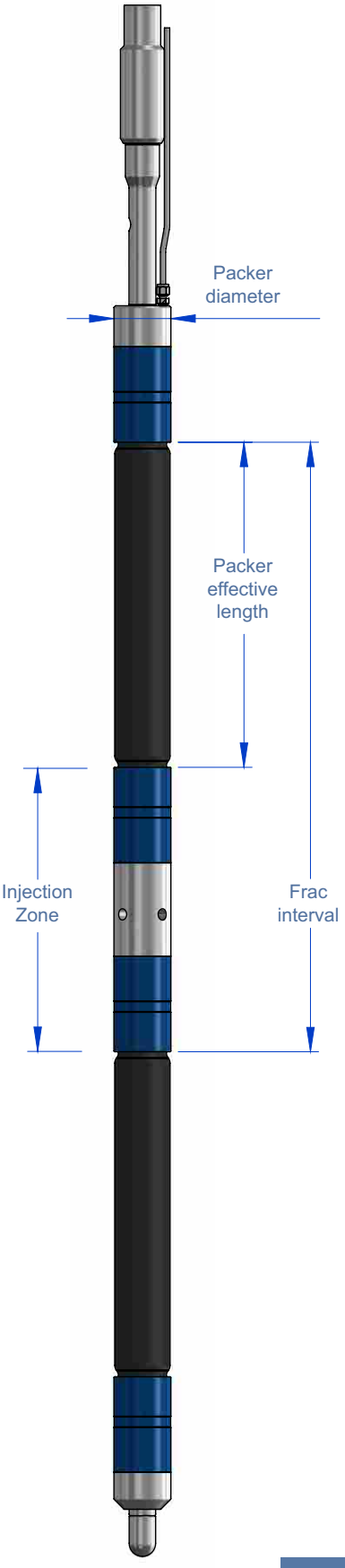
PRODUCT SPECIFICATIONS:

STANDARD SYSTEM CONFIGURATIONS

Hole size	Packer diameter		Packer effective length		Frac interval	
	mm	inch	mm	inch	mm	inch
NQ	70	2.75	400	15.75	750	29.5
NQ	70	2.75	400	15.75	1000	39.4
NQ	70	2.75	900	35.43	1500	59.0
HQ	89	3.50	900	35.43	1475	58.0

PACKER PRESSURE vs. INFLATED DIAMETER





DuraFRAC® Mini

Designed for hydraulic fracturing determination of in-situ rock stresses using IPI DuraFRAC® inflatable packer elements. IPI packers deflate faster and recover to their original diameter better than any packers on the market, enabling them to be run with smaller radial clearances.

APPLICATIONS:

- Rock stress testing
- Other geotechnical applications

FEATURES:

- Exceptional packer durability
- Single or Straddle packer system options
- Use in any hole orientation (i.e up-hole or horizontally)
- Standard 1m injection (test) zone - can be designed shorter, if shorter intervals are required
- Standard diameters from: 33 mm (1⅓") up
- Pressures up to 12,000 psi (850 bar)

OPTIONAL EQUIPMENT

- Deflation dump valve
- Use in conjunction with impression packers to analyze formation fractures.
- Downhole pressure sensors and housings available for larger sizes.
- Dual wall push rods (see over for more details)
- Air vent valve for up-hole use.
- H.P. inflation & test pump
- Data acquisition system
- Flow control board

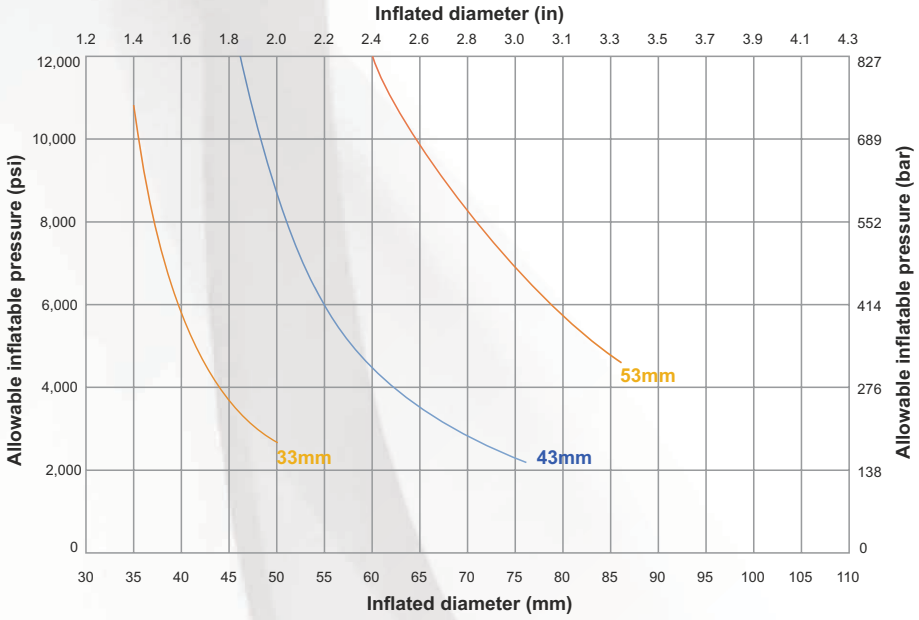
PRODUCT SPECIFICATIONS:

STANDARD SYSTEM CONfiGURATIONS

Packer diameters	33mm, 43mm, 53mm
Packer effective lengths	175mm, 500mm
Test zone length	100mm, 500mm
Rubber options	Natural (NR) Nitrile (NBR) Hydrogenated Nitrile (HNBR)

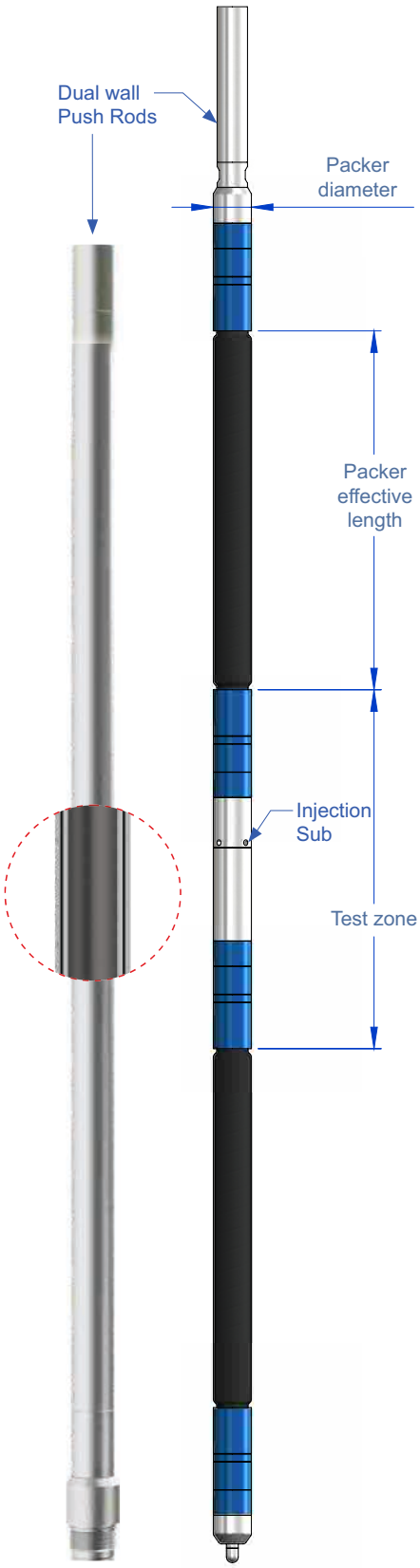
(other sizes available on request)

PACKER PRESSURE RATING vs. INFLATED DIAMETER



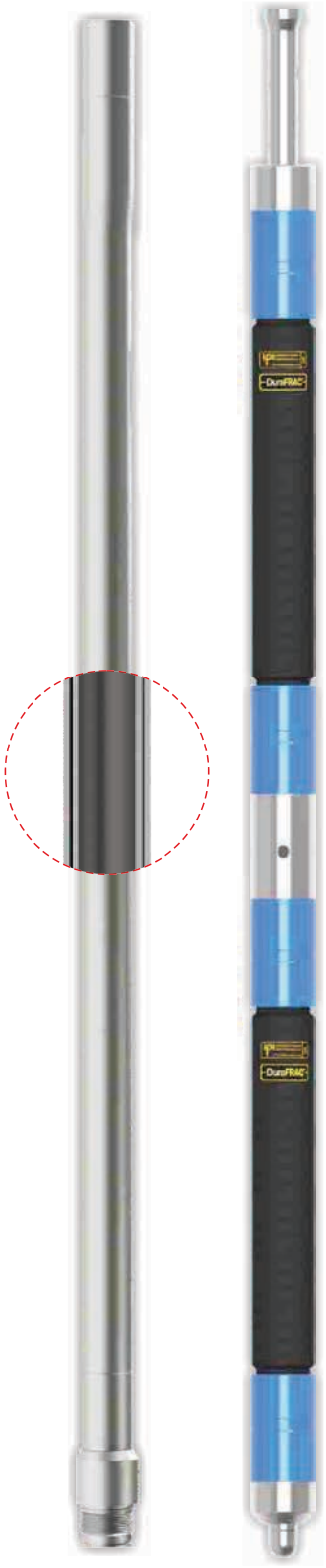
Dual Wall Push Rods

Designed specifically for DuraFRAC® Mini packer system, Push rods are light weight and enable manual deployment of the packers without the complication of separate injection pipe & inflation tube. Being O-ring sealed to guarantee pressure integrity, they simply screw together by hand as the system is installed in the Borehole.



DuraFRAC® with Dual Wall Frac Pipe

Dual wall frac pipe is designed for use with IPI DuraFRAC® packer system and eliminates the use of control line for packer inflation to the surface. It is also suitable for high flow, high pressure and abrasive/corrosive injection treatments



APPLICATIONS:

- Open or cased hole hydraulic fracturing
- Hydraulic pre-conditioning for block caving
- Rock burst mitigation
- In-situ stress testing

FEATURES:

- Multi set with exceptional packer durability
- Use in any hole orientation
- Injection zones as short as 350mm
- Pressure rating up to 12,000 psi (850 bar)
- Available in both carbon steel and stainless steel
- Lead-in wiper to minimize rock particle puncture when used up-hole
- Bypass feature to equalise pressure below and above the injection zone (optional).
- No moving parts, no exposed seals, no control line
- Suitable for use with proppant

AUXILIARY EQUIPMENT:

- Deflation dump valve for low static fluid levels
- Priming valves for up-hole use
- Downhole pressure sensors and housings

Impression Packers

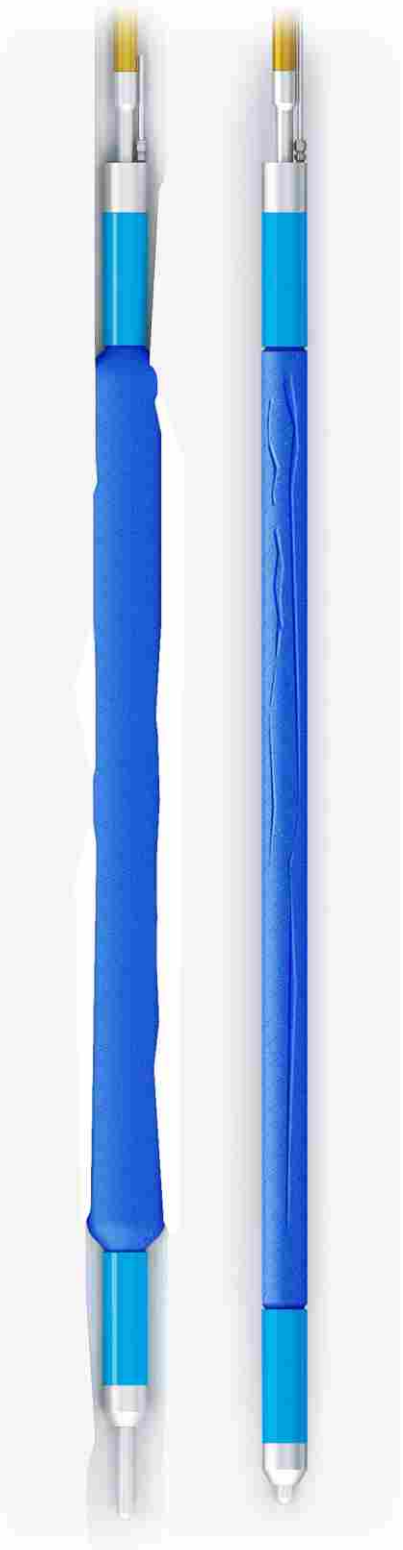
The IPI impression packer is an inflatable packer element that can be run in on tubing or drill pipe, that after being inflated into open hole or casing imprints the details of the sidewall with its unique memory retention rubber. Fine details of the sidewall are permanently imprinted on the packer element for examination at surface. Directional tools can be run in conjunction with the Impression Packer to determine the orientation of the imprint.

APPLICATIONS:

- Formation fractures
- Rock characterization
- Casing damage or splits in casing
- Corrosion or erosion pitting

FEATURES:

- Customizable packer diameter and impression lengths
- Redressable packer element
- Directional tools for impression orientation
- Impression rubber is reformable to remove previously imprinted impressions



Low Pressure Inflatable Packers

IPI offers a range of simple, lower pressure inflatable packers that typically find application for grouting works and simple hydrogeological investigations. These packers have long been the standard in the foundations and construction industries for reliable use in lower pressure grouting and similar applications.

FEATURES:

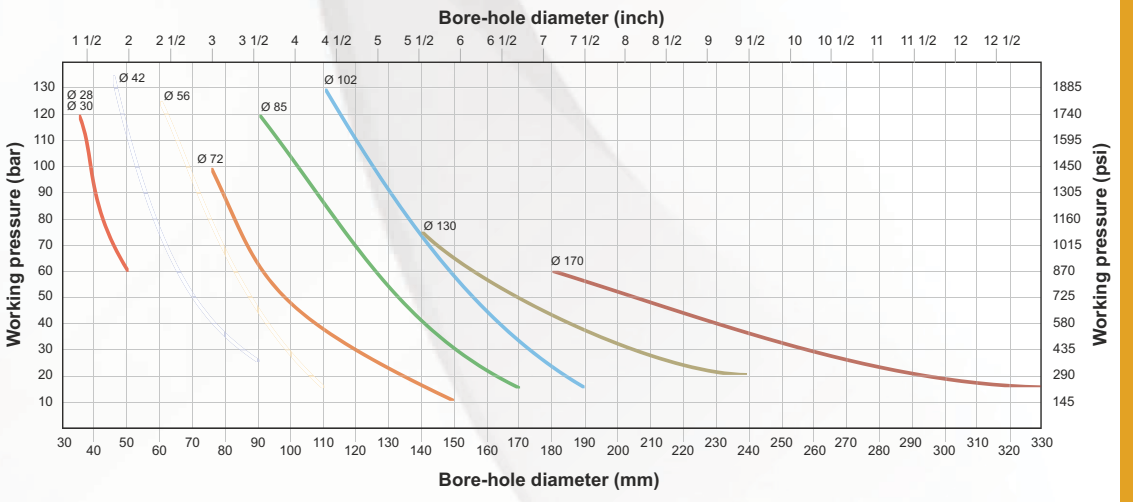
- Available as either single or straddle (double) packer assemblies
- Single packers are easily converted to double packers
- Suitable for Tube à Manchette grouting
- Double packer test zone lengths easily adjusted
- Field replaceable packer elements
- Inflated by small diameter control tube run to surface

The length of the rubber sealing element depends on the application requirements with the standard lengths being:

- 300mm for Ø 28, 30 and 42mm packers
- 500mm and 1000mm for Ø 28, 30, 42, 56, 72, 85, 102, 130 & 170mm packers

STANDARD SIZES AND WORKING PRESSURES:

Nominal diameter, mm	Connection upper	Central tube Inner diameter, mm	Expansion Max. diameter, mm	Inflation Inlet(s)
28	⅜" BSP	8	55	1 x ⅛" BSP
30	⅜" BSP	8	55	1 x ⅛" BSP
42	½" BSP	17	98	2 x ⅛" BSP
56	¾" BSP	20	125	2 x ⅛" BSP
72	1 ¼" BSP	35	160	2 x ⅛" BSP
85	1 ¼" BSP	35	185	2 x ⅛" BSP
102	2" BSP	53	200	2 x ⅛" BSP
130	3" BSP	83	270	2 x ¼" BSP
170	3" BSP	83	350	2 x ¼" BSP



STRADDLE PACKER SYSTEM

SINGLE PACKER SYSTEM

ASR Flow Control Valve

The IPI ASR (Aquifer Storage & Recovery) Flow Control Valve is an innovative and cost-effective tool for minimizing the introduction of air into injection and recovery wells. The flow control element with tapered, inflated shape in conjunction with PLC control provides a single-point choke that controls high volume flow without causing fluttering, and eliminates the need to create a variable tortuous flow path. This simple approach means that the IPI ASR Valve is lighter and more economical than other similar valves. IPI can tailor the FCV design to suit your operational requirements.

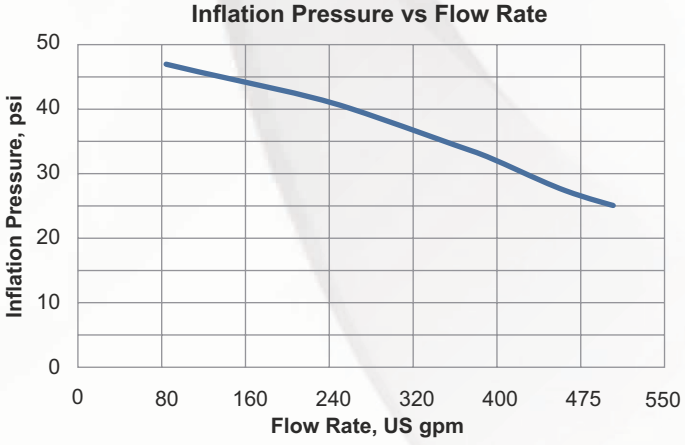
APPLICATIONS:

- Aquifer storage and recovery (requires submersible pump)
- Produced water reinjection

FEATURES:

- Provision for down hole sensors
- Inflatable element expands in a tapered shape to control annular are during injection phase
- Flow rate controlled by packer inflation pressure via a PLC (Programable Logic controller) control system which monitors injection pressure at surface and adjusts the inflation pressure to maintainthe injection pressure set points (max/min)
- Packer expands full-length in closed position. Normally closed to prevent cavitation
- Integrated downhole air-over-water inflation reservoir for rapid valve response
- Economical construction
- Scalable to fit a wide range of flow rates

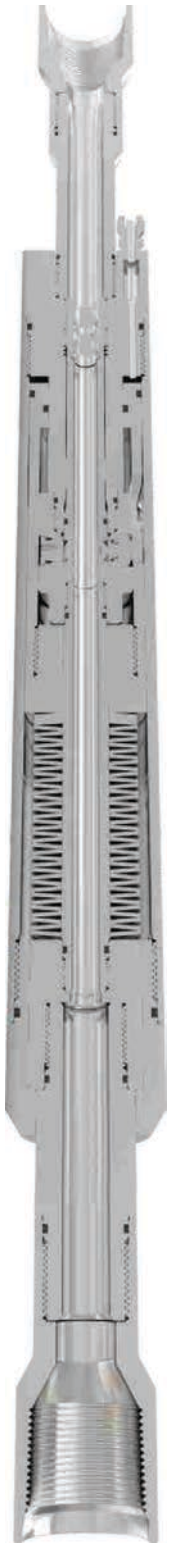
7 inch Casing ASR Valve Performance



Down-Hole Shut-In Valve (DHSIV)

The IPI Down-hole Shut-in Valve (DHSIV) is designed to be run in-line above a single or straddle packer assembly and is used to isolate a test section in communication with the running pipe ID for the purpose of hydrological testing of a well. A typical test regime requiring such down-hole pressure isolation is an Injection Fall-Off (IFO) Test.

In brief, the DHSIV comprises a ball valve maintained in position by a spring and actuated to a second position via hydraulic pressure supplied by a pressure control line run to the surface. It is usually setup in the “normally-open” condition and hydraulically actuated to the closed position although it may also be set up as “normally-closed” and actuated to “open”.



APPLICATIONS:

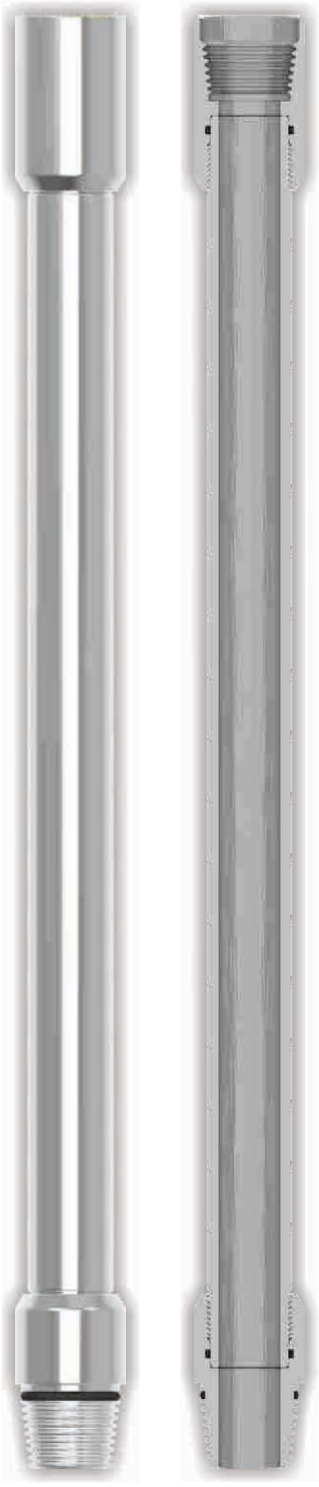
- Down-hole pressure shut-in
- Injection Fall-Off (IFO) Testing
- Drill Stem Testing (DST)
- Slug Test (Falling head test)

FEATURES:

- Zero-volume displacement shut-in
- 100% sealing ball valve
- Pressure ratings up to 10,000 psi (700 bar)
- Full stainless steel construction
- Available vented to annulus or non-vented
- High strength, long life disk springs
- Standard O.D. & I.D. sizes are:
  - 60 mm (2.362”) O.D. x 10 mm (0.394") I.D.
  - 70 mm (2.756”) O.D. x 12.7 mm (0.5") I.D.
  - 89 mm (3.5”) O.D. x 19.05 mm (0.75") I.D.
  - 114 mm (4.5”) O.D. x 25.4 mm (1.0") I.D.

O-Rod

IPI O-Rods were specifically developed to provide a 100% leak tight rod string for hydrogeological investigations. Typically mineral mining rods such as the Q-series are used for these applications but such rods, even new, are not guaranteed to offer leak tight connections. By incorporating an O-ring seal in the threaded connection, IPI O-Rods can offer this guarantee. Furthermore, these rods offer a tapered round thread connection for robustness, ease of stabbing, quick and secure make-up for a leak-free, high pressure rated rod string. The couplings have an external upset and are internally flush with the matching pipe ID to facilitate handling and deployment of tools internally.



APPLICATIONS:

Leak free, high pressure rods for:

- Hydraulic fracturing
- Other Straddle Packer applications, eg:
  - Testing of low permeability rock

FEATURES:

- High pressure rating (up to 10,000 psi)
- Robust O-ring seal
- Tapered round thread for easy make-up
- Couplings threaded and chemically bonded (Loctite®) to pipe
- Damaged couplings can be replaced
- External upset couplings for ease of running and flush internal diameter
- Standard length is 6m (20ft)
- Custom lengths, diameters and higher pressure ratings available on request
- Each rod is pressure tested at the factory for quality assurance
- Flush ID
- Carbon or Stainless steel available

NOMINAL SIZE	ID [mm]	OD [mm]	COUPLING OD [mm]	INTERNAL PRESSURE RATING
1”	24.1	33.4	44	10,000 psi
1,5”	38.1	48.3	60	8,000 psi
2”	49.3	60.3	73	6,000 psi

Replacement Inflatable Packer Elements

IPI inflatable packers are based on an Australian developed technology that has been in use since the early 1980's. Its wire reinforcing is different to more traditional cable, braided wire or slat reinforcement and offers distinctly superior multi set performance compared to other types of inflatable packer element. IPI has taken the basic design and improved both the strength and temperature characteristics to offer market leading performance in water, mining, oil and gas applications. A significant characteristic of this type of packer is its full diameter recovery on deflation – enabling high pressure multi set capability that is beyond that of more traditional designs in either cased or open hole. For an IPI packer to achieve several hundred inflate/deflate cycles in open hole is quite common – although packer life has many variables affecting it.

APPLICATIONS:

Replacement and OEM elements on service tools, including:

- Well Testing Tools
- Hydraulic Fracturing Equipment

FEATURES:

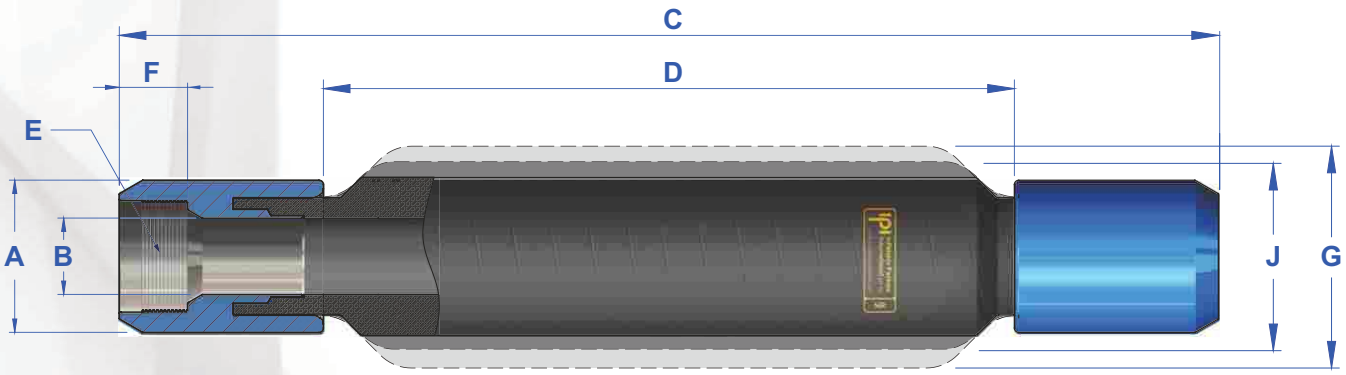
- Predicted performance from sophisticated computer modelling
- Individually factory pressure tested and supplied with test certificates
- Full diameter recovery on deflation

OPTIONS:

Min. packer element Ø	28mm	1.1in
Max. packer element Ø	≥ 2800mm	≥ 110in
Max. inflation Ø	200% Standard	
Temperature range	-40 °C (Min.) 150 °C (Max.)	-40°F (Min.) 302°F (Max.)
Effective length range	100mm - 6000mm	4in - 236in
Max. pressure	15000 psi	
Hydraulic inflation	Yes	
Standard elastomer options **Alternative materials available on request	- Natural (NR) - Nitrile (NBR) - Hydrogenated Nitrile (HNBR)	

Listed below is IPI's stocked range of oilfield standard replacement packer elements.

Custom packer elements can be built on request



A	B	C	D	E	F	G	H	J	K
Outer Diameter	Inner Diameter	Overall Length	Rubber Effective Length	Thread Connection *	Thread Length	Maximum Inflation Diameter	Maximum Pressure at Max Diameter	Optimum Inflation Diameter	Max Pressure at Optimum Inflation
3.15 in 80 mm	2.00 in 50.8 mm	65.75 in 1670 mm	51.57 in 1310 mm	2.81 x 8 SA 71.4 x 8 SA	1.93 in 49 mm	6.25 in 159 mm	750 psi	3.50 in 89 mm	5000 psi
4.33 in 110 mm	2.44 in 62 mm	65.75 in 1670 mm	49.61 in 1260 mm	3.87 x 6 SA 98.25 x 6 SA	2.41 in 61.2 mm	8.27 in 210 mm	1000 psi	5.00 in 127 mm	5000 psi
5.00 in 127 mm	2.00 in 51 mm	65.75 in 1670 mm	50.00 in 1270 mm	2.81 x 8 SA 71.4 x 8 SA	1.97 in 50 mm	8.50 in 216 mm	3000 psi	6.25 in 159 mm	5000 psi
5.50 in 140 mm	3.19 in 81 mm	66.02 in 1677 mm	47.91 in 1217 mm	4.87 x 6 SA 123.8 x 6 SA	3.03 in 77 mm	10.25 in 260 mm	1350 psi	6.50 in 165 mm	5000 psi
6.75 in 171 mm	3.39 in 86 mm	66.02 in 1677 mm	47.91 in 1217 mm	4.87 x 6 SA 123.8 x 6 SA	3.03 in 77 mm	12.50 in 317 mm	2200 psi	8.00 in 203 mm	5000 psi
7.50 in 190 mm	4.45 in 113 mm	66.02 in 1677 mm	47.91 in 1217 mm	6.25 x 6 SA 158.7 x 6 SA	2.78 in 70 mm	13.25 in 337 mm	1800 psi	8.00 in 203 mm	5000 psi
10.50 in 267 mm	4.06 in 103 mm	66.14 in 1680 mm	37.80 in 960 mm	6.25 x 6 SA 158.7 x 6 SA	3.00 in 76 mm	16.50 in 419 mm	1400 psi	11.50 in 292 mm	5000 psi

* 'SA' - Abbreviated Stub Acme

Custom Made Packers

IPI packer technology is probably the most versatile of inflatable packer technologies and has many potential non-standard formats and applications. IPI's business started from custom design and manufacture to order and IPI still develops specific products for clients, completely customized or a customization of the growing list of our standard inflatable packer products. This may be as simple as stainless steel versions, higher temp versions (requiring different seals and elastomers) and chemically resistant versions, to IPI rising to the challenge of something totally new. This covers the application of our core packer technology as well as the developing tools the elements are run on. If needed to put together a complete system, IPI will also buy in equipment from third parties – delivery of which often defines the critical path on the delivery schedule. A high level of inventory, SolidWorks CAD software, years of experience and a strong client service ethic result in a high level of client service and satisfaction. We cannot always reveal details of our custom designs, or certain details, owing to confidentiality restraints, but the following are some examples of customized and custom designed products and detail that we can feature.

For an underground mining project in an Andean mountain location in 2015, comprising of both standard products and custom made equipment, including customized water flow diverter systems, plug and abandonment packers and monitoring packers, together with stainless steel versions of SWiPS®.

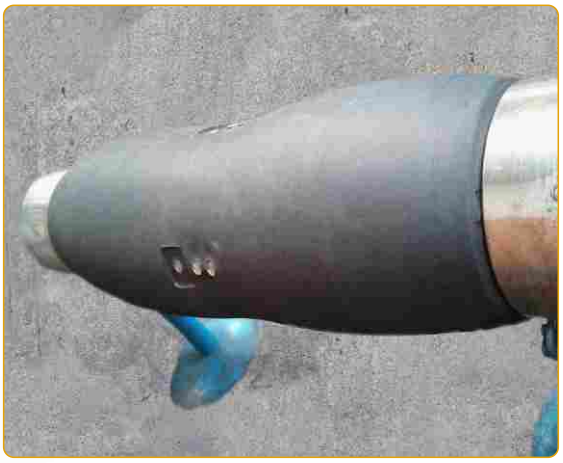
A high temperature blow out preventer to use with mineral drilling equipment in SE Asia shipped at 3 weeks notice in 2015. The BOP uses inward inflating IPI packer technology.

130mm stainless steel packers for solution mining (In Situ Leaching/ In Situ Recovery) in South Western USA. ISR is expected to be a significant mining technique in the future.

A shipment of customised 70mm Hydraulic Fracture Straddles with special 400mm long elements for a major South American mine in 2013. Now a standard product.

Special purpose inflatable packers deployed as part of a subglacial geological drilling operation performed for an Antarctic research project. This is another IPI supplied project funded by the United States Government. IPI has clients on every continent, including those operating in Antarctica's extreme conditions.

A series of PVC tube mounted pipe packers for a copper mine's tailing dam.



A 355mm dilatometer sleeve – an example of IPI providing an OEM component solution for a European client who has made the rest of this advanced tool for rock elasticity measurement. Now a regular order from this client, covering various sizes.

Inflatable Packers International