

BEISMI

**Catalog
6**

**Manufacturer of
Inflatable Packers, Flow Control Valves,
Pitless Units and other products for
investigating, controlling and
producing the
*EARTH'S FLUIDS.™***



Dear Friends,

This catalog marks the 25th anniversary of the founding of Baski, Inc. We have expanded our product line over the years to include standard and custom designs of packers, pitless units, and flow control valves.

Our packer sales are growing worldwide as we expand into the gas and oilfield markets with our proven water well inflatable packer technology. Established applications such as hydrofracturing continue to do well as contractors experience our packer's long life and dependability.

Installations of our extra heavy-duty pitless units have been remarkably successful, with some pump installations exceeding 2,500 feet. We expect that sales will continue to increase as users become familiar with the unit's high strength and long, trouble-free operation.

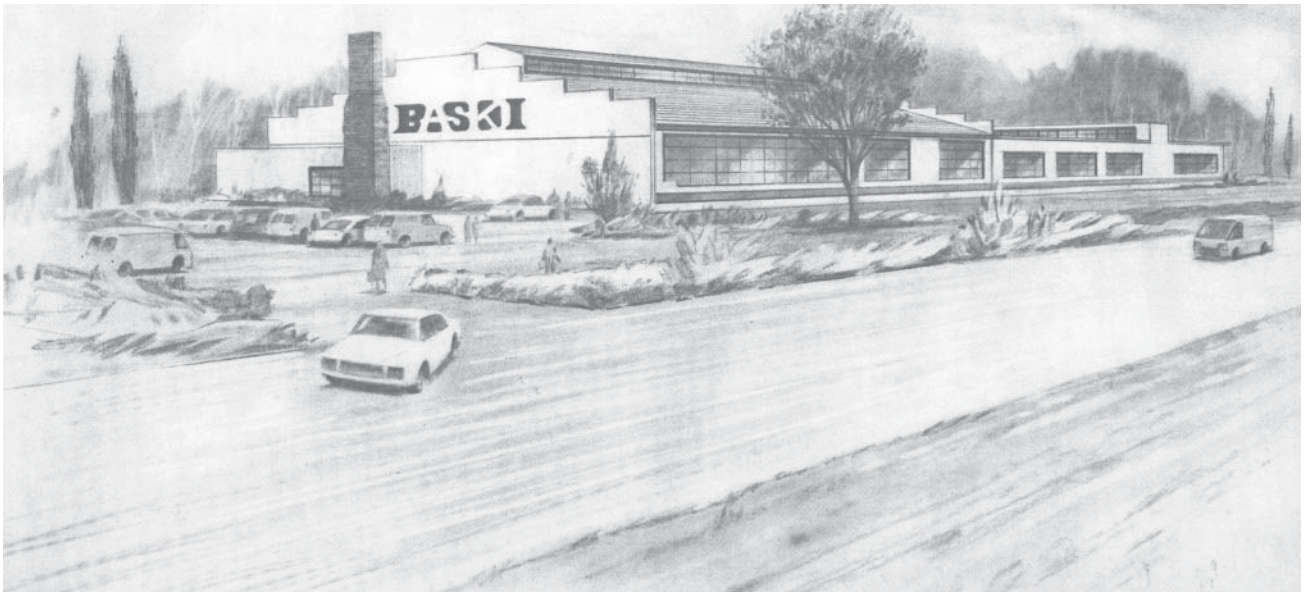
In 1992, we manufactured the world's first downhole Flow Control Valve (FCV™) for Aquifer Storage and Recovery (ASR). Today, the use of our valves in ASR projects is growing rapidly in order to ensure a safe and dependable water supply. Water organizations depend on our valves' reliable delivery of cavitation-free flow control over a wide range of injection capacities. In the future, we expect the valve to also be used in Aquifer Thermal Energy Storage (ATES), as this energy management application emerges from its infancy.

In closing, Baski, Inc. will continue to customize and develop new products in order to meet the growing needs of our customers. Our mission is to provide reliable, high quality products and service on every job for every customer.

Sincerely,

A handwritten signature in cursive script that reads "Henry A. Baski".

Henry A. Baski, President



Ask Baski

Custom products are an important part of what Baski, Inc. designs and manufactures. We welcome inquiries from customers with challenging projects and the opportunity to work with them through the many facets of design and construction towards a successful solution. We can offer helpful hints on many aspects, including the integration of third-party and Baski custom products. We are also happy to show you our manufacturing facility in Denver, Colorado and to discuss any application you may have in person. Below are answers to some frequently asked questions:

Q. Can you provide for a submersible pump between two packers for pump testing?

A. Yes, we have done pump testing for well sizes from 3 to 16 inch. For example, we have incorporated a pump with shroud, shut-in valve, two packers, and three transducers in a 3 inch hole.

Q. What do you recommend for hydrofracturing an 8 inch well?

A. Most hydrofracturing is done in 6 inch wells. For single packer applications we have a low-cost solution using a sleeve (5 inch ID x 7 inch OD) that is slipped over our commonly-used FR-4.9 Fracker™. For higher pressure applications or straddle zone applications, two of our FR-6.8 are the ideal solution.

Q. I have had trouble with packer elements rupturing. Can you help?

A. Yes, because we use a proprietary design and manufacturing process to make the entire packer, including its critical element. Our inflatable elements typically have four to twenty carefully oriented plies of reinforcing vs. commonly-made designs using only one layer of slats or two plies of cords or cables. Our unique Baski Inflatable Packer (BIP™) design provides a very high pressure rating and virtually eliminates rupturing during normal use. In fact, we test every medium-duty packer before it is shipped to 500 psi in the open and 1,000 psi confined. Frackers™ are tested to 3,000 psi in the open and 4,500 psi confined. Custom rock stress testing packers are tested to 6,000 psi in the open and 10,000 psi confined. To the best of our knowledge, we are the only manufacturer worldwide who subjects their packers to such a rigorous testing program.

Q. What are your manufacturing capabilities for pitless units?

A. We can make units in all casing sizes, including line pipe sizes and oilfield casing sizes, from 8 inch nominal (8-5/8 inch OD) to 30 inch OD. We are the only manufacturer to make extra heavy duty units

that can accommodate depths down to 3,000 feet, using high-strength oilfield casing for column pipe instead of low-strength line pipe. We look forward to inquiries involving even larger casing and deeper set applications.

Q. How large do you make Flow Control Valves (FCV™) and how deep can I set them?

A. The smallest valve we have made was for a 2 inch column pipe and the largest was a 16 inch OD housing with a 12 inch column pipe size. We have FCV™ designs ready for 14, 16 and 18 inch column pipe sizes, and can go even larger. While our valves are typically set to depths of 200 to 1,000 feet, we have installations at 2,500 feet and designs for 3,000+ foot applications. As an added note, we have found that ASR wells are a much more corrosive environment than conventional water wells. This is due to the variable quality of the injected water, which can include corrosive chlorine and dissolved air that function as oxidizers. Therefore, our valves are constructed of Type 316 stainless steel. A potable rubber compound is used to make the reinforced element. There are no sliding seals or o-rings to wear out or leak. All of the valves are infinitely adjustable from drip-tight shut-off to maximum flow. Finally, each valve is tested at various flow rates and pressures in our custom-built testing facility.

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Baski Inflatable Packers (BIP™)

U.S. Patents 4,455,027 and 5,778,982

A packer is an expandable plug used to isolate sections in a well or borehole for pumping, injection, hydrofracturing, grouting, flow control, sampling, and monitoring.

Inflatable packers have been used in the oil and gas industry since the 1940's. Until recently, however, their use was restricted by prohibitive costs and limited availability. Now, several disciplines (e.g. ground water development, contamination studies, dewatering, geothermal, mining, coal bed methane, and geotechnical studies) use a wide selection of reasonably priced packers.

Basically, a packer separates a well or borehole into two sections, while still allowing access to both. Additional packers allow more sections.

The **inflatable** packer has significant advantages compared to other packer designs. These advantages

include a high expansion ratio, a minimal outside diameter combined with a large interior diameter opening, a long sealing section, which conforms to uneven sides in a borehole, and a high pressure rating. Hence, the inflatable packer is very efficient and versatile.

The inflatable packer consists of a mandrel (pipe base) with a reinforced rubber element on the outside that is attached at both ends. Generally, packers have threaded connections at each end. National pipe taper (NPT) connections are commonly used to depths of 500 feet, while higher strength oil field API threads are used for deeper sets. An inflation port allows gas, water or a solidifying liquid to enter between the element and mandrel to expand the rubber. When placed inside a well casing or borehole, the reinforced rubber element seals against the inside well diameter and prevents fluids from passing up or down the well along the outside of the packer. Since the packer has a passageway through its center, fluids can be pumped through it, and tubes, wires, etc. can pass through it. For example, water beneath the packer can be pumped to the surface without contacting a contaminated aquifer above the packer.

A Baski Inflatable Packer (**BIP™**) can be used multiple times for different applications simply by changing adapters and end fittings. For example, a pump can be placed between straddle packers and the appropriate adapter end fittings assembled from stock to allow passage of various wires, inflation tubes, and air line monitoring tubes.

Normally, packers are lowered and suspended in a well by pipe. Inflation lines, wires, tubing, and other lines are attached to the outside of the pipe and over-the-coupling protectors can be utilized to protect all of these various lines where they go over a coupling. Occasionally, the packer string is lowered on rods in order to have more room for all of the above lines. These rods will typically be "sucker rods" from the water well or oilfield industries. For smaller holes, where room is a serious constraint, we have developed our Versatile Packer System (**VPS™**) wherein the entire string of supporting pipe and packers are of the same outside diameter (OD). In this case, all of the various lines are located inside of the pipe and packers, where there is more room and they are better protected.

Please refer to "Custom Products" on page 10 for further information on custom BIP™ and the VPS™.



Assortment of Baski Inflatable Packers

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Typical Packer Applications

The selection of a packer for a particular job application is very important for success at a reasonable cost. The differential pressure and hole size are primary considerations. Next, the materials of construction should be considered, especially when adverse chemical and physical conditions could exist.

First, we will discuss the hole diameter size and borehole differential pressure in a packer application. **For example, to pump a 2 inch diameter by 50 foot deep monitor well that is full of water, the maximum drawdown (max. borehole differential pressure) would be 50 feet of water times 0.433 psi/foot of water which equals 22 psi.** Therefore, a 1-3/4 inch OD packer with a 22 psi differential pressure rating would do the job. In addition, the packer should be constructed of stainless steel and have an element gland covered with Viton* to reduce sample contamination. The Baski ReFlex™ packer (fully-reinforced, fixed-end design) would be ideal.

Another packer application might be in a mud-filled pilot drill hole at a potential water well site. If there is nonpotable water at an unknown depth, packer testing can define where the “poor” water is located. A straddle packer configuration is attached to the drill pipe and lowered into the open borehole. Water is then pumped from a specific zone between the straddle packers by using airlift or conventional pumping methods inside the drill pipe. The testing would normally start from the bottom of the hole and progress upward. After locating the poor water, it can be cased off and a potable water well completed.

To be specific, let us examine a straddle packer arrangement for the above application with a 7-7/8 inch ID by 1,000 foot deep hole. For a competent rock hole, a 5-1/2 inch OD packer with a 2-1/2 inch (Sch. 80) mandrel would be an economical choice. However, if unstable hole conditions are possible, then a better choice would be a 6-1/2 inch OD packer with a 3 inch (Sch. 160) mandrel. API round threads for a higher joint strength are also recommended in case the hole collapses. If the hole were completely pumped dry, there would be a 433 psi differential pressure. Therefore, a packer with a 500 psi differential pressure rating is recommended. Standard construction materials (aluminum, stainless steel and steel components, and a reinforced natural rubber element) should be sufficient. All stainless steel construction, a longer-than-

standard and/or Viton*-covered element are also available options.

A third packer application could be hydrofracturing a low-yielding, 6 inch diameter, domestic well with an installed pitless adapter. A good selection would be the FR-4.9 Fracker™, a fracture packer with a 4.9 inch OD, to clear the pitless adapter which may protrude inside the well casing. A 3,000 psi differential pressure rating would suffice for most fracking jobs using 3,000 psi injection pressure.

The life of the Fracker™ (i.e., the number of packer settings with high pressure injection) is a direct function of the inflatable packer specifications and construction, the hole conditions, and the proper procedures used on site. The normal life of our Frackers™ is 500 to 1,000+ inflations, as reported to us by contractors.

Remember that hydrofracturing between two packers can develop extremely high tension forces on the connecting pipe between the packers. In a 10 inch hole at 3,000 psi, the tension force is close to a quarter of a million pounds! Proper selection of the pipe and thread pattern between the packers prevents failure that could result in the loss of the lower packer and damage to the upper packer.



Ray Boyle hydrofracturing with a Fracker™ in Africa

*DuPont

Dimensions, Inflation and Differential Pressure

The general specifications for a packer include:

1. Uninflated Outside Diameter (OD)
2. Maximum inflated OD
3. Borehole differential pressure
4. Uninflated exposed rubber element length
5. Materials of construction

The uninflated OD must always be smaller than the minimum hole diameter through which the packer must pass. The maximum inflated outside diameter is the largest suggested hole size for which the packer should be used. The borehole differential pressure is the difference in pressures above and below the packer, e.g. drawdown or injection pressure over hydrostatic. With gas inflation, the packer inflation pressure is the sum of the pressures necessary to:

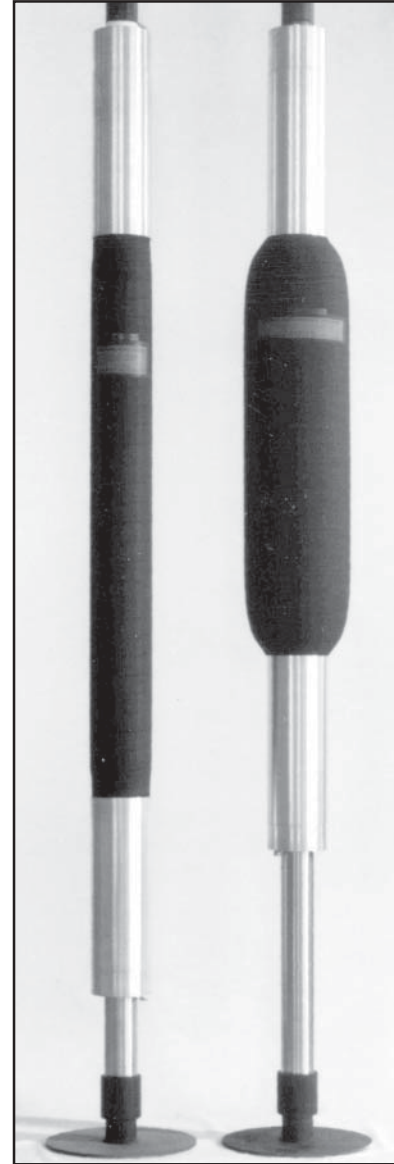
1. Match the water pressure above the packer (submergence pressure), or to match the injection pressure at the packer;
2. Stretch the rubber element out to the borehole; and
3. Seat the packer firmly enough against the well hole to prevent any movement caused by the borehole differential pressure.

The exposed element length affects the “holding power” and sealing ability of the packer. A longer element has more rubber contact against the hole and provides a larger frictional force to support a larger borehole differential pressure. The packer is strongest (highest differential pressure rating) if its uninflated OD is close to the hole size and is weakest when inflated to its maximum diameter.

As a manufacturer of inflatable packers, Baski carefully controls all aspects of design, machining, element-building, processing, and testing. Since all operations are “in-house”, there is a wide selection of materials and sizes available beyond standard design. Our standard off-the-shelf packers are available for 2 to 21 inch boreholes, and custom sizes for 1 to 60 inch holes can be provided.

Oftentimes, packer installations can require additional equipment. In order to pressurize a packer, a pressure source (nitrogen cylinder, gas booster, or water pump), pressure regulator, and inflation tubing are usually necessary. The inflation tubing can be inexpensive, 1/4 inch OD nylon tubing for working pressures up to 625 psi, or 3/16 inch ID hydraulic hose and stainless steel tubing for higher pressures. A fluid intensifier pump uses 100 psi compressed air to pump water to 4,500 psi or higher. When pumping water out from between two packers, a pump shroud can be used to provide cooling water for the submersible pump motor and to mechanically connect the pump to the packers. Perforated pipe or screen is also available for injection or withdrawal of fluids from between the packers. In-Line Adapters (ILA) are commonly used to

seal electrical and pneumatic feed-throughs, lines that pass through the inside of the packer. Finally, rubber packer sleeves can be manufactured to economically increase the packer OD for larger diameter applications.

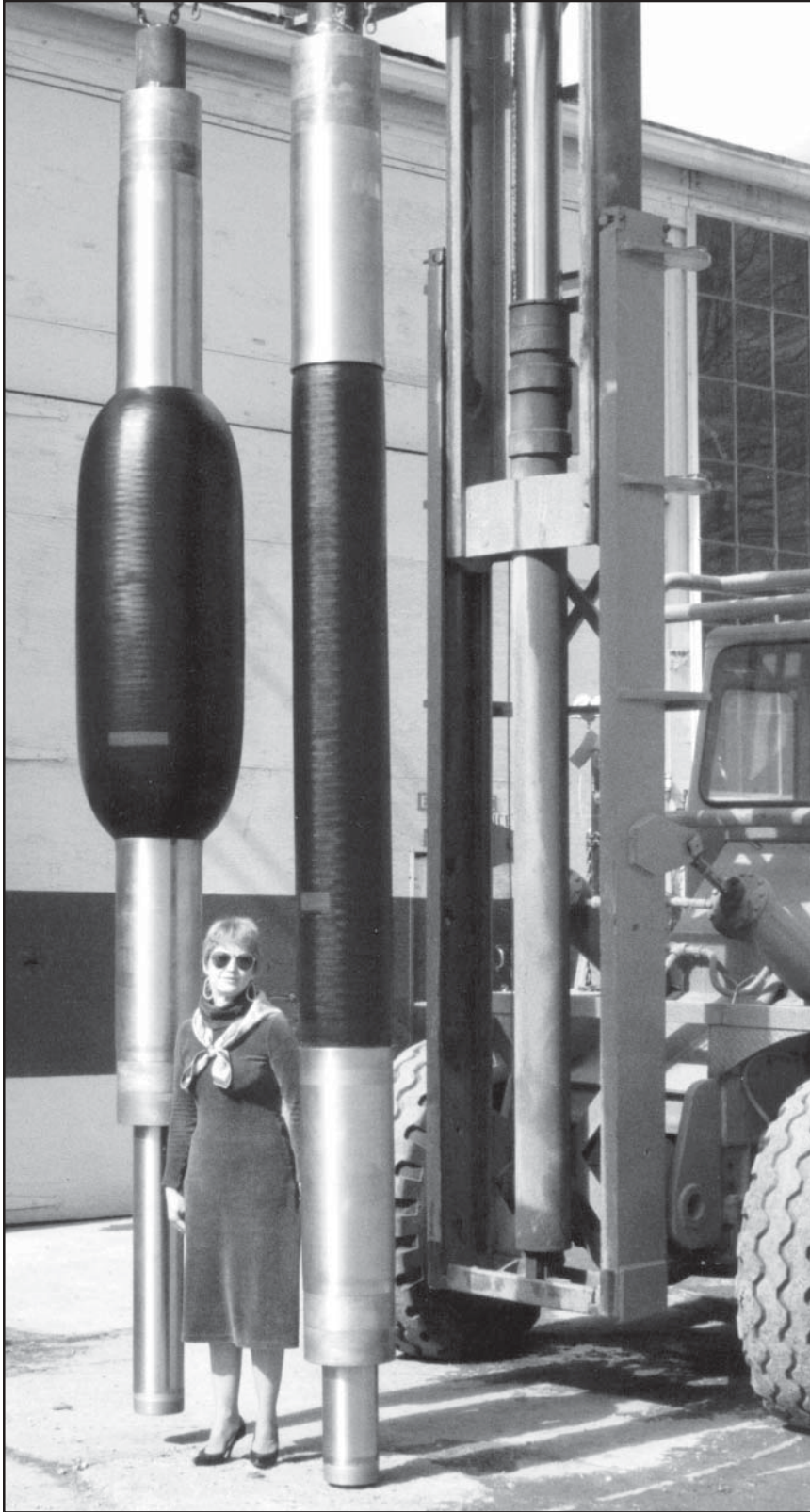


Uninflated and Inflated Sliding-End Packers

Borehole Differential Pressure Rating

In order to choose the appropriate Baski Inflatable Packer (BIP™), the anticipated borehole differential pressure must be known. The borehole differential pressure is the difference between the test zone pressure below and the borehole pressure above the packer. **The pumping drawdown in a well or the downhole injection pressure at the packer over the hydrostatic are two common examples of the borehole differential pressure.**

Fixed-End vs. Sliding-End Packers



Our unmatched Medium-Duty MD-11.2 packer is available off-the-shelf with a 6 inch mandrel (11.2 inch OD uninflated and 21 inch OD inflated).

There are two types of inflatable packer constructions: fixed-end and sliding-end.

A **Fixed-End Packer** has both ends of the element (or element gland) fixed. The element can be one of three styles: non-reinforced, partially-reinforced, or fully-reinforced. Non-reinforced or "balloon"-type packers can easily fail because of element extrusion into open borehole fractures, or into the annular area between the packer ends and the casing or borehole. Partial reinforcement at the ends of the element helps to prevent extrusion into the annular area near the packer ends, but the element can still extrude into borehole fractures. In 1993, Baski introduced the **ReFlex™** packer (U.S. Pat. 5,778,982), a fixed-end packer with a fully-reinforced element to prevent extrusion problems. ReFlex™ packers can be used for high pressure applications that require moderate expansion ratios in casing or open borehole conditions.

A **Sliding-End Packer** allows the element gland to slide on one end. As the element diameter increases during inflation, an o-ring seal allows one end of the element to move (or slide) on the pipe base. The sliding-end packer is recommended for open borehole or high pressure applications where the differential pressure between the top and bottom of the packer ranges from 100 to 10,000 psi. Also, the sliding-end design with a fully-reinforced element offers high expansion ratios.

The materials used to manufacture our packers can be varied to suit individual applications. Standard elements are constructed of natural rubber with high-strength reinforcing such as aramide fibers (Kevlar*). Optional elastomers include nitrile, neoprene, or fluorocarbon elastomers (Viton*). The standard metal components of our packers include a combination of aluminum, stainless steel, and steel for applications in normal environments. "All aluminum" or "all stainless steel" metal components can be supplied for use in semi-corrosive, extended-term, or other applications. Titanium, copper, and Hasteloy are examples of metals available for highly specialized applications.

*DuPont

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Medium Duty & Light Duty Packers

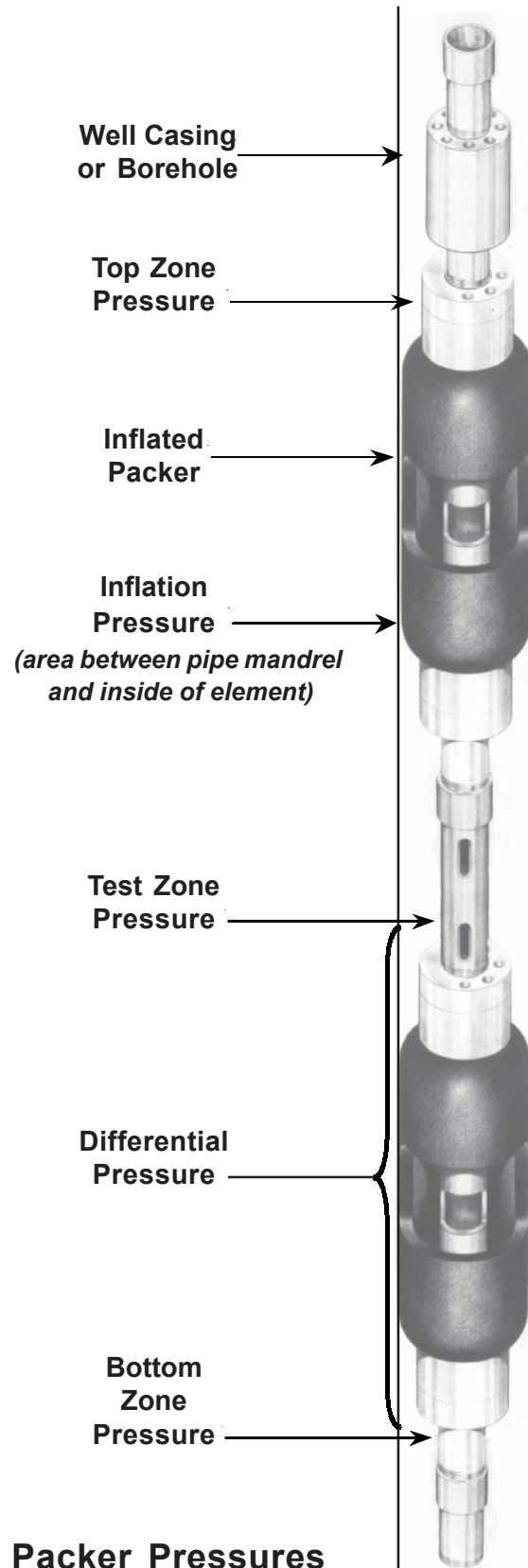
Medium Duty Packers

The Medium Duty Packer is the most popular of the Baski Inflatable Packers (BIP™). **A large expansion ratio and high differential pressure rating make this packer a versatile tool for a wide range of hole sizes and depths.** For example, a 3.4 inch OD Medium Duty Packer can seal a 6 inch hole with a 300 psi differential pressure rating, allowing it to be set at 700 feet and used for pump testing. The same packer has a differential pressure rating of 900 psi in a 4.5 inch hole, permitting injection tests up to 900 psi over the hydrostatic. Of course, it can also be used at shallow depths for low pressure applications. The long life of a strong Medium Duty Packer further adds to its cost effectiveness. Standard construction includes aluminum, steel, stainless steel, and a reinforced natural rubber element. Special oil resistant covers and stainless steel metal parts can be ordered. Some of our Medium Duty Packers are constructed of Type 316 stainless steel as standard (refer to page 8 for "Standard Packer Selection"). The Medium Duty Packer is a wise investment for a majority of applications.

Light Duty Packers

Monitor well use has increased in the last few years. The very shallow sets for water and/or gas sampling in these wells initiated our Light Duty Packers. **Designed with low cost and reliability in mind, Light Duty Packers provide convenient methods for zone sampling in 2, 4, and 6 inch wells.** For those special applications requiring inert materials, stainless steel and Viton* options are available.

*DuPont



Fracker™ with Replaceable Element

The **Baski Fracker™** is a versatile sliding-end packer for use in single or straddle-type configurations to increase water production from low-yielding wells. Further applications include: hydrology testing (zone testing and sampling), geotechnical investigations, and grouting. Rock stress testing can be done with custom-made packers rated at 6,000+ psi. Although the most popular size is for a 6 inch hole, Frackers™ are available for hole sizes ranging from 3 to 20 inches. Please refer to page 8 for standard and page 10 for custom Fracker™ sizes.

The materials and proprietary construction of the Fracker™ element make it a standard of comparison for longevity, ruggedness, predictability and cost-effectiveness. The element and supporting components represent the most significant inflatable packer design change in the past 20 years!

Advantages of the **replaceable Fracker™ element** are:

- **Ruggedness**

The Fracker™ element uses a multi-ply construction with 8 to 20 plies of aramide (Kevlar*). Kevlar*, which is the same material used in bulletproof vests, provides strength and puncture resistance. Kevlar* is non-corrosive, longer-lasting, and stronger than steel.

- **High pressure ratings**

As an example, every Fracker™ for a 6 inch well is tested at an unconfined pressure of 3,000 psi and a confined (in-pipe) pressure of 4,500 psi.

- **Improved sealing capability**

The long element length combined with a tough rubber cover provides an effective seal in the borehole.

- **High frictional holding capability**

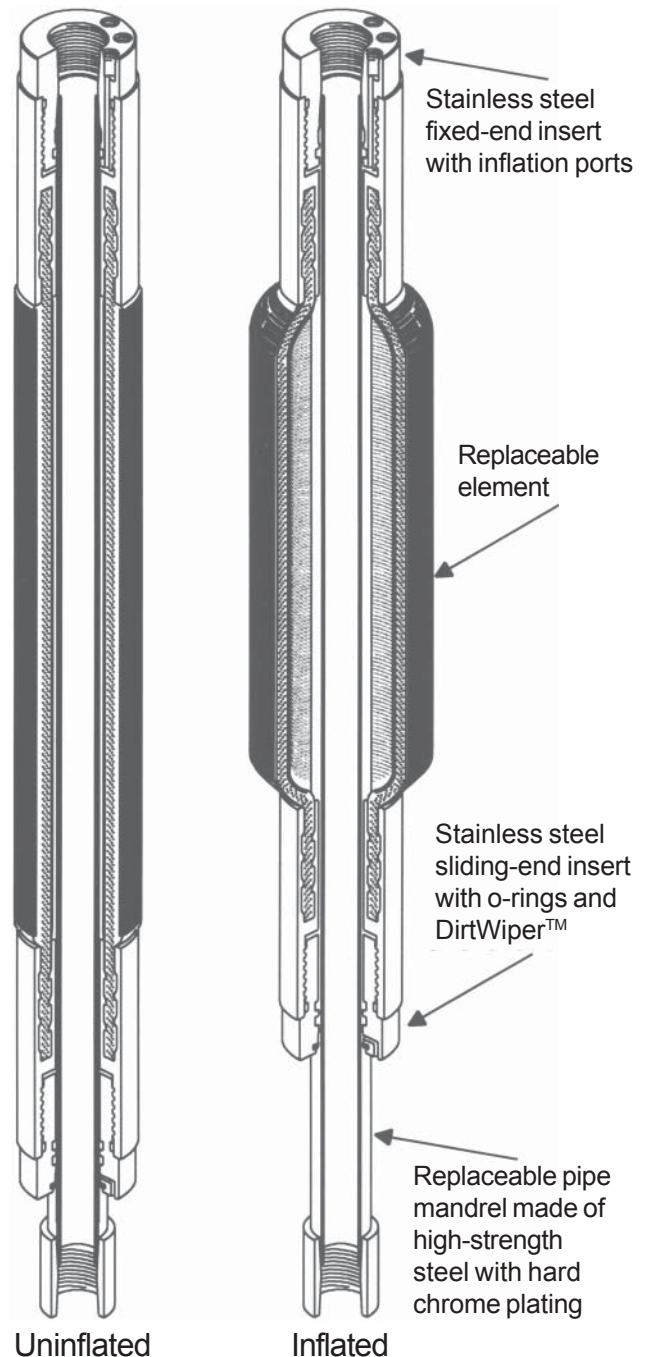
Depending upon borehole conditions, the Fracker™ element uses an inflation pressure of 1.2 to 1.5 times the injection pressure to anchor the packer.

- **Long-life**

The design of the replaceable element allows the use of "either end up" to promote even wear and prolong element life. Contractors report 500 to 1,000+ inflations!

- **Quick Deflation**

Our Fracker™ deflates in 1 to 2 minutes.



*DuPont

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Standard Packer Selection Table

U.S. Patents 4,455,027 and 5,778,982

Model Number	Uninflated O D		Largest Recommended Hole Size		Mandrel Pipe Size			Uninflated Element Length		Material
	inch	(mm)	inch	(mm)	Nominal inch	Actual ID inch	Actual ID (mm)	inch	(mm)	
Medium Duty (Sliding-End):										
MD-1.8	1.8	(46)	3.2	(81)	1/2	0.55	(14)	40	(1,016)	316 SS
MD-2.4	2.4	(61)	4.5	(114)	3/4	0.74	(19)	40	(1,016)	Al-Steel-SS
MD-2.7	2.7	(69)	5.0	(127)	1	0.96	(24)	40	(1,016)	316 SS
MD-3.4	3.4	(86)	6.5	(165)	1-1/4	1.28	(32)	40	(1,016)	316 SS
MD-4.0	4.0	(102)	7.5	(191)	1-1/2	1.50	(38)	40	(1,016)	Al-SS
MD-4.5	4.5	(114)	8.5	(216)	2	1.94	(49)	40	(1,016)	316 SS
MD-5.5	5.5	(140)	10.5	(267)	2-1/2	2.32	(59)	50	(1,270)	Al-SS
MD-6.4	6.4	(163)	12.5	(318)	3	2.90	(74)	50	(1,270)	Steel
MD-7.4	7.4	(188)	14.0	(356)	4	3.83	(97)	60	(1,524)	Steel
MD-9.4	9.4	(239)	18.0	(457)	5	4.81	(122)	70	(1,778)	Steel
MD-11.2	11.2	(284)	21.0	(533)	6	5.76	(146)	80	(2,032)	Steel
MD-14.5*	14.5	(368)	27.5	(699)	8	7.63	(194)	100	(2,540)	Steel
MD-16.0*	16.0	(406)	30.0	(762)	10	9.56	(243)	110	(2,794)	Steel
Fracker™ (Sliding-End):										
FR-3.8	3.8	(97)	6.2	(157)	1-1/4	1.00	(25)	45	(1,143)	Steel-SS
FR-4.4	4.4	(112)	6.5	(165)	1-1/4	1.00	(25)	45	(1,143)	Steel-SS
FR-4.9	4.9	(124)	7.0	(178)	2	1.60	(41)	45	(1,143)	Steel-SS
FR-5.4	5.4	(140)	8.0	(203)	2	1.60	(41)	45	(1,143)	Steel-SS
FR-6.8	6.8	(173)	9.3	(236)	2-1/2	2.25	(57)	55	(1,397)	Steel-SS
FR-8.0*	8.0	(203)	11.5	(292)	3	2.50	(64)	70	(1,778)	Steel-SS
FR-9.5*	9.5	(241)	14.0	(356)	4	3.50	(89)	80	(2,032)	Steel-SS

Differential pressure ratings of a given packer for different hole sizes are available.

Please contact us for detailed individual packer specifications.

The specifications above are subject to change without notice.

Testing: All Medium Duty models are tested to 500 psi (35 bar) unconfined and 1,000 psi (70 bar) confined.

FR-3.8 tested to 1,500 psi (103 bar) unconfined and 3,000 psi (207 bar) confined.

FR-4.4 through FR-9.5 tested to 3,000 psi (207 bar) unconfined and 4,500 psi (310 bar) confined.

* All of the above models are normally stocked, except those marked by an asterisk.

Please refer to page 10 for "Custom Packers"



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APV, ILA, Tubing, Hose, and Accessories

Access Port Valves (APV)

APVs are pneumatically actuated valves that control fluid flow into or out of a packer string, as shown on page 13. Our design can handle differential pressures of 1,500 psi during opening and closing. We stock APV for pipe sizes of 3/4, 1-1/4, and 2 inch (nominal) and make custom models of all sizes, desired materials, and pressure ratings.

In-Line Adapters (ILA)

An ILA is used to feed all leads from outside a packer string to within and through the packer, as shown on page 12. We make standard sizes ranging from 3/4 to 6 inch (nominal) and custom models in all sizes and desired materials.

Nylon Tubing

Nylon tubing rated at 2,500 psi burst at room temperature is custom extruded in 5,000 foot lengths for 3/16 and 1/4 inch OD sizes, and 3,000 foot lengths for the 3/8 inch OD size. We stock a large quantity of the 1/4 inch OD size. A typical working pressure of 625 psi provides a 4:1 safety factor.

Medium Pressure Hose

This is a hose we have designed for deep sets. It is 1/4 inch OD nylon tubing overlaid with braided reinforcement and a urethane cover. This provides a 2,000 psi working pressure (8,000 psi burst) and a high collapse pressure of 1,500 psi.

High Pressure Hose

High pressure, thermoplastic hose is available with the following specifications: 0.187 inch ID, 0.36 inch OD, 3,000 psi working pressure, and 12,000 psi minimum burst pressure. It also has a 3.5 inch minimum bend radius, 3.41 lbs./100 feet, nylon 11 tube construction, single Aramid braid reinforcement, black urethane cover, and -40°F to +150°F temperature range. The collapse pressure is 500 psi. For higher pressures and temperatures, stainless steel tubing is recommended.

Stainless Steel Tubing

High temperature or high pressure applications require stainless steel tubing. Long lengths of tubing are custom manufactured and coiled onto reels. Outside diameters (OD) of 3/16 inch and 1/4 inch are most commonly used. We stock the 1/4 inch OD size in 5,000 foot lengths.

API Couplings

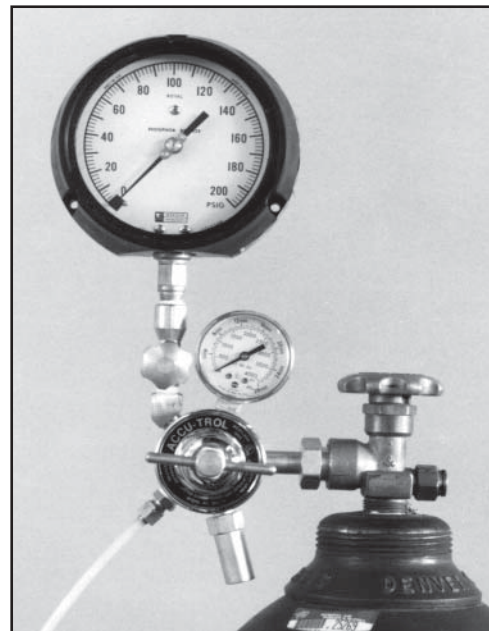
For deep-set applications at more than 500 feet, we provide API couplings and tubulars made from high strength steel (55,000 psi yield).

Fittings

Brass, steel, and stainless steel tube and pipe fittings are available. These fittings are used for air lines, air-lifting installations, and packers.

Pressure Regulators (Nitrogen)

Pressure regulators are designed to maintain a constant downstream line pressure. Typical regulators provide a delivery pressure of 0 to 400, 0 to 1,500 or 0 to 2,000 psi. The regulators attach to a nitrogen bottle using a CGA-580 cylinder connection. An optional downstream gauge valve allows an accurate gauge to be installed or changed without depressurization of the line (shown). The adjustable constant pressure is ideally suited for packer inflation, pneumatic water sampling, air line water level determination, and Flow Control Valve™ operation.



Pressure Gauges

Economical, 4-1/2 inch face, 1/2 percent accuracy gauges are stocked in the following ranges: 0-15, 30, 60, 100, 160, 200, 300, 400, 600, 800 and 1,000 psi. Other diameter faces and accuracies are available.

Other Accessories

For your convenience, we can complement orders with intensifier pumps, gas booster pumps, Teflon* tubing, and other accessories.

*DuPont

Custom Products

Custom Packers

Baski, Inc. will design and build custom packers tailored to meet the specific requirements of your unique application. Because we operate a fully-equipped design and manufacturing facility, you can choose:

- Specific metal and elastomer combinations
- Packer sizes for boreholes ranging from 1-1/2 to 80 inch (38 to 2,032 mm) in diameter
- Pressure ratings from 50 to 15,000 psi (3 to 1,034 bar)

Custom packers can also be variations of existing designs, such as our:

- **ReFlex™ Packers**

This design combines a fully-reinforced element (U.S. Pat. 5,778,982) with the economical design of a fixed-end packer. It is ideal for applications (including open-hole) which require moderate expansion ratios combined with medium to high pressure ratings. It is well suited for low permeability testing, external casing packers, and multiple completions. Available for hole sizes from 1 to 60 inch (25 to 1524 mm).

- **Fracker Plus™ Packers**

This is a packer developed **for rock stress testing and other high pressure applications**. It is tested at 6,000 psi (414 bar) unconfined and 10,000 psi (690 bar) confined. If you have higher pressure applications, please contact us. This packer is stocked for 3 inch (76 mm) or N-size core holes.

- **Acidizing Packers**

- **Wireline Packers**

- **Grouting Packers**

These heavy-duty packers are tested unconfined to a minimum of 800 psi (55 bar) or higher depending upon the specific application. A slight taper across the length of the bottom metal parts helps the packer to release from the injected grout.

Other Custom Products include:

- **Access Port Valve (APV)**

APVs can be made in all sizes, desired materials, and pressure ratings.

- **In-Line Adapters (ILA)**

ILAs are available in all sizes and desired materials.

- **Jimmy Jet Valve™ (JJV™)** for use with our Fracker™ Packers:

This is a jetting valve that replaces the top fixed head of the lower Fracker™ in a straddle hydrofracturing configuration. This allows injection below the bottom packer until a ball is dropped into the string. The injection is then redirected to the zone between the packers. The JJV™ can also be installed at the top of a single Fracker™ and then only activated if the packer becomes “stuck”. The injection would then be directed up and down at a 45° angle for loosening debris which may interfere with withdrawal of the packer.

- **Submersible Pump Shrouds**

- **Multi-level Packer Completions**

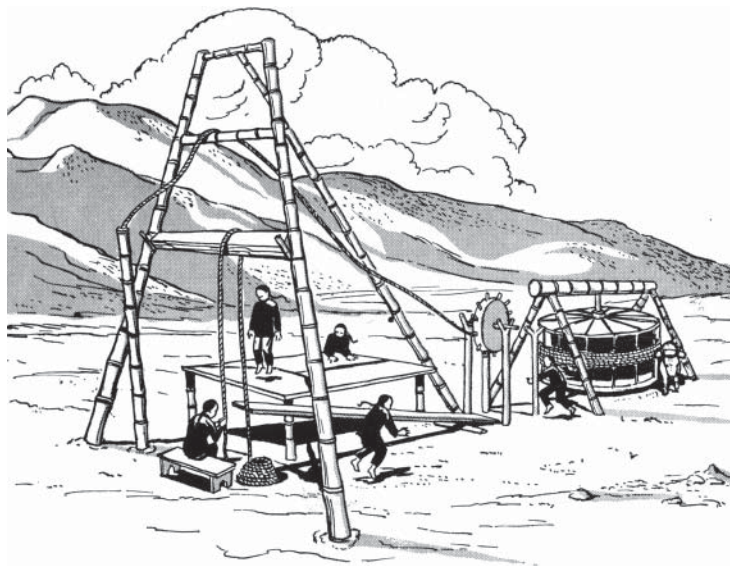
- **Versatile Packer System (VPS™)**

This system is ideal for vertical, inclined, and horizontal boreholes where there are room constraints. VPS™ is completely flush on the outside and incorporates our ReFlex™ packer. All tubes, wires, hoses, and other access lines are inside of the flush-coupled packers and supporting pipe string. All threads are double o-ring sealed. Downhole valving, instrumentation packages, and ports for injection, pumping, and monitoring can also be included.

For pricing, please call with details of application (refer to page 14 for “Packer Application Worksheet”).

Oilfield Packers

The historical development of oilfield and water well technology is quite instructive. Drilling of water wells is the older art and has been done for thousands of years. The oil discoveries of the 1800's used the water well technology of that time. It has since been developed to a high technological level, enabling the drilling of oil and gas wells to 30,000 feet or more under all conditions. Well screens also originated in the water well field. The early 1900's brought the introduction of wire wrap screens, which are now popular in the oilfield.



The ancient Chinese used oil from wells drilled to find salt.

In contrast, the modern inflatable packers used in the water well field today trace back to designs used in the oilfield in the early 1940's. Most of today's oilfield packers are of the slat or rib design, which is not suited for repeated use and cannot tolerate unconfined conditions. Filling this gap, Baski is presently involved in inflatable packer projects for a variety of oilfield applications. Our multi-ply construction using man-made fibers offers significant advantages over the above mentioned slat-type packers. Contact us regarding specifics on higher pressure ratings, multi-set capabilities, sand-resistance, and longer life of Baski oilfield packers. We expect these packers to benefit the following initial applications:

External Casing Packers (ECP) are installed in a casing string and are used to isolate productive zones in both vertical and horizontal oil and gas wells. ECPs are frequently used in conjunction with the primary cementing of casing strings. They are also used in separating screen intervals in horizontal wells. Our sliding-end and patented ReFlex™ fixed-end designs are ideally suited for external casing packer use.

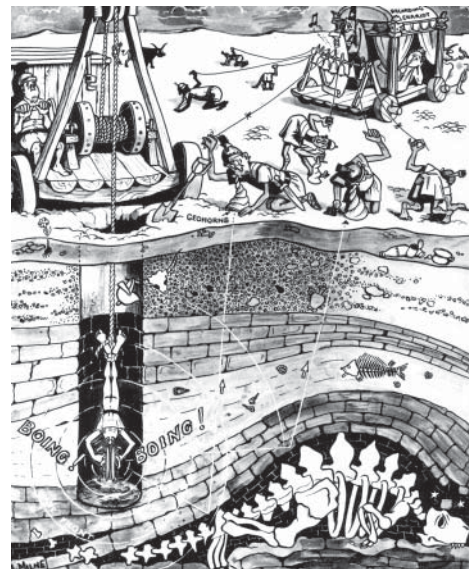
Drill Stem Testing (DST) Packers have been used for a long time to collect permeability and pressure data,

and to recover fluid samples from drill holes. Inflatable DST packers were originally used in areas where mechanical set, or compression packers, were not able to seal the borehole because of washed out or unstable borehole conditions. Our Fracker™ is of a size and construction that is suitable both for fracturing hard rock water wells and drill stem testing. In the water well industry, natural rubber is used for the element, whereas Baski utilizes a proprietary nitrile for the oilfield packers.

Coiled Tubing Packers are a rapidly growing field of inflatable packers for the petroleum industry. Coiled tubing is typically 1 to 3 inch in diameter and is coiled up on large reels that are used for drilling, testing, workover, and completion of wells. Coiled tubing has the significant advantage that a well can be worked on "live". This means that the gas pressure in a well does not have to be "killed" by heavy drill mud prior to intervention. The use of inflatable packers in perforated casing for hydraulic fracturing using proppant is a rapidly growing area. Baski has been collaborating with BJ Services on development of coiled tubing packers.

Coalbed Methane (CBM) development is becoming a significant source of natural gas worldwide. These wells are generally shallow, i.e. less than 2,000 feet deep, and are essentially water wells used to reduce the water pressure. They allow methane to desorb from the coal and be produced at low pressure at the well head. Inflatable packers are used for testing the coal seams and as external casing packers for multiple completions. In addition, inflatable packers are used for hydrofracturing the coal to increase its permeability, i.e. water and methane gas production.

Baski, Inc. and its development partners welcome inquiries regarding projects in the above areas.



Over the years, we have made remarkable progress for oilfield technology.

BASKI Inc.

1586 South Robb Way • Denver, Colorado 80232 USA
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info@baski.com

Straddle Packer Assemblies

Straddle Packer Configurations

Two packers define three zones in a hole. The test zone between the packers is normally the primary zone of interest.

Four packers define five zones, as shown on the left. Forty or even more packers can be installed on a single string when there are many zones of interest.

Installations may be retrievable or permanent. Also, they can be vertical or horizontal. The latter requires centralizers.

Applications

Injection of water or gas for:

1. Hydrology testing to determine permeabilities
2. Enhancement of well yields by pressure stimulation (hydrofracturing) and/or chemical injection
3. Casing integrity testing
4. Locating zones of contaminated water in open boreholes or screened sections
5. Rock stress analyses
6. Tracer testing
7. Injection well disposal

Pumping Out fluid from the isolated zone for:

1. Aquifer or pumping tests (using electric submersibles, vertical turbines, air-lift, bladder, piston, or inertia pumps)
2. Measurement of water quality at various depths in a mud filled rotary drill hole to determine optimum screen and casing completion intervals
3. Cleanup of contaminated water
4. Monitor well sampling programs

Monitoring of downhole data on pressures, water levels, temperatures, conductivity, and chemical parameters for:

1. Aquifer testing
2. Barometric efficiency
3. Profiling
4. Short-term and long-term trends
5. Vertical and horizontal gradients
6. Location of contaminated zones
7. Casing integrity checks

Shroud

A mechanical connection that provides protection and cooling for submersible pumps.

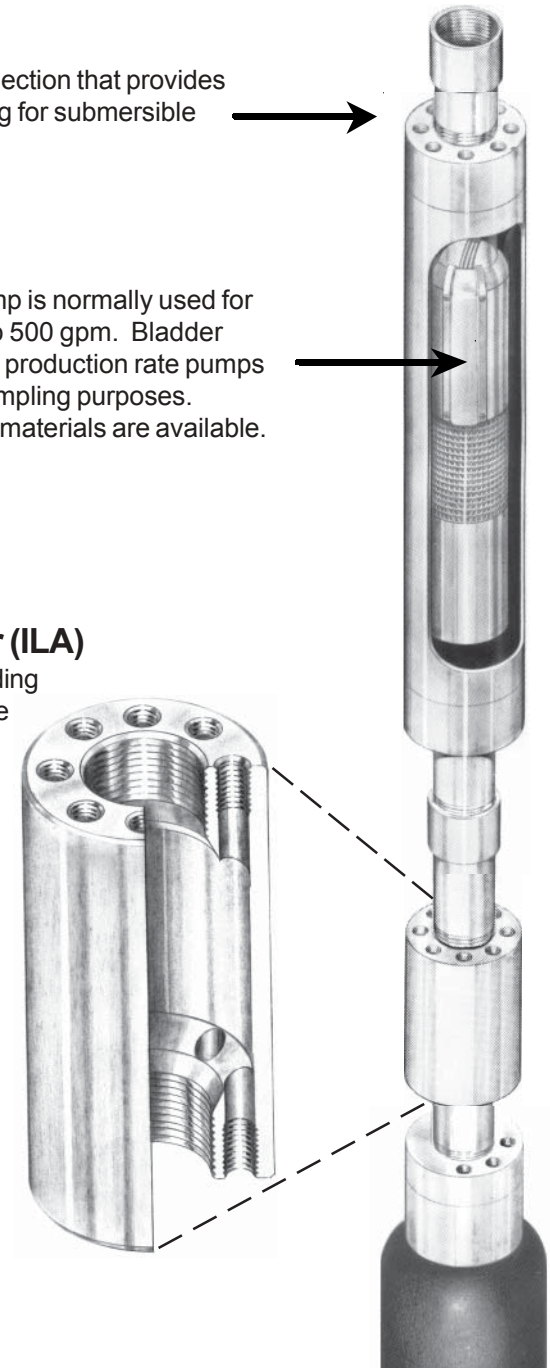
Pump

A submersible pump is normally used for pumping rates of 5 to 500 gpm. Bladder pumps and other low production rate pumps are often used for sampling purposes. Various construction materials are available.

In-Line Adapter (ILA)

An adapter for feeding all leads from outside the packer string to within and through the packer and sealing them.

Cut away view of In-Line Adapter



Inflatable Packers

Pressure Ratings

The free air pressure rating (FAPR) is the highest recommended inflation pressure a packer could withstand if unconfined. When confined in a hard rock or competent hole, the packer can withstand much higher inflation pressures . . . up to two or three times the FAPR when the hole size is close to the packer OD. The borehole differential pressure that a packer can withstand between its top and bottom is a function of the FAPR, hole diameter, downhole conditions, and element length. Packers are available in FAPR pressure ratings of 50 to 6,000 psi or higher on special order.

Uninflated OD

The outside diameter of the packer at rest. The packer must be smaller by some acceptable clearance than the hole size in which it will be used. Sizes are available from 1.8 to 11 inch. Other sizes are available on special order.

Inflated OD

The outside diameter of the packer upon inflation; thus, the largest hole size for which the packer can be used. Baski packers are available for 1-1/4 to 40 inch and larger hole sizes.

Element

The reinforced rubber gland that expands to increase the packer's outside diameter. A long element length ensures a better borehole seal and a high borehole differential pressure rating.

Access Port Valve (APV)

The APVs are pneumatically operated valves that control fluid flow into or out of the string. Each valve is operated with two actuating lines: one to close it and another to open it.

Perforated Pipe

Pipe that allows fluids to pass into and out of the string, and allows leads to pass into a zone.

Inflatable Packer

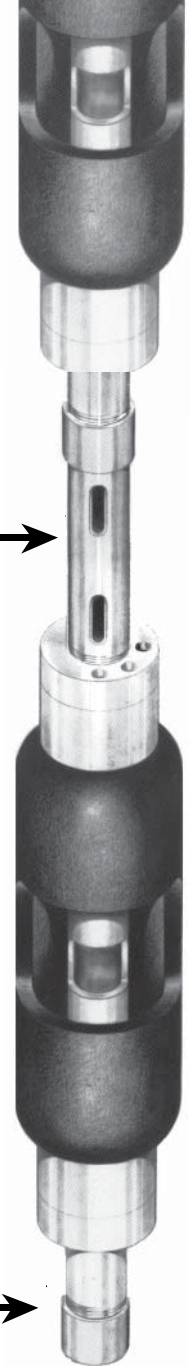
Expandable "plug" used to isolate sections of the borehole. (Small holes in packer ends are for inflation.)

Mandrel

The pipe or tube upon which the packer is built. The inside diameter provides the space necessary for tubes, wires, hoses or other feed-throughs, and/or pumping injection access. Baski, Inc. provides nominal pipe size mandrels from 3/8 to 10 inch or larger.

Bottom Adapter

The adapter that passes leads to the bottom zone. (Access ports on bottom adapter are not visible.)



Packer Application Worksheet

Page 1 of 2

General Information - please fill out for each different well size and application

Customer: _____ Phone: _____ Date: _____

Company: _____ Fax: _____ Project: _____

Address: _____ Email: _____

Comments: _____

The Current Application is for:

- | | | | |
|---|---|--|--|
| <input type="checkbox"/> Pump testing | <input type="checkbox"/> Zone sampling | <input type="checkbox"/> Hydrofracturing | <input type="checkbox"/> Oilfield |
| <input type="checkbox"/> Air-Lifting | <input type="checkbox"/> Wireline | <input type="checkbox"/> Other: _____ | <input type="checkbox"/> External Casing Packers (ECP) |
| <input type="checkbox"/> Injection at _____ [psi] over the hydrostatic of _____ [psi] | | | <input type="checkbox"/> Drill Stem Testing (DST) |
| <input type="checkbox"/> Grouting at _____ [psi] over the hydrostatic of _____ [psi] | | | <input type="checkbox"/> Coiled Tubing |
| <input type="checkbox"/> Leachate sampling | <input type="checkbox"/> Low permeability : range _____ | | <input type="checkbox"/> Hydrofracturing |
| | | | <input type="checkbox"/> Other: _____ |

The packer will be set in:

- | | |
|---------------------------------|------------------------------------|
| <input type="checkbox"/> Casing | <input type="checkbox"/> Open hole |
| Casing ID _____ [inch] | Open hole ID (range) _____ [inch] |
| Depth of casing _____ [feet] | Depth of hole _____ [feet] |

A sketch of the well casing, screens, and their depths is included.

The maximum depth the packer will be used (Set Depth) is _____ [feet]

The Static Water Level (SWL) is _____ [feet]

Submergence of lowest packer = Set Depth - SWL = _____ [feet of water]

The Maximum Differential Pressure possible (from one end of packer to the other) and the minimum pressure rating for the packer is the

Injection pressure at the packer over the hydrostatic = _____ [psi]

Total pump test drawdown = Submergence of packer = _____ [psi]

Surface pressure on grout + grout column - Submergence of the packer = _____ [psi]

The smallest hole the packer must pass through is _____ [inch].

How many holes will be tested? _____ The packer will be used in each hole about _____ times.

The Water or Fluid Conditions:

- | | | | | |
|---|---|--|-------------------------------|---------------------------------------|
| <input type="checkbox"/> Nominal (drinking water, not contaminated) | | | | |
| <input type="checkbox"/> Acids | <input type="checkbox"/> Alkalis | <input type="checkbox"/> Organics | <input type="checkbox"/> Oils | <input type="checkbox"/> Other: _____ |
| The water temperature is: | <input type="checkbox"/> Room temperature | <input type="checkbox"/> High temperature = _____ [°F] | | |

Required Sampling and Measuring of:

- | | | | | | |
|---------------------------------|--------------------------------|-----------------------------------|--------------------------------------|-------------------------------|---------------------------------------|
| <input type="checkbox"/> Liquid | <input type="checkbox"/> Vapor | <input type="checkbox"/> Pressure | <input type="checkbox"/> Temperature | <input type="checkbox"/> Flow | <input type="checkbox"/> Other: _____ |
|---------------------------------|--------------------------------|-----------------------------------|--------------------------------------|-------------------------------|---------------------------------------|

Number of packers:

- | | | |
|---|--------------------------------------|---|
| <input type="checkbox"/> Single packer | <input type="checkbox"/> Two packers | <input type="checkbox"/> Three or more packers: _____ |
| <input type="checkbox"/> Guard zones (around the zone of interest) with _____ packers | | |

Preferred Metal of construction:

- | | | |
|--|---|---|
| <input type="checkbox"/> Aluminum and/or stainless 304/303 (standard construction) | <input type="checkbox"/> Steel is OK | |
| <input type="checkbox"/> All stainless 304/303 | <input type="checkbox"/> Other stainless types: _____ | |
| <input type="checkbox"/> Anti-galling Nitronic 60 / stainless steel combinations | | |
| <input type="checkbox"/> All copper | <input type="checkbox"/> Aluminum bronze | <input type="checkbox"/> Other metals or rigid materials: _____ |

Reinforced Rubber / elastomers of choice:

- | | | | |
|--|---|---------------------------------------|--|
| <input type="checkbox"/> Natural rubber for water applications, unless contaminants require: | | | |
| <input type="checkbox"/> Neoprene rubber | <input type="checkbox"/> Nitrile rubber | <input type="checkbox"/> Fluorocarbon | <input type="checkbox"/> Teflon* (DuPont) covers |

Preferred seal length of packer against the borehole or casing:

- | | | |
|---|---|---------------------------------------|
| <input type="checkbox"/> Manufacturer recommended | <input type="checkbox"/> 3x hole size, min. | <input type="checkbox"/> Other: _____ |
|---|---|---------------------------------------|

Delivery Schedule: need equipment on site by _____

General Terms & Conditions of Baski, Inc. are: Acceptable Not Acceptable (please explain)

BASKI Inc.

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Packer Application Worksheet

Page 2 of 2

Additional (Application-Specific) Information - please attach additional sheets as needed

Customer: _____

Date: _____

Comments: _____

Project: _____

Pumping:

Pump size: OD = _____ [inch]

Length = _____ [inch]

Pump connection size: _____

Number of leads: _____

- Pump water from below the packer (pump may be above or below the packer)
- Pump water from above the packer (pump is placed above the packer). Packer may be lowered into the well on a cable, inflated, and the cable tension released to allow pump installation.

If a pump is placed above the packer, there must be some mechanical connection to support the packer.

- Pump shroud needed. A pump shroud surrounds and protects the pump, providing a means of supporting the packer below the pump, and directing water past the motor for cooling.
- Pump water from between two packers (pump may be above or between the packers). It is preferred to have the pump above the packers, for ease of sealing leads.

Transducers: *please provide for each type of transducer*

Transducer maximum OD = _____ [inch] Transducer length = _____ [inch]

Number of leads: _____ Diameter of wires (including insulation): _____ [inch]

Is there a vent tube? yes no

A pressure transducer transfer tube is a tube (like 1/4 inch nylon) that has one end connected to the end of the transducer and the other end sealed into the zone of interest. It is easier to assemble straddle packer configurations with transducer transfer tubes since the transducers are above the packer, and only the tubes go into the zone. Some variable "offset" can result in pressure readings because the tube may have air in it, which compresses and occupies less volume of the transfer tube as the hydrostatic pressure increases. This offset can be reduced or eliminated by filling the tube with water. Water can be held in the transfer tube by a specialized "porous tube end" installed at the (zone) end of the tubing.

Is a pressure transducer tube acceptable? yes no

Do you need transducer protectors, carriers, or mounting hardware? yes no

Inflation:

single inflation line

multiple inflation lines

Separate inflation for each packer may be preferred for packers used in open holes, since each packer may be inflated to different inflation pressures to assure proper seating in the borehole. A single inflation line may be satisfactory for multiple packers set in casing, if the maximum difference in packer set depths is not over a few hundred feet.

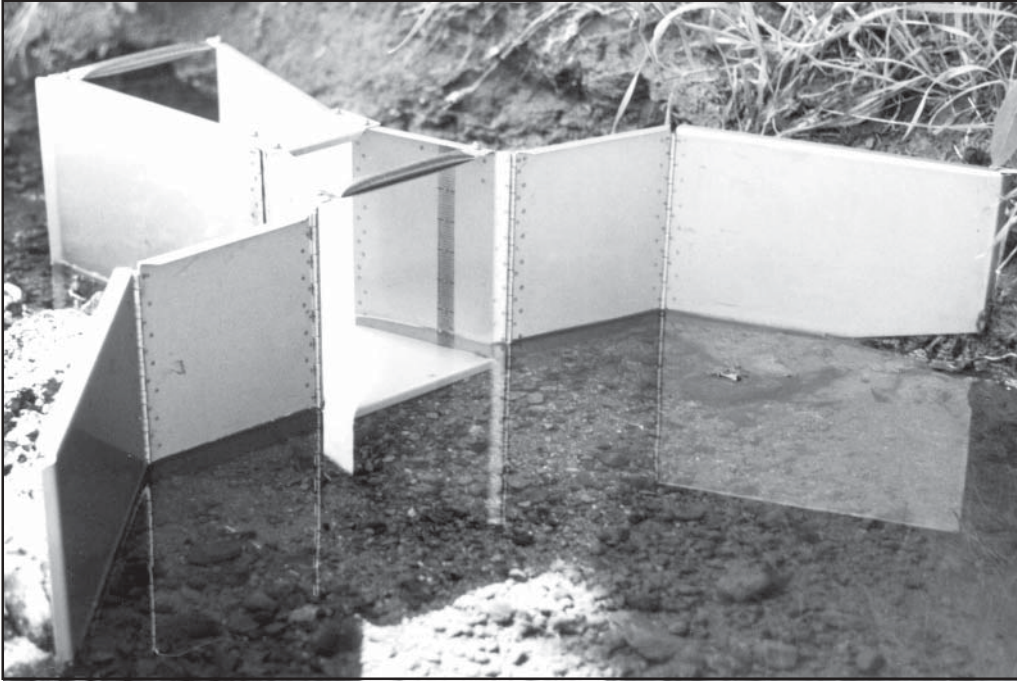
Gas inflation

For gas inflation, use Nitrogen. Never use oxygen, carbon dioxide or flammable gases. Compressor air may have hydrocarbons from the compressor cylinder lubricants. If the packer fails, these hydrocarbons may be introduced into the well, with possible adverse environmental and legal consequences. Inflation tubing can be standard size nylon, stainless steel, or copper tubing; or small diameter high-pressure thermoplastic hose. Pressure gauges should be of an accuracy and range appropriate for the anticipated inflation pressures of the packer. Pressure gauges should only be operated in the first 2/3rds of their range.

Liquid inflation

If the maximum differential pressure (listed under "General information") is more than 300 psi, use liquid inflation. When utilizing liquid inflation, the packer element stretch pressure to the borehole or casing wall must be more than the Liquid Inflation Head (LIH). Check with us for the stretch pressure of the packer you plan to use in this application. If the stretch pressure is less than the LIH, the water in the inflation line above the static water will keep the packer expanded. If this happens, you may not be able to retrieve the packer. This can be advantageous for permanent installations. Dual inflation tubing from the surface to the packer can deflate packers in these cases. Single line inflation is possible with the use of specialized valves. A variety of liquid pumps have been used for inflating packers including positive displacement pumps, mud pumps, car wash pumps, and even fire engine pumps! Accumulators can be used to provide a relatively constant pressure liquid to packers. Downhole liquid inflation chambers can provide the convenience of gas inflation at the surface, and high liquid pressure to the packer required in some applications. Liquid intensifiers use 100 psi compressor output to supply liquid pressures to 10,000 psi. Both the accumulators and liquid intensifiers can be set up for long term packer pressurization. Contact us regarding additional information as needed.

Cutthroat Flume



*Cutthroat Flume
with an 8 inch throat
and optional 19 inch
entrance wing walls*

Cutthroat Flume

Cutthroat flumes are ideal for measuring water flow rates. Applications include:

- stream surveys
- well pumping tests
- irrigation studies
- drainage surveys
- seepage inspections
- industrial outflows
- sewage treatment plant flows
- mine drainage
- tail water runoff
- spring discharge

These stainless steel, collapsible flumes can be set up in minutes and are ideal for a broad range of field applications. When the job is finished, the flume (weighing only 6-15 lbs) can be disassembled and put into an attache case.

The name "Cutthroat" comes from the fact that there is no parallel throat section in these flumes, as in Parshall flumes.

In the Cutthroat flume, the throat width can be, for example, changed from 1 inch to 2, 4, or 8 inch by exchanging the top and bottom pieces with a conversion set, while continuing to use the same sides. Thus, flows ranging from 2-1/2 to 1,000 gallons per

minute may be measured. Wing walls may be added to divert the stream into the upstream convergent section of the flume. The 19 inch wing walls are in two sections, as illustrated in the picture.

Readings from the upstream and downstream staff gauges are used to determine if the flume has sufficient free-fall discharge. If so, a simple calculation, using the upstream staff gauge reading, will give the flow rate in gallons/minute, liters/second, or cubic feet/second.

Model No.	Item Description
COLLAPSIBLE CUTTHROAT FLUME	
CTF1	1 inch throat width, 2.5 - 125 gpm
CTF2	2 inch throat width, 5.0 - 250 gpm
CTF4	4 inch throat width, 10.0 - 500 gpm
CTF8	8 inch throat width, 20.0 - 1,000 gpm
TOP & BOTTOM CONVERSION SET	
CTTB1	1 inch throat width
CTTB2	2 inch throat width
CTTB4	4 inch throat width
CTTB8	8 inch throat width
ENTRANCE WING WALLS	
CTWW6.5	6.5 inch length
CTWW19	19 inch length

General Terms & Conditions

1. Pricing

- in US dollars; FOB Denver factory; exclusive of all taxes
- valid for 60 days; stock items subject to prior sale
- based on the terms, conditions and warranty of the quotation; based on the quantities quoted
- other terms, conditions, equipment, and/or services, may change pricing

2. Payment

- standard products: prepayment or, with approved credit, net 30 days
- custom products require a prepayment
- invoice amounts are due net 30 days from date of invoice
- finance charge of 0.0657% per day on unpaid balances, compounded daily (= 2% per month)

3. Delivery and returns

- ready-to-ship dates based upon lead time estimated at the time of quotation and subject to change
- risk of loss passes to buyer upon seller's delivery to carrier
- some assembly may be required
- no returns without authorization; restock charges and additional fees for non-original packaging may apply; no returns on gauges, tubing, reels, regulators; made-to-order equipment is not returnable
- no reschedules, changes, or cancellations without our written agreement

4. Warranty

Seller warrants that the items sold hereunder shall be free from defects in material or workmanship for a period of 365 days from the date of shipment to Buyer, or 2,000 hours of use, whichever expires first. Seller warrants the products sold hereunder to be free from defects in material and workmanship at the date of shipment. NO OTHER WARRANTY, WHETHER EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, SHALL EXIST IN CONNECTION WITH THE SALE OR USE OF SUCH PRODUCTS. All claims under this warranty must be made in writing and delivered to Seller prior to the expiration of the warranty. Upon receipt of a timely claim, the Seller shall repair, or at its option, replace any part or parts which Seller determines to have been defective at the time of shipment from the Seller; provided, however, that if circumstances are such as to preclude the remedying of warranted defects by repair or replacement, Seller shall, upon return of the goods, refund to Purchaser any part of the purchase price of the goods therefore paid to Seller. Inspection shall be performed at the Seller's plant. Pulling and resetting of the ASR valves, and the freight for returning any products to the plant for inspection, shall be paid by Buyer. The product must be returned in original or equivalent crating.

Abuse, over-pressurization, casing wear from vibrating (unbalanced) pump, misuse, acts of God, aggressive and/or non potable water quality, high levels of chlorine, and excessive temperature are specifically excluded from this warranty.

The foregoing states the sole and exclusive remedy for any breach of warranty or for any other claim based on any defect in, or non-performance of, the products, whether sounding in contract, warranty or negligence. Without limiting the generality of the foregoing, Seller shall under no circumstances be liable for any other charges, labor costs, or any other incidental or consequential loss or damage of any kind or description whatsoever arising out of, or in any way relating to, any such breach of warranty or claimed defect in, or non-performance of, the products.

ASR Valve replacement may take 1 to 2 months.

Notwithstanding the foregoing, there are no warranties whatsoever on items built or acquired wholly or partially, to buyer's designs or specifications.

5. Miscellaneous

- specifications are subject to change without notice; schematics do not necessarily represent the exact design details of equipment which will be supplied
- liability limited to repair or replacement; or refund of the purchase price
- no liability for failure to perform obligations by reason of circumstances beyond our reasonable control (accidents, labor disputes, acts of god, and other similar causes)
- no liability for infringements of any intellectual property rights (patents, trademarks, or similar rights)
- no liability for any incidental, consequential or special damages of any kind or nature
- agreements governed by the law of the State of Colorado

6. Disclaimer

Baski, Inc. is pleased to offer suggestions on the use of its various products. However, Baski neither assumes responsibility for any omissions or errors, nor assumes liability for any damages that result from the use of its products.

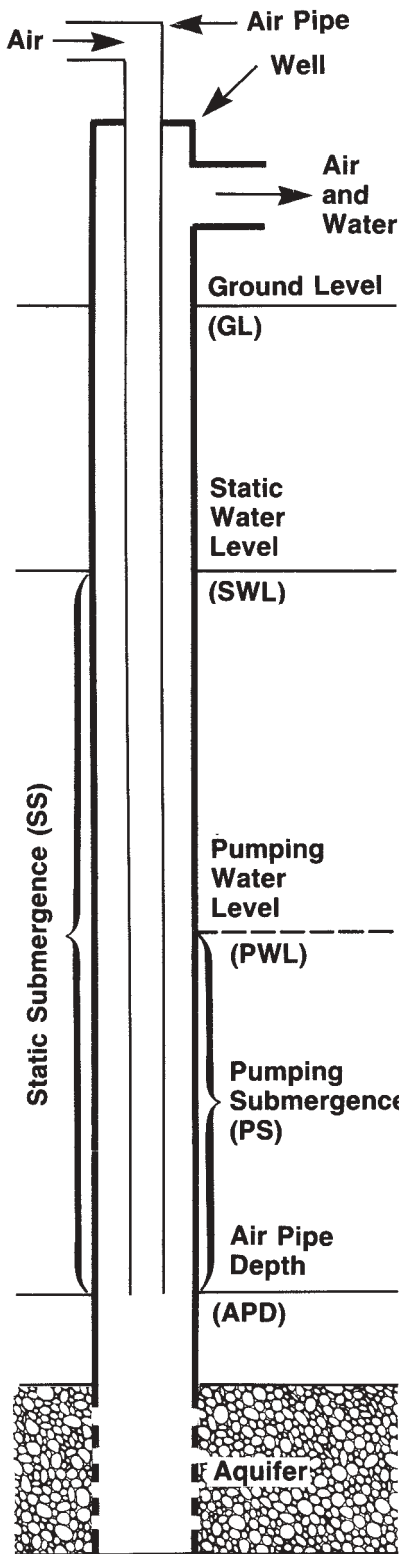
National Pipe Taper (NPT) Joint Strength Table

Nominal Size (inches OD)	Schedule	NPT Joint Strength (pounds)	Wall Size (inches)	Inside Diameter (inches)	Weight Per Foot (pounds)
3/8 (0.675)	40	355	0.091	0.493	0.573
	80	716	0.126	0.423	0.746
1/2 (0.840)	40	490	0.109	0.622	0.851
	80	984	0.147	0.546	1.088
	160	1,448	0.187	0.466	1.304
3/4 (1.050)	40	715	0.113	0.824	1.131
	80	1,410	0.154	0.742	1.474
	160	2,390	0.218	0.614	1.937
1 (1.315)	40	1,000	0.133	1.049	1.679
	80	2,010	0.179	0.957	2.172
	160	3,400	0.250	0.815	2.844
1-1/4 (1.660)	40	1,500	0.140	1.380	2.273
	80	2,970	0.191	1.278	2.997
	160	4,540	0.250	1.160	3.765
1-1/2 (1.900)	40	1,910	0.145	1.610	2.718
	80	3,740	0.200	1.500	3.631
	160	6,240	0.281	1.338	4.859
2 (2.375)	40	2,410	0.154	2.067	3.653
	80	5,160	0.218	1.939	5.022
	160	10,100	0.344	1.687	7.462
2-1/2 (2.875)	40	3,580	0.203	2.469	5.793
	80	7,320	0.276	2.323	7.661
	160	12,100	0.375	2.125	10.01
3 (3.500)	40	5,340	0.216	3.068	7.576
	80	10,700	0.300	2.900	10.25
	160	18,900	0.438	2.624	14.32
3-1/2 (4.000)	40	6,930	0.226	3.548	9.109
	80	13,700	0.318	3.364	12.51
4 (4.500)	40	8,710	0.237	4.026	10.79
	80	17,000	0.337	3.826	14.98
	160	32,100	0.531	3.438	22.51
5 (5.562)	40	11,200	0.258	5.047	14.62
	80	23,500	0.375	4.813	20.78
	160	48,000	0.625	4.312	32.96
6 (6.625)	40	15,900	0.280	6.065	18.97
	80	34,900	0.432	5.761	28.57
	160	68,500	0.719	5.187	45.35

The above data are based on material with 30,000 psi minimum yield, minimum allowable wall, maximum allowable OD, and a safety factor of 4. Notch sensitivity, material imperfections, internal pressure, and stresses from bending and temperature have been ignored. Wall thickness of A53, A106 and A312 pipe can be 12.5% less than nominal. A312 pipe is almost always 10% less than nominal. The information and data presented herein are typical or average values and are not a guarantee of maximum or minimum values. No liability is assumed for the correctness of this, or any other, data in this publication, either direct or indirect. Applications specifically suggested are made only for the purpose of illustration, to enable the reader to make his own evaluation, and are not intended as warranties, either expressed or implied, of fitness for these or other uses.

Air-Lift Pumping

Approximate Air-Lift Pumping Capacities (gpm)



Borehole or well	Air Pipe Pipe Nominal Size (inch)	Tube Actual OD (inch)	Pumping Submergence %					Air Compressor Delivery (cfm)
			10% (gpm)	20% (gpm)	40% (gpm)	60% (gpm)	80% (gpm)	
	3/8	1/8		0.08	0.3	0.5	0.7	7.4
	1/2	3/16		0.17	0.6	1	1.4	12
	3/4	1/4		0.4	1.4	2.4	3.4	20
	1	3/8		1	3	5	7	31
	1-1/2	1/2		3	8	13	18	77
	Pipe Nominal Size	Pipe Nominal Size						
	2	1/2	0.5	5	15	25	35	120
	3	3/4	2.5	15	40	65	90	270
	4	1	5	28	75	125	175	470
	5	1-1/4	7.5	50	140	230	320	740
	6	1-1/2	12	80	225	370	520	1100
	8	2	25	150	450	720	1000	1900
	10	2-1/2	50	300	800	1300	1800	3000
	12	4	75	450	1200	1950	2700	4000
	14	4	90	600	1700	2900	4000	5100
	16	5	100	800	2400	3900	5500	6600

Air Compressor Requirements

- Pressure rating [psi] must be 20% greater than the Static Submergence [psi].
- Volume rating [cfm or cubic feet per minute] must equal or exceed values from above table for hydrology testing. If the water production surges, i.e. varies in gpm rate, then a GREATER cfm is needed. On the other hand, well development by air-lift pumping is enhanced by surging; therefore, a LOWER cfm is desired for part of the development period.
- Pumping submergence % = $(APD - PWL) / APD$
- Static Submergence [psi] = $APD - SWL$

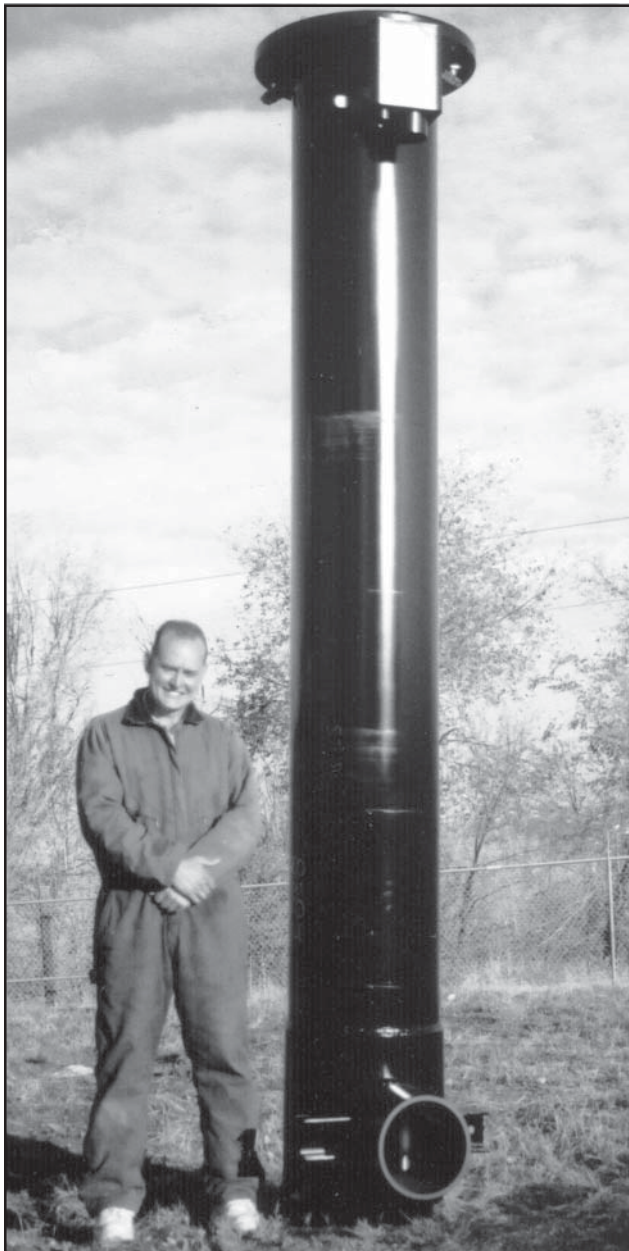
Note: 1 foot of water = 0.433 psi
1 psi = 2.31 feet of water

Pitless Unit

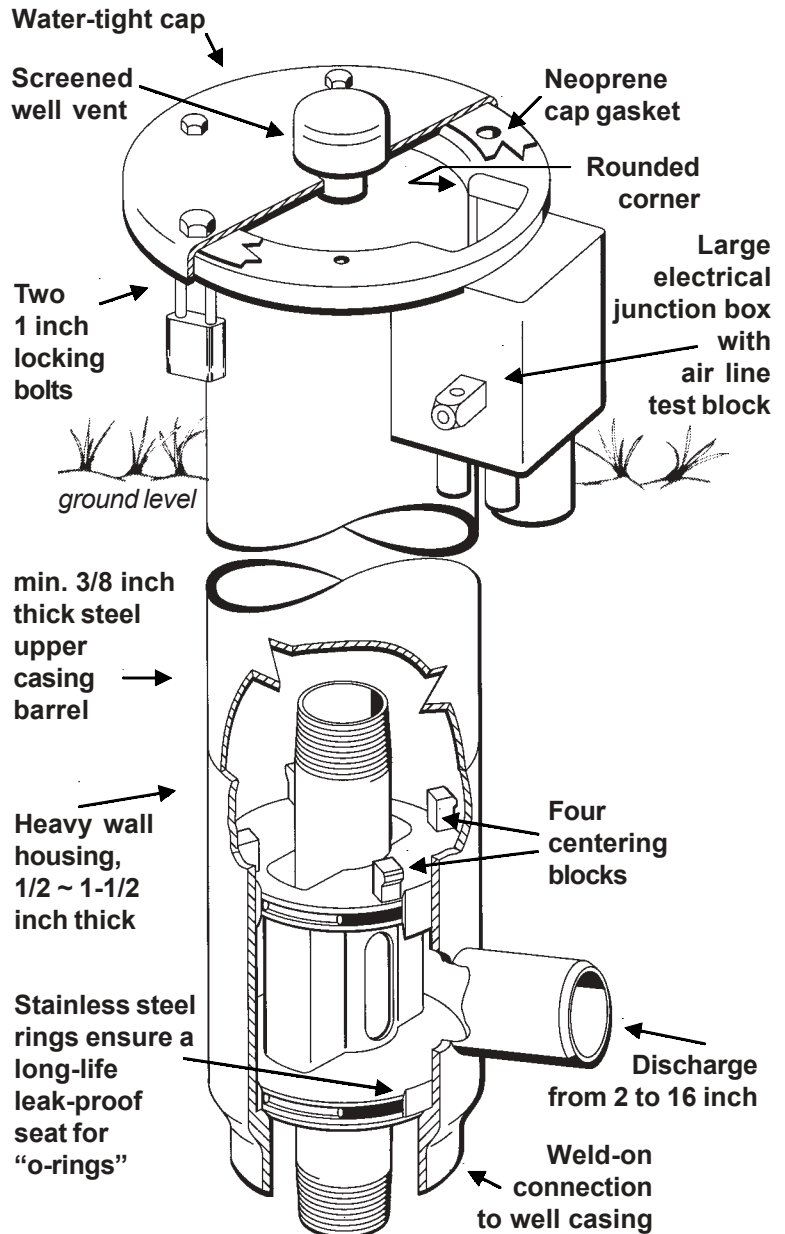
U.S. Patents 4,298,065; 4,416,328 and 4,531,664

A pitless unit replaces above-ground well housing and well pits, improving sanitation, convenience, frost protection, and vandalism security. Welded to the well casing underground, the pitless unit safely redirects water below the frost line. It can provide well completions that occupy little room in highly populated areas and, with a submersible pump, it is virtually noiseless. At some installations fake rocks cover the top of the pitless, making for an attractive completion in parks and easements.

The patented Baski Pitless is a rugged spool-type unit designed for quick delivery, ease of installation, convenience in setting and pulling pumps, and long trouble-free operation. The extra heavy duty construction is specifically designed for deep sets below 500 feet. The upper casing barrel is made from a minimum 3/8 inch thick steel, welded onto the heavy wall housing made of 1/2 ~ 1-1/2 inch thick steel. Stainless steel o-ring sealing surfaces in the housing ensure a long-life, leak-proof seal. Two 1 inch locking bolts provide for pad-locked security of the well cap.



Keith Baski and a 16 inch casing pitless unit with 9 foot bury depth, 10 inch discharge pipe, and restraining tabs



Pitless Unit

U.S. Patents 4,298,065; 4,416,328 and 4,531,664

Standard Features of Baski Pitless Units:

- Water-tight cap with screened vent, including two 1 inch locking bolts for security using padlocks
- Large electrical junction box for easy and convenient setting and pulling of pumps
- Rounded corner on flanged top to prevent damaging wires during installation
- Air line test block for well monitoring access
- Extra heavy duty construction with a 3/8 inch thick, steel upper casing barrel (standard size: 2 inch larger than casing), a 1/2 ~ 1-1/2 inch thick, heavy wall steel housing, a heavy wall spool pipe, and thick flanges
- Durable potable epoxy coating (FDA & NSF approved) for all wetted parts
- Black outside epoxy coating
- Type 304 stainless steel seating rings opposite the spool o-rings to ensure a long-life, trouble-free seal
- Steel spool with large access holes and centering blocks
- Discharge from 2 to 16 inch (standard: plain end)
- Available in all casing sizes, including line pipe and oilfield casing sizes, from 8 to 30 inch and larger
- Column (drop or spool) pipe from 3 to 16 inch; with NPT, oilfield casing (API), or BSPT threads

Options:

- All wetted parts made of stainless steel
- Restraining tabs ("ears")
- Sealed spool passages (equalizing/open is standard): stainless steel nipples with wire seals pass through both spool plates to provide access to the well
- Torque arrestor: for shallow applications where pump torque may cause the pump and spool to rotate within the well
- Lift-out pipe/bail: facilitates setting of the pump
- Hydrant sampling port (a female threaded port fitted to the top plate of the adapter spool) from which water samples can be collected
- Check valves in spool: replace the two discharge openings in the spool (not recommended for submersible pump applications)
- Other outside coating colors (standard: black)
- Quick connect attachment to well casing (weld-on connection is standard)
- Can be used as a booster pump station
- Can be used for lake/reservoir diversion

Model Numbering: The two most common model systems are cross-referenced below. Please contact us for detailed specifications and drawings.

BASKI and Maass-Baski (Model MB) Model Numbering System	Type	Style	Well Casing Diameter [inch]	Upper Barrel Diameter [inch]	Discharge Diameter [inch]	Discharge Type	Spool (column or drop) Pipe Diameter [inch]	Spool (column or drop) Pipe End	Well Cap	Bury Depth [feet]	Stick-up above ground level [feet]	Options
Sample	EHD	S	16	18	10	P	8	APIR	WT	9	3	RT-2
	HD = Heavy Duty EHD = Extra Heavy Duty	S = Submersible B = Booster T = Turbine				P = Plain End, F = Flanged End, MT = Male Thread, FT = Female Thread		NPT = NPT Threads, BSPT = BSPT Threads APIR = API Round Threads	WT = Steel Water Tight AL = Aluminum Submersible AWT = Aluminum Water Tight	(0 = "kit")		ALLSS = All Stainless Steel RT = Restraining Tabs (2 or 4) SSP = Sealed Spool Passages TA = Torque Arrestor LOP = Lift Out Pipe / Bail HYD = Hydrant Sampling Port

Monitor (Baker Mfg.) Model Numbering System	Bury Depth [feet]	Pitless Unit for	Well Size [inch]	Upper Case Size [inch]	Attachment to Well Casing	Upper Case Coating	Watertight Cap with Screened Air Vent	Pressure Equalizing Spool Passages	Standard Spool (no check valves)	Drop (Spool) Pipe ID [inch]	Discharge Connection	Discharge ID [inch]	Options
Sample	9	PS	16	18	W	B	W	F	0	8	M	10	
		PS = Submersible Pump PT = Turbine Pump			W = Welded N = Kwikconnect	B = Black					W = Welded, F = Flange ASA 150#, T = Threaded NPT, M = Mech. Joint		

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InFlex™ Flow Control Valve (FCV™)

U.S. Patents 5,316,081 and 6,273,195

The InFlex™ Flow Control Valve (FCV™) is a fluid-actuated valve that permits pumping water to the surface or regulating the flow of water from the surface into the well, while using the same column pipe and maintaining a column of water in it at all times. The InFlex™ FCV™ may be used in conjunction with a submersible pump or a vertical turbine pump for Aquifer Storage and Recovery (ASR) and Aquifer Thermal Energy Storage (ATES) applications. Advantages of the InFlex™ FCV™ include:

- **Impressive Performance**

Testing at the factory and field use of the InFlex™ FCV™ confirm that it effectively adjusts and holds desired injection rates. Because of its unique design features, including no sliding seals to fail, it is the most durable and versatile valve on the market.

- **Cavitation-Free Design**

The key to the successful control of the injection water through this valve is its long, adjustable, annular-gap flow path through a series of circular annular orifices. This flow path provides non-cavitating head loss that is easily controlled by changing the gap between the annular orifices and the rubber element. Stainless steel channels are a part of the adjustable flow system and stabilize the rubber element as it is pushed down and stretched by the inflation liquid.

- **Impossible to Sand-lock**

By design, there is no place for sand to collect; therefore, the InFlex™ FCV™ cannot sand lock. It is impossible for the rubber element to “stick” at any time during pumping or injection, as there are no sliding surfaces to become “stuck” due to corrosion or sand-locking.

- **Wear-resistant**

The InFlex™ FCV™ is extremely wear-resistant due to its rubber control element, similar to slurry pumps which are rubber lined to reduce wear. Due to its low-velocity, cavitation-free flow, the InFlex™ FCV™ resists sand and silt far better than conventional valve designs. Conventional valves have all of their pressure loss (at high velocities) across only one orifice stage, leading to wear from suspended solids and erosion with cavitation.

- **Ask about our 5-year limited warranty**

The InFlex™ FCV™ utilizes a reinforced rubber element, the only “moving” part. This element is an adaptation of the element that has been successfully used in our inflatable downhole packers in demanding open-hole conditions for over two decades. All metal parts of the valve are constructed of stainless steel. Other more corrosion-resistant alloys are optional for aggressive environments.

- **Wide Range of Injection Capacities**

Our InFlex™ FCV™ offers injection capacities of 10,000 gpm and higher with driving heads of 20 to 3,000 feet. All of the valves are infinitely adjustable from drip-tight shut-off to maximum flow. Furthermore, their maximum flow rate can be limited by using two control lines.

Casing Size nominal [inch]	Valve OD maximum [inch]	Column Pipe nominal [inch]	Flow Rate	
			typical [gpm]	min - max [gpm]
5	4	2	100	0 - 300
6	5	3	200	0 - 600
8	6-5/8	4 or 5	400	0 - 1,200
10	8-5/8	6	800	0 - 2,000
12	10-3/4	8	1,400	0 - 3,000
16	12-3/4	10	2,000	0 - 4,000
20	16	12	3,000	0 - 6,000
22	18	14	3,500	0 - 7,000
24	20	16	4,000	0 - 8,000
28	24	18 or 20	5,000	0 - 10,000

Flow Rate Discussion:

$$\text{Flow Rate [gpm]} = C_v \sqrt{\text{Head [feet]}}$$

The flow rate through a given valve is proportional to the square root of the driving head. The driving head is the sum of the injection pipeline pressure in feet of water plus the distance down to the injection water level in the well minus the head loss in the column pipe.

Baski customizes the flow coefficient (C_v) range of each valve to the intended application (its column pipe size and driving head). Flow control results from changing this C_v between 0 (closed) and the valve’s maximum (open).

For more information on aquifer storage and recovery (ASR), please refer to *Groundwater Recharge and Wells - A Guide to Aquifer Storage Recovery* by R. David G. Pyne

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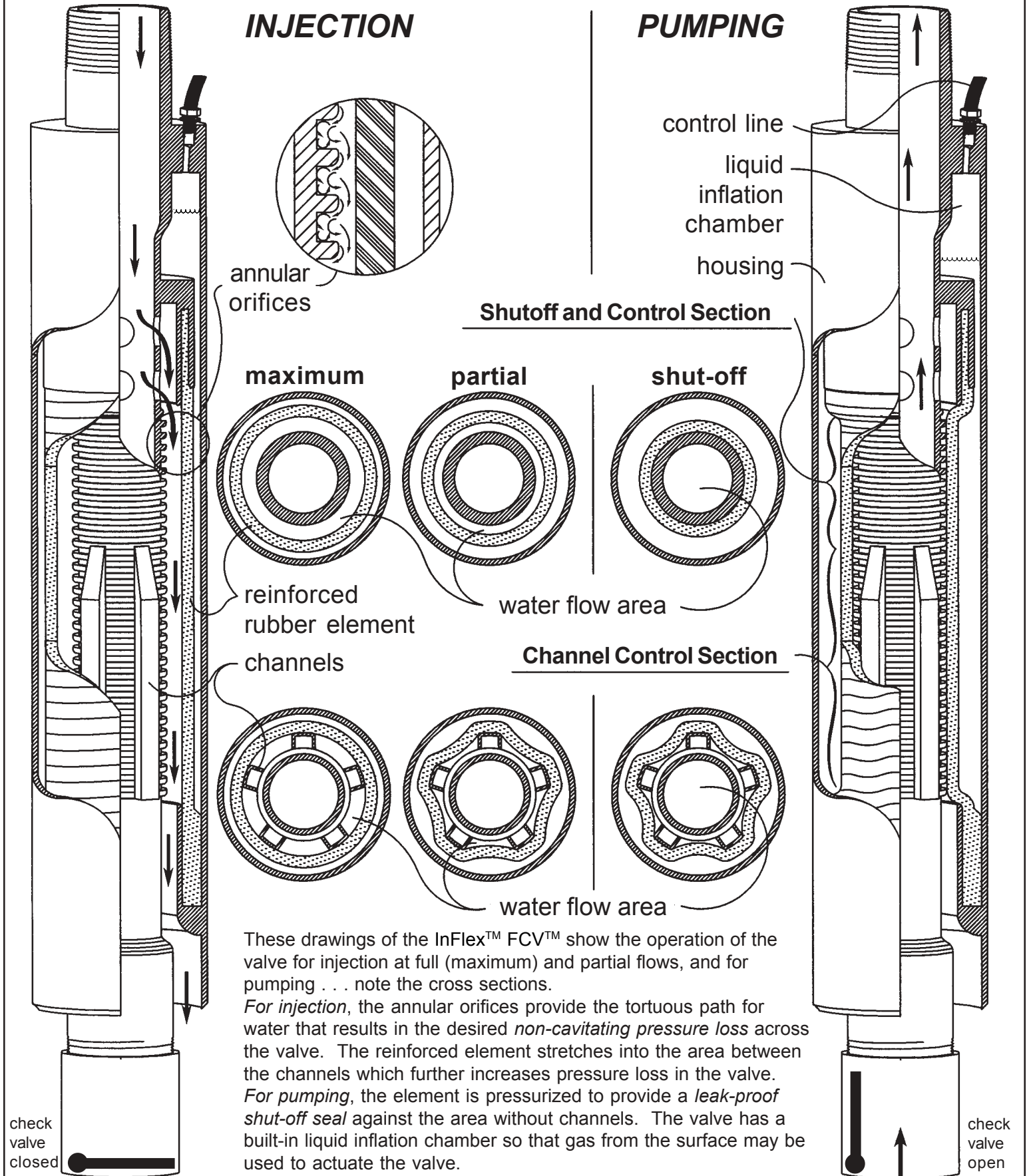
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InFlex™ Flow Control Valve (FCV™)

U.S. Patents 5,316,081 and 6,273,195

INJECTION

PUMPING



These drawings of the InFlex™ FCV™ show the operation of the valve for injection at full (maximum) and partial flows, and for pumping . . . note the cross sections.

For injection, the annular orifices provide the tortuous path for water that results in the desired *non-cavitating pressure loss* across the valve. The reinforced element stretches into the area between the channels which further increases pressure loss in the valve.

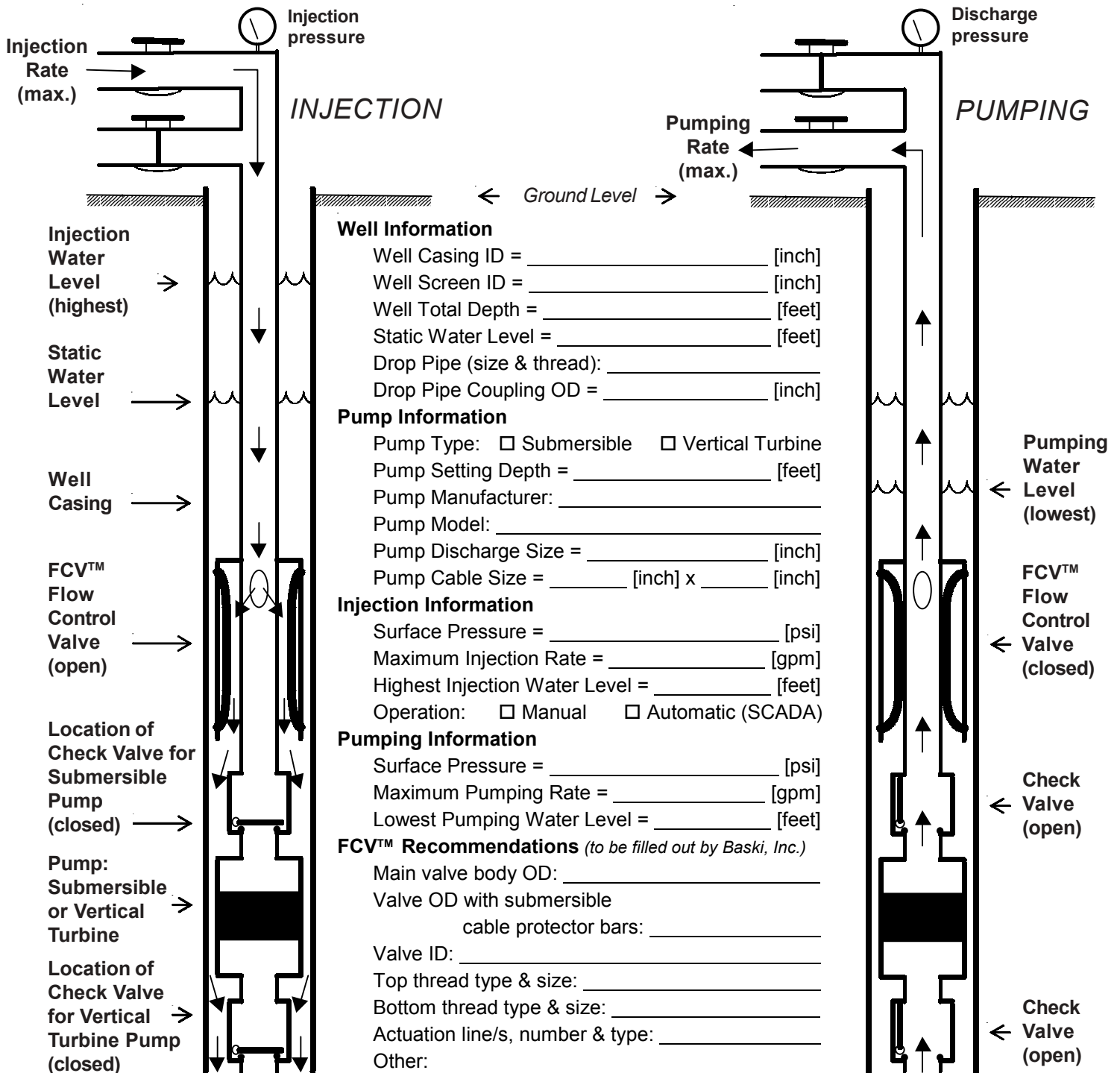
For pumping, the element is pressurized to provide a *leak-proof shut-off seal* against the area without channels. The valve has a built-in liquid inflation chamber so that gas from the surface may be used to actuate the valve.

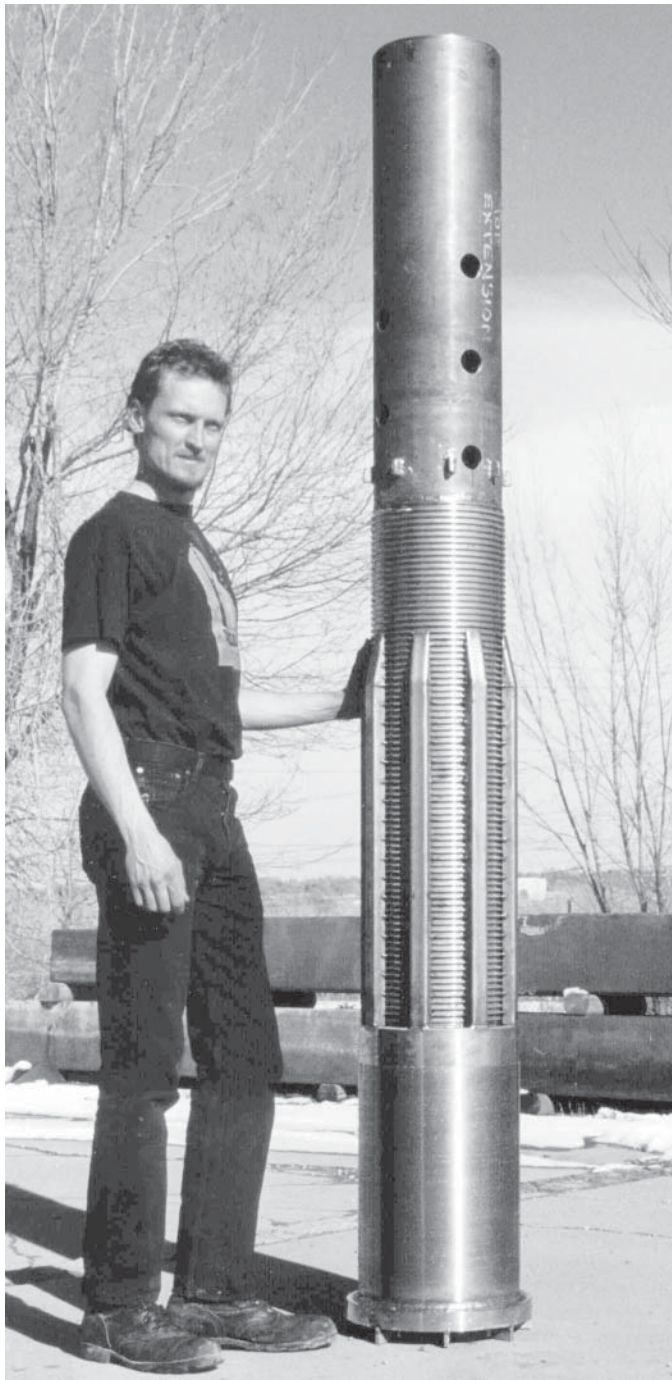
InFlex™ Flow Control Valve (FCV™) Worksheet

U.S. Patents 5,316,081 and 6,273,195

General Information

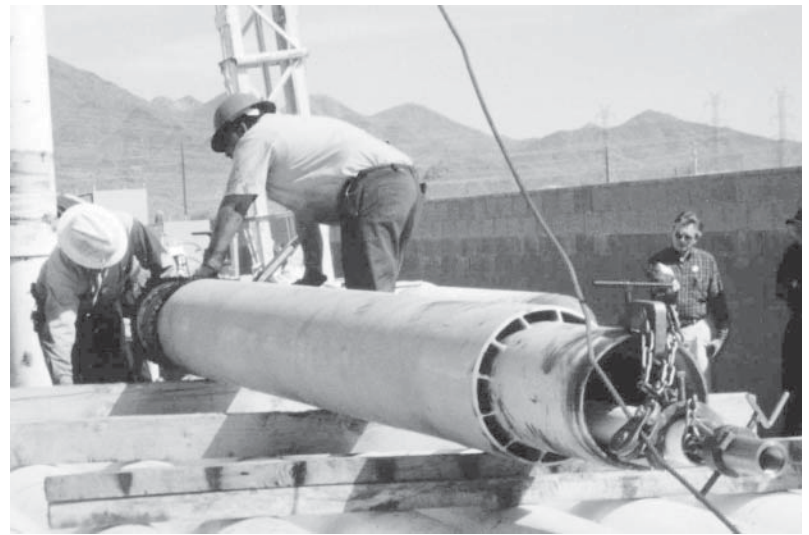
Customer: _____ Phone: _____ Date: _____
 Company: _____ Fax: _____ Project: _____
 Address: _____ Email: _____
 _____ Comments: _____





*Above:
Cort Baski with the inner control section of a
FCV™ Flow Control Valve (16-inch OD, all
stainless steel), with the channels and annular
orifices visible.*

*Right:
After fabrication this unit was installed
at 645 feet below ground level,
just above a vertical turbine bowl assembly.*





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