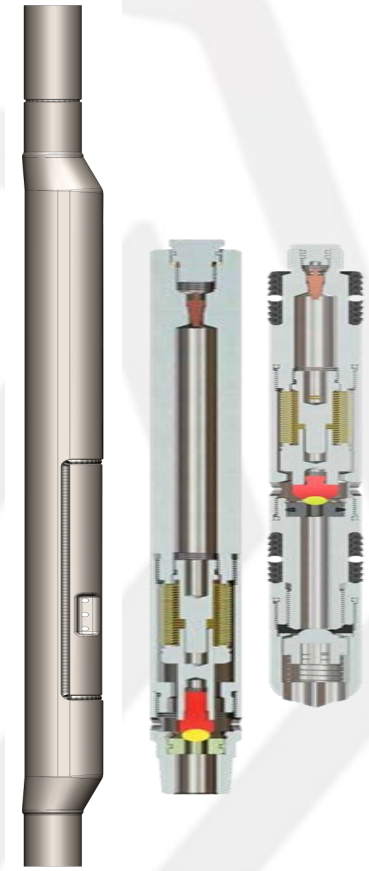
SAZ

Enhancing Well Completions



SAZ Oilfield Services

Gas Lift System

Gas Lift System

SAZ Oilfield Services offers a complete portfolio of Gas Lift Valves & Mandrels in different metallurgy and configuration to cater to a wide range of well conditions. Gas Lift is a widely used method of Artificial Lift due to the versatility in its application and cost effectiveness. In terms of production rate range, depth of lift, and suitability over a wide range of well conditions. Ability to change the Gas Lift Valves via simple well intervention, allows operator to optimize production over life of the well. Highly deviated wells, with high formation Gas to Liquid Ratio and solids production are good candidates for Gas Lift.

SAZ provides both conventional & retrievable gas lift system for continuous and intermittent flow conditions. The most common valves are Injection-Pressure-Operated (IPO) and Production-Pressure-Operated (PPO) gas lift valves.
We also offer Pilot Operated gas lift valves and Single Point Injection Orifice valves.

Orion™ and **Sirius**™ family of gas lift valves and mandrels are based on field proven design and have an extensive track record globally over a wide range of downhole conditions and production scenarios.

Orion Conventional Gas Lift Valves and **Tubing Retrievable Mandrels** offer cost effective solution to customers. They are widely used on land wells where workover is frequent and economical.

Sirius Retrievable Gas Lift Valves and **Side Pocket Mandrels** provide customer flexibility to deploy various valves type over the life of the well. They are widely used on offshore wells where workover is not cost effective.

Ursa™ **Water Injection Valves** and **Side Pocket Mandrels** offer reliable option for customer's Water Flood requirements as these are manufactured with high corrosion resistance materials. Along with valves and mandrels, SAZ Oil offers various accessories such as Dummy Valves, Check Valves, Latches, Running Tools and Pulling Tools.

Our valves and mandrels are manufactured in accordance with API Q1 and are monogrammed with API 19G-1 for Gas Lift Valves and API 19 G-2 for Gas Lift Mandrels.

Orion Conventional Valves and Mandrels

- **Orion GM** Conventional Gas Lift Mandrel
- **Orion GV** Conventional Gas lift Valve (IPO)
- **Orion CI** Conventional Chemical Injection Valve
- **Orion PO** Conventional Pilot Operated Valve
- **Orion CV** Conventional Check Valve

Sirius Retrievable Valves and Mandrels

- **Sirius GM** Side Pocket Mandrel
- **Sirius GV** Retrievable Gas Lift Valve (IPO)
- **Sirius OV** Retrievable Orifice Valve
- **Sirius PO** Wireline Retrievable Pilot Operated Valve
- **Sirius DV** Retrievable Dummy Valve

Ursa Water Injection Valves and Mandrels

- **Ursa IM** Water Flood Injection Mandrel
- **Ursa IV** Water Flood Injection Valve
- **Ursa CV** Water Flood Check Valve

Accessories

- **SBK**, **SRK** Wireline Retrievable Latches
- **SRT** Running Tool
- **SJD** Pulling Tool
- **SKT** Kickover Tool

Orion Gas Lift Mandrel

SAZ Orion GM Conventional Gas Lift Mandrels are available in various tubing sizes, end connections and metallurgy to match the tubing and offer full drift. It is designed to receive 1.0" and 1.5" diameter conventional gas lift valves and conventional check valves. These valves are mounted externally on the mandrel which features external side guards to protect the gas lift valve and check valve.

Features

- Enhanced operational flexibility due to concentric ID
- Suitable for use in combination with Plunger Lift system
- Enable Well Intervention due to drift ID same as production tubing
- Protective Guard plates on the sides of the mandrels protects gas lift valves during running in and pull out

Mandrel Tubing Size (in)	PPF	Valve Size (in)	Connection	Metallurgy	Mandrel OD (in)	Mandrel ID (in)	Drift ID (in)	Mandrel Length (ft)
2-3/8	4.7	1.0	API Premium	J-55 L-80 N-80 P-110 13 Cr	3.783	1.995	1.901	4
		1.5			4.283			
2-7/8	6.5	1.0			4.335	2.441	2.347	
		1.5			4.835			
3-1/2	9.2	1.0			4.765	2.992	2.867	
		1.5			5.160			
4-1/2	12.6	1.0			5.765	3.958	3.833	
		1.5			6.185			

Orion Gas Lift Valve

SAZ Orion GV Conventional Injection Pressure Operated (IPO) gas lift valves are available in 1.0" and 1.5" diameter. The valve is controlled by injection gas pressure (casing pressure). The valve is installed on a conventional mandrel which is deployed on production tubing. The valve has bellows assembly that contains a nitrogen charge over damping fluid. The dome charge provides the closing force for the valve. When injection gas pressure exceeds the closing force, the bellows compress, lifting the valve stem off the seat, and allowing gas in the casing to be injected through the valve into the tubing.

Features

- Body material in stainless steel SS304/SS 316L, 17-4PH and Monel.
- Three-ply Monel bellows.
- Mechanical stop prevents bellows over stroke.
- Viscous fluid shear dampening prevents bellow fatigue and stem chattering.
- Tungsten Carbide ball and ball stem assembly.
- Replaceable floating Monel seat (also available in Tungsten Carbide material)
- Silver brazed bellows connections

Valve Type & Size	Effective Bellow Area (in^2)	Port Size (in)	Port Area (in^2)	Ap/Ab	1-Ap/Ab	*Rtef - (Ap/Ab)/ (1-Ap/Ab)
IPO 1.0	0.31	3/16	0.029	0.094	0.906	0.103
		1/4	0.051	0.165	0.835	0.197
		5/16	0.079	0.255	0.745	0.342
IPO 1.5	0.77	3/16	0.029	0.038	0.962	0.039
		1/4	0.051	0.066	0.934	0.071
		5/16	0.079	0.103	0.897	0.114

A_b = total effective bellows area, in^2
A_p = valve port area (ball/seat line contact area for sharp-edged seat), in^2
Rtef = Tubing Effective Factor

Orion Chemical Injection Valve

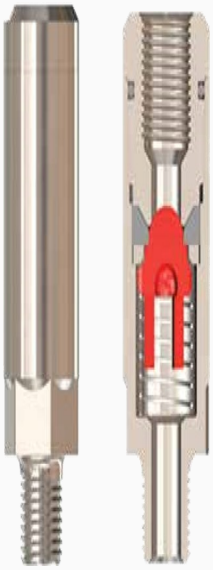
SAZ Orion CI Conventional Chemical Injection Valves are used for injection of corrosion inhibitors and chemicals to prevent corrosion of the tubing and downhole tools. It is a spring loaded valve installed on a conventional mandrel and deployed on tubing. Injection rate of the valve is adjusted by the port size and tension of the power spring. The preset power spring keeps the valve in closed position.

Features

- Inconel power spring and check-valve spring to withstand corrosive environment.
- Spring Loaded integral reverse-flow check valve prevents tubing-to-casing annulus communication during operation.
- Simple design increases the flow efficiency.
- Tungsten Carbide ball and insert seat (standard) offer high abrasion and impact resistance for a robust and stable injection system
- Available in 316L Stainless Steel, Monel or Inconel material.

Valve Type & Size	Top Connection	Port Size (in)
Chemical Injection. 1.0”	1/4” NPT	3/16
		1/4
		5/16

SAZ Orion CV Conventional Check Valve are available in 1.0” and 1.5” diameter. The Check Valve is installed externally on conventional mandrel. Check dart prevents gas and fluid flow from the tubing back into the casing annulus. An elastomeric check pad is first contacted by the check dart and as differential pressure increases, a metal-to-metal contact acts as a secondary seal. The check valve is manufactured from premium material for corrosion resistance in wells with high concentrations of H_2S and/or CO_2.



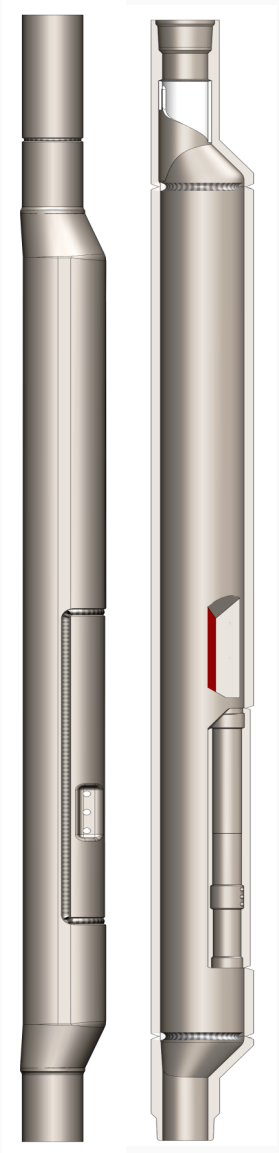
Features

- Body material in stainless steel SS304/SS 316L, 17-4PH and Monel
- Check valve back pressure rating 5,000 PSI.
- Spring material Inconel X 750.
- Compatible with other industry standard conventional (tubing retrievable) mandrels

Check Valve Type	Check Valve OD (in)	Effective Port Diameter (in)	Top & Bottom Connection	Flow Direction
Spring Loaded	1.0	5/16	1/2" NPT	Annulus to Tubing
Spring Loaded	1.5	1/2	1/2" NPT	

Sirius Gas Lift Mandrel

SAZ Sirius GM Side Pocket Mandrels are available in various tubing sizes, end connections and metallurgy to match the tubing and offer full drift. Oval/Round Body Mandrel configuration is designed to provide a full opening tubing drift and receives 1.0" or 1.5" O.D Retrievable Gas Lift Valves and Dummy Valves. These mandrels feature an orienting sleeve and a deflector above the forged pocket. The orienting sleeve allows an option to use a positive orienting kickover tool to run and retrieve valves via slickline /wireline. Deflectors are in place to deflect and protect the valve latch.



Features

- Offset design eliminates the need to pull or re-run the tubing string to install or replace gas lift valves
- Pocket is offset from tubing ID, allowing maximum flow from tubing
- 180° Pocket Latch configuration
- Mandrels are with Orientation Sleeve
- Orienting sleeve has a mule profile which allows precise installation and retrieval of gas lift equipment in straight and deviated wellbores

Tubing Size (in)	Mandrel Type	Pocket (in)	Major O.D. (in)	Minor O.D. (in)	Drift (in)
2-3/8	Oval	1.0	4.25	2.91	1.901
		1.5	4.75	4.00	
	Round	1.0	4.60	-	
2-7/8	Oval	1.0	4.75	4.00	2.347
		1.5	5.40	4.62	
	Round	1.0	5.00	-	
		1.5	5.44	-	
3-1/2	Oval	1.0	5.31	4.12	2.867
		1.5	5.97	5.00	
	Round	1.0	5.75	-	
		1.5	6.00	-	
4-1/2	Oval	1.0	6.41	5.50	3.833
		1.5	7.03	6.63	
	Round	1.5	7.07	-	
5-1/2	Oval	1.5	8.01	6.84	4.663
	Round	1.5	8.00	-	

Sirius Gas Lift Valve

SAZ Sirius GV Retrievable Injection Pressure Operated (IPO) gas lift valves are available in 1.0" or 1.5" diameter. These valves are controlled by injection gas pressure (casing pressure). The valves are installed inside the side pocket mandrels with the help of wireline tools. The valve has a bellows assembly that contains a nitrogen charge over damping fluid. The dome charge provides the closing force of the valve. When injection gas pressure exceeds the closing force, the bellows compress, lifting the valve stem off of the seat, allowing gas to be injected through the valve and into the tubing. The valve has an integral back check device which prevents gas and fluid flow from the tubing back into the casing annulus.

Features

- Body material in stainless steel SS304/SS 316L, 17-4PH and Monel
- Standard packing material Neoprene others are also available.
- Three-ply Monel bellows
- Mechanical stop prevents bellows over stroke
- Viscous fluid shear dampening prevents bellow fatigue and stem chattering
- Tungsten Carbide ball and ball stem assembly
- Replaceable floating Monel seat (also available in Tungsten Carbide material)
- Silver brazed bellows connection

Valve Type & Size (in)	Latch Type	Effective Bellow Area (in^2)	Port Size (in)	Port Area (in^2)	Ap/Ab	1-Ap/ Ab	*Rtef(Ap/Ab)/ (1-Ap/ Ab)
IPO 1.0	SBK-2	0.31	3/16	0.029	0.094	0.906	0.103
			1/4	0.051	0.165	0.835	0.197
			5/16	0.079	0.255	0.745	0.342
IPO 1.5	SRK	0.77	3/16	0.029	0.038	0.962	0.039
			1/4	0.051	0.066	0.934	0.071
			5/16	0.079	0.103	0.897	0.114

A_b = total effective bellows area, in^2
A_p = valve port area (ball/seat line contact area for sharp-edged seat), in^2
Rtef = Tubing Effective Factor

Pilot Operated Valves

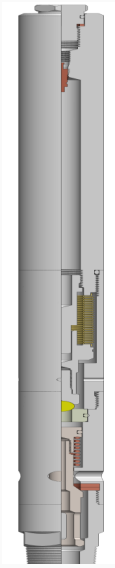
SAZ Sirius PO Retrievable Pilot Operated gas lift valves are used in Intermittent flow gas lift application. During Intermittent gas lift operations, the valve controls gas pressure and its flow from the casing annulus into the tubing. A slug of fluid is displaced from the injection point to the surface. The valve maintains a large primary injection port since Intermittent gas lift requires a large volume of gas to be injected rapidly into the tubing for a short period of time to displace fluid. The control of gas during this cyclic operation is enhanced by the valve's ability to control the spread (difference in valve opening and closing pressure). The valve uses nitrogen charged bellows to provide the closing force.

Features

- Small spread between the opening and closing pressure
- Control ports optimize the Injection cycle by controlling the valve spread
- Maximizes production rates in Intermittent gas lift application
- Enables high volume gas injection through large flow area
- Available in various metallurgies to suit different environment

Valve Type	Latch Type	Valve OD (in)
Sirius PO	SBK	1.0
	SRK	1.5

SAZ Orion PO Conventional Pilot Operated gas lift valves are used in Intermittent flow gas lift application. Orion PO are installed on tubing retrievable gas lift mandrels. These valves are available in either nitrogen charged or spring-loaded options. The spring loaded valve has a pilot section which contains a bellow assembly, spring, stem and seat that controls the opening and closing of the main power section. The spring provides the closing force that acts on the pilot valve stem. When injection gas pressure and production pressure exceeds the spring force, the pilot opens and applies pressure to the main power section. The piston in the power section shifts open to expose a very large port, allowing rapid injection of a large volume of gas into the tubing. The spread can be adjusted by changing pilot valve stems and seats.



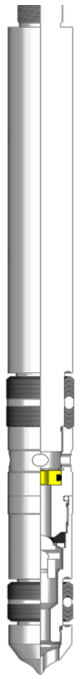
Features

- Spring & Bellows design negates temperate effect compared to Nitrogen charged valves
- Reverse flow check valve prevents tubing to casing annulus communication
- Large port size in the power section allows large volume of gas to lift a slug of fluid
- Fluids are lifted at a high velocity which minimizes liquid fallback.
- Shock absorber in the power stem increases the life of the valve
- Available in various metallurgies to suit different environment

Nominal Size (in)	Max OD (in)	Bottom Connection
1.0	1.0	1/2-14 NPT PIN
1.5	1.5	1/2-14 NPT PIN

Sirius OV Orifice Valves

SAZ Sirius OV Retrievable Orifice Valves are used to control the flow of gas from the casing annulus into the tubing. The valves are installed inside the side pocket mandrels. The valve is designed with a square edged orifice which, when properly sized, allows volume control when the casing and tubing pressures are known. An integral reverse flow check valve prevents gas and or fluid from flowing from the tubing back into the casing annulus. The valve consists of a flow barrel, seat housing and floating square edged orifice, lower packing retainer, and check nose with a reverse flow check drop. Gas and/or fluids that are injected into the casing annulus enter the ports in the side pocket mandrel. This gas and/or fluid then enter through the ports in the valve that is located in the flow barrel between the two sets of packing. The gas and/or fluid then flows through the seat housing and square edged orifice, past the reverse flow check drop, through the check nose and into the tubing.



Features

- Replaceable square edged orifice (Tungsten Carbide available)
- Flow capacity determined by orifice sizing.
- Integral reverse flow check valve.
- Compatible with standard 1.0" (SBK) and 1.5" (SRK) latches.
- Standard packing material Neoprene; others are also available

Valve Type & Size (in)	Latch Type	Port Size (in)
Orifice 1.0	SBK	3/16
		1/4
		5/16
Orifice 1.5	SRK	3/16
		1/4
		5/16

Ursa IM Water Flood Mandrels

SAZ Ursa IM Water Flood Side Pocket Mandrels are single pocket mandrels that accept 1.0" and 1.5" diameter water flood devices. These side pocket mandrels are available in variety of tubing connection sizes and are used in single string, multi zone fluid injection/ water flood installations. These mandrels have an outlet port at the bottom of the side pocket, protecting the casing from high-velocity turbulence associated with water flood process. Non retrievable check valve is attached directly to the outlet port to prevent back flow from the annulus to the tubing through the empty pocket when the water flood flow regulator is removed.

Features

- Machined Pocket is offset from tubing ID which allows the maximum flow from tubing
- Orienting sleeve has a mule profile which allows precise installation and retrieval of equipment in straight and deviated wellbores
- Pockets combined with deflectors protects gas lift equipment from damage
- Mandrels are available in 4140/4130 and 13 Cr material
- Mandrels can be furnished in either API threads or premium connections
- Guard protector protects the pocket port thread from damage
- Round body design is available for high pressure applications

Tubing Size (in)	Mandrel Type	Pocket (in)	Major O.D. (in)	Minor O.D. (in)	Drift (in)
2-7/8	Oval	1.5	5.50	4.62	2.347
	Round		5.44		
3-1/2	Oval	1.5	5.96	5.00	2.867
	Round		6.00		

Ursa IV & Ursa CV

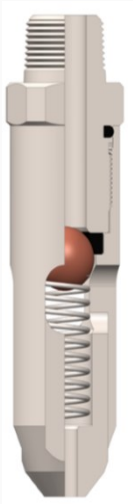
SAZ Ursa IV Water Flood Valves are used in water injection (water- flood) applications. These valves are designed to ensure a constant flow rate into each zone, independent of pressure changes in the reservoir or in the surface pressure system. Water is injected down a single tubing and distributed in a controlled manner into different zones by the valves. These valves are used with side pocket mandrels.

Features

- Easy redress of the valve
- Flow variation by changing orifice with different port sizes
- Compatible with SRK and SBK latches
- Metallic screen on top of the valve to filter debris
- Valves are available in different alloy steel for sour services
- Valves feature integral check valves
- Flow configurations are available inside and bottom exit

Nominal Size (in)	Max OD (in)	Total Length (in)	Top Connection
1.50	1.50	19-5/8	1-1/16"-18 UNEF

SAZ Ursa CV Water Flood Check Valves are designed to connect on bottom of the side pocket mandrel to prevent back flow from the reservoir.



Features

- Simple design
- Viton Seals
- Stainless Steel Body
- Ceramic check balls are also available

Normal Size (in)	Top Connection
1.0	Ø ½" - 14 NPT
1.5	Ø ¾" - 14 NPT

Accessories

SAZ Sirius DV Dummy Valves are Wireline Retrievable isolation tools designed to install in a side pocket mandrel to blank off the pocket to prevent communication between tubing and annulus. This allows pressurizing of the tubing or casing for setting packers, testing, stimulation and self flow prior to the need for gas lift valves. The simple design of the Dummy Valve allows for easy replacement of the gas lift valve for redressing. Dummy Valves can also be used to hang-off Memory Gauges for reservoir pressure monitoring. Both equalizing and non-equalizing type Dummy Valves are available. The rugged, solid construction and premium materials assure a long service life.

Features

- Body material in stainless steel SS304/SS 316L, 17-4PH and Monel
- Standard packing material Neoprene others are also available.
- Compatible with standard 1.0" (SBK) and 1.5" (SRK) latches.
- Compatible with Sirius GM Side Pocket Mandrels

Valve Type & Size (in)	Latch Type
Dummy; 1.0	SBK
Dummy; 1.5	SRK

SAZ SBK and SRK Wireline Retrievable Latches are designed to secure retrievable gas lift valves and any other flow control devices, such as chemical injection valves and water flood valves, into the appropriate side pocket mandrels. equipped with 1" or 1.5" outside diameter receiver pockets. All the running post and bodies for the **SBK** and **SRK** model latches are drilled and pinned.

SRK SBK

Features

- Available in SS316/SS316L, SS304 and Monel
- Latch design allows valves to be pulled and serviced or replaced without pulling the whole tubing
- 1.5" OD latch includes two O-rings that provide a barrier against fine sands and debris thereby protecting the latch from getting stuck during retrieval.
- Compatible with pulling tools, gas lift valves and side pocket mandrels.

Pocket Size (in)	Lug Profile	Model	Locking Profile	Pulling Neck OD (in)	Running Neck OD (in)	Running Tool	Pulling Tool
1.0	180°	SBK	Ring Type	0.875	0.750	SRT	1-1/4" SJDC
1.5	180°	SRK	Ring Type	1.185	0.937	SRT-1	1-5/8" SJDS

Accessories

SRT

SRT-1

SAZ SRT Running Tools are wireline accessories to run and install 1.0" and 1.5" diameter devices inside the side pocket mandrels. These running tools consist of a fishing neck, a pin thread connection on the top end and a skirt on the lower end which attaches to the gas lift device with shear pins.

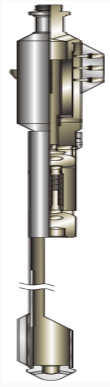
Running Tool Type	Top Connection	Fishing neck	Maximum OD	Device Size
SRT Running Tool	Ø15/16-10 UNS 2A	1.187"	1.25"	1.0"
SRT-1 Running Tool		1.187"	1.45"	1.5"

SAZ SJD Pulling Tools are wireline accessories designed to pullout retrievable devices with outside fishing necks. These tools are available with three different core lengths, which enable the tools to retrieve subsurface devices with fishing necks of different reach lengths. The SJD series pulling tools use the D sub, which is made up to the core of the tool. The dogs, which are mounted on the skirt are inserted into the vertical openings in the skirt. The dogs are spring loaded and have grooves located in the windows on the skirt. The pulling tool can be released in the event that the subsurface device cannot be freed by continuous downward jarring. Three types of SJD series tools are used and differ only by their core length, which is selected according to the reach required.

Features

- **SJDC** long core/short reach
- **SJDS** intermediate core/intermediate reach
- **SJDL** short core/long reach
- All other parts of each tool are identical and entirely interchangeable

Pulling Tool Size (in)	Top Connection	Pulling Tool Fishing neck (in)	Maximum OD (in)	To Pull Finish Neck OD (in)	Core Connection
1-1/4	Ø15/1 6-10 UNS 2A	1.187	1.30	0.875	Ø1/4-20
1-5/8		1.187	1.625	1.187	Ø1/2-13



SAZ SKT Kickover Tools are used to install and retrieve flow-control devices in side-pocket mandrels that have an integral orienting sleeve. The SKT series tools are run into the well using standard wireline techniques. The orienting sleeve aligns the kickover tool above the side pocket, enabling precise installation or retrieval of flow-control devices for gas-lift, chemical-injection, and waterflood applications.

Model	Valve OD (in)	Tubing OD (in)
SKT-1	1.0	2-3/8, 2-7/8, 3-1/2, 4-1/2
SKT-1.5	1.5	3-1/2, 4-1/2, 5-1/2"