

Weir SPM



Weir SPM General Catalog

Well Service Pumps
Flow Control Products
Manifold Trailers
Safety Products
Post Sale Services

The sun never sets on the well service equipment designed and manufactured by Fort Worth based Weir SPM. Product manufactured in Fort Worth, Texas is on the job on nearly every continent of the world, from the jungles of South America, to the deserts of the Middle East, on the Siberian plains of Russia, and in our own backyard in the Barnett Shale. In fact, Weir SPM has more well service pumps operating in the Barnett Shale than any other pump manufacturer.

Through innovative engineering, Weir SPM now offers the well service industry's most comprehensive line of plunger pumps, as well as the industry's most complete array of flow control valves and high-pressure flow control components. Weir SPM has also expanded its product line to include innovative safety equipment for flow line operators, winning the Woelfel "Best Mechanical Engineering Innovation" Award for its Flow Line Safety Restraint System from the American Society of Mechanical Engineering during the 2002 Offshore Technology Conference.

Weir SPM extends its reach around the world in order to fulfill the needs of its customers on a global basis. Though products are designed and manufactured in-house at its Fort Worth location, Weir SPM increases its global coverage through its sales offices and service centers strategically situated around the world. Currently, Weir SPM utilizes twelve sales and service facilities spread across



the United States, as well as three facilities in Canada, one in Mexico, one in Aberdeen, Scotland, one in Dubai, UAE, one in Singapore, one in Australia, and a fleet of Mobile Units operating on demand around the globe. Weir SPM also relies on the numerous Weir Oil and Gas Services facilities located around the globe to provide support services where Weir SPM may not have a local base.

Weir SPM is the worldwide leader in well service pump and flow control equipment for the oil and gas industry. The focal point of Weir SPM's product portfolio is its line of high-pressure plunger pumps - the largest, most comprehensive range offered in the industry. Weir SPM manufactures a variety of pump models to meet any need: intermittent duty service pumps for a full range of well service applications and extended duty plunger pumps for oilfield and industrial applications requiring a smaller footprint. Weir SPM's pumps are technologically advanced and manufactured to the highest quality standards.

In addition to its line of pumps, Weir SPM manufactures the industry's most complete line of valves and flow control products. The valve product line includes various sizes and pressure rated plug valves, emergency relief valves, check valves, dart valves and butterfly valves. Hammer unions, integral union connections, swivel joints, steel hose loops and a variety of well service specialty products complete the flow control product line. Weir SPM also offers innovative safety equipment for well service providers, including the award winning Flow Line Safety Restraint System and the innovative clamp connecting flow line system, Safety Iron®. Weir SPM's Safety Iron® is now available in a next generation manifold trailer package for increased performance during fracturing applications.

Quality is priority number one, therefore Weir SPM operates under an ISO-approved quality system within its manufacturing facility and at its service centers. Additionally, the company is approved by DNV, CE and other entities for the entire Weir SPM product line. Weir SPM's products are designed using state-of-the-art engineering programs to ensure that all products are of the highest quality. To further ensure that each product exported around the world is reliable and safe, all flow control assemblies are pressure tested to 150% of their rated working pressure, and each pump is powered up and tested at full power. Weir SPM does not institute batch testing.

With a half century of experience and a proven track record of steady growth, Weir SPM has well established its presence in the global marketplace. Weir SPM's emphasis on strong customer service and detailed attention to product quality will aid in keeping it a leading supplier of equipment for the worldwide petroleum industry. Weir SPM is focused on growth and maintaining its position as a technical leader in the well service equipment industry. This technical expertise is being developed through highly skilled employees, through state-of-the-art design, superior engineering and manufacturing tools, and a commitment to working tirelessly to acquire the resources needed to expand upon our exponential growth.



Weir SPM Global Locations

Fort Worth, TX	Red Deer, AB, Canada
Houston, TX	Red Cliff, AB, Canada
Odessa, TX	Grande Prairie, AB, Canada
Longview, TX	Villahermosa, Mexico
Alice, TX	Aberdeen, Scotland
Elk City, OK	Dubai, UAE
Brighton, CO	Singapore
Grand Junction, CO	Perth, Australia
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Lafayette, LA	
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The following recommendations for Weir SPM flow control products are intended to be a guide to maximize efficiency, extended product life, and create a safer work environment.

- Treating or discharge iron is produced for the following services:
 - Standard Service
 - H₂S / Sour Gas Service
 - Low Temp Service
- Weir SPM recommends that you designate specific strings of iron for the following applications, and that the designated iron remain in that service application throughout the product's life:
 - Energized Fluids
 - Acids
 - Sour Gas
 - Low Temperature Applications
- **Flow rates above 42 feet per second are not recommended.**
- Every string of iron should be pressurized to its maximum planned working pressure prior to each use.
- Pressure seal line pipe threads are not recommended for pulsating service above 10,000 psi or where side loading or erosion are suspected. (Integral or Non-Pressure seal threads are recommended.)
- Most flow control products are certified for the following temperature rating:
 - Minimum: -30° C
 - Maximum: 110° C
- Personnel must not be around pressure vessel products while pressure is present or being applied.
- Each string, as well as each component, must have regular intervals of maintenance and inspection for safe, proper performance.
- Never tighten or hammer wing unions when pressure is apparent.
- Welding, brazing or heating on high pressure Weir SPM components is prohibited.
- General maintenance will extend the life of flow control products.
 - Grease plug valves and swivel joints after every job.
 - Replace seals to help prevent leaks and washouts of seal faces.
 - Clean all seal areas thoroughly.
 - Flush all products with water after each job.

Hammer Union & Safety Iron® Connections

Broadening the product line to meet the needs of our customers and the industry as a whole, Weir SPM currently offers flow control products in two styles of end connections. Traditional hammer union connections have long been the industry standard for connecting flow line components. Consisting of a wing nut and sub, and threaded end, hammer union connections require the use of a sledgehammer to assemble. Weir SPM's patented Safety Iron® was designed to offer a safer and more effective alternative to the hammer union connection. Consisting of a seal ring, upper clamp utilizing "captive bolts", and lower threaded clamp, Safety Iron® is assembled with the use of an impact wrench instead of a sledgehammer. Both hammer unions and Safety Iron® connections offered by Weir SPM are manufactured under strict quality standards and have proven to perform consistently in the field. For information on Safety Iron®, please see page 15 and 16.

Most flow control products manufactured by Weir SPM can be made with either Safety Iron® or Hammer Union connections.



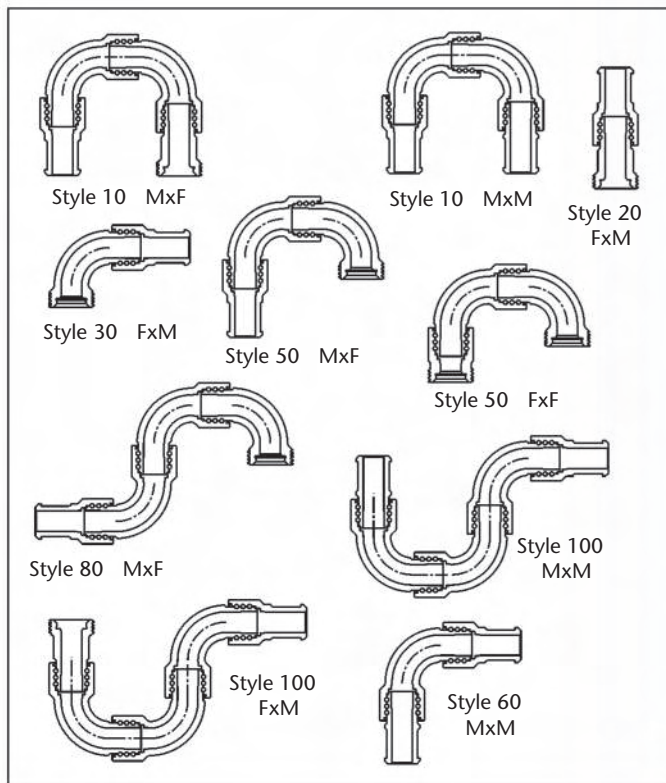
Swivel Joints

Weir SPM's 3" Fig. 1502 and 4" Fig. 1002 Long Radius Swivel Joints have undergone a design enhancement, creating a superior and longer lasting product. New features have created a swivel with extended life while maintaining uniform flow.

New features include:

- Additional erosion material under critical ball race locations:
 - 3" Fig. 1502 - over 13% more
 - 4" Fig. 1002 - over 22% more
- More stable assembly with better load distribution in 3" Fig. 1502 series, featuring longer ball race life.
- Better distribution of material for more robust female ball race components in 3" Fig. 1502 and 4" Fig. 1002 models.
- No danger for any mismatches.
- Available in traditional hammer union styles or in Weir SPM's patented Safety Iron® connections.

All Weir SPM swivel joints feature uniform wall thickness throughout for longer and more uniform flow of fluids (including slurries and abrasives), elastomeric packing for service to 225°F, instream packing that is designed not to enter stream regardless of velocity, and improved lubrication.



Pressure Rating	Size					
	2"	2" H2S	3"	3" H2S	3" x 2"	4"
Style 10 Fig. 1502 MxF	•	•	•	•		•
Style 10 Fig. 1502 MxM	•	•	•	•		•
Style 20 Fig. 1502 MxF	•		•	•		
Style 30 Fig. 1502 MxF	•		•	•		
Style 50 Fig. 1502 MxF	•	•	•	•	•	•
Style 60 Fig. 1502 MxF	•	•	•	•		
Style 80 Fig. 1502 MxF	•	•	•	•		
Style 10 Fig. 602 MxF						•
Style 10 Fig. 602 MxM						•
Style 50 Fig. 602 MxF						•
Style 100 Fig. 1502 MxF	•	•	•	•	•	
Style 100 Fig. 1502 MxM	•	•	•	•	•	
Style 10 Fig. 1002 MxF						•
Style 10 Fig. 1002 MxM						•
Style 50 Fig. 1002 MxF						•
Style 10 Threaded Swivel	•					
Style 20 Threaded Swivel	•					
Style 50 Threaded Swivel	•					

Weir SPM's product mix is constantly being revised to meet customer needs. Contact Weir SPM Engineering for the latest product offering information.

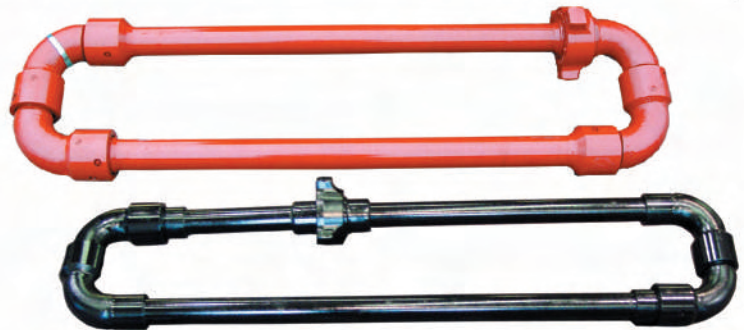
Steel Hose Loops and Pipe

Steel Hose Loops

Weir SPM all-steel hose loops are used for a variety of high pressure well service applications including discharge lines, water lines, cementing and circulating lines, well test lines and temporary flow lines.

Weir SPM all-steel hoses utilize field-proven Weir SPM swivel joints for greater flexibility, shock and vibration resistance, and more uniform flow. Also utilized are Weir SPM wing union end connections for fast, pressure-tight make-up and break-out.

These rugged hoses handle a full range of fluids to cold working pressures up to 15,000 psi and come in sizes and configurations to meet any need. Hoses for sour gas service are available at cold working pressure up to 10,000 psi. Weir SPM hoses are designed to easily and conveniently fold up for storage and transportation.



Weir SPM Model	Color Code	Method of Construction				NSCWP* (PSI)	Size (In.)	
		Threaded	NPS	Integral	Welded		2	3
Long Radius Swivel Joints	Olive Green†		•	•	•	10,000	•	•
	Red		•	•	•	15,000	•	•
Long Radius Swivel Joints	Black	•				10,000	•	

† Sour Gas Service

*Non-Shock Cold Working Pressure

Flow Line Piping

Weir SPM all-steel, one piece flow line piping, with wing union end connections, eliminates the need for welds or threads for an uninterrupted bore and greater flow. This light-weight piping is available in lengths to 10 feet to handle fluids at cold working pressures to 15,000 psi.

They are used on high-pressure discharge lines, auxiliary flow lines, choke-and-kill lines and for abrasive applications.

Weir SPM also manufactures flow line piping in non-pressure seal thread styles as well as butt weld styles in sizes ranging from 1" to 4" and in pressure ranges from 6,000 to 20,000 psi, up to 20 feet in length.

Weir SPM is in the process of adding an identification groove to all NPST subs. This is being implemented per the Shell mandate.



Integral Style

Size (In.)	Type of Service	NSCWP* (PSI)	End Connection
2	Standard	15,000	Fig. 1502 Union
2	Sour Gas	10,000	Fig. 1502 Union
3	Standard	15,000	Fig. 1502 Union
3	Sour Gas	10,000	Fig. 1502 Union
4	Standard	15,000	Fig. 1502 Union

NPS & Butt Weld Piping

Style	NSCWP* (PSI)	1"	1½"	2"	3"	4"	Non Press Seal	Butt Weld
Fig. 602	6,000	•	•		•	•	•	•
Fig. 1002	10,000	•	•	•		•	•	•
Fig. 1502†	10,000	•	•	•	•			•
Fig. 1502	15,000	•	•	•	•	•	•	•
Fig. 2002	20,000			•	•			•
Fig. 2202†	15,000			•	•			•

*Non-Shock Cold Working Pressure

† Sour Gas Service

Weir SPM's product mix is constantly being revised to meet customer needs. Contact Weir SPM Engineering for the latest product offering information.

Plug Valves

1", 1" X 2", 1½", and 2" Plug Valves

Weir SPM high pressure plug valves are tough, field-proven units that provide dependable service for applications such as cementing, fracturing, acidizing, coiled tubing, and sand control. Available in 1", 1" X 2", 1½" and 2" sizes and in pressure ratings to 15,000 psi NSCWP*, Weir SPM plug valves feature quality components throughout for greater dependability, minimum weight, and maximum strength. Plug valves are available in standard service and sour gas service models. Special models are available to 20,000 psi.

3" and 4" Plug Valves

Weir SPM three-inch and four-inch plug valves are available in pressure ratings to 20,000 psi NSCWP*. Features include a flanged body for easier maintenance, integral inlets and outlets, hand crank, locked-open and shut gear drive standard, and multiple lubricating inlets. Standard service and sour gas service models are available. Weir SPM's latest plug valve offering is the 3" SP150 Manual Actuated Plug Valve.

Remote Operation

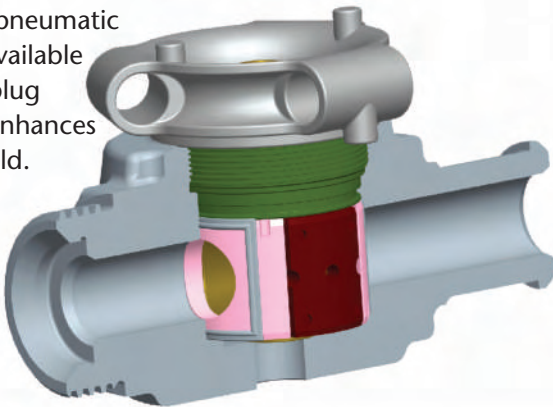
Hydraulic and pneumatic actuators are available for all sizes of plug valves, which enhances safety in the field.



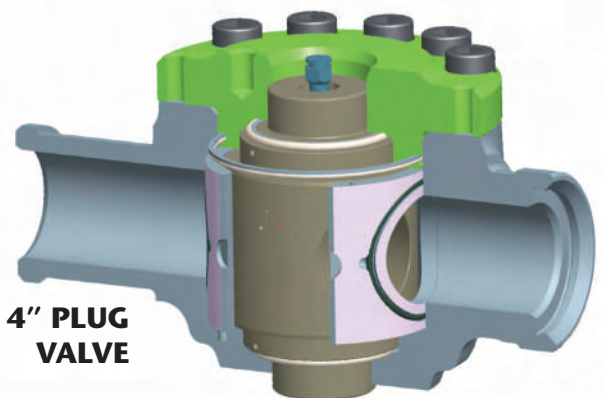
Repair and Seal Kits

Weir SPM repair kits and seal kits contain all the parts necessary to rebuild valves in the field or in the shop. Weir SPM seal kits contain all items in the standard repair kit, except the plug. Individual components and elastomer kits are also available.

2" PLUG VALVE



4" PLUG VALVE



Valve Model	NSCWP* (PSI)	End Connections	Size					
			1"	1" X 2"	1½"	2"	3"	4"
SP50TF	5,000	Threaded	•			•		
SP100TF	10,000	Threaded				•		
SP150TF	15,000	Threaded			•	•		
SP150TM	15,000	Threaded		•				
SP150TMF	15,000	Threaded		•				
SP150WU	15,000	Fig. 1502	•	•	•	•	•	•
SP200WU	20,000	Fig. 2002				•	•	

Special models are available in 20,000 psi. *Non-Shock Cold Working Pressure

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LIBERTY EXHIBIT 1060, Page 7

Check Valves

Weir SPM check valves are made of high strength steel and are precision manufactured to exact tolerances for clapper styles in 2" through 4" sizes, dart styles in 1" through 3" sizes, and CO2/nitrogen styles in 2" and 3" sizes. The clapper design features either a standard coating or superior abrasion and acid resistant coating to give longer operating life in corrosive applications.

The rugged valves operate at working pressures from 6,000 to 20,000 psi in well service applications such as acidizing, cementing, fracturing, and energized fluids. Weir SPM's check valves are manufactured from solid forgings to maximize strength and increase abrasion resistance.

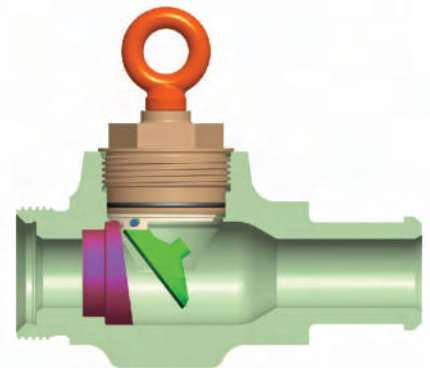
Weir SPM carries the most complete line of check valves available to the well service industry. Various configurations are offered, including wing-ahead (standard flow) or thread-ahead (reverse flow) models.



CLAPPER STYLE

**Available in Standard Flow (Wing Ahead)
and Reverse Flow (Thread Ahead)**

Valve Size	Inlet	Outlet	Upstream / Downstream	NSCWP* (PSI)
2" 1502	Male	Female	Reverse Flow	15,000
2" 1502	Female	Male	Standard Flow	15,000
2" 2002	Female	Male	Standard Flow	20,000
3" 1502	Male	Female	Reverse Flow	15,000
3" 1502	Female	Male	Standard Flow	15,000
3" 1502 Sour Gas	Male	Female	Reverse Flow	10,000
3" 1502 Sour Gas	Female	Male	Standard Flow	10,000
3" 2002	Female	Male	Standard Flow	20,000
4" 602	Female	Male	Standard Flow	6,000
4" 1002	Female	Male	Standard Flow	10,000
4" 1002	Male	Female	Reverse Flow	10,000
4" 1502	Male	Female	Reverse Flow	15,000
4" 1502	Female	Male	Standard Flow	15,000



Weir SPM's Clapper Style Check Valves are placed in the treating line to allow flow to the well but isolate any back flow upstream of the valve. Clapper designs include Buna N rubber coatings for standard service, Viton for solvent and severe acid service, and Urethane coating for high abrasion resistance (HAR).

*Non-Shock Cold Working Pressure

Weir SPM's product mix is constantly being revised to meet customer needs. Contact Weir SPM Engineering for the latest product offering information.

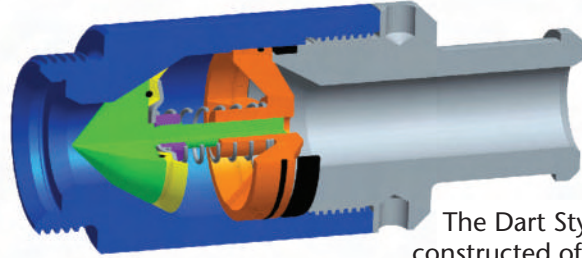
Weir SPM



Check Valves

DART STYLE

**Available in Standard Flow (Wing Ahead)
and Reverse Flow (Thread Ahead)**



The Dart Style Valve is constructed of a two-piece body that houses an inline spring loaded dart. When fluid enters from the inlet side, it will overcome the low spring force on the dart. The dart will travel away from the inlet and allow the fluid to flow around towards the outlet. When fluid flow stops, the light spring force closes the dart against its seat, preventing fluid from flowing back through the flow line. The Weir SPM Dart Style Check Valve is available for standard service and for sour gas (H2S) environments.

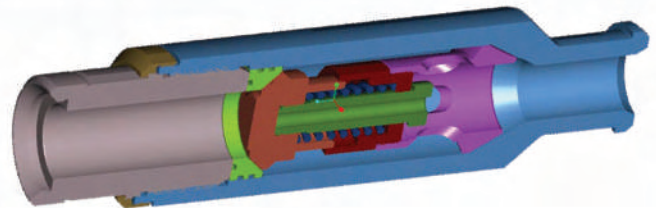
Valve Size	Inlet	Outlet	Upstream / Downstream	NSCWP* (PSI)	Service
1" 1502	Female	Male	Reverse Flow	15,000	Standard
1" 1502	Female	Male	Standard Flow	15,000	Standard
1½" 1502	Male	Female	Reverse Flow	15,000	Standard
1½" 1502	Female	Male	Standard Flow	15,000	Standard
2" 1502	Male	Female	Reverse Flow	15,000	Standard
2" 1502	Female	Male	Standard Flow	15,000	Standard
3" 1502	Male	Female	Reverse Flow	15,000	Standard
3" 1502	Female	Male	Standard Flow	15,000	Standard
2" 1502	Male	Female	Reverse Flow H2S	10,000	H2S
2" 1502	Female	Male	Standard Flow H2S	10,000	H2S
3" 1502	Male	Female	Reverse Flow H2S	10,000	H2S
3" 1502	Female	Male	Standard Flow H2S	10,000	H2S

*Non-Shock Cold Working Pressure

Weir SPM's product mix is constantly being revised to meet customer needs. Contact Weir SPM Engineering for the latest product offering information.

CO2 / NITROGEN STYLE

**Available in Standard Flow (Wing Ahead)
and Reverse Flow (Thread Ahead)**



Weir SPM offers a specially designed CO2/Nitrogen Poppet Check Valve in sizes 2" and 3" to produce increased safety by preventing back flow in volatile CO2 and Nitrogen pumping flow lines. These stainless steel trim valves ensure that fluid cannot flow back into the manifold area or into pumps, and are rated at 15,000 psi.

Valve Size	Inlet	Outlet	Upstream / Downstream	NSCWP* (PSI)	Service
2" 1502	Male	Female	Reverse Flow Low Temp	15,000	Standard
2" 1502	Female	Male	Standard Flow Low Temp	15,000	Standard
3" 1502	Male	Female	Reverse Flow Low Temp	15,000	Standard
3" 1502	Female	Male	Standard Flow Low temp	15,000	Standard

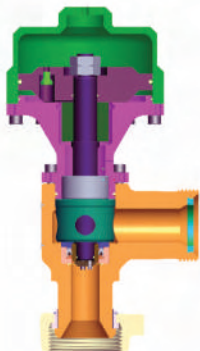
*Non-Shock Cold Working Pressure

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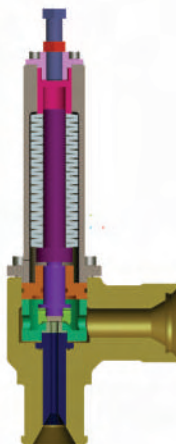
Relief Valves

Weir SPM Emergency Relief Valves provide over-pressure protection for reciprocating pumps, treating lines, pressure vessels and other equipment operating under a variety of pressure and flow conditions. The valves are compact, simple to operate and rely on the system's pressure to open when a preset pressure is exceeded, and automatically snap shut when the pressure drops.

The valves are externally adjustable, and unlike shear relief valves, which use common nails to trigger the valve, Weir SPM's Emergency Relief Valves utilize an internal spring, nitrogen, or rig air to activate opening and closing. Valves are available in 2", 3" and 4" models. Operating pressures range from 1,000 psi to 20,000 psi. Standard service and sour gas models are available.



3" Nitrogen Actuated Relief Valve



3" Spring Actuated Relief Valve



Note:

Approximate flow rate for relief valves:

- 2" Spring - 150 GPM Max.
- 3" Spring - 430 GPM Max.
- 3" and 4" Back Pressure ERV - 750 GPM Max.
- 3" and 4" Unloading Valve - 1000 GPM Max.

As flow requirements increase, then multiple valves may be preferred, and are permissible. You may find that two of the 2" valves are a better economic combination than one 3" valve. Multiples of either valve are allowed as long as the valves are all set within 10% of each other.

Example: If a customer requires a flow of 400 GPM, he may choose to use three 2" spring operated valves or one 3" spring operated valve.

		Design Style	
Size	Description	Spring	Nitrogen Actuated
2"	1502 M Inlet, Line Pipe Thread Outlet	•	
	1502 M Inlet, 1502 F Outlet	•	
	1502 M Inlet, 1502 F Outlet Sour Gas	•	
	2002 M Inlet, 2002 F Outlet	•	
	2202 M Inlet, 2202 F Outlet Sour Gas	•	
3"	602 M Inlet, 602 F Outlet	•	•
	1502 M Inlet, 1502 F Outlet	•	•
4"	602 M Inlet, 602 F Outlet		•
	1002 M Inlet, 1002 F Outlet		•
	1502 M Inlet, 1502 F Outlet		•



The Remote Control Panel is a simple and accurate tool to adjust the settings of the Nitrogen Actuated Relief Valves from a safe distance during operation.

For more information, see page 35.

Weir SPM's product mix is constantly being revised to meet customer needs. Contact Weir SPM Engineering for the latest product offering information.

Hammer Unions

Weir SPM hammer unions are available in a wide range of sizes and in working pressures to 20,000 psi. Pressure seal, non-pressure seal, and welded styles are offered in various sizes and pressures. All Weir SPM hammer unions provide pressure-tight, positive sealing and are available for standard service and sour gas models. Weir SPM hammer unions for sour gas service are specially heat-treated for controlled hardness and utilize fluorocarbon elastomer seal rings.

Figure Number	Pressure Rating (NSCWP*)	Nominal Pipe Size (Inches)								
		1	1½	2	2½	3	4	6	8	10
100	1,000			•	•	•	•	•	•	
200	2,000	•	•	•	•	•	•			
206	2,000	•	•	•	•	•	•	•	•	•
207	2,000					•	•			
400	4,000			•		•	•			
402	4,000			•						
602	6,000	•	•	•		•	•			
1002	10,000	•	•	•		•	•			
1502	15,000	•	•	•		•	•			
2002	20,000			•		•				
2202	15,000			•		•				

*Non-Shock Cold Working Pressure Weir SPM's product mix is constantly being revised to meet customer needs. Contact Weir SPM Engineering for the latest product offering information.

Fig. 100

Black Nut
Yellow Subs



An economical union with precision machined metal-to-metal sealing surfaces for air, water, oil or gas service to 1,000 psi NSCWP*.

Fig. 200

Blue Nut
Gray Subs



A precision metal-to-metal sealing surface between male and female subs for air, water, oil, gas and mud service to 2,000 psi NSCWP*.

Fig. 206

Blue Nut
Gray Subs



A precision metal-to-metal seal plus O-ring seal for air, water, gas, oil, and mud service to 2,000 psi NSCWP*.

Fig. 207

Blue Cap
Gray Subs



Interchangeable Fig. 206 sub with blanking cap and O-ring seal to assure no-leak closure of manifolds and lines to 2,000 psi NSCWP*.

Fig. 400

Black Nut
Red Subs



Features a precision ball and cone sealing surface for sure metal-to-metal seal for air, water, oil, gas and mud service to 4,000 psi NSCWP*.

Fig. 402

Black Nut
Black Subs



A resilient lip-type seal for air, water, oil or mud service to 4,000 psi NSCWP*.

Fig. 602

Black Nut
Orange Subs



A replaceable lip-type seal ring minimizes fluid flow turbulence and gives pressure seal for air, water, oil, gas and mud service to 6,000 psi NSCWP*.

Fig. 1002

Red Nut
Blue Subs



A resilient lip-type seal protects ball and cone seal against abrasion in air, water, oil, gas and mud service to 10,000 psi NSCWP*.

Fig. 1502

Blue Nut
Red Subs



For manifold and truck mountings or installations encountering high pressures including air, water, oil, gas and mud service to 15,000 psi NSCWP*.

Fig. 2002

White Nut
White Subs



For cementing, fracturing, acidizing, testing and choke-and-kill lines where extreme pressures are encountered to 20,000 psi NSCWP*.

Fig. 2202

Green Nut
Green Subs



Especially for sour gas service; with heat-treated components, fluorocarbon elastomer seal rings. For service to 15,000 psi NSCWP*.

*Non-Shock Cold Working Pressure

Integral Union Connections

Weir SPM manufactures a quality line of high-pressure integral union connections in a broad range of configurations and sizes from 1" through 4" and in pressure ratings to 20,000 psi NSCWP*. Manufactured from high strength alloy steel forgings, Weir SPM integrals feature a lightweight design not found in competitors' products. All Weir SPM integral union connections are subjected to controlled heat-treat processes.



Size	Fig. 602 6,000 psi*	Fig. 1002 10,000 psi*	Fig. 1502 15,000 psi*	Fig. 1502 10,000 psi* H2S	Fig. 2002 20,000 psi*	Fig. 2202 15,000 psi* H2S	All Female (Thread)	All Male (Wing)	Combination Styles and Sizes
1"			•				•	•	•
1½"			•		•	•	•	•	•
2"			•	•	•	•	•	•	•
3"	•		•	•	•	•	•	•	•
4"	•	•	•	•			•	•	•

*Non-Shock Cold Working Pressure Weir SPM's product mix is constantly being revised to meet customer needs. Contact Weir SPM Engineering for the latest product offering information.

UNION CHANGEOVER AND CROSSOVER ADAPTORS

Available in a variety of sizes and thread types in female-to-male, female-to-female, and male-to-male configurations from 1" thru 4", in pressure ratings from 6,000 to 20,000 psi NSCWP* in standard service, and up to 15,000 psi in sour gas service.



UNION BULL, GAUGE AND LIFTING BULL PLUGS

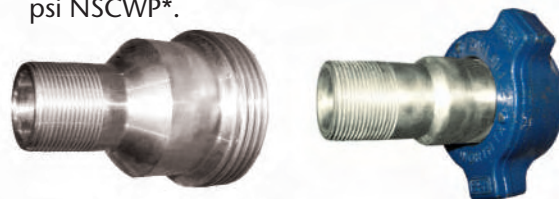
Available in 1", 1 1/2", 2", 3" and 4" sizes in male and female models. Available in pressure ratings to 20,000 psi NSCWP* in standard service, and up to 15,000 psi in sour gas service. Also available with special ports for high pressure testing.



*Non-Shock Cold Working Pressure

UNION MALE AND FEMALE TO PIPE, AND TUBING THREAD SWAGES

Available in numerous sizes and threaded configurations from 1" thru 4" in pressure ratings from 6,000 to 10,000 psi NSCWP*.

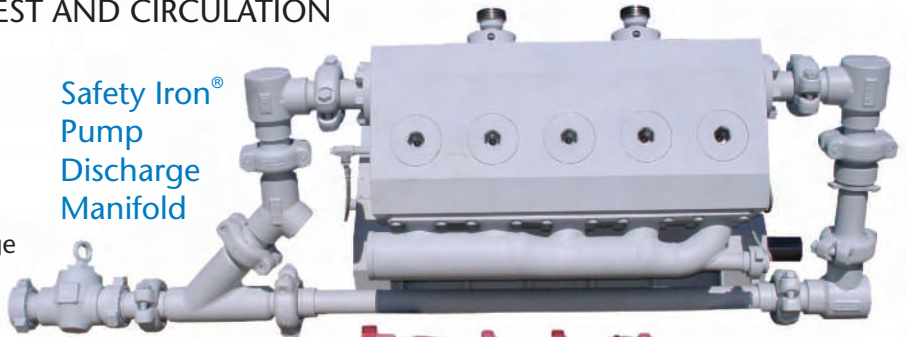


Manifolds, Frac Heads and Cement Heads

PUMP DISCHARGE, FLOW-THRU, TEST AND CIRCULATION MANIFOLDS

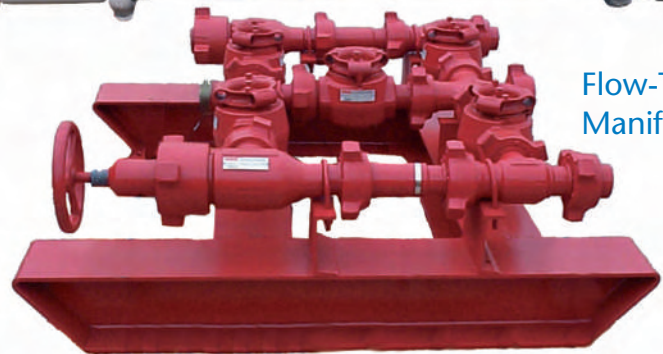
Pump discharge manifolds are available in single or multiple discharge outlets in a variety of integral union connections up to 20,000 psi NSCWP*. Features include full bore, thick-wall tubing and pump discharge flanges to fit most major brands of pumps.

Safety Iron®
Pump
Discharge
Manifold



Flow-thru, test, and circulation manifolds are available in both 5,000 and 10,000 psi NSCWP* for threaded, and to 20,000 psi NSCWP* for all-integral connection sizes. All styles utilize proven Weir SPM plug valves of all sizes, 1" through 4". Available variations include fixed choke and adjustable choke models.

Flow-Thru
Manifold



Weir SPM's Safety Iron® has proven to be an ideal choice for semi-permanent applications. Flow-thru manifolds and pump bridles are just two of the applications when Safety Iron® has performed exceptionally in the field.

*Non-Shock Cold Working Pressure

CEMENT HEADS

Utilizing superior field-tested welding techniques, Weir SPM cement heads provide high-pressure performance in a variety of designs to meet the needs of the industry. Featuring single or double plug head designs, easy-to-attach landing joints, and reliable plug pin performance, Weir SPM cement heads perform with consistency and reliability in the field.

Single and Double Head designs are available in the following sizes:

2.875"
3.50"
4.50"
5.0" - 5.5"
7.0" - 7.63"
8.63" - 9.63"
10.75" - 11.75"
13.375"
16.0"
18.63" - 20.0"

Cement Head Manifolds
also available.



FRAC HEADS

Weir SPM's customizable frac heads allow customers to design their ideal frac head for reliable and consistent performance on their frac sites.

Weir SPM frac heads are manufactured from hardened steel and feature field-proven durable welds at the branches. Available in two styles, the "Goat Head" Style and "Inlet" Style, Weir SPM customizes frac head orders to customer specifications through the use of a *Frac Head Request Form*.

Through the utilization of the *Frac Head Request Form*, customers may customize their purchase through the following design options:

- Pressure Rating
- Top Connection Type
- Minimum Through-Bore Width
- Number of Side Connections
- Side Connection Branch Angle
- Side Connection Branch, Type, and Pressure Rating
- Bottom Connection Type



Weir SPM



Misc. Flow Control Products

Choke Tees

Adjustable and positive choke tees are primarily used in choke manifolds, flow thru manifolds and test manifolds. Various forged-body configurations are available in 2-inch and 3-inch sizes, each rated at 15,000 psi NSCWP*. Choke tees are also available in sour gas configuration.

*Non-Shock Cold Working Pressure

Butterfly Valves

Weir SPM butterfly valve's specially designed disc allows for a noticeably smoother media flow, reducing or eliminating turbulence commonly found in other valves. Another superior design feature is the split stem, which allows the disc to automatically center in the media flow path, thus assuring an even seal around the disc. A one-piece phenolic back-up ring allows internal pressure to anchor the seat within the valve body and prevents seat walking. Various seat and disk materials are available.

Available in Sizes
Ranging from 3 Inches
to 12 Inches.



Sur-Drop® Ball Injectors

Weir SPM's Sur-Drop® High-Pressure Ball Injector features the "Positive Feed System", resulting in a reliable feed and injection rate. New design revisions have enhanced operating performance, made maintenance more convenient, and greatly reduced lead time for faster response to customer needs.

New Design Upgrades:

- Improved manufacturing processes allow for more precise machined parts.
- Increased flexibility in operation by consolidating ball cartridge sizes.
 - « 5/8" & 3/4"
 - « 7/8" & 1"
 - « 1-1/8" & 1-1/4"
- Increased convenience in maintenance.
 - « Two-piece screw assembly allows for more convenient replacement of drive stem, without replacing entire assembly.
- Easy manual loading eliminates use of awkward tools.



No-Go Gauge Kits

During extended service of flow control products in the field, components will naturally begin to show symptoms of wear.

In order to allow convenient inspection of these components, Weir SPM now offers No-Go Gauge Kits. These gauges allow for easy qualification of worn hammer union assemblies, swivel ball races, and sub connections.



Available in 1 1/2", 2",
3" and 4"

By inserting the gauge into the worn feature of the component, the part can be easily deemed acceptable or unacceptable. Each Weir SPM gauge is machined from hardened tool steel and is chrome plated for exceptional long life.

Safety Iron® is a clamp connecting flow line system developed to replace traditional wing nut union connections. The product consists of a seal ring utilizing a soft seal and a metal-to-metal seal, an upper clamp with "captive" bolts, and a lower threaded clamp. The metal seal ring and rubber seal freely slip into the tapered flange end. Sealing is accomplished by the end crush on the rubber seal and tapered metal contact from the clamp force. The result is a superior performing connection compared to traditional hammer union connections, and a safer work environment by allowing the user to "throw away the hammer."

**Available in 1½" through 4"
in pressure ratings up to 20,000 psi.**

U.S. Patent No. 7,204,525

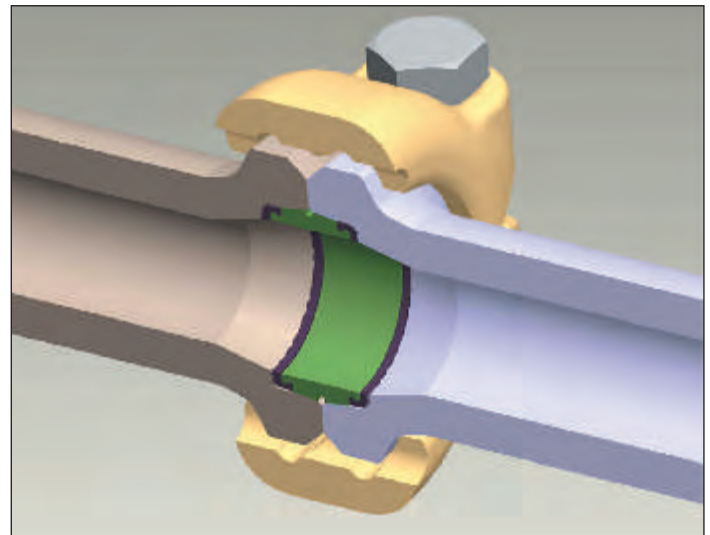


Benefits of Safety Iron® vs. Traditional Hammer Union Connections

- Greater Safety
- Less Physically Demanding Assembly/Disassembly
- Less Injury Prone
- Less Labor Intensive & Less Expensive Reinspection
- Faster Break-down
- More Reliable Seal

Safety Iron® Product Line:

- Swivel Joints
- Check Valves
- Plug Valves
- Relief Valves
- Integrals (Tees, Wyes, Elles, Crosses, and Crossovers)
- Pipe
- Pump Discharge Manifolds



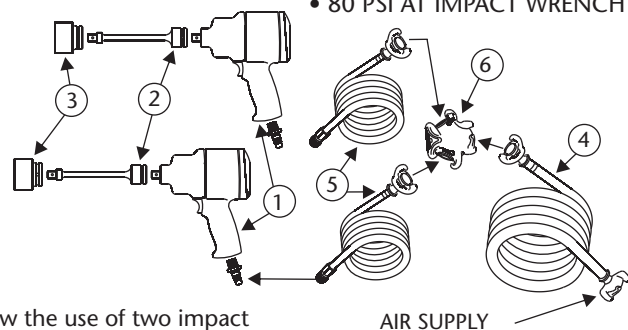
Weir SPM offers Safety Iron® Kits in 1 1/2" 15K, 2" 15K, 2" 20K, 3" 15K, 3" 20K, 4" 10K, and 4" 15K.

Kits Include:

1. (2) Impact Wrenches - 3/4" Drive w/ 3/8" Plug
2. (2) Torque Stick - 3/4" Drive
3. (2) Hex Socket - 3/4" Drive
4. (1) Hose Assembly - 50' x 3/4" Hose w/ Crowsfoot Connection
5. (2) Hose Assembly - 50' x 1/2" Hose w/ Crowsfoot and 3/8" Coupler Connection
6. (1) Wye - 3/4" Crowsfoot
7. (7) Crowsfoot Washer Seal
8. (8) Crowsfoot Pin

MINIMUM AIR REQUIREMENTS

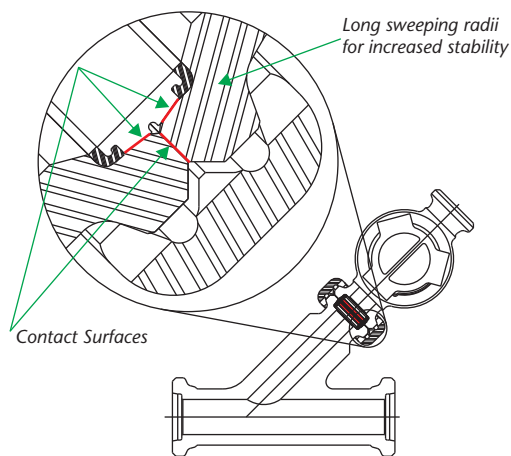
- 45 SCFM PER IMPACT WRENCH
- 80 PSI AT IMPACT WRENCH



*The kits allow the use of two impact wrenches from one air supply source.

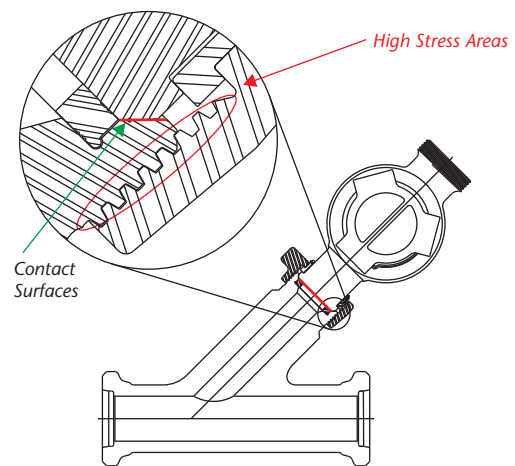
Safety Iron® Connection

Safety Iron® connections have a greater surface contact area for a much more stable connection compared to hammer union seals. Safety Iron® flanges are also more robust with larger sweeping radii for additional strength and vibration resistance.



Traditional Hammer Union Connection

Hammer union connections are limited to only one contact seal surface, greatly reducing the integrity of the connection. Hammer unions, with their thinner wall section at vital points and higher stress areas due to the jagged grooves of the threads, are more susceptible to damage as a result of vibration or side loading.



Fire Safe Safety Iron®

Weir SPM's newest addition to its groundbreaking Safety Iron® product line is Fire Safe Safety Iron®. Fire Safe Safety Iron® is designed to reduce many dangers associated with assembly of traditional flow lines on offshore rigs, while meeting API 6FB compliance for a safer working environment.

Fire Safe Safety Iron® utilizes a metal-to-metal seal, consisting of a metal seal ring, an upper clamp featuring "captive bolts", and a lower threaded clamp. The system provides an effective seal while minimizing the necessary number of components needed to complete a flow line. There is no other offshore clamp-connecting flow line product on the market that utilizes less component parts than Fire Safe Safety Iron®.

Benefits:

- Removes the sledgehammer from the assembly of iron, increasing safety during offshore operations.
- Designed to replace other existing clamp style connections with a reliable, easier to assemble connection.
- Produces a reliable seal that will maintain integrity in the instance of fire.
- For use in permanent or semi-permanent installation.
- Metal-to-metal seal meets API 6FB compliance.
- Available in 2" - 4", rated up to 10,000 psi.

Safety Iron® Manifold Trailers

Weir SPM's Safety Iron® Manifold Trailer provides the market with a uniquely designed manifold system that is ideally suited for stimulation operations, where vibration and side load have proven to be detrimental to the existing hammer union trailer models currently on the market.



Product Features:

- Multiple configurations allow for increased variability in flow rate, and inlet/outlet configuration.
- Greater vibration resistance compared to traditional hammer union alternatives.
- Large sweeping radii in high pressure components for increased strength at connections.
- More robust wall thickness to prevent failure in high risk areas.
- Available built-in coiled-cable suspension for high pressure component mounting increases flexibility and reduces risk of cracked integrals.
- Isolation valves available for flexibility in flow line communication and utilization.
- Available with crossovers at high pressure outlets for greater compatibility with existing inventories.
- DOT certified trailer.



Weir SPM Safety Iron® Manifold Trailers are available with flexible mounts, such as a coiled cable suspension mounting, for high pressure components, greatly reducing the chance of fatigue cracks in integral components due to the vibration caused during transport and operation.

Optional Design Configurations:

- Flexible high and low pressure line arrangements for various flow rates
- Flexible high and low pressure inlet/outlet arrangements for various station configurations
- High pressure iron size and pressure ratings (3" & 4" / 10K & 15K)
- Isolation valves between the high and low pressure lines
- Tee or lateral connections leading to swing arms
- Configuration of swing arms

Safety Hammer™

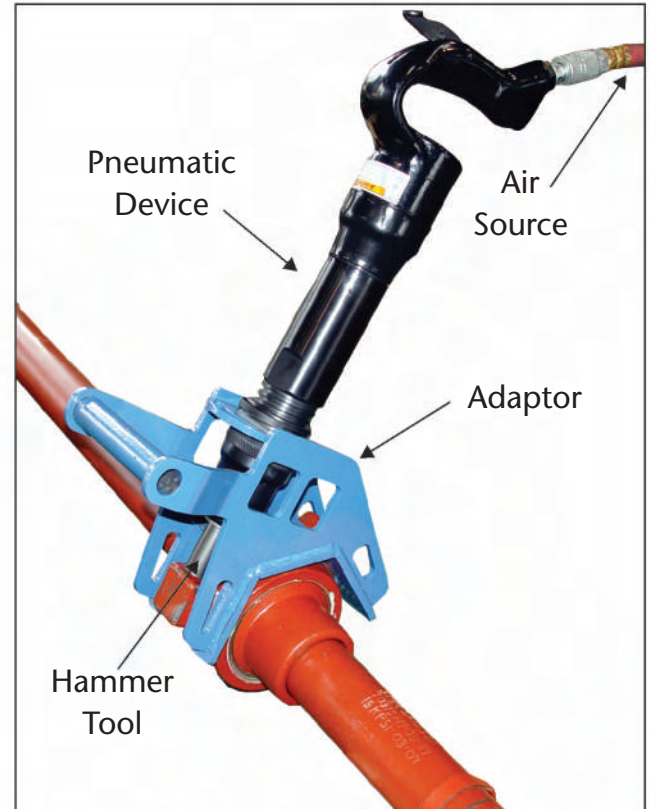
Weir SPM's newest product designed to increase safety on the work site is the Safety Hammer™. The Safety Hammer™ promotes a safer work environment by reducing the dangers associated with assembling hammer union connections using a sledgehammer. Safety Hammer™ is a pneumatic tool designed to properly seal hammer union connections with the ease of pushing a button. The dangers of using a sledgehammer are greatly reduced as most connections on-site can be made with the Safety Hammer™.

The Safety Hammer™ is an assembly composed of two main parts: high strength alloy steel adaptor and pneumatic hammer. The steel adaptor can be changed out as needed to fit different union sizes. In order for the Safety Hammer™ to function as intended, Weir SPM recommends 29 SCFM per hammer, with an air pressure of 90 psi and 1/2" air supply hose size. The Safety Hammer™ will make up and break down the hammer union depending on its orientation.

Available in 2" 1502, 3" 1502, 4" 200/206 and 4" 602/1002.



The Safety Hammer™ now features an upgraded impact tool made of a harder and tougher material for improved life with extended utility, and a redesigned contact end to minimize flaring of the edge.



To use the Safety Hammer™, simply hand-tighten the hammer union connection until the wing nut ceases to rotate. Slide the Safety Hammer™ adapter over the wing nut so that it bears against one of the three lugs. Orient so that the impact tool striking the wing nut lug will tighten the connection. Apply a turning force to the gooseneck handle until the wing nut ceases to rotate. Squeeze the trigger and continue to apply a slight turning force to the gooseneck handle. The hammer union will be quickly tightened. There is no other tool on the market that allows for such convenient and safe assembly of hammer union connections.

Benefits:

- Lightweight design that is easy to install and operate.
- Less labor intensive assembly/disassembly.
- Lower risk of injury by removing hammer from assembly process.
- Adaptor can easily be interchanged for different size wing unions.

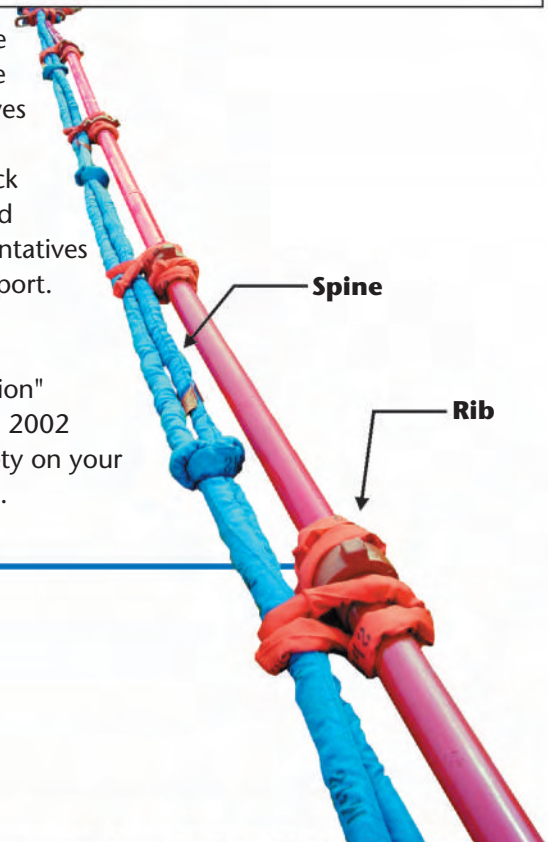
Weir SPM



Flow Line Safety Restraint System

Weir SPM's Flow Line Safety Restraint System is designed to help provide a safer environment in case of rupture or disengagement of the flow line while under pressure. The FSR has been credited with saving multiple lives and preventing catastrophic damage since its inception. FSR is recommended for all pumping service lines as they leave the skid or truck all the way to the wellhead, and should be mandatory for energized fluid pumping services. Systems are available for rent with Weir SPM representatives available to perform on-site training and full-service installation and support.

The FSR system was acknowledged for its innovation and performance capabilities, receiving the Woelfel "Best Mechanical Engineering Innovation" Award from the American Society of Mechanical Engineering during the 2002 Offshore Technology Conference. For peace of mind and increased safety on your site, there is no better option than the Flow Line Safety Restraint System.



RENTAL PACKAGES

Weir SPM has a large fleet of FSR Rental Units located around the globe for quick response to customer requests. Upon order, Weir SPM technicians will deliver the unit to a site as requested and will provide training to customers' employees to ensure proper installation of components or provide full service installation. Weir SPM offers FSR trailers, and customized cargo containers for offshore use, to better organize component parts and make transport of materials safer and more convenient. There is no more convenient way to satisfy the safety requirements of both the operator and service provider on site.



The FSR Rental Fleet undergoes constant inspection, as well as regular recertification and testing to insure that the FSR components perform as expected. Each component features identification and recertification badges so the customer may verify the components comply with regulations.



The Flow Line Safety Restraint System prevented this wellhead from becoming airborne and deterred the flow line from striking a functional gas well. Notice how the pipe is bent, yet still held in place.

It is critical that, since most Weir SPM products generate, control or direct pressurized fluids, those who work with these products be thoroughly trained in their proper application, safe handling, and installation. Misuse, side loading, improper maintenance, or disassembly under pressure can cause serious injury or death!

LIBERTY EXHIBIT 1060, Page 19

Weir SPM



Well Service Pumps

Weir SPM manufactures the most comprehensive range of high-pressure plunger pumps in the industry. Weir SPM's plunger pump designs incorporate the ultimate in weight and space savings while having a reputation for dependable service even in today's hybrid extended duty applications, such as under-balanced coiled tubing drilling.

Weir SPM offers intermittent duty pump models for the full range of well service applications, and extended duty plunger pump models for those oilfield and industrial applications requiring greater work periods with a small-footprint, lightweight pump.

Weir SPM's DNV Type Approved intermittent duty plunger pumps range from 250 BHP to 3500 BHP with pressure capabilities up to 20,000 psi. Premium plungers, valves, seats, packing, etc. can be configured to a variety of well service needs from mud based coiled tubing support services to hot oil, cementing, acidizing, fracturing, gravel packing, etc.

Weir SPM's durable extended duty plunger pumps range from 175 BHP to 1575 BHP. These extended duty plunger pumps are specially designed to provide durable service in extended applications one day and provide exceptional high pressure / high rate intermittent service the next. These pumps' unique versatility in duty cycle adaptability greatly increases the range of work that can be performed and the amount of revenue than can be generated with a single pump. These pumps are designed so that the expendable parts (packing, etc.) can easily be reconfigured for mud, water, drill cutting, acid, cement, etc.

Weir SPM pumps are available with life cycle enhancing "auto-fretting" processing of the fluid cylinder. This very economical process adjusts for the harmful effects of cyclic stress and the stress corrosion cracking which can occur in high-pressure fluid cylinders. Weir SPM's state-of-the-art auto-fretting process results in a fluid cylinder with several times the fatigue life expectancy at a fractional increase in cost.

Classroom and shop training is available to better familiarize the customer with the design parameters, technical specifications and operating characteristics of each pump model.

Weir SPM provides a wealth of technical data, assembly drawings and maintenance information on it's pumps (and flow control products as well) through an interactive home page on the Internet at www.weiroilandgas.com.



Every Weir SPM pump is tested to full power in house before it is delivered to the customer to ensure quality and proper performance. Weir SPM's 4500 hp test booth can run any pump up to full working power before delivery to the end user.





Pump Reference Guide

WEIR SPM PUMP MODEL EXPLANATION:

QWS		-	2500	-	SD
1st letter indicates number of cylinders:			2nd two letters indicate the intended duty cycle:		Numbers indicate max. rated BHP:
T = triplex			WS = intermittent, such as well service		2500 = 2500 BHP
Q = quintuplex			HB = extended, such as hydroblast		SD = super duty
					LW = special lightweight design
					S = short
					HV = horizontal valve
					DD = direct drive

Common Pump Formulas:

- Hydraulic Horse Power (HHP) = (GPM x PSI) / 1714
- Brake Horse Power (BHP) = (GPM X PSI) / (1714 x ME)
- Pressure (PSI) = (BHP x 1714 x ME) / GPM
- GPM = (BHP x 1714 x ME) / PSI
- Rod Load = PD x PD x .7854 x PSI
- GPR = (PD x PD x .7854 x SL x NC) / 231
- GPM = GPR x RPM

GPM - Gallons Per Minute
 PD - Plunger Diameter
 NC - Number of Cylinders
 ME - Mechanical Efficiency
 SL - Stroke Length
 GPR - Gallons Per Revolution

Extending Pump Life & Preventative Maintenance Program

Extending Pump Life:

Extending pump life requires careful operation by the customer. The customer should observe and utilize the following tools and practices:

- Dual inlet or Zoomie manifold
- Properly sized and maintained suction pulsation dampeners
- Properly maintained valves/seats/inserts
- Improved discharge harmonics (may require high pressure dampener)
- Correct piping placement, proper supercharging
- Proper sand and gel concentrations and blender operations

Maintenance:

At the very least, the following maintenance programs should be set up, operated, and recorded for review:

- Power end lube oil and filter inspection
- Fluid end valves and inserts inspection
- Fluid end seats inspection
- Fluid end valve springs inspection
- Plunger packing inspection

Proper maintenance practices are the best way to increase the life of your pumps and pump components. Weir SPM strongly suggests that each customer develop a maintenance program to be followed at all times.

Pump Duty Cycles

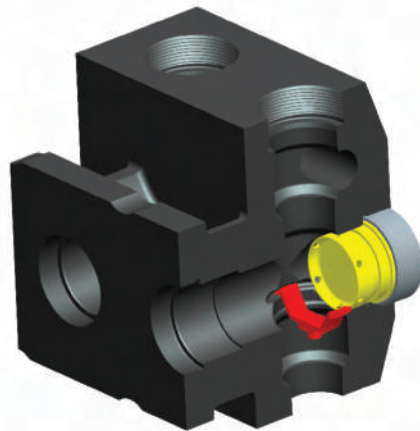
For information on pump duty cycles, Contact Weir SPM Engineering.

Autofrettage

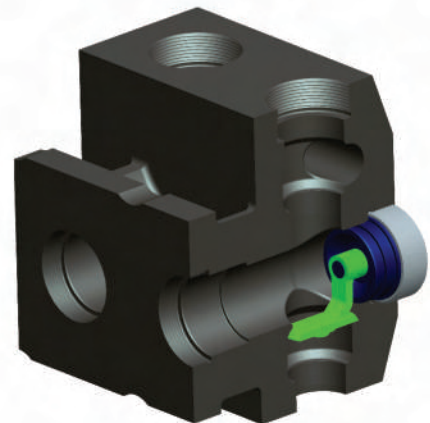
Intersecting bores in a fluid cylinder exhibit very high stresses at the corners of the intersection. To combat this problem created at the bore intersections, Weir SPM recommends that the customer utilize the Autofrettage option when purchasing a fluid end. The Autofrettage procedure is a technique where a "one-time" high hydraulic pressure is imposed on the bore intersection of a new cylinder inducing plastic strain at the intersection while elastic strain remains elsewhere. Relaxation of this one time pressure treatment causes these high-risk areas to develop a residual compressive stress, mitigating the destructive effects of the fatigue. The Autofrettage process may not completely eliminate the likelihood of fatigue failure (since corrosion and erosion still occur). However, it should significantly increase the number of cycles the product can tolerate, ultimately extending the life of the fluid cylinder.

Fluid End Configurations

Weir SPM currently offers fluid ends in three configurations, OPI, "Wing" Style Suction Valve Stop, and Grooveless. The "Wing" style fluid end was an improvement over the industry standard OPI style for a number of reasons including cost, serviceability and fluid cylinder life. Due to the customer's need for increased pumping durations, rates, and pressures, Weir SPM has adopted a Grooveless (GL) version of the suction valve stop. The GL design eliminates a groove in the fluid cylinder and is intended to extend the cylinder's life. All three versions are available and can be used throughout a broad range of the Weir SPM pump product line. Consult Weir SPM Sales to determine which style would be beneficial for you.



The traditional "**wing style**" fluid end uses a grooved suction bore to lock the valve stop in place. This groove reduces material in key locations possibly leading to cracks in the cylinder during the mature phase of its life cycle.

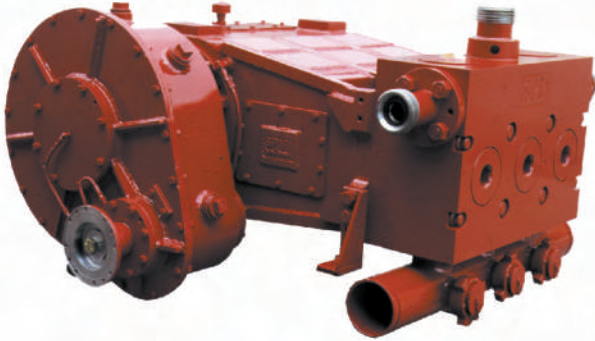


Weir SPM's new **Grooveless Fluid End** eliminates the groove in the fluid cylinder by replacing the old "wing style" valve stop. The new valve stop design locks under a ridge in the fluid cylinder bore and is held in place through a stem on the suction cover.

Weir SPM



TWS 600S



The TWS 600S offers a versatile small footprint pump that can perform a variety of duties for the well service industry. The unique design features an offset crankshaft / crosshead design which substantially reduces the load on both the crosshead and crosshead guides as well as the main roller bearings supporting the crankshaft. The TWS 600S can be utilized in a back-to-back configuration to perform rugged acidizing, cementing, gravel packing and snubbing operations.

TWS 600S Performance Data ^{1, 2}

PLUNGER DIAMETER	OUTPUT PER REV	DISPLACEMENT AT PUMP STROKES PER MINUTE / PINION RPM									
		50 / 230		120 / 552		200 / 920		300 / 1380		450 / 2070	
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
2½ (63.5)	.38 (1.4)	19 (72)	20,372 (1436)	46 (174)	20,165 (1421)	76 (290)	12,099 (853)	115 (434)	8,066 (568)	172 (651)	5,377 (379)
2¾ (69.9)	.46 (1.8)	23 (87)	16,836 (1186)	56 (210)	16,665 (1174)	93 (350)	9,999 (705)	139 (526)	6,666 (470)	208 (788)	4,444 (313)
3 (76.2)	.55 (2.1)	28 (104)	14,147 (997)	66 (250)	14,003 (987)	110 (417)	8,402 (592)	165 (625)	5,601 (395)	248 (938)	3,734 (263)
3½ (88.9)	.75 (2.8)	37 (142)	10,394 (732)	90 (341)	10,288 (725)	150 (568)	6,173 (435)	225 (851)	4,115 (290)	337 (1277)	2,744 (193)
4 (101.6)	.98 (3.7)	49 (185)	7,958 (561)	118 (445)	7,877 (555)	196 (741)	4,726 (333)	294 (1112)	3,151 (222)	441 (1668)	2,100 (148)
4½ (114.3)	1.24 (4.7)	62 (235)	6,288 (443)	149 (563)	6,224 (439)	248 (938)	3,734 (263)	372 (1407)	2,489 (175)	558 (2111)	1,660 (117)
INPUT POWER: BHP (Kw)		253 (188)		600 (448)		600 (448)		600 (448)		600 (448)	

1 Based on 90% ME and 100% VE - Intermittent Service Only.

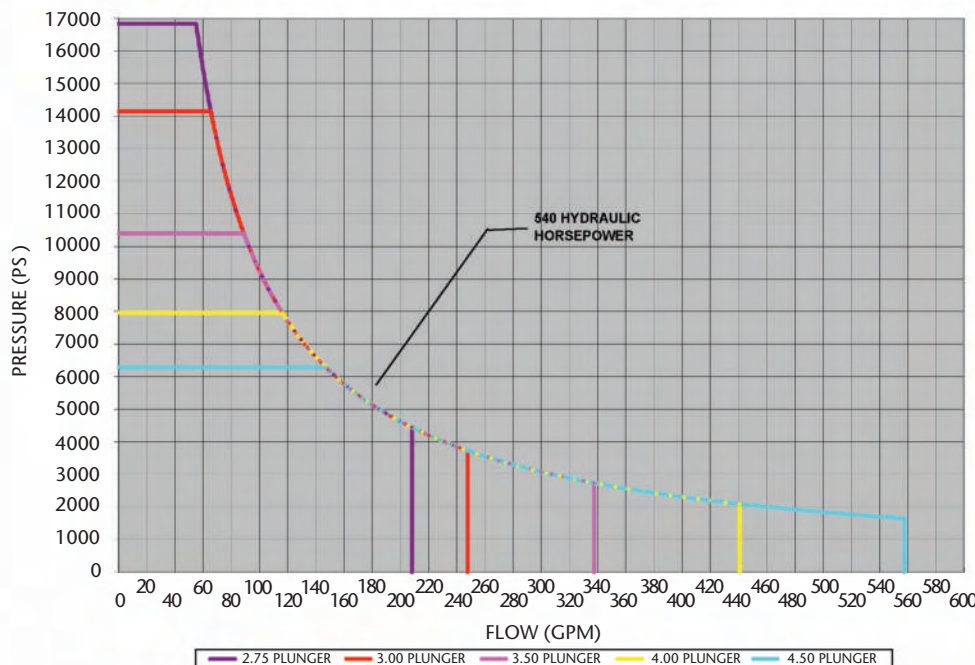
2 For applications demanding pressures over 15,000 psi, contact Weir SPM Engineering.

APPLICATIONS: Acidizing, cementing, gravel packing, snubbing.

Rated Max. Brake HP.....600 BHP (447 Kw)
 Maximum Rod Load.....100,000 Lbs. (43,360 kg)
 Stroke Length.....6" (152.4 mm)
 Gear Ratio.....4.61:1
 Length.....50 1/4" (1,276 mm)
 Width.....52 15/16" (1,344 mm)
 Height.....23 7/8" (607 mm)
 Weight Dry (Approx.).....4,940# (2,040 kg)

Pump dimensions are approximate. For full detailed drawings, please contact Weir SPM Engineering.

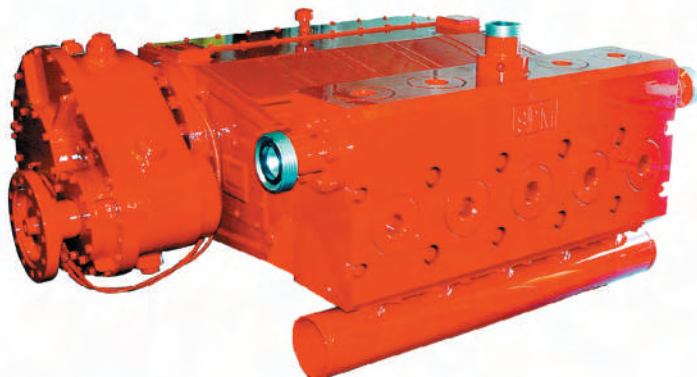
TWS 600S Hydraulic Horsepower Curve



Note: This chart shows this pump's performance at max hydraulic horsepower. Notice as the plunger size for the pump increases, a greater max flow rate is achieved while the max pressure decreases.



QWS 1000S



The QWS 1000S offers a similar design as the TWS 600S with its small footprint, but offers a larger power output. The QWS 1000S can also be set up in the back-to-back configuration to perform acidizing, cementing, gravel packing, and snubbing operations.

QWS 1000S Performance Data^{1, 2}

PLUNGER DIAMETER	OUTPUT PER REV	DISPLACEMENT AT PUMP STROKES PER MINUTE / PINION RPM											
		50 / 231		100 / 461		119 / 548		200 / 922		300 / 1383		450 / 2075	
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
2½ (63.5)	0.64 (2.4)	32 (121)	20,372 (1436)	64 (241)	20,372 (1436)	76 (287)	20,368 (1435)	127 (483)	12,009 (853)	191 (724)	8,066 (568)	287 (1086)	5,377 (379)
2¾ (69.9)	0.77 (2.9)	39 (146)	16,836 (1186)	77 (292)	16,836 (1186)	92 (347)	16,833 (1186)	154 (584)	9,999 (705)	231 (876)	6,666 (470)	347 (1314)	4,444 (313)
3 (76.2)	0.92 (3.5)	46 (174)	14,147 (997)	92 (347)	14,147 (997)	109 (413)	14,145 (997)	184 (695)	8,402 (592)	275 (1042)	5,601 (395)	413 (1564)	3,734 (263)
3½ (88.9)	1.25 (4.7)	62 (236)	10,394 (732)	125 (473)	10,394 (732)	148 (562)	10,392 (732)	250 (946)	6,173 (435)	375 (1419)	4,115 (290)	562 (2128)	2,744 (193)
4 (101.6)	1.63 (6.2)	82 (309)	7,958 (561)	163 (618)	7,958 (561)	194 (734)	7,956 (561)	326 (1235)	4,726 (333)	490 (1853)	3,151 (222)	734 (2780)	2,100 (148)
4½ (114.3)	2.07 (7.8)	103 (391)	6,288 (443)	207 (787)	6,288 (443)	245 (929)	6,287 (443)	413 (1564)	3,734 (263)	620 (2345)	2,489 (175)	929 (3518)	1,660 (117)
INPUT POWER: BHP (Kw)		421 (314)		842 (628)		1000 (746)		1000 (746)		1000 (746)		1000 (746)	

¹ Based on 90% ME and 100% VE - Intermittent Service Only.

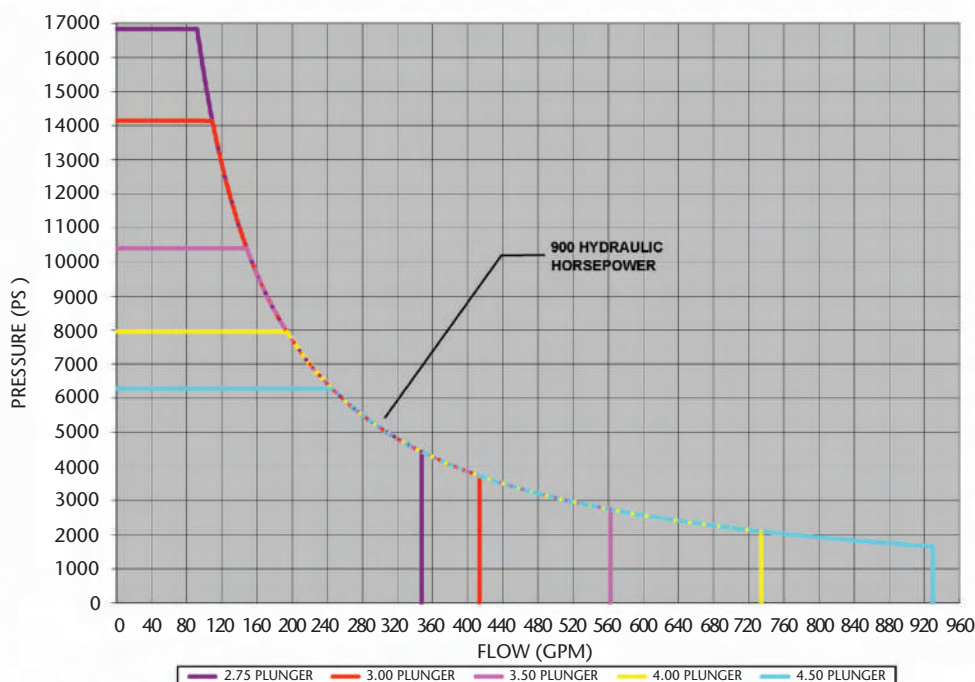
² For applications demanding pressures over 15,000 psi, contact Weir SPM Engineering.

APPLICATIONS: Acidizing, cementing, gravel packing, snubbing.

Rated Max Brake HP.....1,000 BHP (746 Kw)
 Maximum Rod Load.....100,000 Lbs. (45,359 kg)
 Stroke Length.....6" (152.4 mm)
 Gear Ratio.....4.61:1
 Length.....50" (1,270 mm)
 Width.....73" (1,854 mm)
 Height.....24" (609 mm)
 Weight Dry (Approx.).....7,040# (3,193 kg)

Pump dimensions are approximate. For full detailed drawings, please contact Weir SPM Engineering.

QWS 1000S Hydraulic Horsepower Curve



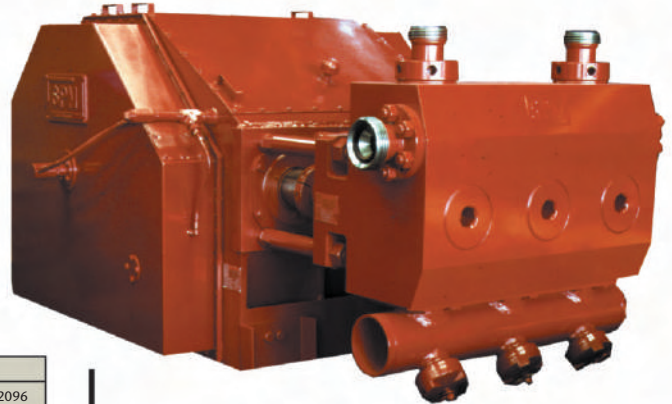
Note: This chart shows this pump's performance at max hydraulic horsepower. Notice as the plunger size for the pump increases, a greater max flow rate is achieved while the max pressure decreases.

Weir SPM



TWS 2250

The TWS 2250 is the most powerful triplex in Weir SPM's line of well service pumps. This staple of the Weir SPM line of well service pumps offers great pressure and flow ratings in a smaller package than the large quintuplex pumps offered by Weir SPM.



TWS 2250 Performance Data^{1, 2}

PLUNGER DIAMETER	OUTPUT PER REV	DISPLACEMENT AT PUMP STROKES PER MINUTE / PINION RPM									
		75 / 476		115 / 731		200 / 1271		300 / 1906		330 / 2096	
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
3 3/4 (95.3)	1.15 (4.3)	86 (326)	20,372 (1436)	132 (499)	20,372 (1436)	229 (869)	15,124 (1066)	344 (1303)	10,082 (711)	379 (1433)	9,166 (646)
4 (101.6)	1.31 (4.9)	98 (371)	17,905 (1262)	150 (568)	17,905 (1262)	261 (988)	13,292 (937)	392 (1483)	8,861 (624)	431 (1631)	8,056 (568)
4 1/2 (114.3)	1.65 (6.3)	124 (469)	14,147 (997)	190 (719)	14,147 (997)	330 (1251)	10,502 (740)	496 (1876)	7,002 (493)	545 (2064)	6,365 (449)
5 (127.0)	2.04 (7.7)	153 (579)	11,459 (808)	235 (888)	11,459 (808)	408 (1544)	8,507 (600)	612 (2316)	5,671 (400)	673 (2548)	5,156 (363)
5 1/2 (139.7)	2.47 (9.3)	185 (701)	9,470 (667)	284 (1074)	9,470 (667)	494 (1869)	7,031 (495)	741 (2803)	4,687 (330)	815 (3083)	4,261 (300)
5 3/4 (146.1)	2.70 (10.2)	202 (766)	8,665 (611)	310 (1174)	8,665 (611)	540 (2042)	6,433 (453)	809 (3063)	4,288 (302)	890 (3370)	3,898 (275)
6 (152.4)	2.94 (11.1)	220 (834)	7,958 (561)	338 (1279)	7,958 (561)	588 (2224)	5,908 (416)	881 (3336)	3,938 (278)	969 (3669)	3,580 (252)
6 1/2 (165.1)	3.45 (13.0)	259 (979)	6,781 (478)	396 (1501)	6,781 (478)	690 (2610)	5,034 (355)	1,034 (3915)	3,356 (236)	1,138 (4306)	3,051 (215)
6 3/4 (171.5)	3.72 (14.1)	279 (1055)	6,288 (443)	428 (1618)	6,288 (443)	744 (2810)	4,668 (329)	1,115 (4222)	3,112 (219)	1,227 (4644)	2,829 (199)
7 (177.8)	4.00 (15.1)	300 (1135)	5,847 (412)	460 (1740)	5,847 (412)	800 (3027)	4,340 (306)	1,200 (4540)	2,894 (204)	1,319 (4994)	2,630 (185)
7 1/2 (190.5)	4.59 (17.4)	344 (1303)	5,093 (359)	528 (1998)	5,093 (359)	918 (3475)	3,781 (266)	1,377 (5,212)	2,521 (178)	1,515 (5733)	2,291 (161)
INPUT POWER: BHP (Kw)		1137 (848)		1743 (1301)		2250 (1679)		2250 (1679)		2250 (1679)	

¹ Based on 90% ME and 100% VE - Intermittent Service Only.

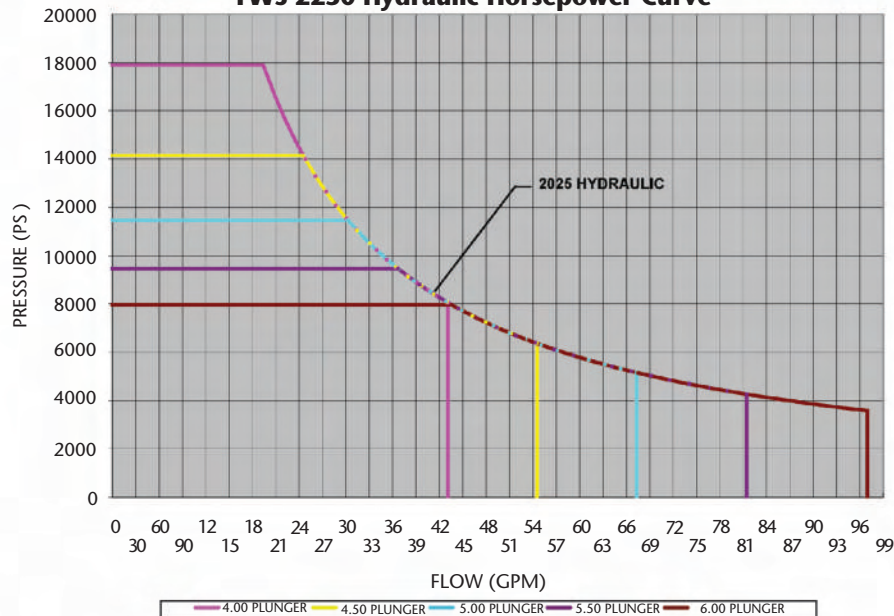
² For applications demanding pressures over 15,000 psi, contact Weir SPM Engineering.

APPLICATIONS: Fracturing.

Rated Max Brake HP.....2,250 BHP (1,641 Kw)
 Maximum Rod Load.....225,000 Lbs. (102,060 kg)
 Stroke Length.....8" (203.2 mm)
 Gear Ratio.....6.353:1
 Length.....89 3/4" (2,280 mm)
 Width.....59 3/4" (1,518 mm)
 Height.....44 1/4" (1,124 mm)
 Weight Dry (Approx.).....12,680# (5,751 kg)

Pump dimensions are approximate. For full detailed drawings, please contact Weir SPM Engineering.

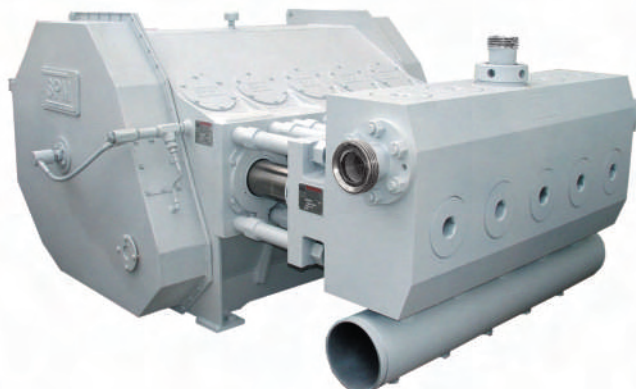
TWS 2250 Hydraulic Horsepower Curve



Note: This chart shows this pump's performance at max hydraulic horsepower. Notice as the plunger size for the pump increases, a greater max flow rate is achieved while the max pressure decreases.



QWS 2500 Classic



The QWS 2500 Classic is a proven high-powered quintuplex pump. This durable pump can produce large pressure and flow ratings and is a cost efficient alternative to the heavy duty QWS 2500SD. The QWS2500 Classic is a reduced duty cycle pump in comparison to the SD model. Weir SPM recommends the QWS 2500SD for use in harsh pumping environments, such as slick water fracturing. See page 27 for more information.

QWS 2500 Classic Performance Data ^{1, 2}

PLUNGER DIAMETER	OUTPUT PER REV	DISPLACEMENT AT PUMP STROKES PER MINUTE / PINION RPM									
		111 / 705		150 / 953		200 / 1271		250 / 1588		330 / 2100	
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
3½ (88.9)	1.67 (6.3)	185 (700)	20,000 (1406)	251 (950)	15,365 (1083)	334 (1264)	11,546 (814)	418 (1582)	9,226 (650)	551 (2086)	6,999 (493)
3¾ (95.3)	1.91 (7.2)	212 (802)	17,420 (1255)	287 (1086)	13,437 (947)	382 (1446)	10,096 (711)	478 (1809)	8,068 (569)	630 (2385)	6,121 (431)
4 (101.6)	2.17 (8.2)	241 (912)	15,315 (1077)	326 (1234)	11,830 (834)	434 (1643)	8,886 (626)	543 (2055)	7,102 (500)	716 (2710)	5,386 (380)
4½ (114.3)	2.75 (10.4)	305 (1154)	12,100 (851)	413 (1563)	9,338 (658)	550 (2082)	7,012 (494)	688 (2604)	5,605 (395)	908 (3437)	4,247 (299)
5 (127.0)	3.40 (12.9)	377 (1427)	9,800 (689)	510 (1930)	7,562 (533)	680 (2574)	5,671 (400)	850 (3217)	4,537 (320)	1,122 (4247)	3,437 (242)
5½ (139.7)	4.11 (15.6)	456 (1726)	8,100 (569)	617 (2335)	6,250 (440)	822 (3111)	4,692 (331)	1,028 (3891)	3,751 (264)	1,356 (5132)	2,844 (200)
5¾ (146.1)	4.49 (17.0)	498 (1885)	7,410 (521)	674 (2551)	5,722 (403)	898 (3399)	4,295 (303)	1,123 (4251)	3,434 (242)	1,482 (5609)	2,602 (183)
6 (152.4)	4.89 (18.5)	543 (2055)	6,805 (478)	734 (2778)	5,254 (370)	978 (3702)	3,943 (278)	1,223 (4629)	3,153 (222)	1,619 (6109)	2,382 (168)
6½ (165.1)	5.74 (21.7)	637 (2411)	5,800 (408)	861 (3259)	4,479 (316)	1,148 (4345)	3,359 (237)	1,435 (5431)	2,687 (189)	1,894 (7169)	2,036 (143)
INPUT POWER: BHP (Kw)		2400 (1790)		2500 (1866)		2500 (1866)		2500 (1866)		2500 (1866)	

1 Based on 90% ME and 100% VE - Intermittent Service Only.

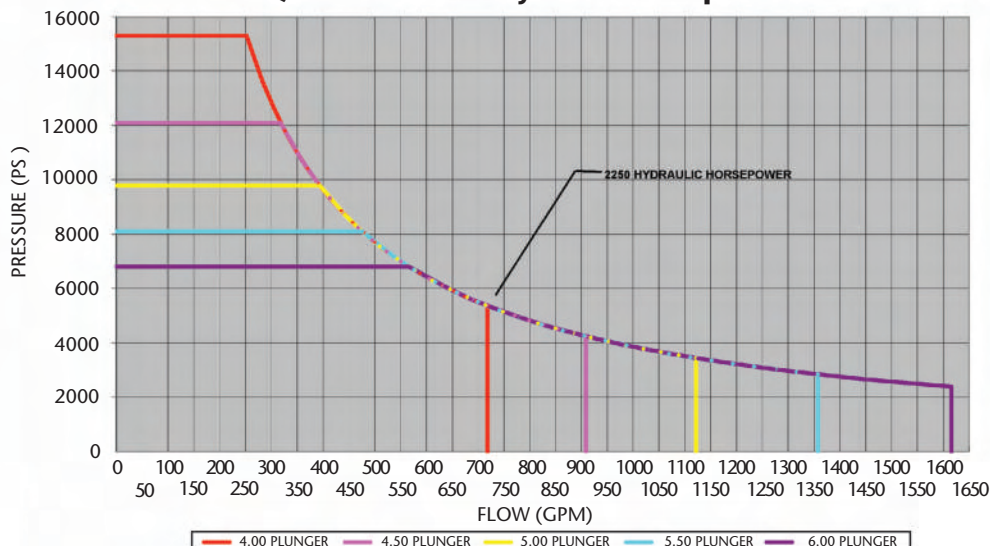
2 Pumps with pressures in excess of 15,000 psi require special gauge and discharge flanges. Contact Weir SPM Engineering for information.

APPLICATIONS: Fracturing.

Rated Max Brake HP.....2,500 BHP (1,866 Kw)
 Maximum Rod Load.....192,325 Lbs. (87,239 kg)
 Stroke Length.....8" (203.2 mm)
 Gear Ratio.....6.353:1
 Length.....84 3/4" (2,153 mm)
 Width.....73 7/8" (1,877 mm)
 Height.....43 3/8" (1,102 mm)
 Weight Dry (Approx.).....15,180# (6,885 kg)

Pump dimensions are approximate. For full detailed drawings, please contact Weir SPM Engineering.

QWS 2500 Classic Hydraulic Horsepower Curve



Note: This chart shows this pump's performance at max hydraulic horsepower. Notice as the plunger size for the pump increases, a greater max flow rate is achieved while the max pressure decreases.

Weir SPM



QWS 2500SD

The QWS 2500SD was developed to handle harsh frac conditions, as seen in the premier North American shale plays. The QWS 2500SD is designed to withstand 10 hours of operation up to 6 days a week while maintaining a high performance rod load capacity that is necessary for pumping in harsh conditions.



QWS 2500SD Performance Data ^{1, 2}

PLUNGER DIAMETER	DISPLACE. PER REV	DISPLACEMENT AT PUMP STROKES PER MINUTE / PINION RPM											
		100	635	116	736	150	953	200	1271	250	1588	330	2096
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
3 1/2 (88.9)	1.67 (6.3)	167 (631)	19,990 (1409)	193 (730)	19,990 (1409)	250 (946)	15,432 (1088)	333 (1261)	11,574 (816)	416 (1576)	9,259 (653)	550 (2081)	7,015 (494)
3 3/4 (95.3)	1.91 (7.2)	191 (724)	17,413 (1227)	221 (838)	17,413 (1227)	287 (1086)	13,443 (947)	382 (1448)	10,082 (711)	478 (1810)	8,066 (568)	631 (2389)	6,111 (431)
4 (101.6)	2.18 (8.2)	218 (824)	15,305 (1079)	252 (954)	15,305 (1079)	326 (1235)	11,815 (833)	435 (1647)	8,861 (624)	544 (2059)	7,089 (500)	718 (2718)	5,371 (378)
4 1/2 (114.3)	2.75 (10.4)	275 (1042)	12,093 (852)	319 (1207)	12,093 (852)	413 (1564)	9,336 (658)	551 (2085)	7,002 (493)	688 (2606)	5,601 (395)	909 (3440)	4,243 (299)
5 (127.0)	3.40 (12.9)	340 (1287)	9,795 (690)	394 (1490)	9,795 (690)	510 (1930)	7,562 (533)	680 (2574)	5,671 (400)	850 (3217)	4,537 (320)	1,122 (4247)	3,437 (242)
5 1/2 (139.7)	4.11 (15.6)	411 (1557)	8,095 (570)	476 (1803)	8,095 (570)	617 (2336)	6,249 (440)	823 (3114)	4,687 (330)	1,028 (3893)	3,750 (264)	1,358 (5139)	2,841 (200)
5 3/4 (146.1)	4.50 (17.0)	450 (1702)	7,406 (522)	521 (1971)	7,406 (522)	674 (2553)	5,718 (403)	899 (3404)	4,288 (302)	1,124 (4255)	3,431 (242)	1,484 (5616)	2,599 (183)
6 (152.4)	4.90 (18.5)	490 (1853)	6,802 (479)	567 (2146)	6,802 (479)	734 (2780)	5,251 (370)	979 (3706)	3,938 (278)	1,224 (4633)	3,151 (222)	1,616 (6115)	2,387 (168)
6 1/2 (165.1)	5.75 (21.7)	575 (2175)	5,796 (408)	665 (2518)	5,796 (408)	862 (3262)	4,474 (315)	1,149 (4350)	3,356 (236)	1,436 (5437)	2,685 (189)	1,896 (7177)	2,034 (143)
6 3/4 (171.5)	6.20 (23.5)	620 (2345)	5,375 (379)	718 (2716)	5,375 (379)	929 (3518)	4,149 (292)	1,239 (4691)	3,112 (219)	1,549 (5863)	2,489 (175)	2,045 (7740)	1,886 (133)
INPUT POWER: BHP (Kw)		2159 (1611)		2500 (1866)		2500 (1866)		2500 (1866)		2500 (1866)		2500 (1866)	

1 Based on 90% ME and 100% VE - Intermittent Service Only.

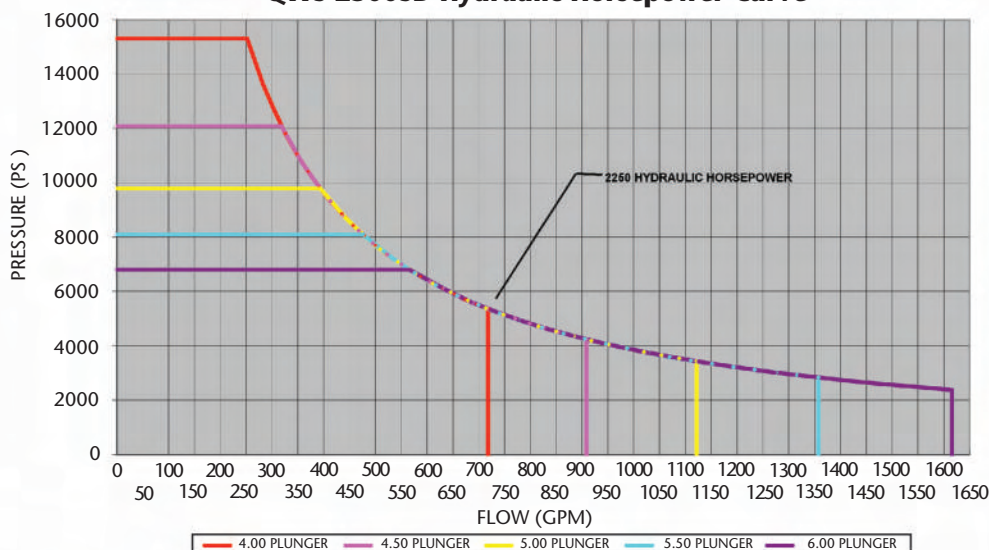
2 For applications demanding pressures over 15,000 psi, contact Weir SPM Engineering.

APPLICATIONS: Fracturing.

Rated Max. Brake HP.....2,500 BHP (1,866 Kw)
 Maximum Rod Load.....192,325 Lbs. (87,239 kg)
 Stroke Length.....8" (203.2 mm)
 Gear Ratio.....6.353:1
 Length.....84 3/4" (2,153 mm)
 Width.....73 7/8" (1,877 mm)
 Height.....43 3/8" (1,102 mm)
 Weight Dry (Approx.).....16,000# (7,257 kg)

Pump dimensions are approximate. For full detailed drawings, please contact Weir SPM Engineering.

QWS 2500SD Hydraulic Horsepower Curve



Note: This chart shows this pump's performance at max hydraulic horsepower. Notice as the plunger size for the pump increases, a greater max flow rate is achieved while the max pressure decreases.

Weir SPM



QWS 3500



The QWS 3500 is the most powerful well service pump on the market. With 3500 BHP, the pump is designed to eliminate the number of units required on a site to reach its high pressure pumping capabilities, reducing the user's operational costs.

QWS 3500 Performance Data^{1, 2}

PLUNGER DIAMETER	DISPLACE. PER REV	DISPLACEMENT AT PUMP STROKES PER MINUTE / PINION RPM									
		50 / 355		75 / 532		96 / 680		150 / 1064		200 / 1418	
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
4 (101.5)	2.72 (10.3)	136 (515)	20,690 (1458)	204 (772)	20,690 (1458)	261 (988)	20,690 (1458)	408 (1544)	13,233 (933)	544 (2059)	9,925 (699)
4 1/2 (114.3)	3.44 (13.0)	172 (651)	16,348 (1152)	258 (977)	16,346 (1152)	330 (1250)	16,346 (1152)	516 (1954)	10,456 (737)	688 (2606)	7,842 (553)
5 (127.0)	4.25 (16.1)	212 (804)	13,242 (933)	319 (1206)	13,242 (933)	408 (1543)	13,242 (933)	637 (2413)	8,469 (597)	850 (3217)	6,352 (448)
5 1/2 (139.7)	5.14 (19.5)	257 (973)	10,944 (771)	386 (1460)	10,944 (771)	493 (1867)	10,944 (771)	771 (2920)	6,999 (493)	1,028 (3893)	5,250 (370)
6 (152.4)	6.12 (23.2)	306 (1158)	9,196 (648)	459 (1737)	9,196 (648)	587 (2222)	9,196 (648)	918 (3475)	5,881 (414)	1,224 (4633)	4,411 (311)
6 1/2 (165.1)	7.18 (27.2)	359 (1359)	7,835 (552)	539 (2039)	7,835 (552)	689 (2608)	7,835 (552)	1,077 (4078)	5,011 (353)	1,436 (5437)	3,759 (265)
7 (177.8)	8.33 (31.5)	416 (1576)	6,756 (476)	625 (2365)	6,756 (476)	799 (3025)	6,756 (476)	1,249 (4729)	4,321 (305)	1,666 (6306)	3,241 (228)
INPUT POWER: BHP (Kw)		1824 (1361)		2736 (2042)		3500 (2612)		3500 (2612)		3500 (2612)	

¹ Based on 90% ME and 100% VE - Intermittent Service Only.

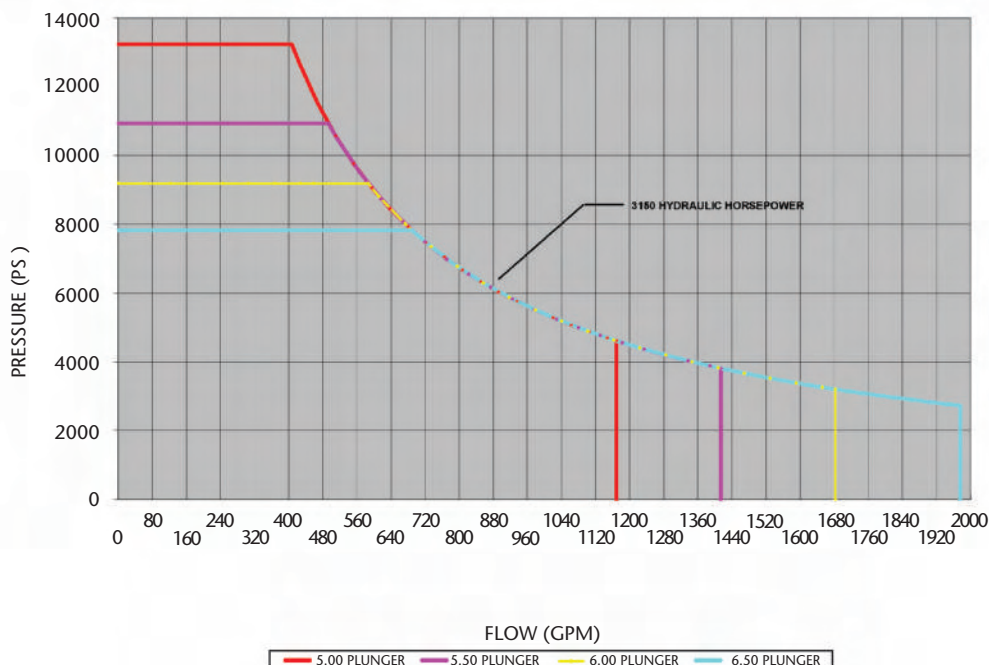
² For applications demanding pressures over 15,000 psi, contact Weir SPM Engineering.

APPLICATIONS: Fracturing.

Rated Max. Brake HP.....3,500 BHP (2,609 Kw)
 Maximum Rod Load.....260,000 Lbs. (117,934 kg)
 Stroke Length.....10" (254 mm)
 Gear Ratio.....7.091:1
 Length.....94" (2,388 mm)
 Width.....108" (2,743 mm)
 Height.....36" (914 mm)
 Weight Dry (Approx.).....24,000# (10,866 kg)

Pump dimensions are approximate. For full detailed drawings, please contact Weir SPM Engineering.

QWS 3500 Hydraulic Horsepower Curve

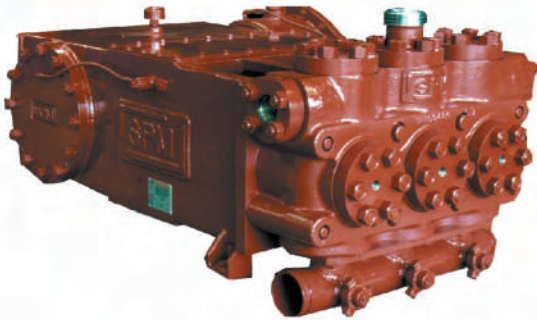


Note: This chart shows this pump's performance at max hydraulic horsepower. Notice as the plunger size for the pump increases, a greater max flow rate is achieved while the max pressure decreases.



Additional Intermittent Duty Pumps

TWS 250



APPLICATIONS: Coiled tubing, snubbing, hot oil, reverse circulation.

Rated Max. Brake HP.....250 BHP (186 Kw)
Maximum Rod Load.....50,000 Lbs. (22,680 kg)
Stroke Length.....5" (127 mm)
Gear Ratio.....4.44:1

TWS 250 Performance Data^{1, 2}

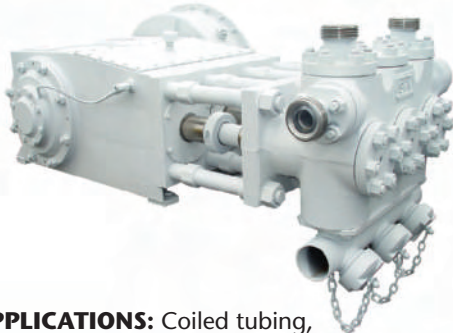
PLUNGER DIAMETER	OUTPUT PER REV	DISPLACEMENT AT PUMP STROKES PER MINUTE / PINION RPM									
		65 / 289		115 / 511		200 / 888		300 / 1332		473 / 2100	
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
2 (50.8)	.204 (0.8)	13 (49)	15,915 (1119)	23 (87)	15,915 (1119)	41 (155)	9,409 (661)	61 (231)	6,324 (445)	96 (363)	4,018 (282)
2 1/4 (57.2)	.258 (1.0)	17 (64)	12,575 (884)	30 (114)	12,575 (884)	52 (197)	7,418 (521)	77 (291)	5,010 (352)	122 (462)	3,162 (222)
2 1/2 (63.5)	.319 (1.2)	21 (79)	10,186 (716)	37 (140)	10,186 (716)	64 (242)	6,027 (424)	96 (363)	4,018 (282)	151 (572)	2,555 (180)
2 3/4 (69.9)	.386 (1.5)	25 (95)	8,418 (592)	44 (167)	8,418 (592)	77 (291)	5,010 (352)	116 (439)	3,325 (234)	183 (693)	2,108 (148)
3 (76.2)	.459 (1.7)	30 (114)	7,074 (497)	53 (201)	7,074 (497)	92 (348)	4,193 (295)	138 (522)	2,795 (196)	217 (821)	1,778 (125)
3 1/2 (88.9)	.625 (2.4)	41 (155)	5,197 (365)	72 (273)	5,197 (365)	125 (473)	3,086 (217)	188 (712)	2,052 (144)	296 (1120)	1,303 (92)
3 3/4 (95.3)	.717 (2.7)	47 (178)	4,527 (318)	82 (310)	4,527 (318)	143 (541)	2,698 (190)	215 (814)	1,794 (126)	339 (1283)	1,138 (80)
4 (101.6)	.816 (3.1)	53 (201)	3,979 (280)	94 (356)	3,979 (280)	163 (617)	2,367 (166)	245 (927)	1,574 (111)	384 (1453)	1,005 (71)
INPUT POWER: BHP (Kw)		135 (101)		235 (175)		250 (186)		250 (186)		250 (186)	

1 Based on 90% ME and 100% VE - Intermittent Service Only.

2 For applications demanding pressures over 15,000 psi, contact Weir SPM Engineering.

Length.....59" (1,499 mm)
Width.....45" (1,143 mm)
Height.....26" (660 mm)
Weight Dry (Approx.).....4,070# (1,850 kg)

TWS 400



APPLICATIONS: Coiled tubing, hot oil, snubbing, reverse circulation, cementing.

Rated Max. Brake HP.....400 BHP (298 Kw)
Maximum Rod Load.....80,000 Lbs. (36,288 kg)
Stroke Length.....6" (152.4 mm)
Gear Ratio.....4.6:1

TWS 400 Performance Data^{1, 2}

PLUNGER DIAMETER	OUTPUT PER REV	DISPLACEMENT AT PUMP STROKES PER MINUTE / PINION RPM									
		50 / 230		100 / 460		200 / 920		300 / 1380		450 / 2070	
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
2 1/2 (63.5)	.38 (1.4)	19 (72)	16,305 (1146)	38 (144)	16,305 (1146)	76 (288)	8,120 (571)	114 (431)	5,415 (381)	171 (647)	3,610 (254)
2 3/4 (69.9)	.46 (1.7)	23 (87)	13,475 (947)	46 (174)	13,475 (947)	92 (348)	6,705 (471)	138 (522)	4,470 (314)	207 (783)	2,980 (209)
3 (76.2)	.55 (2.1)	28 (106)	11,320 (796)	55 (208)	11,320 (796)	110 (416)	5,610 (394)	165 (625)	3,740 (263)	248 (939)	2,490 (175)
3 1/2 (88.9)	.75 (2.8)	37 (140)	8,320 (585)	75 (284)	8,320 (585)	150 (568)	4,115 (289)	225 (852)	2,740 (193)	338 (1279)	1,825 (128)
4 (101.6)	.98 (3.7)	49 (185)	6,370 (448)	98 (371)	6,370 (448)	196 (742)	3,150 (221)	294 (1113)	2,100 (148)	441 (1669)	1,400 (98)
4 1/2 (114.3)	1.24 (4.7)	62 (235)	5,030 (354)	124 (469)	5,030 (354)	248 (939)	2,485 (175)	372 (1408)	1,660 (117)	558 (2112)	1,105 (78)
INPUT POWER: BHP (Kw)		203 (151)		400 (298)		400 (298)		400 (298)		400 (298)	

1 Based on 90% ME and 100% VE - Intermittent Service Only.

2 For applications demanding pressures over 15,000 psi, contact Weir SPM Engineering.

Length.....71-1/4" (1,810 mm)
Width.....75-3/8" (1,913 mm)
Height.....26-1/2" (674 mm)
Weight Dry (Approx.).....4,500# (2,041 kg)

TWS 500 LW



APPLICATIONS: Coiled tubing, reverse circulation, snubbing, acidizing, cementing, gravel packing.

Rated Max. Brake HP.....500 BHP (373 Kw)
Maximum Rod Load.....100,000 Lbs. (43,360 kg)
Stroke Length.....6" (152.4 mm)
Gear Ratio.....4.6:1

TWS 500 LW Performance Data^{1, 2}

PLUNGER DIAMETER	OUTPUT PER REV	DISPLACEMENT AT PUMP STROKES PER MINUTE / PINION RPM									
		50 / 230		100 / 460		200 / 920		300 / 1380		450 / 2070	
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
2 1/4 (60.9)	.46 (1.7)	23 (87)	16,845 (1184)	46 (174)	16,845 (1184)	92 (348)	8,385 (589)	138 (522)	5,590 (393)	207 (783)	3,725 (262)
3 (76.2)	.55 (2.1)	28 (106)	14,155 (995)	55 (208)	14,155 (995)	110 (416)	7,015 (493)	165 (625)	4,675 (329)	248 (939)	3,110 (219)
3 1/2 (88.9)	.75 (2.8)	37 (140)	10,400 (731)	75 (284)	10,400 (731)	150 (568)	5,145 (362)	225 (852)	3,430 (241)	338 (1279)	2,280 (160)
4 (101.6)	.98 (3.7)	49 (185)	7,960 (560)	98 (371)	7,960 (560)	196 (742)	3,935 (277)	294 (1113)	2,625 (185)	441 (1669)	1,750 (123)
4 1/2 (114.3)	1.24 (4.7)	62 (235)	6,290 (442)	124 (469)	6,290 (442)	248 (939)	3,110 (219)	372 (1408)	2,075 (146)	558 (2112)	1,380 (97)
INPUT POWER: BHP (Kw)		253 (189)		500 (373)		500 (373)		500 (373)		500 (373)	

1 Based on 90% ME and 100% VE - Intermittent Service Only.

2 For applications demanding pressures over 15,000 psi, contact Weir SPM Engineering.

Length.....69-11/16" (1,770 mm)
Width.....50-7/8" (1,242 mm)
Height.....29-3/8" (746 mm)
Weight Dry (Approx.).....3,950# (1,792 kg)

Pump dimensions are approximate. For full detailed drawings, please contact Weir SPM Engineering.

LIBERTY EXHIBIT 1060, Page 29

Weir SPM



Additional Intermittent Duty Pumps

TWS 600



APPLICATIONS: Acidizing, cementing, gravel packing, snubbing.

Rated Max. Brake HP.....600 BHP (447 Kw)
Maximum Rod Load.....100,000 Lbs. (43,360 kg)
Stroke Length.....6" (152.4 mm)
Gear Ratio.....4.61:1
Length.....73-1/2" (1,867 mm)
Width.....50-7/8" (1,292 mm)

TWS 600 Performance Data^{1, 2}

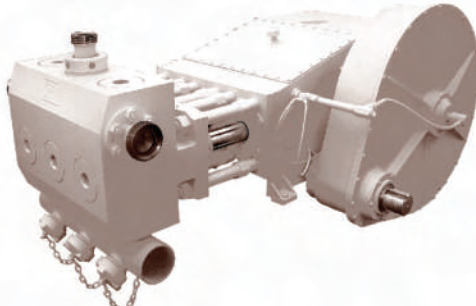
PLUNGER DIAMETER	OUTPUT PER REV	DISPLACEMENT AT PUMP STROKES PER MINUTE / PINION RPM									
		50 / 230		120 / 552		200 / 920		300 / 1380		450 / 2070	
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
2 1/2 (63.5)	.38 (1.4)	19 (72)	20,372 (1436)	46 (174)	20,165 (1421)	76 (290)	12,099 (853)	115 (434)	8,066 (568)	172 (651)	5,377 (379)
2 3/4 (69.9)	.46 (1.7)	23 (88)	16,845 (1186)	56 (210)	16,665 (1174)	93 (350)	9,999 (705)	139 (526)	6,666 (470)	208 (788)	4,440 (313)
3 (76.2)	.55 (2.1)	28 (104)	14,147 (997)	66 (250)	14,003 (987)	110 (417)	8,402 (592)	165 (625)	5,610 (395)	248 (938)	3,734 (263)
3 1/2 (88.9)	.75 (2.8)	37 (142)	10,394 (732)	90 (341)	10,288 (725)	150 (568)	6,173 (435)	225 (851)	4,115 (290)	337 (1277)	2,744 (193)
4 (101.6)	.98 (3.7)	49 (185)	7,958 (561)	118 (445)	7,877 (555)	196 (741)	4,726 (333)	294 (1112)	3,151 (222)	441 (1668)	2,100 (148)
4 1/2 (114.3)	1.24 (4.7)	62 (235)	6,288 (443)	149 (563)	6,224 (439)	248 (938)	3,734 (263)	372 (1407)	2,489 (175)	558 (2111)	1,660 (117)
INPUT POWER: BHP (Kw)		253 (188)		600 (448)		600 (448)		600 (448)		600 (448)	

1 Based on 90% ME and 100% VE - Intermittent Service Only.

2 For applications demanding pressures over 15,000 psi, contact Weir SPM Engineering.

Height.....29-3/8" (746 mm)
Weight Dry (Approx.).....5,400# (2,449 kg)

TWS 900



APPLICATIONS: Acidizing, fracturing, frac-pack.

Rated Max. Brake HP.....900 BHP (671 Kw)
Maximum Rod Load.....160,000 Lbs. (72,576 kg)
Stroke Length.....8" (203.2 mm)
Gear Ratio.....6.353:1
Length.....88-3/8" (2,245 mm)
Width.....54-1/8" (1,375 mm)

TWS 900 Performance Data^{1, 2}

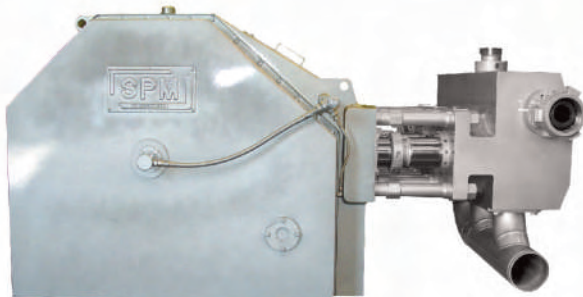
PLUNGER DIAMETER	DISPLACEMENT PER REV	DISPLACEMENT AT PUMP STROKES PER MINUTE / PINION RPM									
		50 / 318		100 / 635		200 / 1271		300 / 1906		330 / 2100	
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
3 3/4 (95.3)	1.15 (4.4)	58 (220)	14,490 (1019)	115 (435)	12,075 (849)	230 (871)	6,035 (424)	345 (1306)	4,025 (283)	380 (1438)	3,665 (258)
4 (101.6)	1.30 (4.9)	65 (246)	12,740 (896)	130 (492)	10,680 (751)	260 (984)	5,340 (375)	390 (1476)	3,560 (250)	429 (1624)	3,235 (227)
4 1/2 (114.3)	1.65 (6.3)	83 (314)	10,065 (708)	165 (625)	8,415 (592)	330 (1249)	4,210 (296)	495 (1874)	2,805 (197)	545 (2063)	2,550 (179)
5 (127.0)	2.04 (7.7)	102 (386)	8,150 (573)	204 (772)	6,805 (478)	408 (1544)	3,405 (239)	612 (2316)	2,270 (160)	673 (2547)	2,065 (145)
5 1/2 (139.7)	2.47 (9.4)	124 (469)	6,740 (474)	247 (935)	5,620 (395)	494 (1870)	2,810 (198)	741 (2805)	1,875 (132)	815 (3085)	1,705 (120)
5 3/4 (146.1)	2.70 (10.2)	135 (511)	6,165 (433)	270 (1022)	5,145 (362)	540 (2044)	2,570 (181)	810 (3066)	1,715 (121)	891 (3372)	1,560 (110)
6 (152.4)	2.94 (11.1)	147 (556)	5,660 (398)	294 (1113)	4,725 (332)	588 (2226)	2,360 (166)	882 (3338)	1,575 (111)	970 (3671)	1,430 (101)
INPUT POWER: BHP (Kw)		540 (403)		900 (671)		900 (671)		900 (671)		900 (671)	

1 Based on 90% ME and 100% VE - Intermittent Service Only.

2 For applications demanding pressures over 15,000 psi, contact Weir SPM Engineering.

Height.....43-1/2" (1,105 mm)
Weight Dry (Approx.).....8,000# (3,629 kg)

TWS 1300



APPLICATIONS: Acid-frac, fracturing, frac-pack.

Rated Max. Brake HP.....1,300 BHP (969 Kw)
Maximum Rod Load.....200,000 Lbs. (90,720 kg)
Stroke Length.....8" (203.2 mm)
Gear Ratio.....7.0:1
Length.....89-3/4" (2,280 mm)
Width.....59-3/4" (1,518 mm)
Height.....44-1/4" (1,124 mm)
Weight Dry (Approx.).....11,550# (5,216 kg)

TWS 1300 Performance Data^{1, 2}

PLUNGER DIAMETER	OUTPUT PER REV	DISPLACEMENT AT PUMP STROKES PER MINUTE / PINION RPM									
		50 / 350		100 / 700		200 / 1400		250 / 1750		330 / 2100	
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
3 3/4 (95.3)	1.15 (4.4)	58 (220)	18,115 (1273)	115 (435)	18,108 (1276)	230 (871)	8,720 (613)	288 (1090)	6,965 (490)	345 (1306)	5,815 (409)
4 (101.6)	1.30 (4.9)	65 (246)	15,925 (1120)	130 (492)	15,430 (1085)	260 (984)	7,715 (542)	325 (1230)	6,170 (434)	390 (1476)	5,145 (362)
4 1/2 (114.3)	1.65 (6.3)	83 (314)	12,580 (884)	165 (625)	12,155 (854)	330 (1249)	6,080 (427)	413 (1563)	4,855 (341)	495 (1874)	4,050 (285)
5 (127.0)	2.04 (7.7)	102 (386)	10,190 (722)	204 (772)	9,830 (691)	408 (1544)	4,915 (346)	510 (1930)	3,935 (277)	612 (2316)	3,275 (230)
5 1/2 (139.7)	2.47 (9.4)	124 (469)	8,420 (592)	247 (935)	8,120 (571)	494 (1870)	4,060 (285)	618 (2339)	3,245 (228)	741 (2805)	2,705 (190)
5 3/4 (146.1)	2.70 (10.2)	135 (511)	7,705 (542)	270 (1022)	7,430 (522)	588 (2044)	3,413 (246)	675 (2555)	2,970 (209)	810 (3066)	2,475 (174)
6 (152.4)	2.94 (11.1)	147 (556)	7,075 (497)	294 (1113)	6,820 (479)	588 (2226)	3,410 (240)	735 (2782)	2,730 (192)	882 (3338)	2,275 (160)
6 1/2 (165.1)	3.45 (13.1)	173 (655)	6,030 (424)	345 (1306)	5,815 (409)	690 (2612)	2,905 (204)	863 (3266)	2,325 (163)	1,035 (3917)	1,940 (136)
6 3/4 (171.5)	3.72 (14.1)	186 (704)	5,590 (393)	372 (1408)	5,390 (379)	744 (2816)	2,695 (189)	930 (3520)	2,155 (151)	1,116 (4224)	1,795 (120)
7 (177.8)	4.00 (15.1)	200 (757)	5,200 (366)	400 (1514)	5,015 (353)	800 (3028)	2,505 (176)	1,000 (3785)	2,005 (141)	1,200 (4542)	1,670 (117)
7 1/2 (190.5)	4.59 (17.4)	230 (871)	4,530 (318)	459 (1737)	4,370 (307)	918 (3475)	2,185 (154)	1,148 (4345)	1,745 (123)	1,377 (5212)	1,455 (102)
INPUT POWER: BHP (Kw)		675 (503)		1300 (969)		1300 (969)		1300 (969)		1300 (969)	

1 Based on 90% ME and 100% VE - Intermittent Service Only.

2 For applications demanding pressures over 15,000 psi, contact Weir SPM Engineering.

Pump dimensions are approximate. For full detailed drawings, please contact Weir SPM Engineering.

LIBERTY EXHIBIT 1060, Page 30

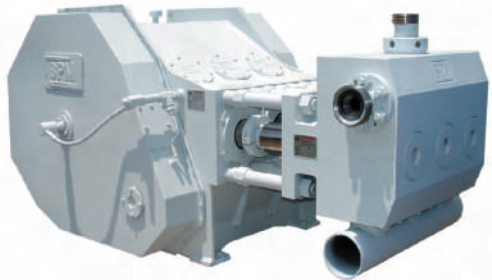
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-0127430

Weir SPM

Additional Intermittent Duty Pumps &
Extended Duty Pumps



TWS 1600 LW



APPLICATIONS: Acid-frac, fracturing, frac-pack.

Rated Max. Brake HP.....1,600 BHP (1,193 Kw)
Maximum Rod Load.....200,000 Lbs. (90,729 kg)
Stroke Length.....8" (203.2 mm)
Gear Ratio.....6.353:1
Length.....84-3/4" (2,153 mm)
Width.....53-7/8" (1,369 mm)
Height.....43-3/8" (1,102 mm)
Weight Dry (Approx.).....8,750# (3,970 kg)

TWS 1600 LW Performance Data^{1, 2}

PLUNGER DIAMETER	OUTPUT PER REV	DISPLACEMENT AT PUMP STROKES PER MINUTE / PINION RPM									
		75 / 476		115 / 731		200 / 1271		300 / 1906		330 / 2100	
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
3 3/4 (95.3)	1.15 (4.4)	86 (326)	18,115 (1273)	132 (500)	18,115 (1273)	230 (871)	10,735 (755)	345 (1306)	7,155 (503)	380 (1438)	6,495 (457)
4 (101.6)	1.30 (4.9)	98 (371)	15,925 (1120)	150 (568)	15,925 (1120)	260 (984)	9,495 (667)	390 (1476)	6,330 (445)	429 (1624)	5,755 (405)
4 1/2 (114.3)	1.65 (6.3)	124 (469)	12,580 (884)	190 (719)	12,580 (884)	330 (1249)	7,480 (526)	495 (1874)	4,985 (350)	545 (2063)	4,530 (318)
5 (127.0)	2.04 (7.7)	153 (579)	10,190 (716)	235 (889)	10,190 (716)	408 (1544)	6,050 (425)	612 (2316)	4,035 (284)	673 (2547)	3,670 (258)
5 1/2 (139.7)	2.47 (9.4)	185 (700)	8,420 (592)	284 (1075)	8,420 (592)	494 (1870)	5,000 (352)	741 (2805)	3,330 (234)	815 (3085)	3,030 (213)
5 3/4 (146.1)	2.70 (10.2)	203 (768)	7,705 (542)	311 (1177)	7,705 (542)	540 (2044)	4,570 (321)	810 (3066)	3,050 (214)	891 (3372)	2,770 (195)
6 (152.4)	2.94 (11.1)	221 (836)	7,075 (497)	338 (1279)	7,075 (497)	588 (2226)	4,200 (295)	882 (3338)	2,800 (197)	970 (3671)	2,545 (179)
6 1/2 (165.1)	3.45 (13.1)	259 (980)	6,030 (424)	397 (1503)	6,030 (424)	690 (2612)	3,580 (252)	1,035 (3917)	2,385 (168)	1,139 (4311)	2,170 (153)
INPUT POWER: BHP (Kw)		1012 (755)		1550 (1156)		1600 (1193)		1600 (1193)		1600 (1193)	

¹ Based on 90% ME and 100% VE - Intermittent Service Only.

² For applications demanding pressures over 15,000 psi, contact Weir SPM Engineering.

Extended Duty Pumps

THB 175



APPLICATIONS: Reverse circulation, waterblasting, drill cuttings re-injection.

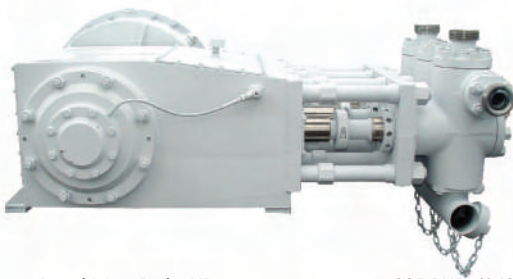
Rated Max. Brake HP.....175 BHP (130 Kw)
Maximum Rod Load.....24,540 Lbs. (11,131 kg)
Stroke Length.....5" (127 mm)
Gear Ratio.....4.44:1
Length.....59" (1,499 mm)
Width.....45" (1,143 mm)
Height.....26" (660 mm)
Weight Dry (Approx.).....4,070# (1,692 kg)

THB 175 Performance Data*

PLUNGER DIAMETER	DISPLACEMENT PER REV	DISPLACEMENT AT PUMP STROKES PER MINUTE / PINION RPM									
		55 / 244		100 / 444		170 / 755		270 / 1200		405 / 1800	
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
1 3/4 (44.5)	.156 (0.6)	9 (34)	10,202 (716)	16 (61)	10,202 (717)	27 (102)	10,202 (717)	42 (159)	6,429 (452)	63 (238)	4,286 (301)
2 (50.8)	.204 (0.8)	11 (42)	7,811 (549)	20 (76)	7,811 (549)	35 (132)	7,811 (549)	55 (208)	4,910 (345)	83 (314)	3,253 (229)
2 1/4 (57.2)	.258 (1.0)	14 (53)	6,172 (434)	26 (98)	6,172 (434)	44 (167)	6,172 (434)	70 (265)	3,858 (271)	104 (394)	2,596 (182)
2 1/2 (63.5)	.319 (1.2)	18 (68)	5,000 (352)	32 (121)	5,000 (352)	54 (204)	5,000 (352)	86 (326)	3,140 (221)	129 (488)	2,093 (147)
2 3/4 (69.9)	.386 (1.5)	21 (79)	4,130 (290)	39 (148)	4,130 (290)	66 (250)	4,130 (290)	104 (394)	2,596 (182)	156 (590)	1,731 (122)
3 (76.2)	.459 (1.7)	25 (95)	3,470 (244)	46 (174)	3,470 (244)	78 (295)	3,470 (244)	124 (469)	2,178 (153)	186 (704)	1,452 (102)
3 1/2 (88.9)	.625 (2.4)	34 (129)	2,550 (179)	63 (238)	2,550 (179)	106 (401)	2,550 (179)	169 (640)	1,598 (112)	253 (958)	1,067 (75)
3 3/4 (95.3)	.717 (2.7)	39 (148)	2,222 (156)	72 (273)	2,222 (156)	122 (462)	2,222 (156)	194 (734)	1,392 (98)	290 (1098)	931 (65)
4 (101.6)	.816 (3.1)	45 (170)	1,950 (137)	82 (310)	1,950 (137)	139 (526)	1,950 (137)	220 (833)	1,227 (86)	330 (1249)	818 (58)
INPUT POWER: BHP (Kw)		57 (43)		103 (77)		175 (130)		175 (130)		175 (130)	

*Based on 90% ME and 100% VE - Extended Service Only.

THB 225



Rated Max. Brake HP.....225 BHP (168 Kw)
Maximum Rod Load.....24,540 Lbs. (11,131 kg)
Stroke Length.....6" (152.4 mm)
Gear Ratio.....4.61:1
Length.....74-1/4" (1,810 mm)
Width.....45-3/8" (1,153 mm)
Height.....26-1/2" (674 mm)
Weight Dry (Approx.).....4,500# (2,041 kg)

THB 225 Performance Data*

PLUNGER DIAMETER	OUTPUT PER REV	DISPLACEMENT AT PUMP STROKES PER MINUTE / PINION RPM							
		75 / 346		100 / 461		125 / 576		185 / 853	
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
2 1/2 (63.5)	.38 (1.4)	29 (110)	5,000 (352)	38 (144)	5,000 (352)	48 (182)	5,000 (352)	70 (265)	5,000 (352)
2 3/4 (69.9)	.46 (1.7)	35 (132)	4,130 (290)	46 (174)	4,130 (290)	58 (220)	4,130 (290)	85 (322)	4,130 (290)
3 (76.2)	.55 (2.1)	41 (155)	3,470 (244)	55 (208)	3,470 (244)	69 (261)	3,470 (244)	102 (386)	3,470 (244)
3 1/2 (88.9)	.75 (2.8)	56 (212)	2,550 (179)	75 (284)	2,550 (179)	94 (356)	2,550 (179)	139 (526)	2,550 (179)
4 (101.6)	.98 (3.7)	74 (280)	1,950 (137)	98 (371)	1,950 (137)	123 (466)	1,950 (137)	181 (685)	1,950 (137)
4 1/2 (114.3)	1.24 (4.7)	93 (352)	1,540 (108)	124 (469)	1,540 (108)	155 (587)	1,540 (108)	229 (867)	1,540 (108)
INPUT POWER: BHP (Kw)		93 (69)		124 (92)		155 (116)		225 (168)	

* Based on 90% ME and 100% VE - Extended Service Only.

APPLICATIONS: Underbalanced CT drilling, industrial grouting, waterblasting, drill cuttings re-injection.

Pump dimensions are approximate. For full detailed drawings, please contact Weir SPM Engineering.

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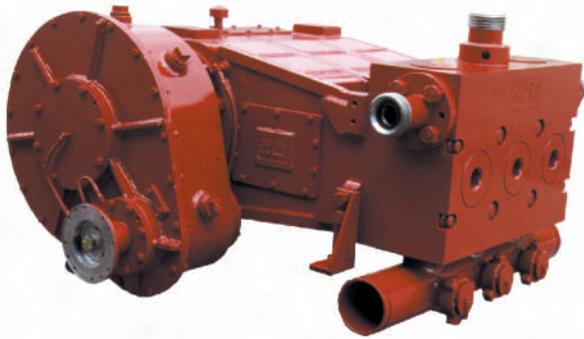
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-0127431

Weir SPM



Extended Duty Pumps

THB 300S



THB 300S Performance Data*

PLUNGER DIAMETER	DISPLACEMENT PER REV	DISPLACEMENT AT PUMP STROKES PER MINUTE / PINION RPM									
		55 / 244		100 / 444		170 / 755		270 / 1200		405 / 1800	
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
1 3/4 (44.5)	.156 (0.6)	9 (34)	10,202 (716)	16 (61)	10,202 (717)	27 (102)	10,202 (717)	42 (159)	6,429 (452)	63 (238)	4,286 (301)
2 (50.8)	.204 (0.8)	11 (42)	7,811 (549)	20 (76)	7,811 (549)	35 (132)	7,811 (549)	55 (208)	4,910 (345)	83 (314)	3,253 (229)
2 1/4 (57.2)	.258 (1.0)	14 (53)	6,172 (434)	26 (98)	6,172 (434)	44 (167)	6,172 (434)	70 (265)	3,858 (271)	104 (394)	2,596 (182)
2 1/2 (63.5)	.319 (1.2)	18 (68)	5,000 (352)	32 (121)	5,000 (352)	54 (204)	5,000 (352)	86 (326)	3,140 (221)	129 (488)	2,093 (147)
2 3/4 (69.9)	.386 (1.5)	21 (79)	4,130 (290)	39 (148)	4,130 (290)	66 (250)	4,130 (290)	104 (394)	2,596 (182)	156 (590)	1,731 (122)
3 (76.2)	.459 (1.7)	25 (95)	3,470 (244)	46 (174)	3,470 (244)	78 (295)	3,470 (244)	124 (469)	2,178 (153)	186 (704)	1,452 (102)
3 1/2 (88.9)	.625 (2.4)	34 (129)	2,550 (179)	63 (238)	2,550 (179)	106 (401)	2,550 (179)	169 (640)	1,598 (112)	253 (958)	1,067 (75)
3 3/4 (95.3)	.717 (2.7)	39 (148)	2,222 (156)	72 (273)	2,222 (156)	122 (462)	2,222 (156)	194 (734)	1,392 (98)	290 (1098)	931 (65)
4 (101.6)	.816 (3.1)	45 (170)	1,950 (137)	82 (310)	1,950 (137)	139 (526)	1,950 (137)	220 (833)	1,227 (86)	330 (1249)	818 (58)
INPUT POWER: BHP (Kw)		57 (43)		103 (77)		175 (130)		175 (130)		175 (130)	

*Based on 90% ME and 100% VE - Extended Service Only.

APPLICATIONS: Underbalanced CT drilling, industrial grouting, waterblasting, drill cuttings re-injection.

Rated Max. Brake HP.....300 BHP (223 Kw)
Maximum Rod Load.....54,082 Lbs. (22,531kg)
Stroke Length.....6" (152.4 mm)
Gear Ratio.....4.6:1

Length.....50" (1,270 mm)
Width.....53" (1,346 mm)
Height.....24" (610 mm)
Weight Dry (Approx.).....4,600# (2,086 kg)

THB 350



THB 350 Performance Data*

PLUNGER DIAMETER	OUTPUT PER REV	DISPLACEMENT AT PUMP STROKES PER MINUTE / PINION RPM							
		75 / 346		140 / 645		193 / 890		282 / 1300	
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
2 1/2 (63.5)	.38 (1.4)	29 (110)	10,185 (716)	54 (204)	10,185 (716)	74 (208)	7,298 (513)	108 (409)	5,000 (352)
2 3/4 (69.9)	.46 (1.7)	35 (132)	8,418 (592)	65 (246)	8,418 (592)	89 (337)	6,068 (427)	131 (496)	4,123 (290)
3 (76.2)	.55 (2.1)	41 (155)	7,074 (497)	77 (291)	7,074 (497)	106 (401)	5,095 (358)	155 (587)	3,484 (245)
3 1/2 (88.9)	.75 (2.8)	56 (212)	5,197 (365)	105 (397)	5,197 (365)	145 (549)	3,724 (262)	211 (799)	2,559 (180)
4 (101.6)	.98 (3.7)	74 (280)	3,979 (280)	137 (519)	3,979 (280)	190 (719)	2,842 (200)	276 (1045)	1,957 (138)
4 1/2 (114.3)	1.24 (4.7)	93 (352)	3,144 (221)	174 (659)	3,144 (221)	239 (905)	2,260 (159)	349 (1321)	1,547 (109)
INPUT POWER: BHP (Kw)		190 (142)		350 (261)		350 (261)		350 (261)	

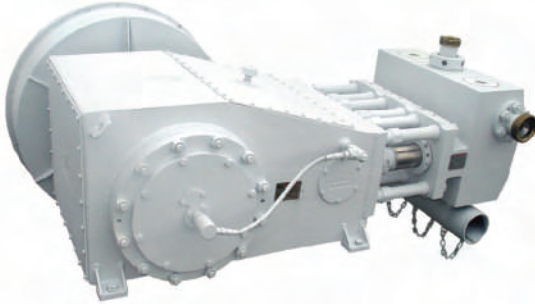
* Based on 90% ME and 100% VE - Extended Service Only.

APPLICATIONS: Underbalanced CT drilling, industrial grouting, waterblasting, drill cuttings re-injection.

Rated Max. Brake HP.....350 BHP (261 Kw)
Maximum Rod Load.....50,000 Lbs. (22,680 kg)
Stroke Length.....6" (152.4 mm)
Gear Ratio.....4.6:1

Length.....73-1/2" (1,867 mm)
Width.....50-7/8" (1,292 mm)
Height.....29-3/8" (746 mm)
Weight Dry (Approx.).....5,700# (2,586 kg)

THB 550



APPLICATIONS: Underbalanced CT drilling, waterblasting.

Rated Max. Brake HP.....550 BHP (410 Kw)
Maximum Rod Load.....71,400 Lbs. (32,387 kg)
Stroke Length.....8" (203.2 mm)
Gear Ratio.....6.353:1
Length.....88 1/16" (2,236 mm)
Width.....54 1/8" (1,375 mm)
Height.....43 1/2" (1,105 mm)
Weight Dry (Approx.).....8,500# (3,856 kg)

THB 550 Performance Data*

PLUNGER DIAMETER	DISPLACEMENT PER REV	FLOW RATE AT CRANKSHAFT RPM & (INPUT RPM)							
		60 (381)		115 (731)		165 (1048)		215 (1366)	
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
3	.73 (2.76)	44 (167)	10,101 (710)	84 (318)	10,101 (710)	120 (454)	7,072 (497)	157 (594)	5,405 (380)
3 1/4 (82.6)	.86 (3.26)	52 (197)	8,607 (605)	99 (375)	8,607 (605)	142 (537)	5,976 (420)	185 (700)	4,587 (322)
3 1/2 (88.9)	1.00 (3.79)	60 (227)	7,421 (522)	115 (435)	7,421 (522)	165 (625)	5,143 (362)	215 (814)	3,947 (277)
3 3/4 (95.3)	1.15 (4.4)	69 (261)	6,464 (454)	132 (500)	6,464 (454)	190 (719)	4,467 (314)	247 (935)	3,436 (242)
4 (101.6)	1.30 (4.9)	78 (295)	5,682 (399)	150 (568)	5,682 (399)	215 (814)	3,947 (277)	280 (1060)	3,031 (213)
4 1/2 (114.3)	1.65 (6.3)	99 (375)	4,489 (316)	190 (719)	4,489 (316)	272 (1030)	3,120 (219)	355 (1344)	2,391 (168)
5 (127.0)	2.04 (7.7)	122 (462)	3,636 (256)	235 (889)	3,636 (256)	337 (1276)	2,518 (177)	439 (1662)	1,933 (136)
5 1/2 (139.7)	2.47 (9.4)	148 (560)	3,005 (211)	284 (1075)	3,005 (211)	408 (1544)	2,080 (146)	531 (2010)	1,598 (112)
5 3/4 (146.1)	2.70 (10.2)	162 (613)	2,750 (193)	311 (1177)	2,750 (193)	446 (1688)	1,903 (134)	581 (2199)	1,461 (103)
6 (152.4)	2.94 (11.1)	176 (666)	2,525 (178)	338 (1279)	2,525 (178)	485 (1836)	1,750 (123)	632 (2392)	1,343 (94)
INPUT POWER: BHP (Kw)		290 (216)		550 (410)		550 (410)		550 (410)	

*Based on 90% ME and 100% VE - Extended Service Only.

THB 1050



APPLICATIONS: Under-balanced CT drilling, waterblasting.

Rated Max. Brake HP.....1,050 BHP (783 Kw)
Maximum Rod Load.....110,500 Lbs. (50,123 kg)
Stroke Length.....8" (203.2 mm)
Gear Ratio.....6.353:1
Length.....89 3/4" (2,280 mm)
Width.....59 3/4" (1,518 mm)
Height.....44 1/4" (1,124 mm)
Weight Dry (Approx.).....12,500# (5,670 kg)

THB 1050 Performance Data*

PLUNGER DIAMETER	DISPLACEMENT PER REV	FLOW RATE AT CRANKSHAFT RPM & (INPUT RPM)							
		215 (1366)		215 (1366)		215 (1366)		215 (1366)	
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
3 3/4 (95.3)	1.15 (4.4)	69 (261)	10,005 (703)	109 (413)	10,005 (703)	162 (613)	10,005 (703)	247 (935)	6,559 (461)
4 (101.6)	1.30 (4.9)	78 (295)	8,794 (618)	124 (469)	8,794 (618)	183 (693)	8,794 (618)	280 (1060)	5,786 (407)
4 1/2 (114.3)	1.65 (6.3)	99 (375)	6,948 (488)	157 (594)	6,948 (488)	233 (882)	6,948 (488)	355 (1344)	4,564 (321)
5 (127.0)	2.04 (7.7)	122 (462)	5,628 (396)	194 (734)	5,628 (396)	288 (1090)	5,628 (396)	439 (1662)	3,691 (259)
5 1/2 (139.7)	2.47 (9.4)	148 (560)	4,651 (327)	235 (889)	4,651 (327)	348 (1317)	4,651 (327)	531 (2010)	3,051 (214)
5 3/4 (146.1)	2.70 (10.2)	162 (613)	4,256 (299)	257 (973)	4,256 (299)	381 (1442)	4,256 (299)	581 (2199)	2,789 (196)
6 (152.4)	2.94 (11.1)	176 (666)	3,908 (275)	279 (1056)	3,908 (275)	415 (1571)	3,908 (275)	632 (2392)	2,564 (180)
6 1/2 (165.1)	3.45 (13.1)	207 (783)	3,330 (234)	328 (1241)	3,330 (234)	486 (1840)	3,330 (234)	742 (2808)	2,183 (153)
6 3/4 (171.5)	3.72 (14.1)	223 (844)	3,088 (217)	353 (1336)	3,088 (217)	525 (1987)	3,088 (217)	800 (3028)	2,025 (142)
INPUT POWER: BHP (Kw)		450 (336)		705 (526)		1050 (783)		1050 (783)	

*Based on 90% ME and 100% VE - Extended Service Only.

QHB 1575



APPLICATIONS: Water-blasting, water jetting, ultra high pressure drilling.

Rated Max. Brake HP.....1,575 BHP (1,175 Kw)
Maximum Rod Load.....100,000 Lbs. (45,450 kg)
Stroke Length.....8" (203.2 mm)
Gear Ratio.....6.353:1
Length.....96" (2,438 mm)
Width.....74" (1,877 mm)
Height.....60" (1,524 mm)
Weight Dry (Approx.).....16,500# (7,500 kg)

QHB 1575 Performance Data*

PLUNGER DIAMETER	DISPLACEMENT PER REV	DISPLACEMENT AT PUMP STROKES PER MINUTE / PINION RPM					
		95 / 604		140 / 889		215 / 1366	
in (mm)	gal/rev (liter/rev)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)	gpm (lpm)	psi (kg/cm ²)
2 1/2 (63.5)	.85 (3.2)	81 (306)	20,372 (1436)	119 (450)	20,372 (1436)	183 (692)	13,295 (937)
2 3/4 (69.9)	1.03 (3.9)	98 (370)	16,836 (1186)	144 (545)	16,836 (1186)	221 (837)	10,987 (774)
3 (76.2)	1.22 (4.6)	116 (440)	14,147 (997)	171 (649)	14,147 (997)	263 (996)	9,232 (651)
3 1/4 (82.6)	1.44 (5.4)	136 (517)	12,054 (849)	201 (761)	12,054 (849)	309 (1169)	7,867 (554)
3 1/2 (88.9)	1.67 (6.3)	158 (599)	10,394 (732)	233 (883)	10,394 (732)	358 (1356)	6,783 (478)
3 3/4 (95.3)	1.91 (7.2)	182 (688)	9,054 (638)	268 (1013)	9,054 (638)	411 (1556)	5,909 (416)
4 (101.6)	2.18 (8.2)	207 (782)	7,958 (561)	305 (1153)	7,958 (561)	468 (1771)	5,193 (366)
4 1/2 (114.3)	2.75 (10.4)	262 (990)	6,288 (443)	386 (1459)	6,288 (443)	592 (2241)	4,103 (289)
5 (127.0)	3.40 (12.9)	323 (1223)	5,093 (359)	476 (1802)	5,093 (359)	731 (2767)	3,324 (234)
INPUT POWER: BHP (Kw)		1066 (796)		1572 (1173)		1575 (1175)	

* Based on 90% ME and 100% VE - Extended Service Only.

Weir SPM



Pump Accessories

Fluid End Expendables



PLUNGERS

Weir SPM plungers are engineered and manufactured to precise dimensions with the proper coatings and surface finishes necessary for rugged well service applications.



HIGH PERFORMANCE PLUNGER PACKING

Weir SPM's line of high performance packing is designed and manufactured to give extended and dependable service life in high pressure, corrosive and abrasive pumping applications.



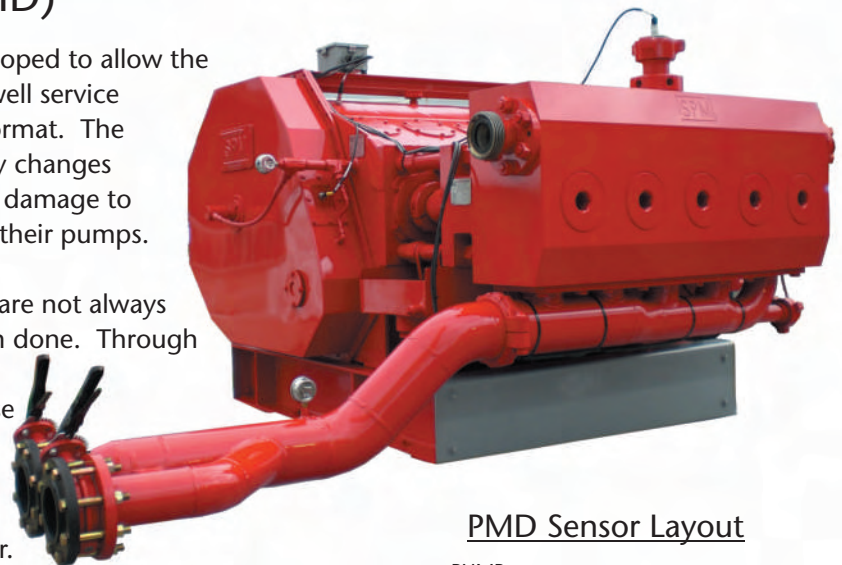
VALVES and SEATS

Weir SPM valves and seats are designed for severe well service applications including high pressure. Weir SPM's new Bonded Valves feature a greater flow area, less abrasion and lower fluid velocity through the seat.

Pump Monitoring Device (PMD)

Weir SPM's Pump Monitoring Device was developed to allow the user to continually monitor the status of their well service pumps with real time data in an easy to read format. The PMD allows the operator to make the necessary changes during operation to minimize or prevent costly damage to pumping equipment and increase longevity of their pumps.

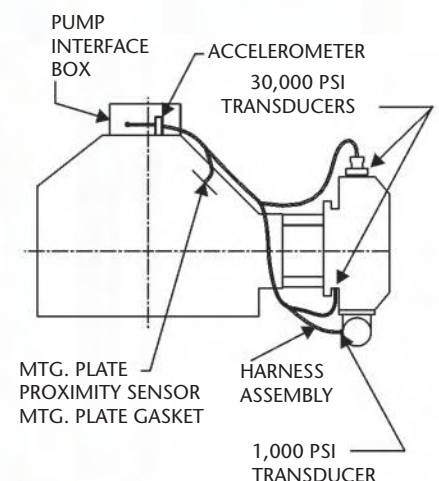
On a loud and hectic frac site, many problems are not always evident until it is too late and damage has been done. Through various sensors installed on the pump, the PMD provides a unique opportunity to diagnose problems such as insufficient charge pressure, discharge and suction valve failure, cavitation, as well as other issues by displaying "alarms" to notify the user of any problems as they occur.



Actual Screenshot

Pump Measurement Device							
WEIR SPM	RPM	Discharge Pressure		Charge Pressure	Shock Loading	Cavitation	Rod Load
		Discharge Valves	Suction Valves				
Pump 01	84 RPM	5297 PSI		39 PSI	0.8 G	OK	54%
Pump 02		1 2 3 4 5	1 2 3 4 5				
Pump 03							
Pump 04							
Pump 05							
Current Status: 15:27:59 09/05/06: Pump Number 1 Charge Pressure Too Low event start							
Calibrate Pumps							
Time: 15:28:05							

PMD Sensor Layout



Unloading Valve for Drilling Operations



Full Bore Unloading Valve

Weir SPM Full Bore Unloading Valves for drilling applications provide over-pressure protection for mud pumps operating under a variety of pressure and flow conditions. The valves are compact, simple to operate and rely on the system's pressure to open when a preset pressure is exceeded and automatically snap shut when the pressure drops.

The valves are externally adjustable, and unlike shear relief valves which use common nails to trigger the valve, Weir SPM's Full Bore Unloading Valve utilizes nitrogen or rig air (properly filtered) to activate opening and closing. This model is available in 3" and 4" sizes. Operating pressures range from 5,000 psi to 20,000 psi. Standard service and sour gas models are available.

REMOTE RELIEF

Utilized together, the Full Bore Unloading Valve and Remote Control Panel increase safety for operators on drilling sites.

Remote Control Panel for Nitrogen Relief Valve Operation

Weir SPM has designed a Remote Control Panel to work in conjunction with Weir SPM's new Full Bore Unloading Valve (drilling applications) and the Emergency Back Pressure Relief Valve (well service applications).

The Remote Control Panel's primary function is to regulate the flow of air or nitrogen to the relief valve from a designated control station, allowing the operator to change the pressure relief settings with the turn of a knob.



Iron Management Rental Program

Weir SPM's Iron Rental Program provides the customer with a cost-effective alternative to purchasing, maintaining, and recertifying treating iron. Benefits of the program include eliminating the upfront cost of purchasing new iron, commissioning new iron, borrowing money, replacing expendable parts, the labor associated with repair, and inventory during down time. The program allows the user to focus on its primary business, ensures all iron is in compliance, and avoids recertification costs.

Features of the program:

- Monthly reports on rental equipment highlighting all product on rental, length of time on rental, and charges to date by part number for all product rented.
- Daily rates, monthly rates or annual rates.
- 24-hour / 7-day a week service.
- Pickup and delivery service available.
- Containers and baskets can be provided.
- Quick response to customer emergency requirements.
- Fully certified iron packages available to health, safety, and environmental requirements.
- Summary billing.
- Large inventories including full baskets or individual items.





Pump Repair

Weir SPM's professionally trained technicians perform complete pump repair services for many makes and models of well service pumps. Weir SPM reduces downtime through convenient repair services in the field (when possible) or at one of its pump repair facilities located around the globe. The most effective way to keep your fleet of units up and running is to utilize Weir SPM's pump repair services.

Procedures Include:

- Disassembly of all components
- Inspection, including magnetic particle
- Evaluation of repairs
- Cost estimates
- Repair utilizing Weir SPM technicians
- Test
- Documentation to verify product quality
- Repaint

Weir SPM has facilities equipped to perform complete pump repairs at:

- Fort Worth, Texas
- Odessa, Texas
- Deer Park, Texas
- Grand Junction, Colorado
- Red Deer, Alberta, Canada
- Aberdeen, Scotland

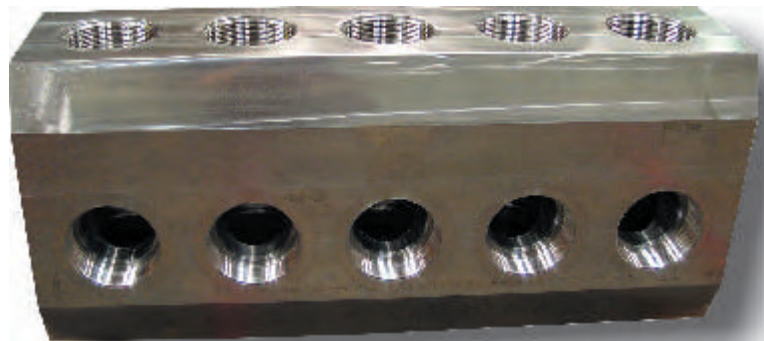


Fluid End Repair

In the past, the only option for operators with cracked, washed or eroded fluid ends was to simply discard them. In an effort to offer customers an alternative to disposing of their equipment, Weir SPM has developed a process to return used blocks as reconditioned fluid ends in "like-new" condition. Weir SPM has been implementing this process in select areas with great success. Now, all customers will have the opportunity to evaluate the status of their fluid cylinders and have options of whether to replace or refurbish.

Refurbishment Process Includes:

- Disassembly of all components.
- Visual inspection vital areas.
- Thorough examination using multiple techniques.
- Evaluation of repairs & cost estimates.
- Repair utilizing skilled Weir SPM technicians.
- Test & documentation to verify product quality.
- Repaint.
- Record of all visual findings and dimensional data on formatted reports presented to customer.



Plunger Repair



Weir SPM now offers Plunger Repair services. This service gives customers the opportunity to repair

damaged plungers that would normally be scrapped. The reliable repaired plungers are returned to the customer in "like new" condition, offering a less expensive alternative to the purchase of new plungers.

Iron Recertification and Refurbishment

Weir SPM's Iron Management Program consists of: commissioning new iron, iron refurbishment, iron rental services, high-pressure manifold recertification, high-pressure manifold periodic maintenance, and high-pressure manifold refurbishment. The program is designed to provide recertification of products on demand to maximize safety, quality, and reliability in a cost effective manner.

Benefits Include:

- Maximizing the useful life of the product
- Enhancing product safety and reliability in the field
- Third party certifiable safety on the job site
- Access to Weir SPM's internet-based **Iron Management Database** for up-to-date electronic information



9 Steps to Iron Recertification Program



Step 1:
Visual Inspection



Step 2:
Wall Thickness



Step 3:
Disassembly



Step 4:
Strip Contaminants



Step 5:
Magnetic Particle



Step 6:
Assembly with New Products Kit



Step 7:
Pressure Test



Step 8:
Paint



Step 9:
Certificates

Mobile Recertification Units

Weir SPM has a fleet of Mobile Recertification Units that are currently providing on site service throughout the United States, Mexico, Middle East, Russia, and Far Eastern countries. The MRUs are designed and manufactured to provide a wide variety of services to the customer at a location that is most convenient to them.



Flow Control Product Services

- Certified inspection
- Ultrasonic wall thickness inspection
- Magnetic particle inspection
- Replacement of parts
- Training
- New product sales
- Iron Management documentation
- Rental



Pressure Test Station with full test capability to 30,000 psi; Inside test chamber for valves and integral connections.



Work table and vise for disassembly, re kitting, and re assembly; Ample storage space for parts kits; ¼ ton hoist and jib crane; Wash vat for cleaning parts

Pump Services

- Field repair pump specialists
- Replacement of fluid end expendables
- Fluid end inspection
- Fluid end magnetic particle inspection
- Pump inspection
- Basic power end repair
- Training - maintenance and operation
- Pumps and pump part sales



Gas Powered Generator



Port hole allows pipe to extend beyond the length of the trailer during poor weather conditions.



Magnetic Particle Inspection, yoke style with spray fluid and black light.



Gas Powered Air Compressor disperses 40 cubic feet per minute.



SALES OFFICES

Houston, Texas
Singapore

STANDARD SERVICE CENTER

**(new product sales, iron recertification,
and rental)**

United States

Alice, Texas
Brighton, Colorado
Elk City, Oklahoma
Jane Lew, West Virginia
Lafayette, Louisiana
Longview, Texas
Searcy, Arkansas
Williston, North Dakota

Canada

Grande Prairie, Alberta, Canada
Red Cliff, Alberta, Canada

Mexico

Villahermosa, Mexico

Middle East

Dubai, United Arab Emirates

Australia

Perth, Australia

SERVICE CENTER WITH PUMP REPAIR

United States

Deer Park, Texas
Fort Worth, Texas
Grand Junction, Colorado
Odessa, Texas

Canada

Red Deer, Alberta, Canada

Europe

Aberdeen, Scotland

WEIR OIL & GAS SERVICE CENTER

Edmonton, Alberta, Canada
Aberdeen, Scotland
Abu Dhabi, UAE
Dubai, UAE
Al Khobar, Saudi Arabia
Baku, Azerbaijan

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