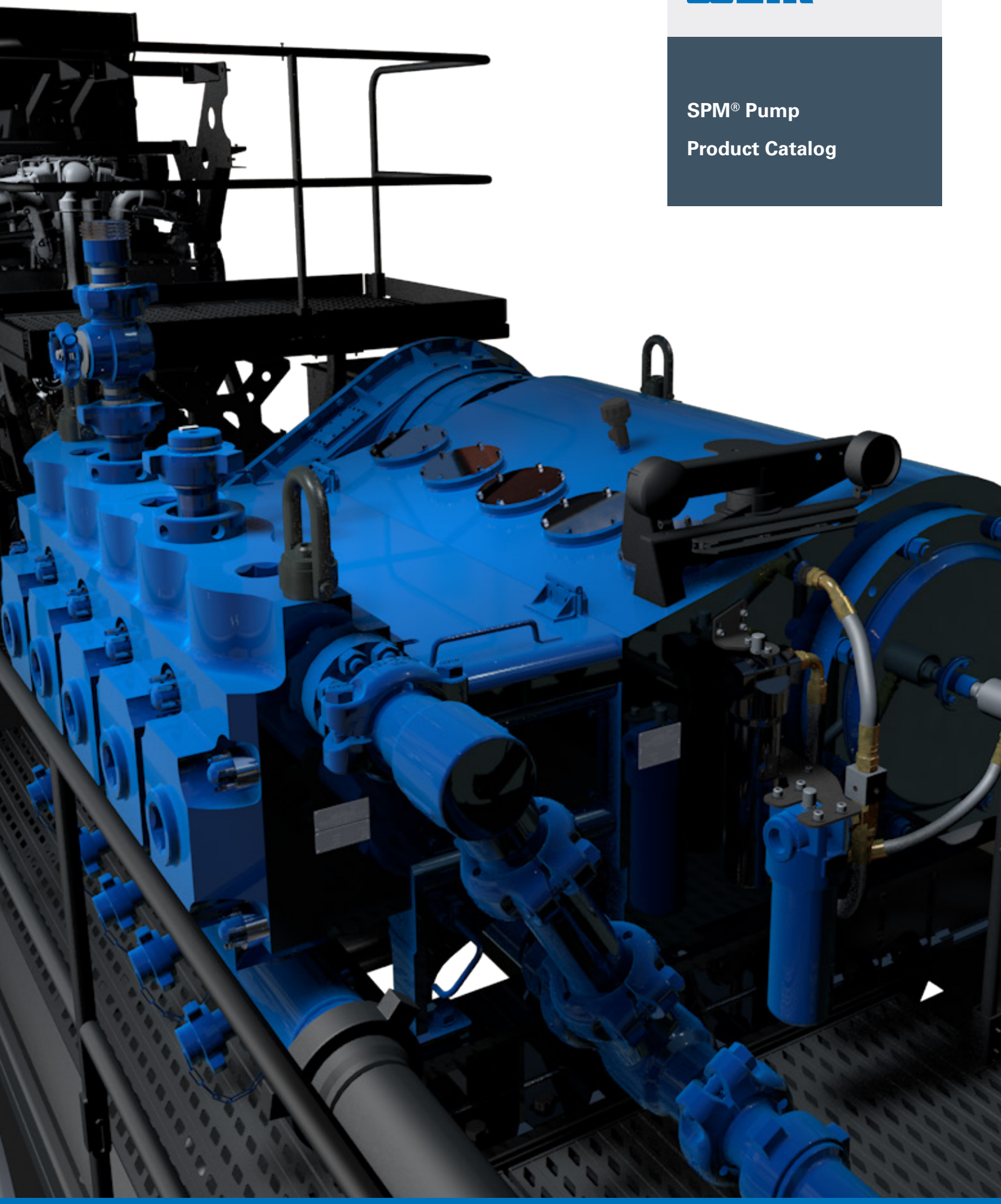
WEIR

SPM® Pump

Product Catalog



General Corporate Overview

Corporate Profile

Weir Oil & Gas provides superior products and service solutions which make our upstream customers more efficient. More customers choose our pressure pumping solutions than any other. We provide well service and stimulation pumps, flow control products and replacement expendable parts from leading brands including SPM, Mesa and Novatech. Pressure Control includes trusted brands such as Seaboard, which provides wellheads, valves and frac trees, and Mathena, which delivers drilling mud-gas separation equipment including chokes, separators, and environmental containment equipment. Engineered mechanical and rotating equipment repairs and upgrades, oilfield and drilling equipment repair and certification, rapid prototyping of spares parts, including robust asset management and field engineering services, are delivered globally by Weir Oil & Gas Services [based in Dubai, UAE].

Founded in 1871, The Weir Group PLC is one of the world's leading engineering businesses. Weir designs, manufactures and services innovative solutions for minerals, oil and gas, power and other process markets. The Group aims to be a partner of choice to our customers with a worldwide network of around 200 manufacturing and service facilities.

Quality, Health, Safety and Environment (QHSE) Systems

Weir's Quality Management System (QMS) is qualified under ISO 9001 and 14001, as well as OHSAS 18001 requirements. Internal audits of Weir manufacturing and service centers are performed semi-annually to verify all policies are being followed and that lean focused continuous improvement drives value for the customer. External audits are performed at a minimum of every three years by a third party certifier.

Commitment to Quality

The Weir Group is committed to managing its activities to safeguard its employees, clients, and the communities within which Weir operates in addition to the environment. Weir global QHSE standards have been disseminated throughout our operations. These standards, based upon a robust risk assessment approach and recognized QHSE management systems, provide a platform for continual improvement.

Commitment to Safety

Global Footprint and Services

Weir prioritizes its ability to provide a rapid response to service needs through its global network of service centers and skilled technicians. Service center teams are located in close proximity to all major shale plays and key production locations around the world to support customers with all repair and maintenance needs.

Commitment to Our Customers

Where You Need Us. When You Need Us.

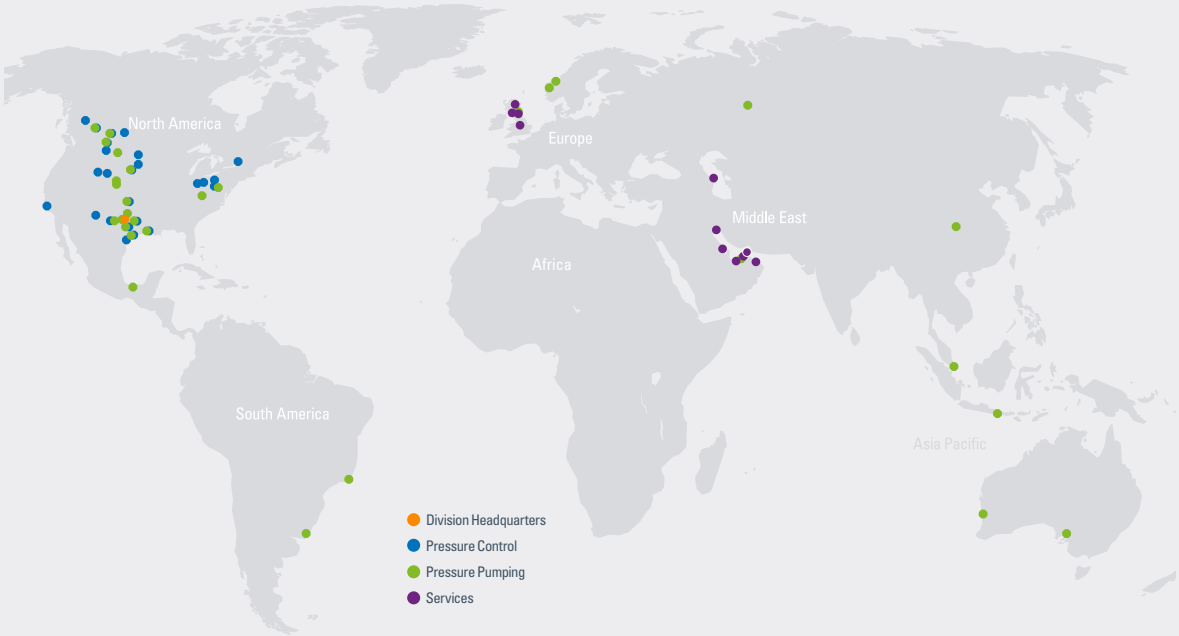


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Third Party Certifications

CE and DNV certification for most flow control product families is offered. Additional third party certifications,such as ABS or BV, may be available upon request. Contact Weir for specific information.

Extending Pump Life and Preventative Maintenance

- Most SPM® products generate, control or direct pressurized fluids; therefore, it is critical that those who work with these products be thoroughly trained in their proper application and safe handling. It is also imperative that these products be used and maintained properly.
- It is a personal responsibility to use the proper tools when servicing SPM® pumps. It is a personal responsibility to be knowledgeable and trained in the use and handling of tools for all maintenance of pumps. Operating and Maintenance Instruction Manuals should be consulted before operating product.
- Each pump is clearly marked with a maximum pressure rating. This pressure must not be exceeded.
- A complete visual inspection of equipment must be made prior to each use. Any leaking seals, broken bolts, leaking hoses or improperly tightened parts must be remedied prior to using.
- Personnel must not be around pressure vessel products while pressure is present or being applied.
- Each pump, as well as each component, must have regular intervals of maintenance and inspection for safe, proper performance.
- Never tighten or hammer wing unions when the system is under pressure.
- Welding, brazing or heating on high pressure components is prohibited.

General Maintenance

- General maintenance will extend the life of pumping assets. Please refer to operating manuals for specific instructions.

Recommended Storage

- Clean and flush the power end with preservation oil and fluid end with rust preventative.
- Plug suction and discharge openings.
- Seal all open fittings and lube ports, remove power end and lube breather cap and plug the hole with a pipe plug. Tie the cap to the pump.
- Coat pinion and pony rods with rust preventative.
- Store inside in a warm, dry place.
- If pump is idle for two or more weeks, remove and lube the plungers and packing with oil before operating.

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General Safety Guide

Personal Responsibilities

- When using SPM® pumps, appropriate PPE is required, including at a minimum safety glasses, approved safety shoes and hard hat. Lifting these assemblies must be done with caution. See product manual for lifting instructions.
- Personnel should only hammer on union lugs and not strike union nut or valve body. Fractures can occur from repeated misuse. Excessive hammering can damage components.
- Proper lifting equipment rated for the load should be used at all times.
- Do not hammer on SPM® product when pressure is present.

On Location

- Proper transportation of SPM® product is important. Never transport any SPM® product in a fashion that would allow it to become dislodged and cause an accident.
- End connections on SPM® product should be clean and lightly oiled prior to each use. A visual inspection for damage should also be performed at this time. Union seals should be checked, and replaced when worn or damaged.
- Since SPM® product may be repainted in different colors for various applications, do not use the factory as the primary means of service identification. Operator specific color schemes should be used.
- SPM® product usage should be monitored by a qualified supervisor or foreman. Supervisory personnel must approve proper placement, position, and handling of all equipment in the pumping system.
- Do not position any part of your body in the path of exit flow of SPM® flow line equipment.
- It is recommended that a rate in excess of 42 feet per second be avoided. Rates above this will cause rapid wear and erosion.
- After each job flush components with clean water and grease with the proper SPM® approved grease. Follow the instructions in the operations manuals or contact a local Weir representative for assistance.

Inspection – Repair – Testing

- Any unauthorized alteration of SPM® pumping equipment is prohibited.
- Use only repair methods as outlined by SPM® service literature. Use only the proper SPM® repair tools.
- Only SPM® repair and service parts should be used for replacement in SPM® product.
- Weir does not allow weld repair to be attempted on any of its product. Replacing worn components is a more effective and safe approach.

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Overview of SPM® Pumps

Weir offers the most powerful continuous duty plunger pumps on the market for today's challenging fracturing operations and a comprehensive line of intermittent duty pump models for the full range of well service applications.

The SPM® continuous duty pump line consists of a 3000 BHP quintuplex pump and a 2500 BHP triplex pump. Engineered to operate at full rod load, 100% of the time, this durable line is an industry first, and performs particularly well during operations that require both high rates and high pressures. SPM® intermittent duty plunger pumps are available as DNV type approved, and range from 600 BHP to 3000 BHP with pressure capabilities exceeding 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.

SPM® frac pumps are manufactured with life cycle enhancing "auto-frettage" processing of the fluid cylinder. This economical process counteracts the harmful effects of cyclic stress and the delays the corrosion-related fatigue cracking that occurs in high-pressure fluid cylinders. Weir's state-of-the-art auto-frettage process results in a fluid cylinder with long fatigue life expectancy at a fractional increase in cost.

Pump Reference Guide

SPM® Pump Model Explanation

QWS		2500	SD
1st letter indicates number of cylinders: **T** = triplex **Q** = quintuplex	**2nd two letters indicate the intended duty cycle:** **WS** = intermittent, such as well service **EM** = Extended Max	**Numbers indicate max. rated BHP:** **2500** = 2500 BHP	**Last two letters indicate specialty designation:** S = short XL = extended life HD = heavy duty

Selecting the Right Pump

In order to select the right pump for your application, a number of variables must be considered, including but not limited to:

Required Flow Rate

How much fluid are you pumping?

Discharge Pressure (PSI)

As the flow rate increases, discharge pressure of a given pump will decrease.

Rod Load (At Maximum Pressure)

The force of pressure pushing against the piston will be transmitted back into the frame, so the entire unit is designed, tested, and rated to withstand this load.

Engine HP (Brake HP)

How much HP do you have available (or will you need) to deliver the required volume at the required pressure?

Operations

Does your application require 100% capacity at all times when pumping, or will 2 smaller units provide required peak capacity allowing for pumping with 1 unit while the other is undergoing routine maintenance (improving operational efficiency overall)?

Contact the Weir engineering team to help select the right pump for your application.

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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

BPM = GPM / 42

Abbreviations

BHP	Brake Horsepower
GPM	Gallons Per Minute
BPM	Barrels Per Minute
GPR	Gallons Per Revolution
ME	Mechanical Efficiency
NC	Number of Cylinders
PD	Plunger Diameter
PSI	Pounds Per Square Inch
RPM	Revolutions Per Minute
SL	Stroke Length

Triplex or Quintuplex?

The decision to purchase a triplex (3-plunger) or quintuplex (5-plunger) pump is also influenced by a variety of factors, and either one may be the right solution. In general, the following tradeoffs should be considered between the two configurations:

Triplex	Quintuplex
Higher maximum pressure	Higher maximum flow
Lower maximum flow	Lower maximum pressure
Smaller footprint	Larger footprint
Lower weight	Higher weight
Lower HP rating	Higher HP rating
Higher peak-to-peak ΔP – pulsation control may be required	Pulsation control rarely needed
Driveline damper needed	Driveline damper seldom used

The table below lists the main features of our standard pump offerings. Additional information about each pump may be found in this catalog, or by contacting Weir Oil & Gas at 1-800-342-7458.

Pump	Recommended Application	# Cyl	Max Brake HP Type	Max Rod Load	Max Pressure, 4" Plunger[1]	Stroke	Gear Ratio	Displace-ment, 4" Plunger[2]	Dimensions	Weight
TWS 600S HD	Acidizing, cementing, gravel packing, snubbing	3	600	106,000 lbf (48,094 kg)	8,438 psi (58 MPa)	6" (152 mm)	4.61 : 1	294 gpm (1,113 lpm)	50.3" x 52.9" x 23.9" (1,276 mm x 1,344 mm x 607 mm)	4,600 lb (2,086 kg)
TWS 2250	Fracturing	3	2,250	238,570 lbf (108,213 kg)	18,985 psi (131 MPa)	8" (203 mm)	6.353 : 1	392 gpm (1,483 lpm)	89.9" x 59.8" x 44.3" (2,284 mm x 1,519 mm x 1,125 mm)	11,750 lb (5,330 kg)
TWS 2500	Fracturing	3	2,500	273,000 lbf (123,810 kg)	21,725 psi (150 MPa)	10" (254 mm)	6.375 : 1	499 gpm (1890 lpm)	91" x 93" x 42" (3,311 mm x 2,362 mm x 1067 mm)	14,450 lb (6,560 kg)
TEM 2500	Fracturing	3	2,500	275,000 lbf (124,738 kg)	21,884 psi (151 MPa)	8" (203 mm)	6.963: 1	392 gpm (1,487 lpm)	87" x 92" x 54" (2,210 mm x 2,337 mm x 1,372 mm)	18,735 lb (9,525 kg)
QWS 1000S HD	Acidizing, cementing, gravel packing, snubbing	5	1,000	106,000 lbf (48,094 kg)	8,438 psi (58 MPa)	6" (152 mm)	4.61 : 1	490 gpm (1,855 lpm)	50" x 73" x 24" (1,270 mm x 1,854 mm x 609 mm)	7,040 lb (3,193 kg)
QWS 2500 XL	Fracturing	5	2,500	207,000 lbf (87,239 kg)	15,305 psi (105 MPa)	8" (203 mm	6.353 : 1	650 gpm (2,458 lpm	84.75" x 73.875" x 43.375" (2,153 mm x 1,877 mm x 1,102 mm)	16,000 lb (7,257 kg)
QEM 3000	Fracturing	5	3,000	275,000 lbf (124,738 kg)	21,880 psi (151 MPa)	8" (203 mm)	6.963:1	612 gpm (2,458 lpm)	87" x 116" x 54" (2,210 mm x 2,946 mm x 1,372 mm)	25,775 lb (13,381 kg)

[1] At 50 pump strokes per minute
[2] At 300 pump strokes per minute: note discharge pressure at this displacement rate will be significantly lower than max pressure.
Pumps can exceed working pressure of the discharge iron. Care must be taken to match discharge iron maximum working pressures.
* Max velocity is 42 FPS. With 3" iron, do not exceed.

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Best Practices to Extend Pump Service Life

Operations and Maintenance

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

- Follow "break-in" procedure for new equipment specified in the operations manual
- Use of a Zoomie manifold to super charge the pump.
- DSS suction pulsation dampeners (especially recommended for Triplex pumps)
- Properly maintain plungers, packing, valves, and seats
- Improve discharge harmonics (may require high pressure dampener)
- Correct low and high pressure connections
- Proper supercharge pressure
- Correct sand/gel concentrations and proper blender operations

Establishing the recommended preventative maintenance (PM) program is the best way to increase the life of your pump and pump components. Weir strongly recommends that each customer establish and follow a PM program for all pumping assets at all times. Further details can be found in the pump operations manual provided with each new pump, but the general PM recommendations include the following.

- Daily (leak checks)
- Weekly (above daily checks plus additional system checks)
- Monthly or every 100 pumping hours (all of the above checks plus tighten bolts, change filters, check consumable/wear parts inventories)
- Quarterly or every 250 hours (all of the above checks plus change oil, clean lube oil strainers and breathers, and other recommended parts)
- Yearly (all of the above checks plus complete pump inspection, replacing worn components, all flange/manifold seals)
- Oil samples will assist in monitoring the pump.

A properly executed PM program will keep the equipment in top performance, and can prevent or identify problems before they occur. This helps to reduce and eliminate unplanned nonproductive time (NPT) and expensive lengthy repairs.

Pump Duty Cycles

Please consult your Weir representative for information on pump duty cycles.

Where you need us, When you need us.

Equipment maintenance is essential to any well-site operation and having the proper training and support is vital to your success and safety. Weir's Technical Services team provides a combined 65 years of oilfield expertise to help address the challenges you face and delivers the insight you need, available 24/7 anywhere in the world.

Weir Technical Services builds on the close relationships built with customers, and operates as a resource for installation guidance, education on wellsite operations, and assists with training for operators, mechanics, and other customer support staff in maintaining and operating Weir products. Weir Technical Services also performs the following services:

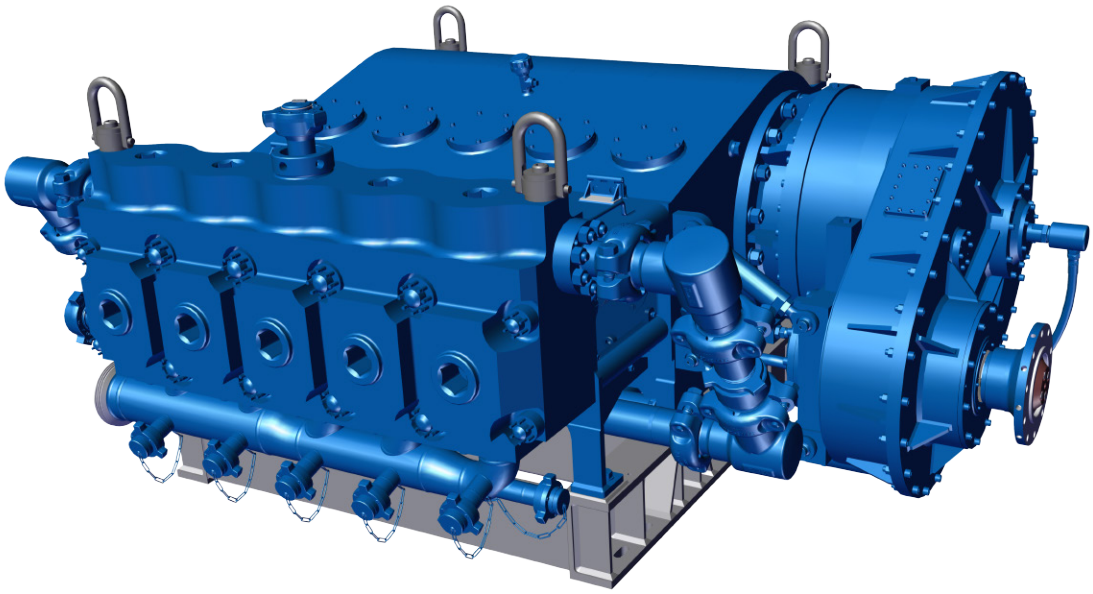
- **Customer visits** to explain causes and solutions to challenges they face from C level employees to field operators.
- **Training assistance** for operators, mechanics, and other customer support staff in maintaining and operating Weir products.
- **Routine calls** to make sure that our product is performing as intended.
- **Custom training** programs for Weir products.
- **Monitor performance** of Beta and Alpha equipment in the field.
- **Troubleshoot** and assist in resolution of problems for the customer, both in the field and at OEM shops.
- **Championing and supporting safety** efforts for all customers.

Please contact your local Weir representative for more details on these services.

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SPM® QEM 3000 Frac Pump

Redefining continuous duty



The SPM® QEM 3000 is a true continuous duty plunger pump. The SPM® QEM 3000 is the industry's first true continuous duty high horse power stimulation pump designed to handle operation at 275,000 lb of rod load 100% of the time. Enhanced structural rigidity through an engineered skid and segmented frame plates dramatically extends component life, while a special dual lubrication system is designed to enhance delivery of clean lubricant to prevent premature failure and nonproductive downtime.

Validated through a 13 million cycle test at the Weir Oil & Gas Research and Development Center and extensive field testing, this durable pump is designed to offer synchronized maintenance schedules with the engine and transmission to decrease downtime and reduce total cost of ownership by 17%.

PATENTS PENDING.

Features and Benefits

- Frame and skid designed to maximize rigidity under operation
- Largest frac pump bearing on the market – increases component life
- Gearbox with double helical gears to reduce thrust loading
- Dual-pressure lube system to optimize lube distribution and maximize component life

Applications: Fracturing

Maximum Brake Horsepower Input	3000 BHP (2,237 kW)
Maximum Rod Load Capacity	275,000 lb_f (1,223 kg)
Stroke Length	8" (203.2 mm)
Gear Ratio	6.963:1
Approximate Length	87" (2,210 mm)
Approximate Width	116" (2,946 mm)
Approximate Height	54" (1,372 mm)
Approximate Weight (Dry)	25,775 lb (13,381 kg)

Note: Pump dimensions and weights are approximate. For full detailed drawings, please contact Weir.

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SPM® QEM 3000 Pump–Performance Chart[1,2]

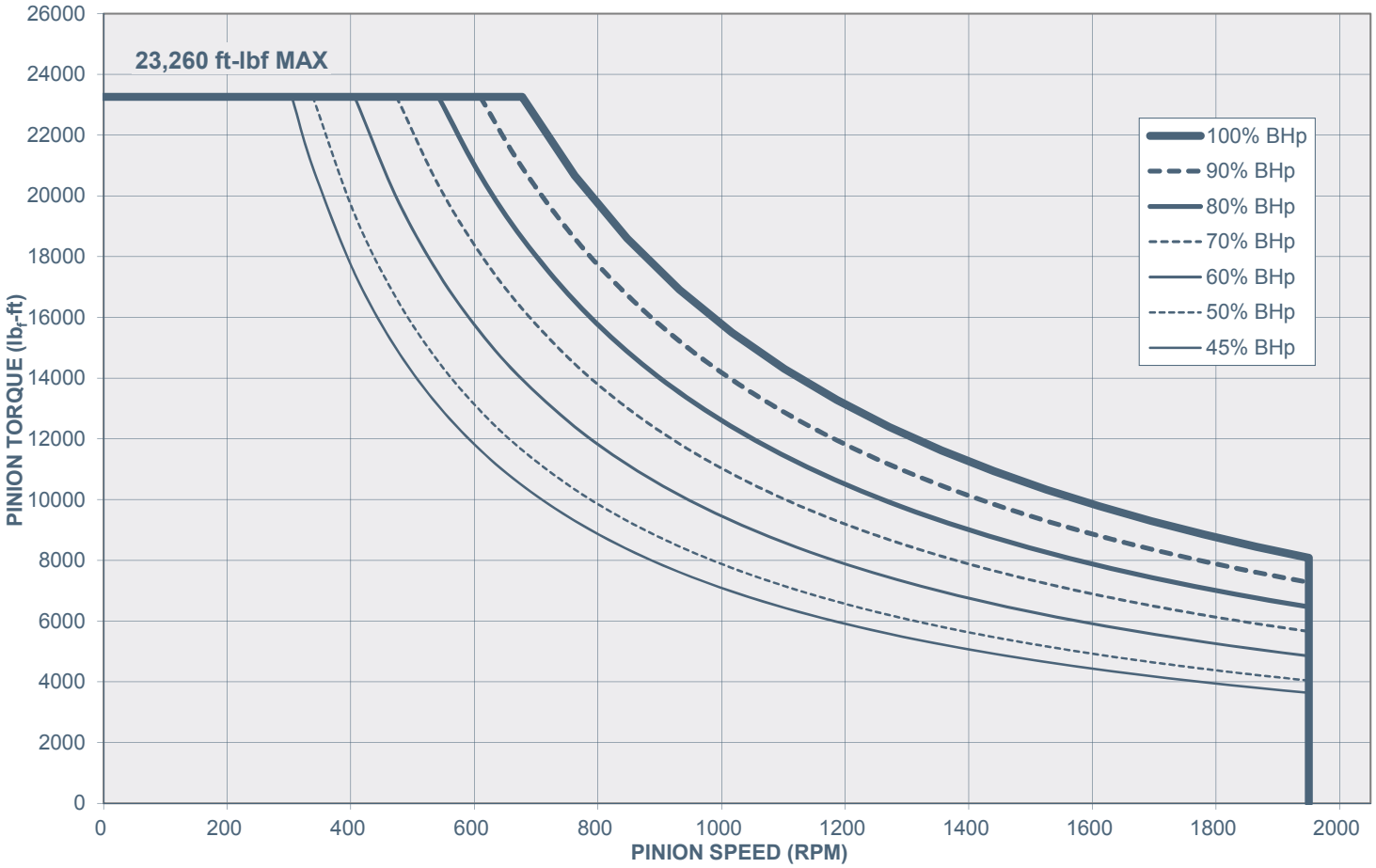
Plunger Diameter in (mm)	Displace Per Rev gal/rev (liter/rev)	Displacement at Pump Strokes per Minute/Pinion RPM											
		50 gpm (lpm)	348 psi (Mpa)	97 gpm (lpm)	677 psi (Mpa)	143 gpm (lpm)	996 psi (Mpa)	189 gpm (lpm)	1314 psi (Mpa)	234 gpm (lpm)	1632 psi (Mpa)	280 gpm (lpm)	1950 psi (Mpa))
3 ¾ (95.3)	1.91 (7.2)	96 (362)	24899 (172)	186 (704)	24895 (172)	273 (1034)	16939 (117)	361 (1365)	12837 (89)	448 (1695)	10334 (71)	535 (2025)	8648 (60)
4 (95.3)	2.18 (8.2)	109 (412)	21884 (151)	212 (801)	21880 (151)	311 (1177)	14888 (103)	410 (1553)	1122 (78)	510 (1929)	9083 (63)	609 (2305)	7601 (52)
4 ½ (101.6)	2.75 (10.4)	138 (521)	17291 (119)	268 (1013)	17288 (119)	393 (1489)	11763 (81)	519 (1965)	8914 (61)	645 (2441)	7176 (49)	771 (2917)	6005 (41)
5 (114.3)	3.40 (12.9)	170 (643)	14006 (97)	330 (1251)	14003 (97)	486 (1838)	9528 (66)	641 (2426)	7221 (50)	796 (3013)	5813 (40)	951 (3601)	4864 (34)
Input Power: BHP (kW)		1543 (1151)		3000 (2237)		3000 (2237)		3000 (2237)		3000 (2237)		3000 (2237)	

[1] Based on 90% ME and 100% VE–Intermitten Service Only.

[2] Pumps operating in excess of 15,000 psil require special gauge and discharge flanges. Contact SPM Engineering for information.

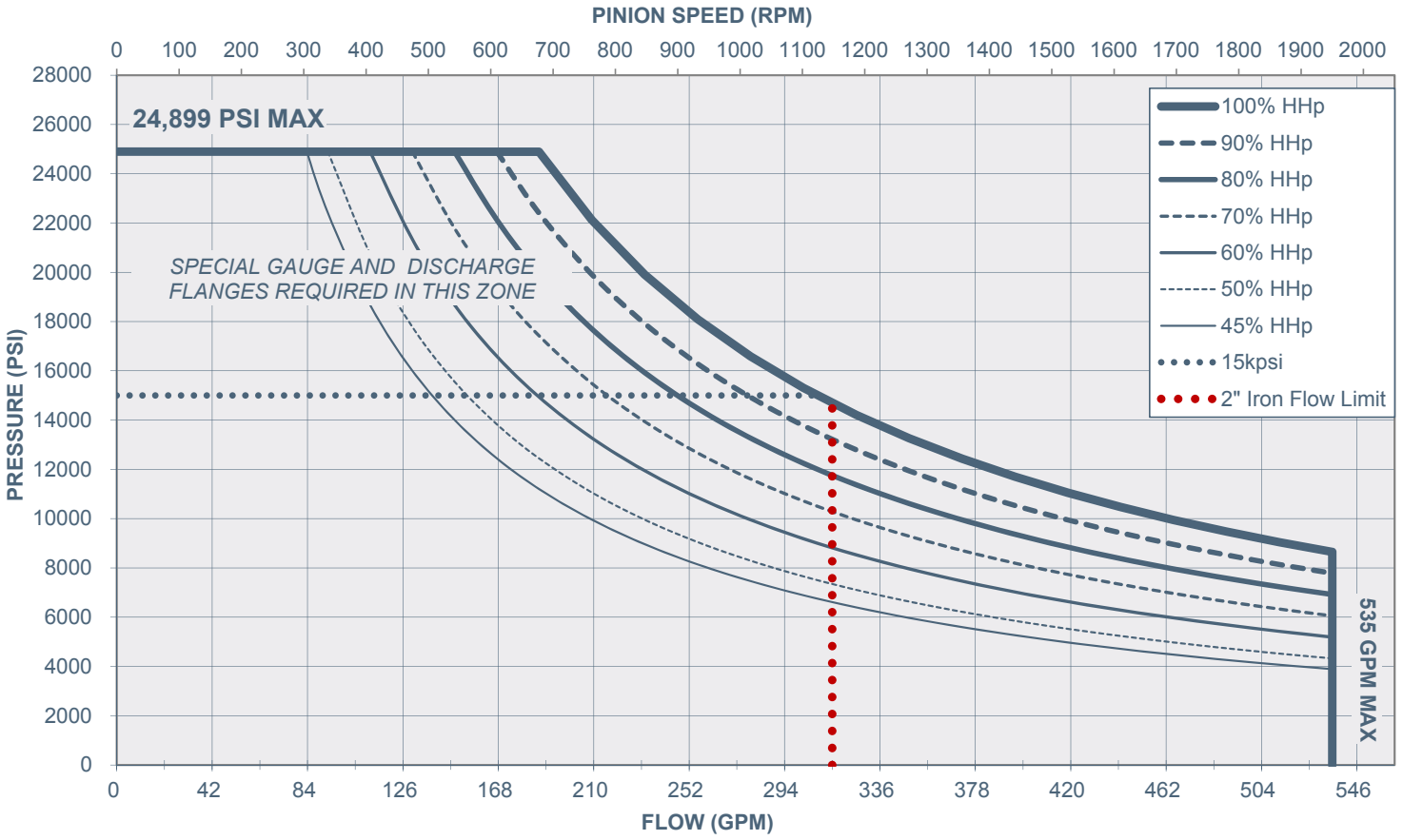
Cells highlighted in blue are are intermediate zones where erosion is more prevalent when 3" iron is used (MAX 778 GPM/2945LPM)

SPM® QEM 3000 Pinion Torque Curve

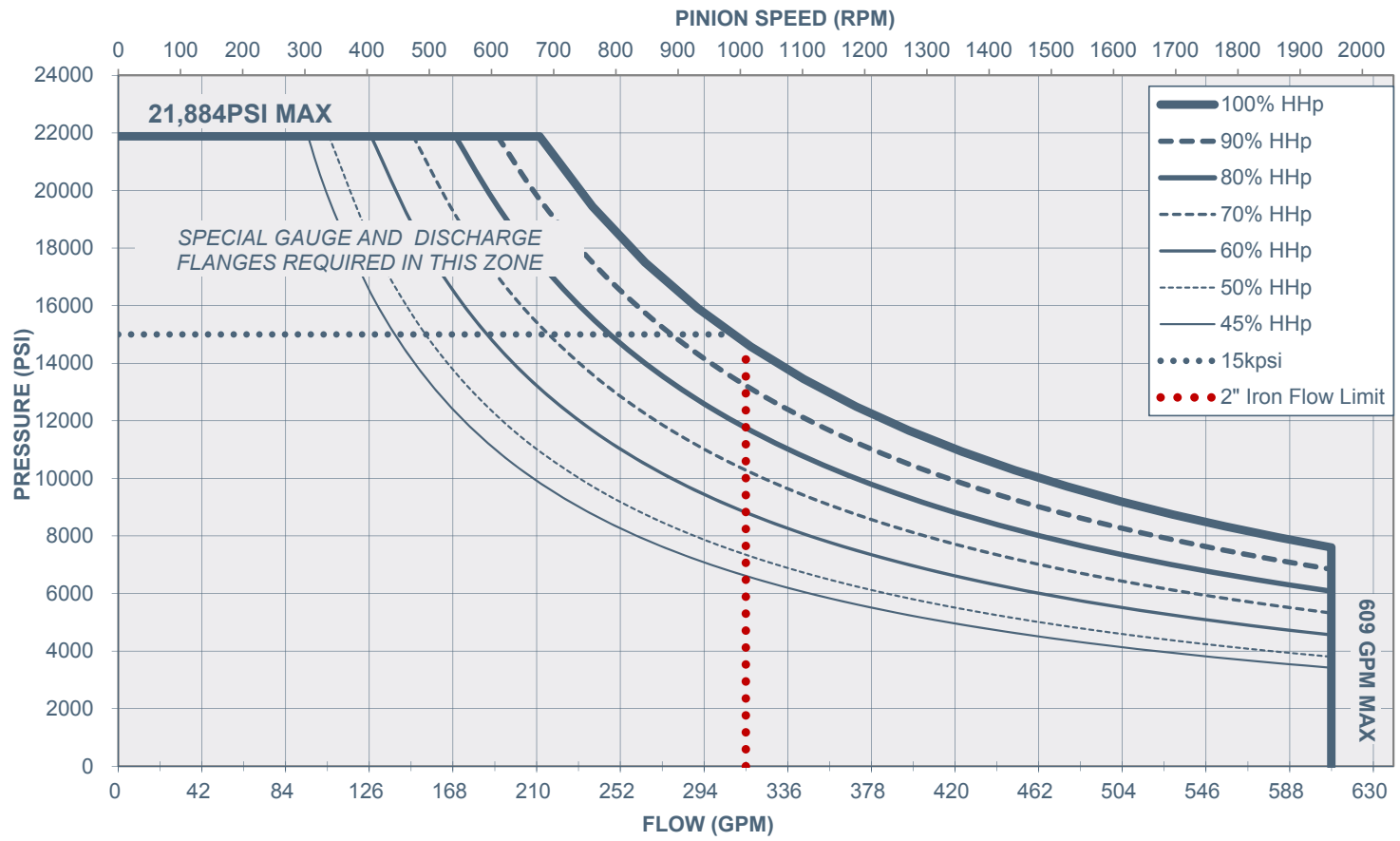


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SPM® QEM 3000 – 3.75" Plunger Horsepower Curve

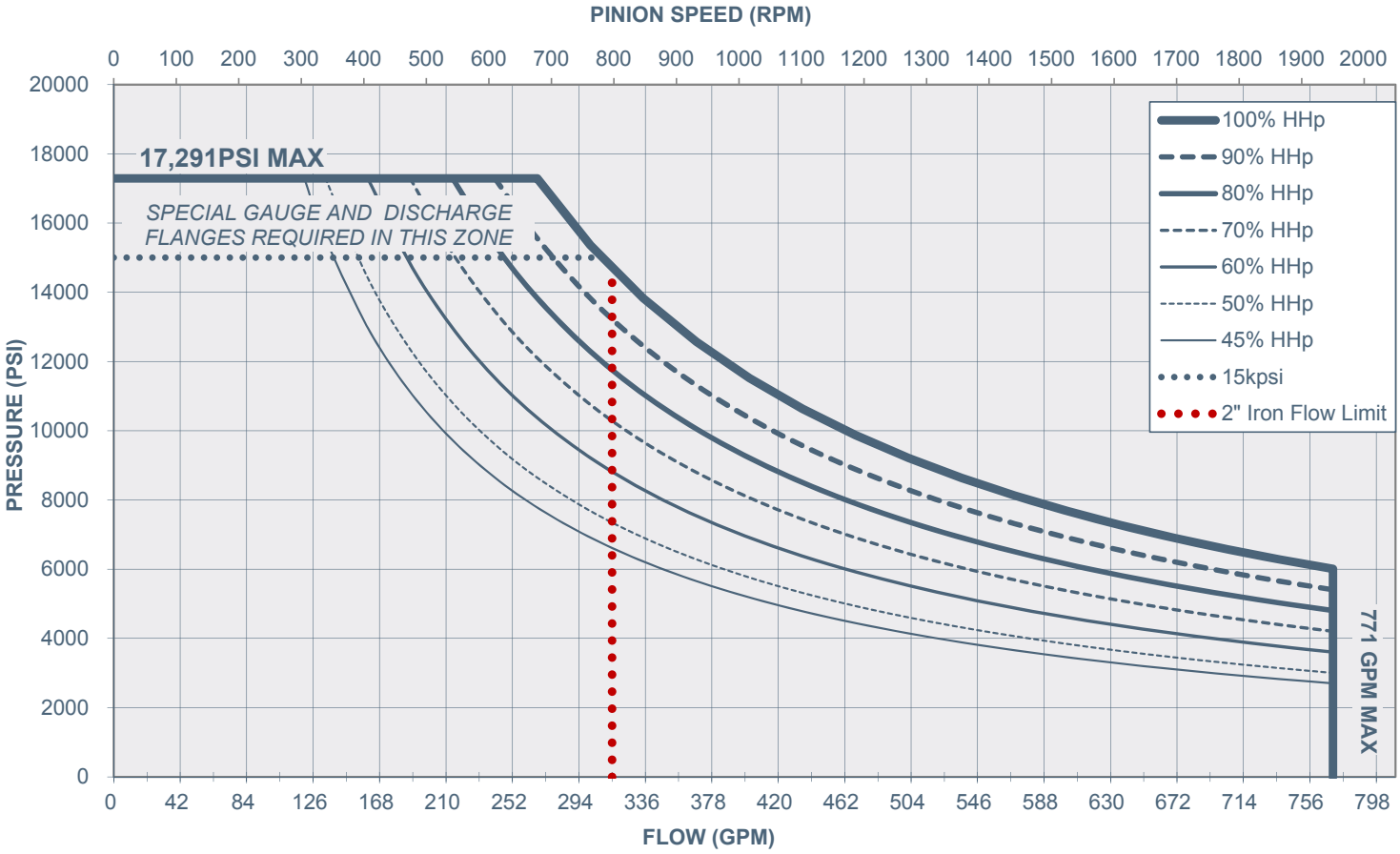


SPM® QEM 3000 – 4.00" Plunger Horsepower Curve

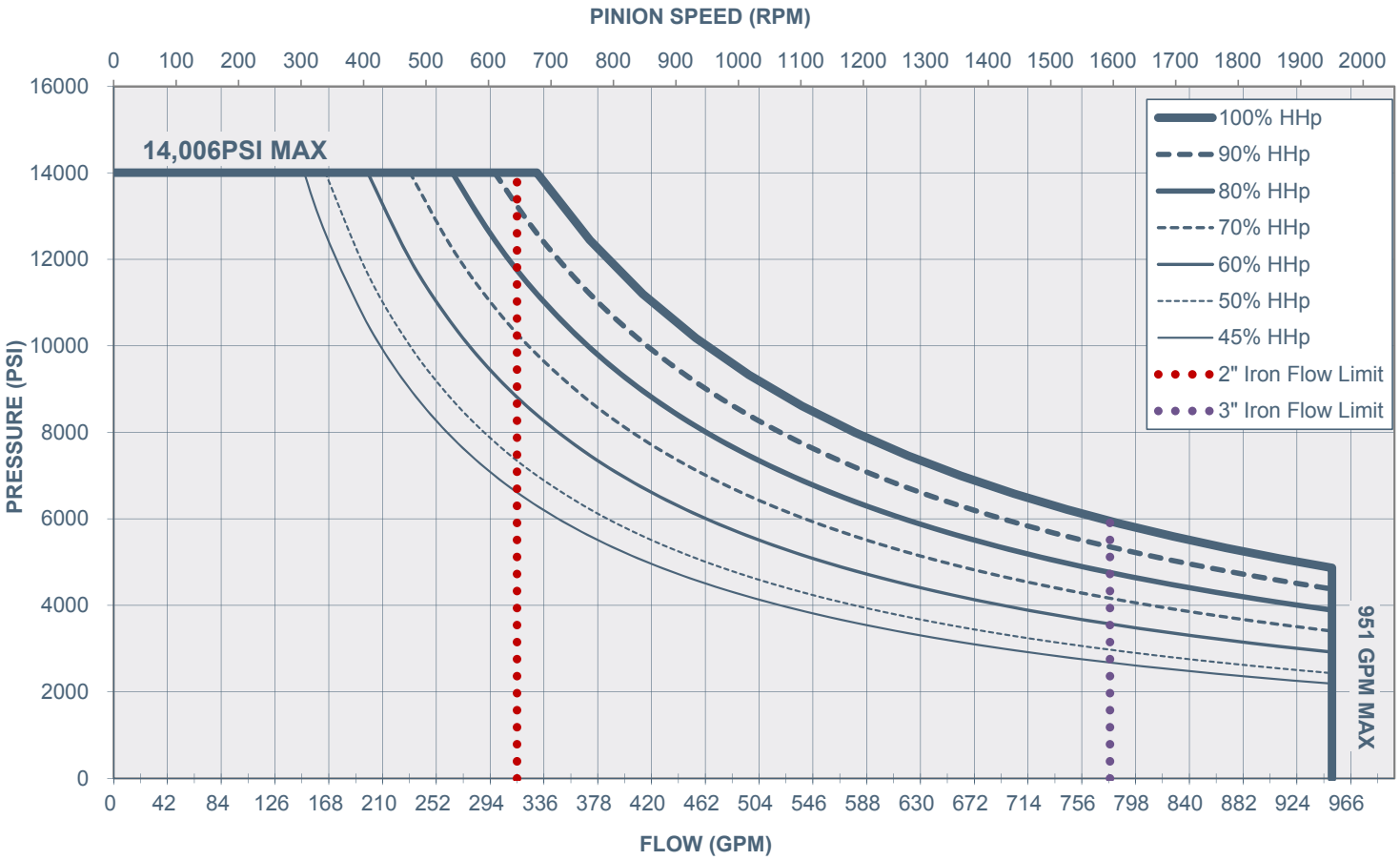


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SPM® QEM 3000 – 4.50” Plunger Horsepower Curve



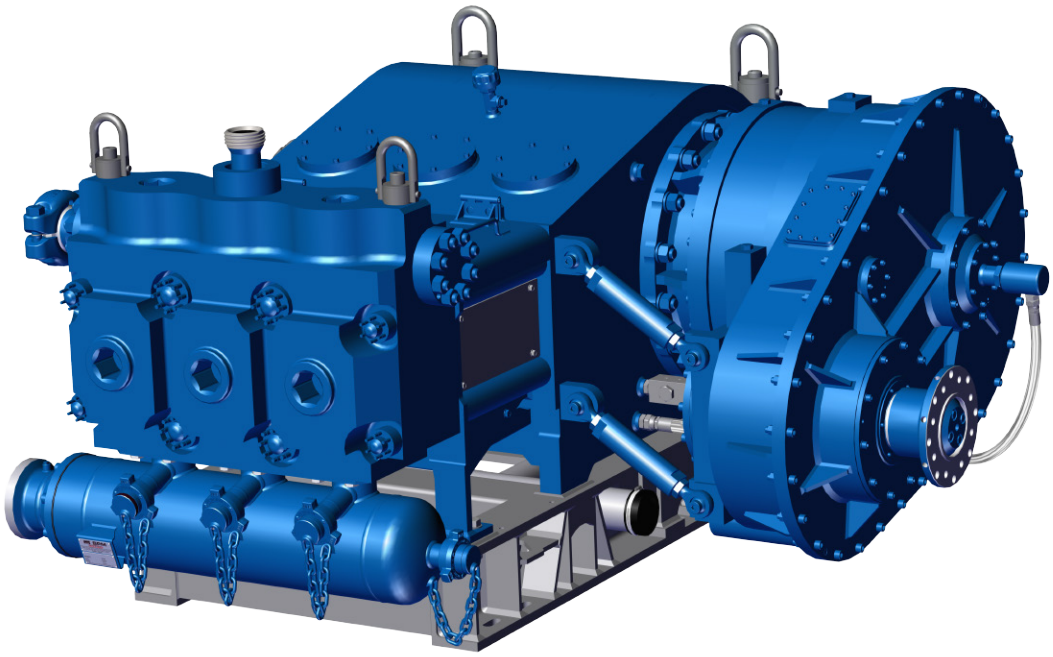
SPM® QEM 3000 – 5.00” Plunger Horsepower Curve



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SPM® TEM 2500 Frac Pump

Redefining continuous duty



The SPM® TEM 2500 is the industry's first true continuous duty high horse power stimulation pump designed to handle operation at 275,000 lbf of rod load 100% of the time. Enhanced structural rigidity through an engineered skid and segmented frame plates dramatically extends component life, while a special dual lubrication system with on board filtration is designed to optimize the flow of oil and enhance the delivery of clean lubricant to prevent premature failure and reduce nonproductive downtime.

Validated through a 13 million cycle test at the Weir Oil & Gas Research and Development Center, this durable pump is designed to offer synchronized maintenance schedules with the engine and transmission to decrease downtime and reduce total cost of ownership.

PATENTS PENDING.

Features and Benefits

- Frame and skid designed to maximize rigidity under operation
- Largest frac pump bearing on the market – increases component life
- Gearbox with double helical gears to reduce thrust loading
- Dual-pressure lube system to optimize lube distribution and maximize component life

Applications: Fracturing

Maximum Brake Horsepower Input	2500 BHP (1,864 kW)
Maximum Rod Load Capacity	275,000 lb_f (1,223 kg)
Stroke Length	8" (203.2 mm)
Gear Ratio	6.963:1
Approximate Length	87" (2,210 mm)
Approximate Width	92" (2,337 mm)
Approximate Height	54" (1,372 mm)
Approximate Weight (Dry)	18,735 lb (9,525 kg)

Note: Pump dimensions and weights are approximate. For full detailed drawings, please contact Weir.

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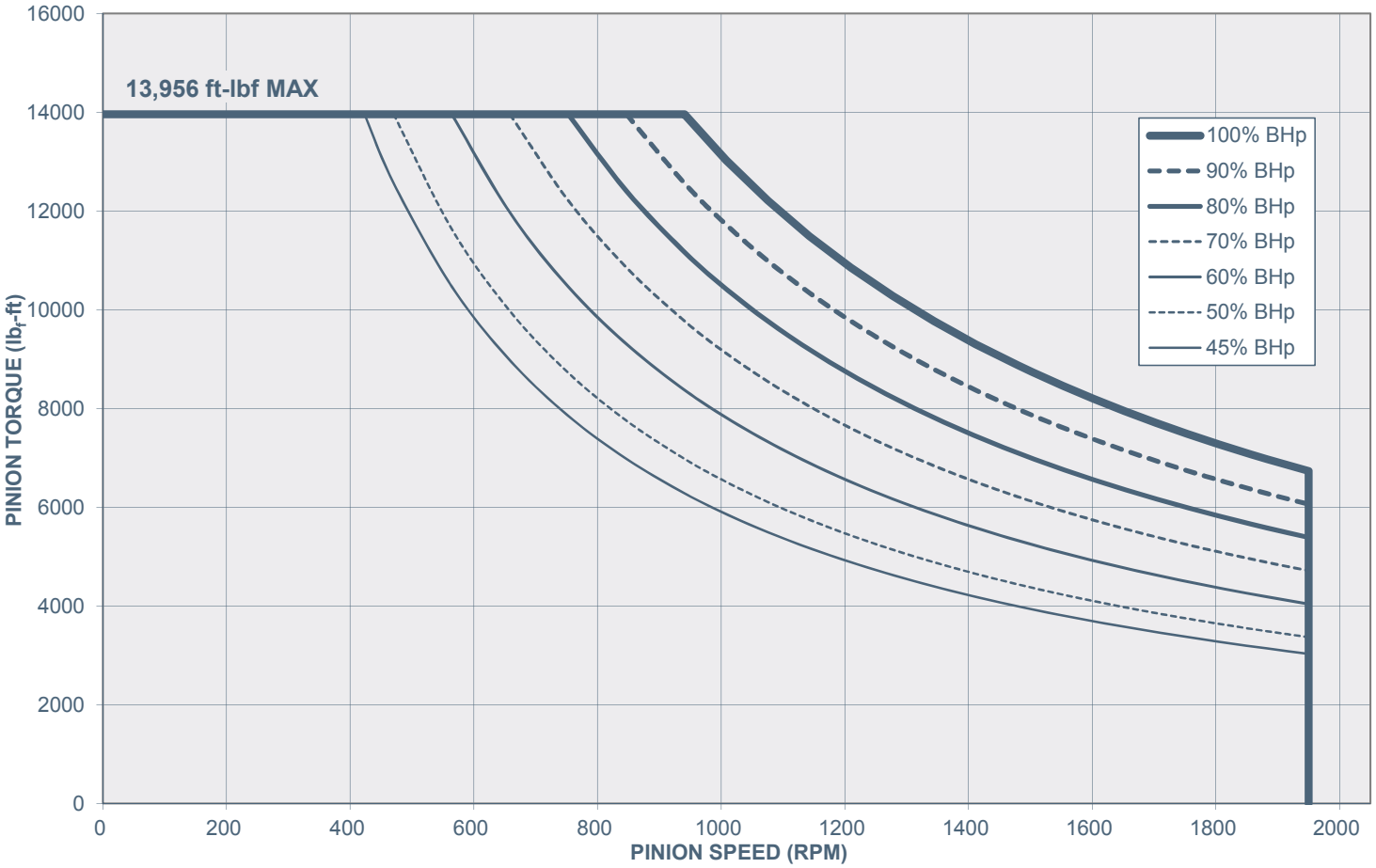
TEM 2500 Pump–Performance Chart[1,2]

Plunger Diameter in (mm)	Displace Per Rev gal/rev (liter/rev)	Displacement at Pump Strokes per Minute/Pinion RPM											
		50 gpm (lpm)	348 psi (Mpa)	135 gpm (lpm)	941 psi (Mpa)	171 gpm (lpm)	1193 psi (Mpa)	207 gpm (lpm)	1445 psi (Mpa)	244 gpm (lpm)	1698 psi (Mpa)	280 gpm (lpm)	1950 psi (Mpa))
4 (101.6)	1.31 (4.9)	65 (247)	21884 (151)	176 (667)	21880 (151)	224 (846)	17253 (119)	271 (1025)	14242 (98)	318 (1204)	12125 (84)	365 (1383)	10557 (73)
4 ½ (114.3)	1.65 (6.3)	83 (313)	17291 (119)	223 (844)	17288 (119)	283 (1071)	13632 (119)	343 (1297)	11253 (78)	403 (1524)	9580 (66)	462 (1750)	8341 (58)
5 (127)	2.04 (7.7)	102 (386)	14006 (97)	275 (1042)	14003 (97)	349 (1322)	11042 (76)	423 (1601)	9115 (63)	497 (1881)	7760 (54)	571 (2162)	6756 (47)
Input Power: BHP (kW)		926 (691)		2500 (1864)		2500 (1864)		2500 (1864)		2500 (1864)		2500 (1864)	

[1] Based on 90% ME and 100% VE–Intermitten Service Only.

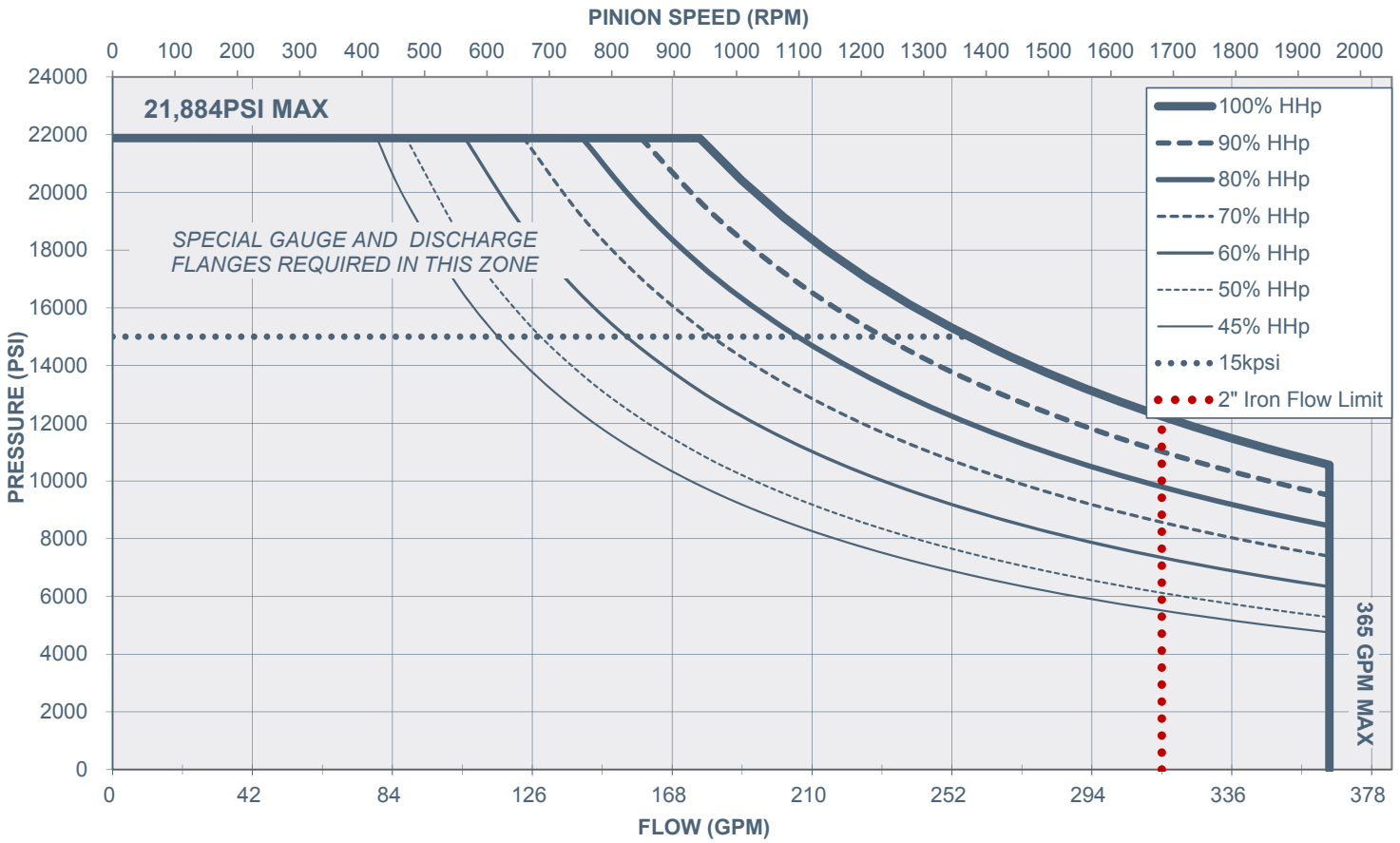
[2] Pumps operating in excess of 15,000 psil require special gauge and discharge flanges. Contact SPM Engineering for information.

SPM® TEM 2500 Pinion Torque Curve

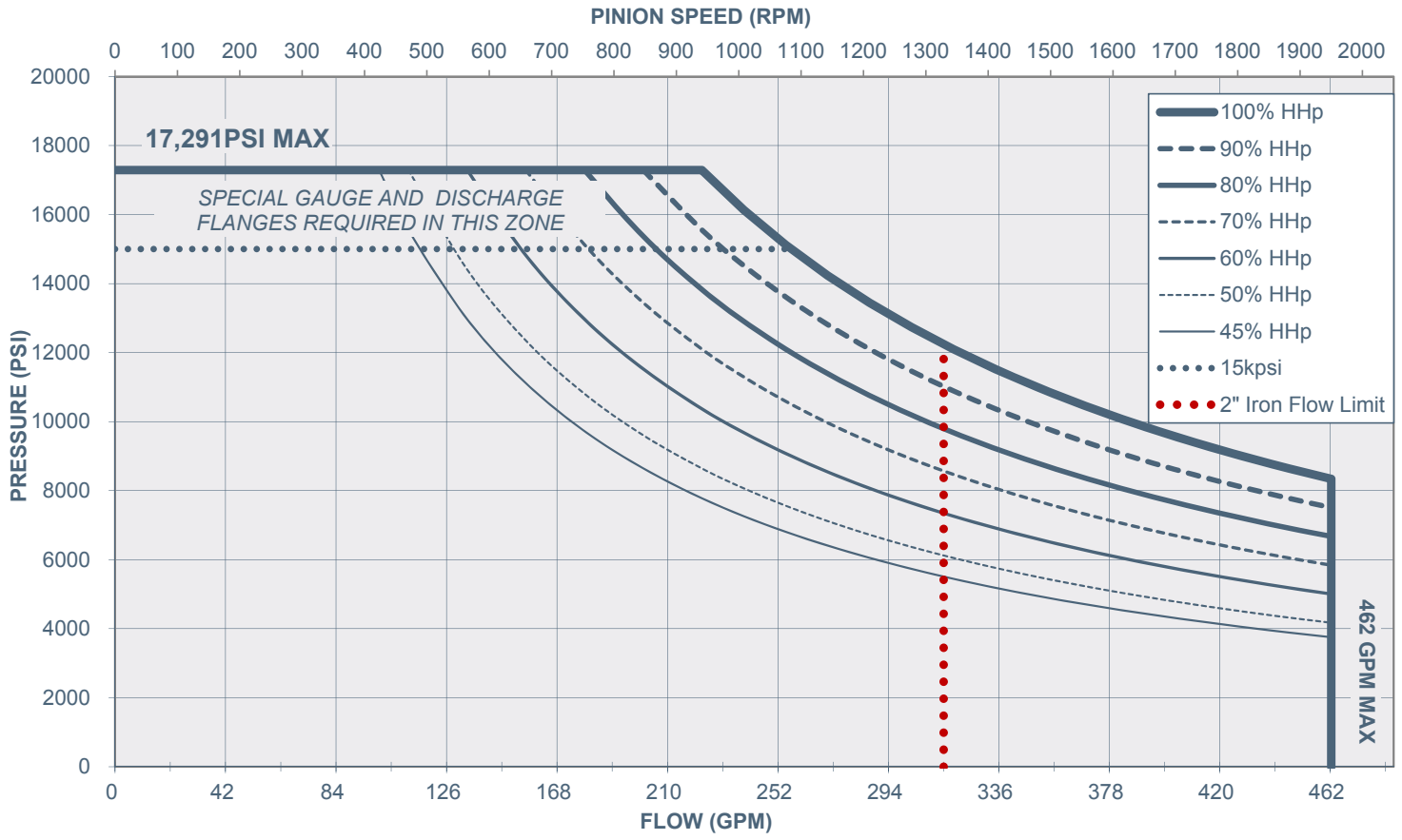


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SPM® TEM 2500 – 4.00” Plunger Horsepower Curve

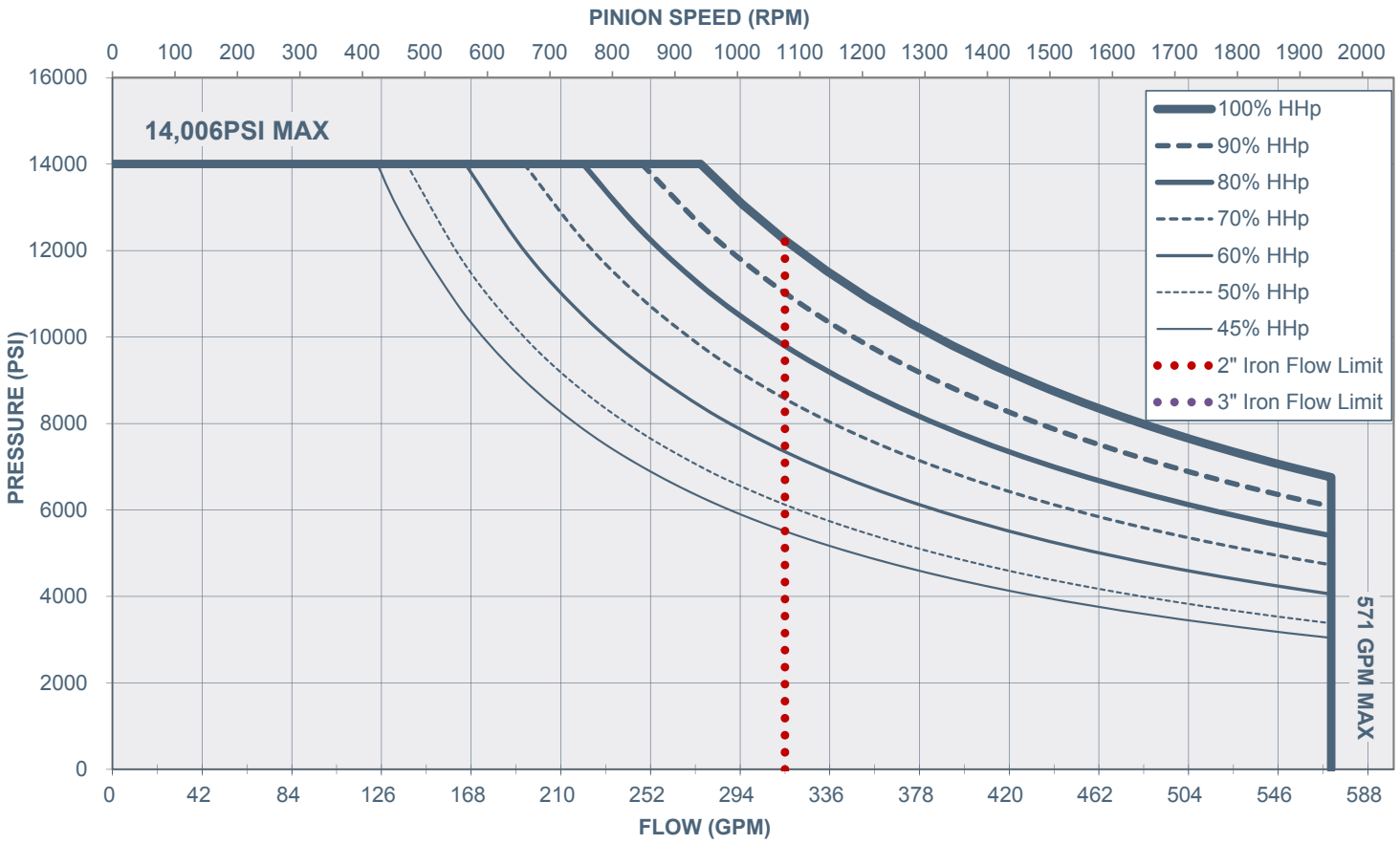


SPM® TEM 2500 – 4.50” Plunger Horsepower Curve



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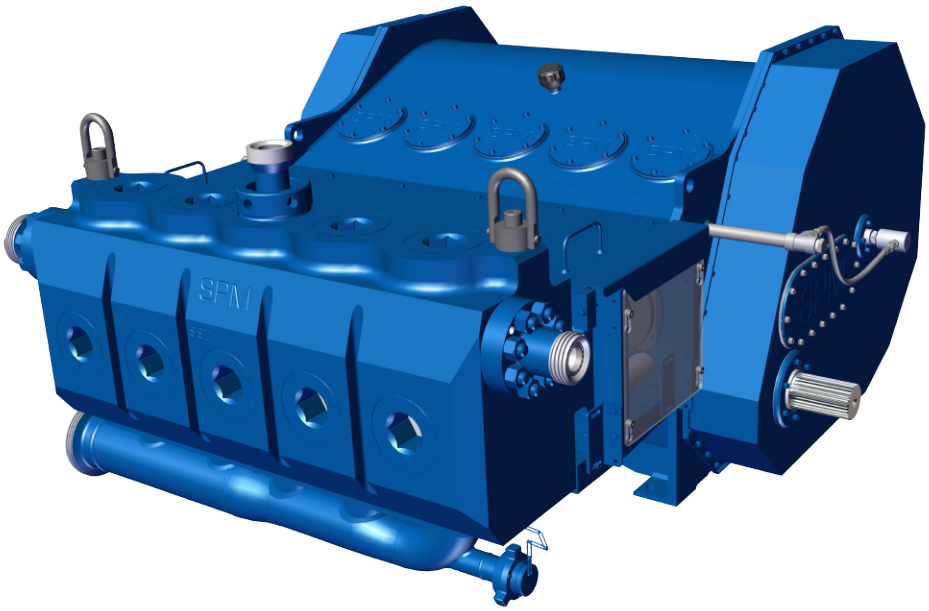
SPM® TEM 2500 – 5.00” Plunger Horsepower Curve



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SPM® QWS 2500 XL Frac Pump

Intermittent Duty Pumps



As the industry continues to evolve, so do our pumps. The enhanced design of the SPM® QWS 2500 XL delivers extended service life and an increased rod load of 207,000 lbf even under the most challenging conditions of shale play operations.

The addition of a bolt-on bearing carrier protects the frame, pinion, and bull gear in the event the bearing clocks in the frame due to overload. This results in faster, more cost effective repair, keeping your assets in the field. Additionally, Weir engineering has evaluated and selected a larger Tier 1 bearing specifically for this application and optimized the lubrication through the bearing groove for a service life up to 4x longer than previous generation pinion bearings.

An updated frame design (patent pending) with improved geometry utilizes advances in welding design and technology to significantly improve the fatigue life of the frame. The new design

also includes blind tapped holes to reduce leakage. To validate these new features, Weir completed an endurance test of more than one million cycles at 107% rod load. The SPM® QWS 2500 XL passed the test and validated the increased rod load of 207,000 lbf.

This pump can be equipped with the SPM® Duralast® fluid end, which is proven to extend the life over conventional SPM® fluid ends. This combination is designed to significantly increase system uptime and lower total cost of ownership over the life of the pumping asset.

Features and Benefits

- New bolt-on pinion bearing carrier improves serviceability and prevents potential frame damage should a bearing clock in the frame due to overload
- Larger pinion bearing for up to 4x the service life of previous designs
- Thicker bottom plate and change in geometry to enhance power frame rigidity
- New frame design with improved weld joint technology increases fatigue life
- Optimized bearing and gear mesh lubrication for improved performance

Applications: Fracturing

Maximum Brake Horsepower Input	2500 BHP (1,864 kW)
Maximum Rod Load Capacity	207,000 lb_f (921 kg)
Stroke Length	8” (203.2 mm)
Gear Ratio	6.353:1
Approximate Length	84 3/4" (2,153 mm)
Approximate Width	73 7/8" (1,877 mm)
Approximate Height	43 3/8" (1,102 mm)
Approximate Weight (Dry)	16,000 lb (7,257 kg)

Note: Pump dimensions and weights are approximate. For full detailed drawings, please contact Weir.

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QWS 2500 XL Pump–Performance Chart[1,2]

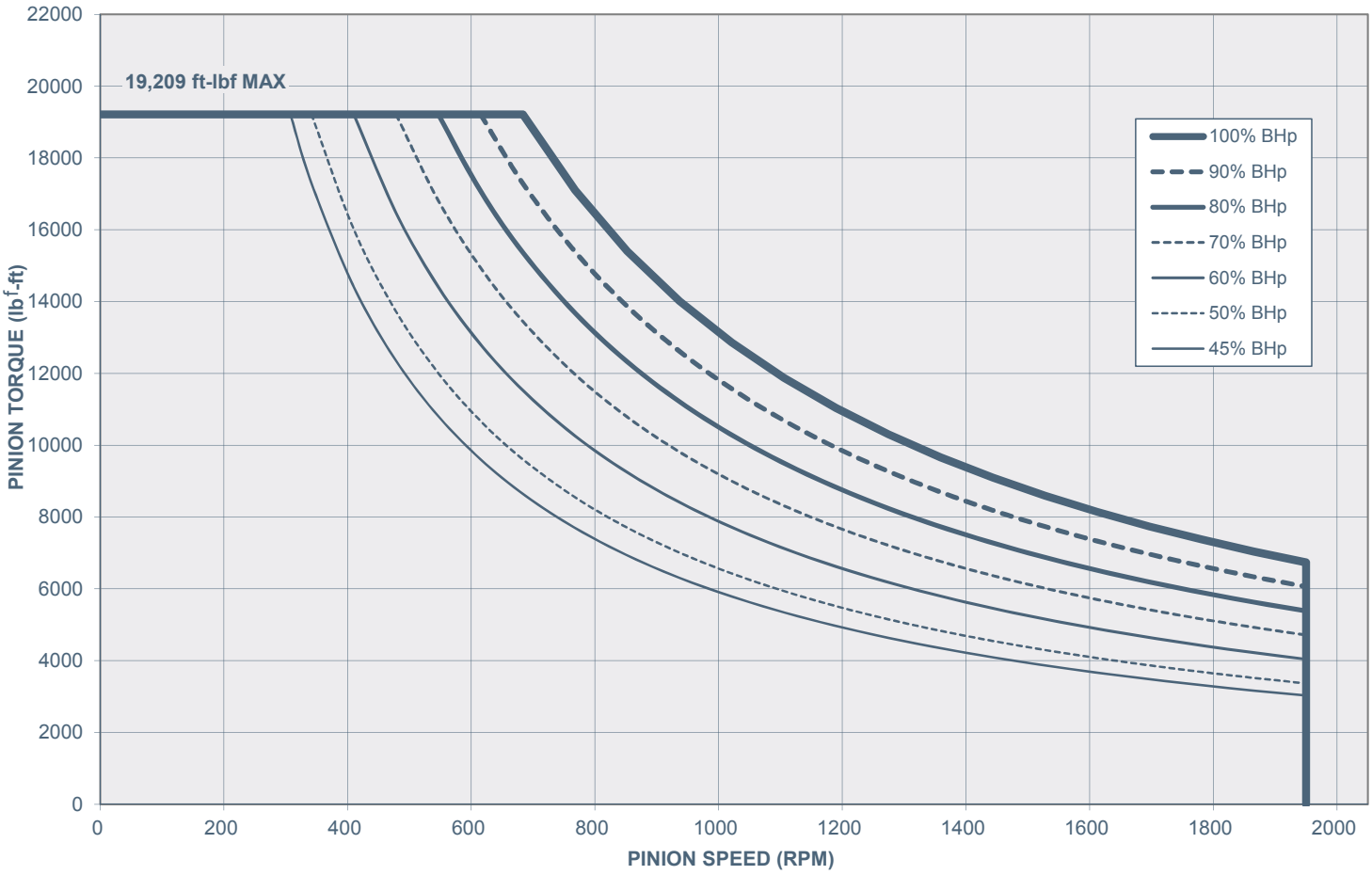
Plunger Diameter in (mm)	Displace Per Rev gal/rev (liter/rev)	Displacement at Pump Strokes per Minute/Pinion RPM											
		50 gpm (lpm)	318 psi (Mpa)	108 gpm (lpm)	684 psi (Mpa)	157 gpm (lpm)	1000 psi (Mpa)	207 gpm (lpm)	1317 psi (Mpa)	257 gpm (lpm)	1633 psi (Mpa)	307 gpm (lpm)	1950 psi (Mpa))
4 (101.6)	2.18 (8.2)	109 (412)	16473 (114)	234 (886)	16473 (114)	343 (1297)	11258 (78)	451 (1707)	8551 (59)	559 (2118)	6893 (48)	668 (2528)	5774 (40)
4 ½ (114.3)	2.75 (10.4)	138 (512)	13015 (90)	296 (1122)	13015 (90)	434 (1641)	8895 (61)	571 (2161)	6756 (47)	708 (2680)	5447 (38)	845 (3200)	4562 (31)
5 (127)	3.40 (12.9)	170 (643)	10542 (73)	366 (1385)	10542 (73)	535 (2026)	7205 (50)	705 (2667)	5473 (38)	874 (3309)	4412 (30)	1044 (3950)	3695 (25)
Input Power: BHP (kW)		1162 (866)		2500 (1864)		2500 (1864)		2500 (1864)		2500 (1864)		2500 (1864)	

[1] Based on 90% ME and 100% VE–Intermitten Service Only.

[2] Pumps operating in excess of 15,000 psil require special gauge and discharge flanges. Contact SPM Engineering for information.

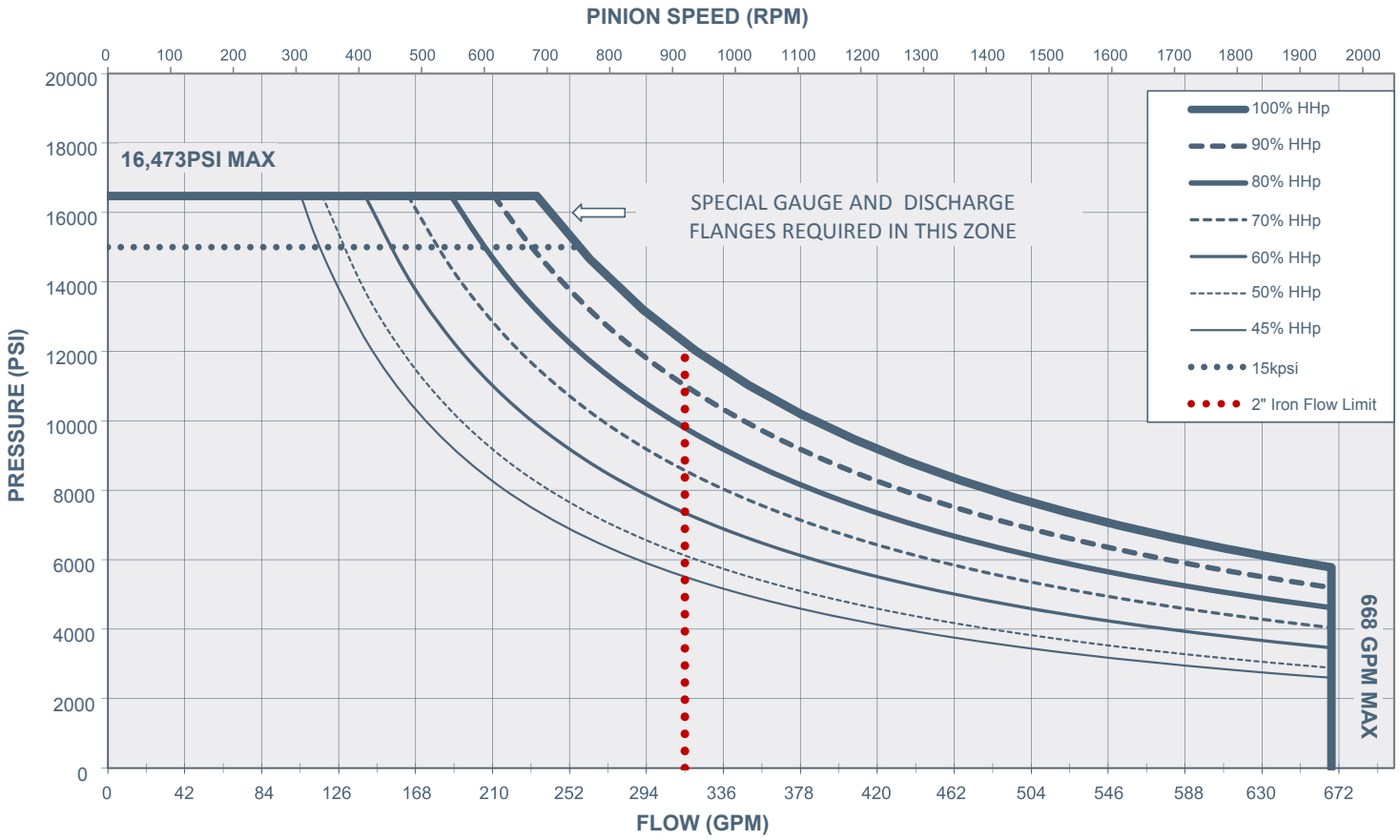
Cells highlighted in blue are are intermediate zones where erosion is more prevalent when 3" iron is used (MAX 778 GPM/2945LPM)

SPM® QWS 2500 XL Pinion Torque Curve

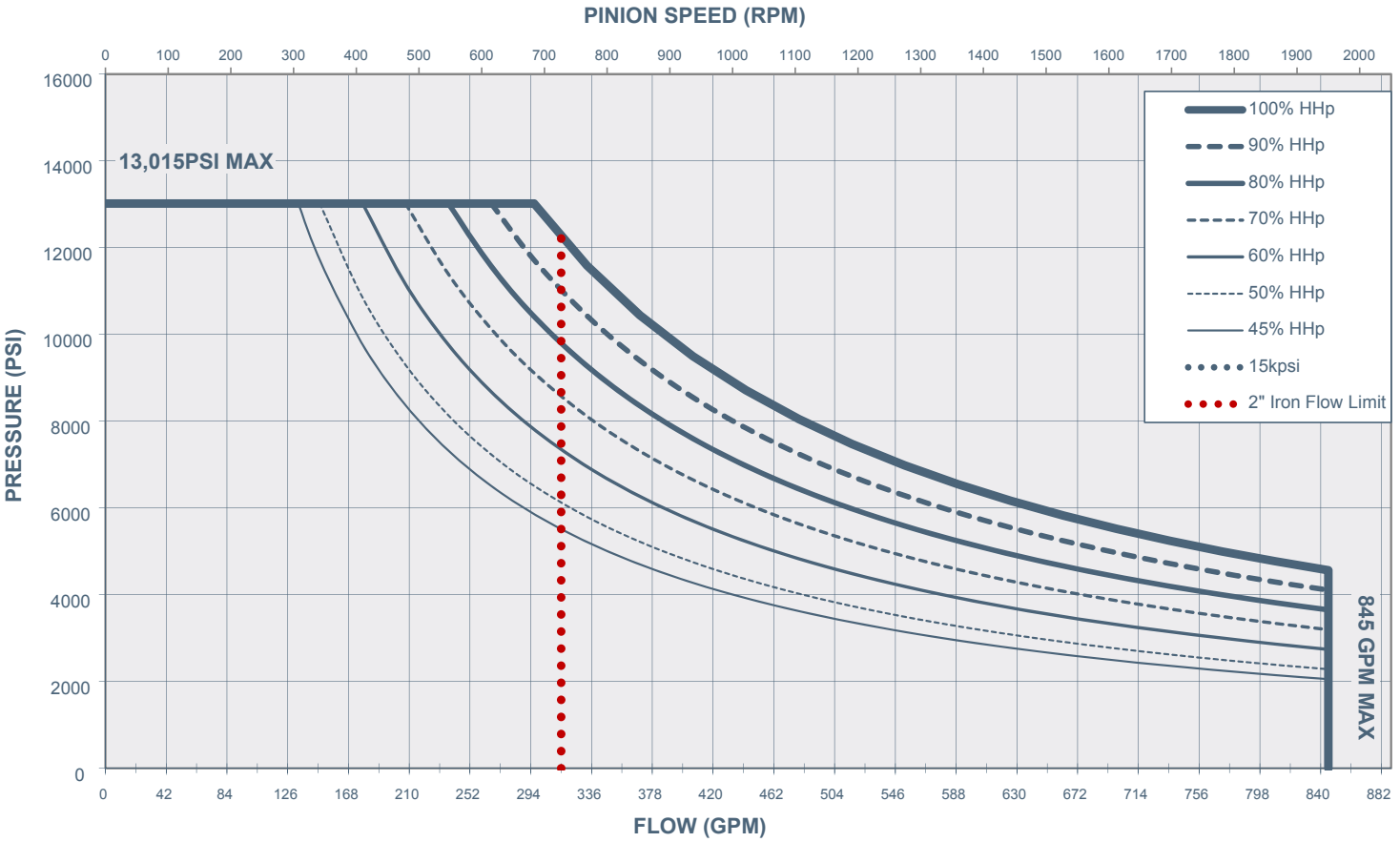


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SPM® QWS 2500 XL – 4.00” Plunger Horsepower Curve

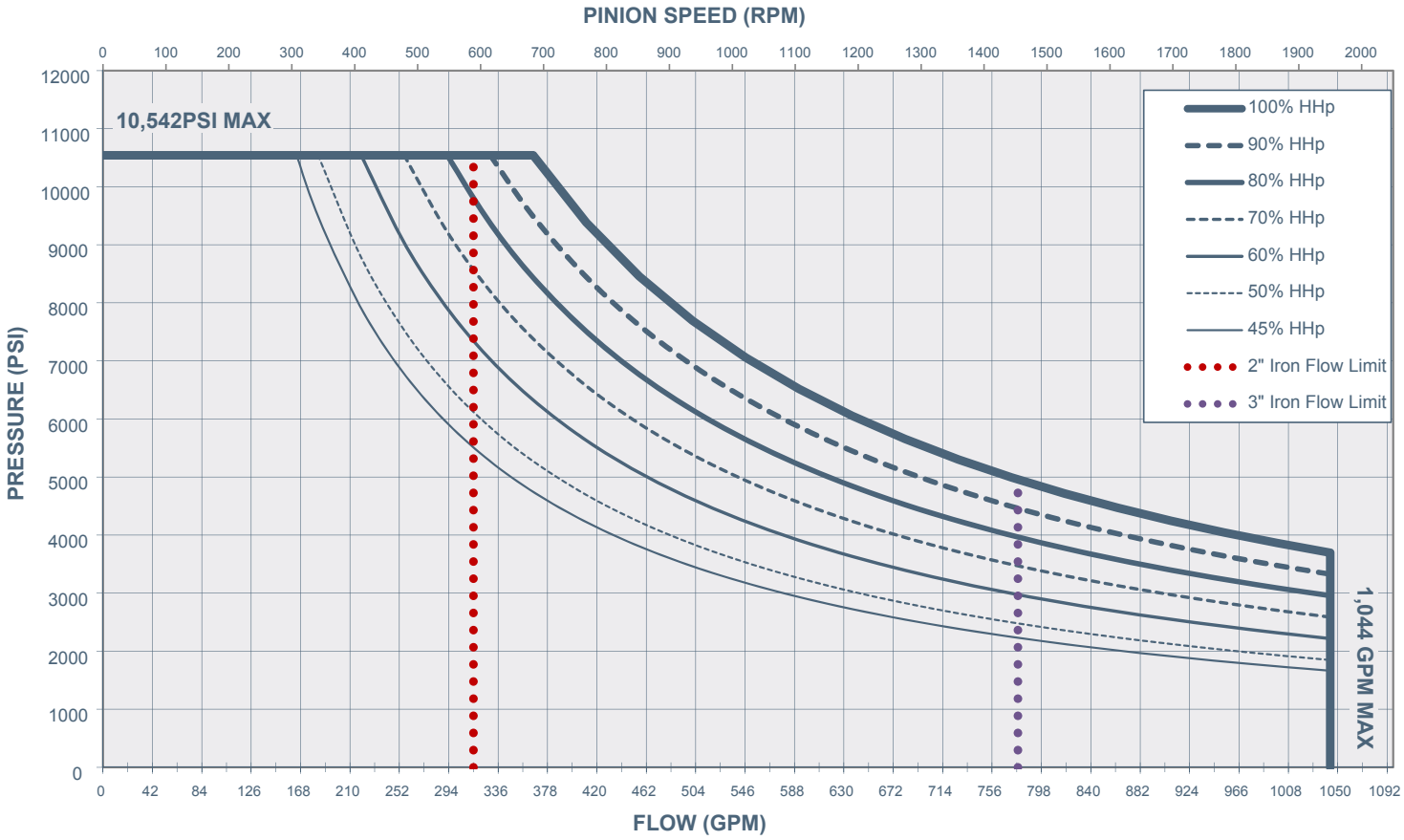


SPM® QWS 2500 XL – 4.50” Plunger Horsepower Curve



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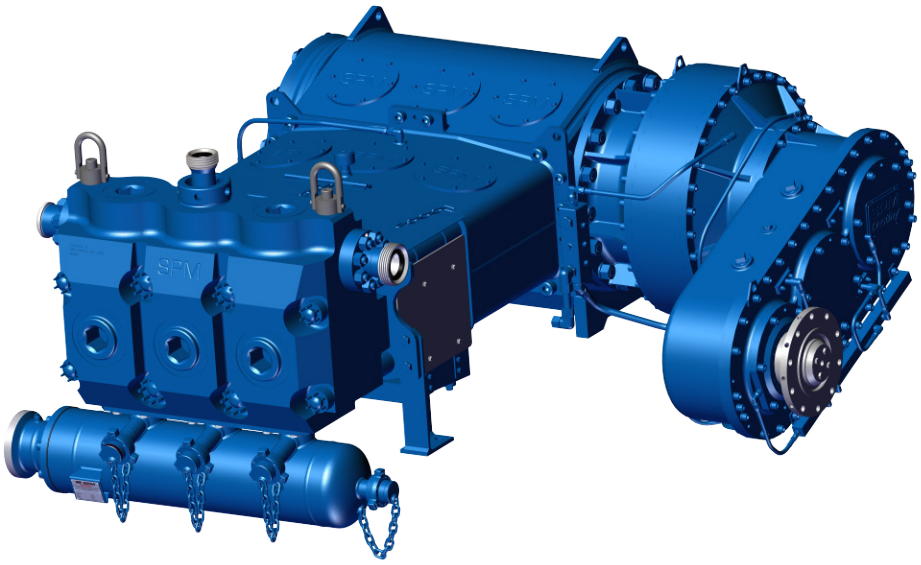
SPM® QWS 2500 XL – 5.00” Plunger Horsepower Curve



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SPM® Destiny®TWS 2500 Frac Pump

Intermittent Duty Pumps



The SPM® Destiny® TWS 2500 frac pump is designed for operation in today's harshest multistage frac applications with a 2500 horsepower rating, 273,000 lbf rod load, and 10" stroke. The longer stroke requires fewer cycles to produce an equivalent flow rate compared to an 8" stroke quintuplex pump, resulting in less overall wear on expendables and improved overall pump durability.

Features and Benefits

- High flow output via 10-inch stroke for reduced cycles and improved operation
- Designed to achieve lower operating costs
- Available with patented Duralast® fluid end technology

Applications: Fracturing

Maximum Brake Horsepower Input ..... 2500 BHP (1,864 kW)
Maximum Rod Load Capacity ..... 273,000 lb_f (1,214 kg)
Stroke Length ..... 10" (254 mm)
Gear Ratio 6.375:1
Approximate Length ..... 91" (2,311 mm)
Approximate Width ..... 88" (2,235 mm)
Approximate Height ..... 39" (9,991 mm)
Approximate Weight (Dry) ..... 14,450 lb (6,560 kg)

Note: Pump dimensions and weights are approximate. For full detailed drawings, please contact Weir.

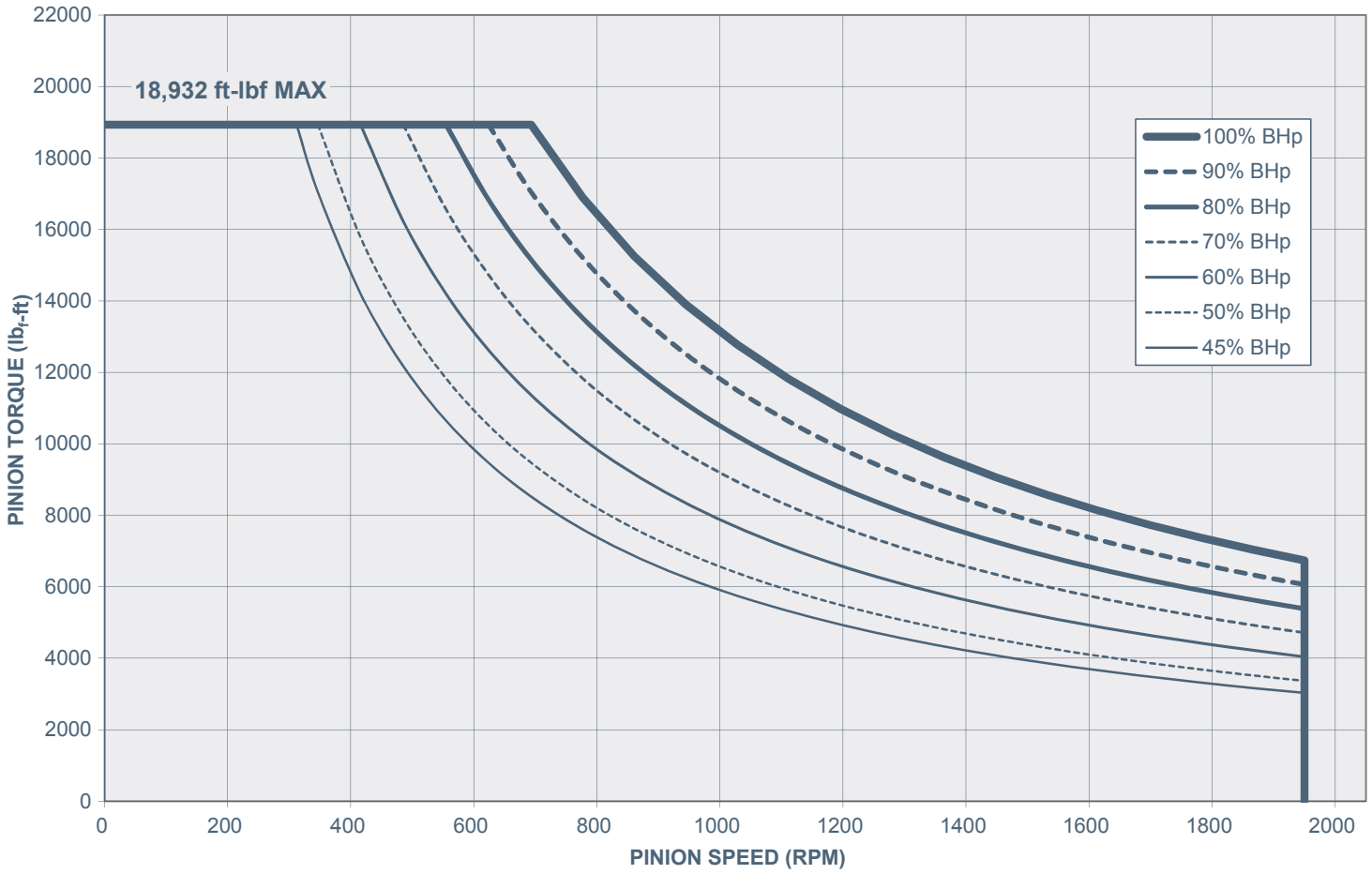
TWS 2500 Pump–Performance Chart[1,2]

Plunger Diameter in (mm)	Displace Per Rev gal/rev (liter/rev)	Displacement at Pump Strokes per Minute/Pinion RPM											
		50 gpm (lpm)	319 psi (Mpa)	109 gpm (lpm)	694 psi (Mpa)	158 gpm (lpm)	1008 psi (Mpa)	207 gpm (lpm)	1322 psi (Mpa)	257 gpm (lpm)	1636 psi (Mpa)	306 gpm (lpm)	1950 psi (Mpa))
4 (101.6)	1.63 (6.2)	82 (309)	21725 (150)	178 (672)	21721 (150)	258 (976)	14950 (103)	338 (1281)	11397 (79)	419 (1585)	9209 (63)	499 (1889)	7725 (53)
4 ½ (114.3)	2.07 (7.8)	103 (391)	17165 (118)	225 (851)	17162 (118)	326 (1236)	11812 (81)	428 (1621)	9005 (62)	530 (2006)	7276 (50)	632 (2391)	6104 (42)
5 (127)	2.55 (9.7)	127 (483)	13904 (96)	277 (1050)	13901 (96)	403 (1526)	9568 (66)	529 (2001)	7294 (50)	654 (2477)	5894 (41)	780 (2952)	4944 (34)
Input Power: BHP (kW)		1149 (857)		2500 (1864)		2500 (1864)		2500 (1864)		2500 (1864)		2500 (1864)	

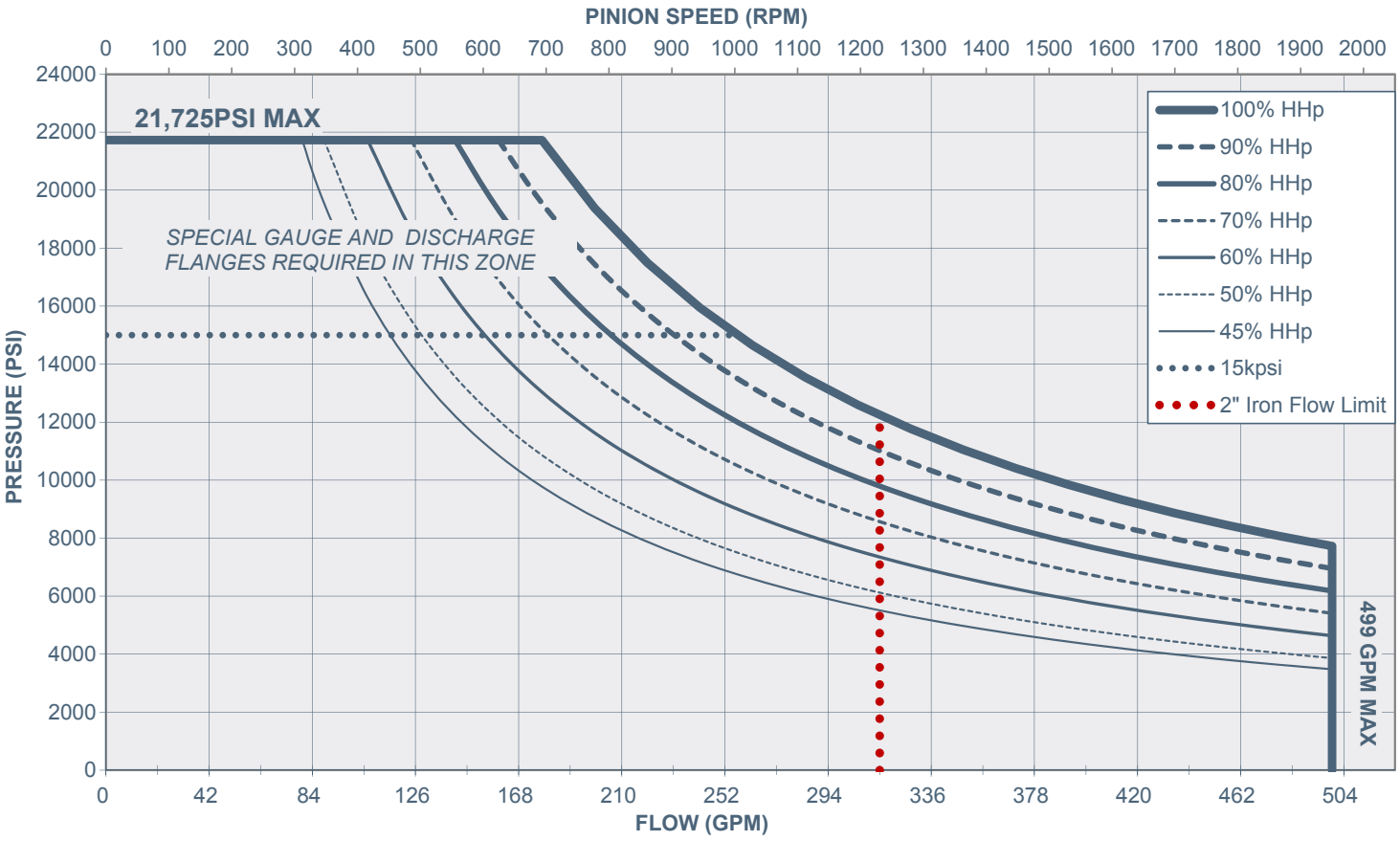
[1] Based on 90% ME and 100% VE–Intermitten Service Only.
[2] Pumps operating in excess of 15,000 psil require special gauge and discharge flanges. Contact SPM Engineering for information.
Cells highlighted in blue are are intermediate zones where erosion is more prevalent when 3" iron is used (MAX 778 GPM/2945LPM)

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SPM® TWS 2500 Pinion Torque Curve

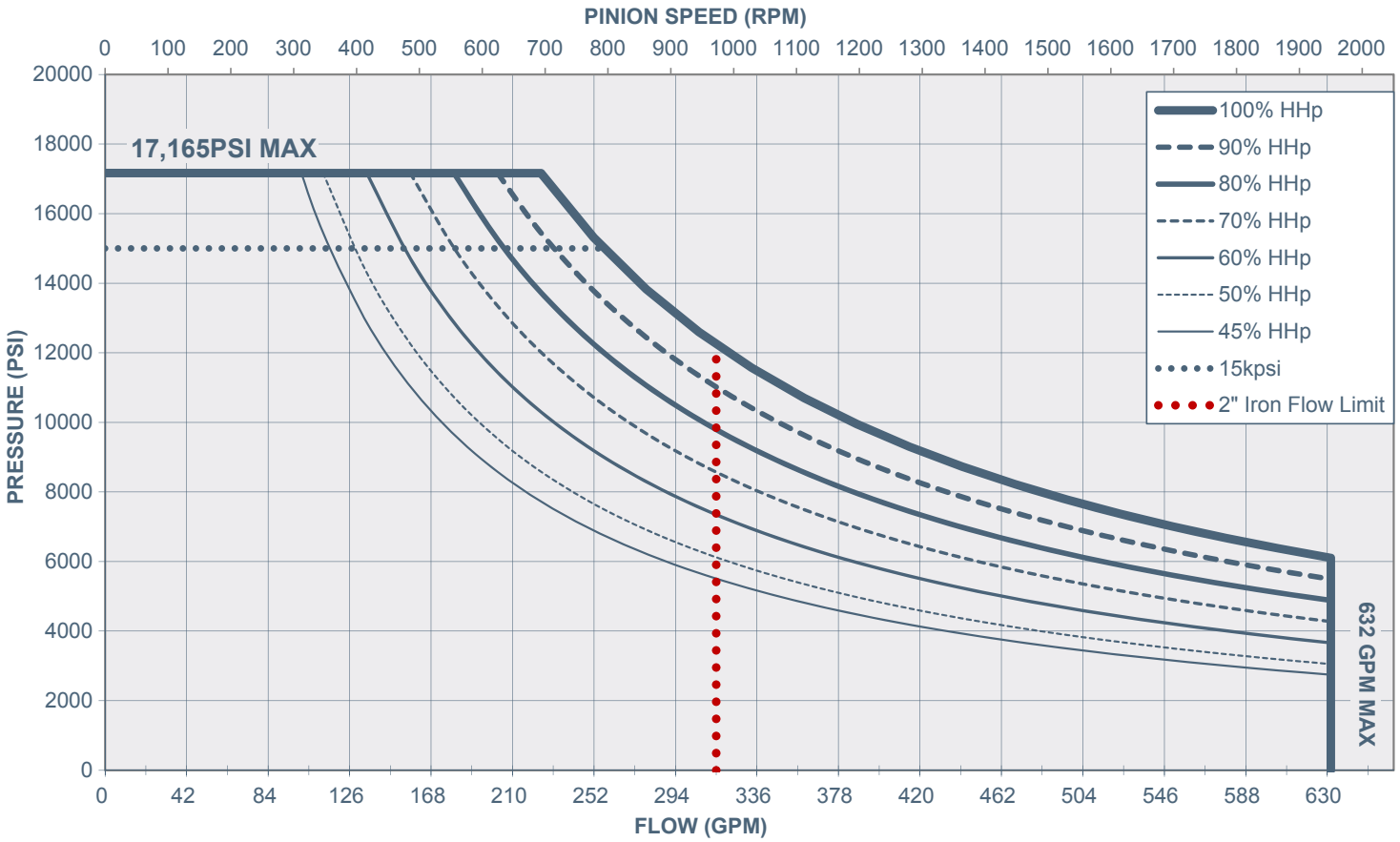


SPM® TWS 2500 – 4.00" Plunger Horsepower Curve

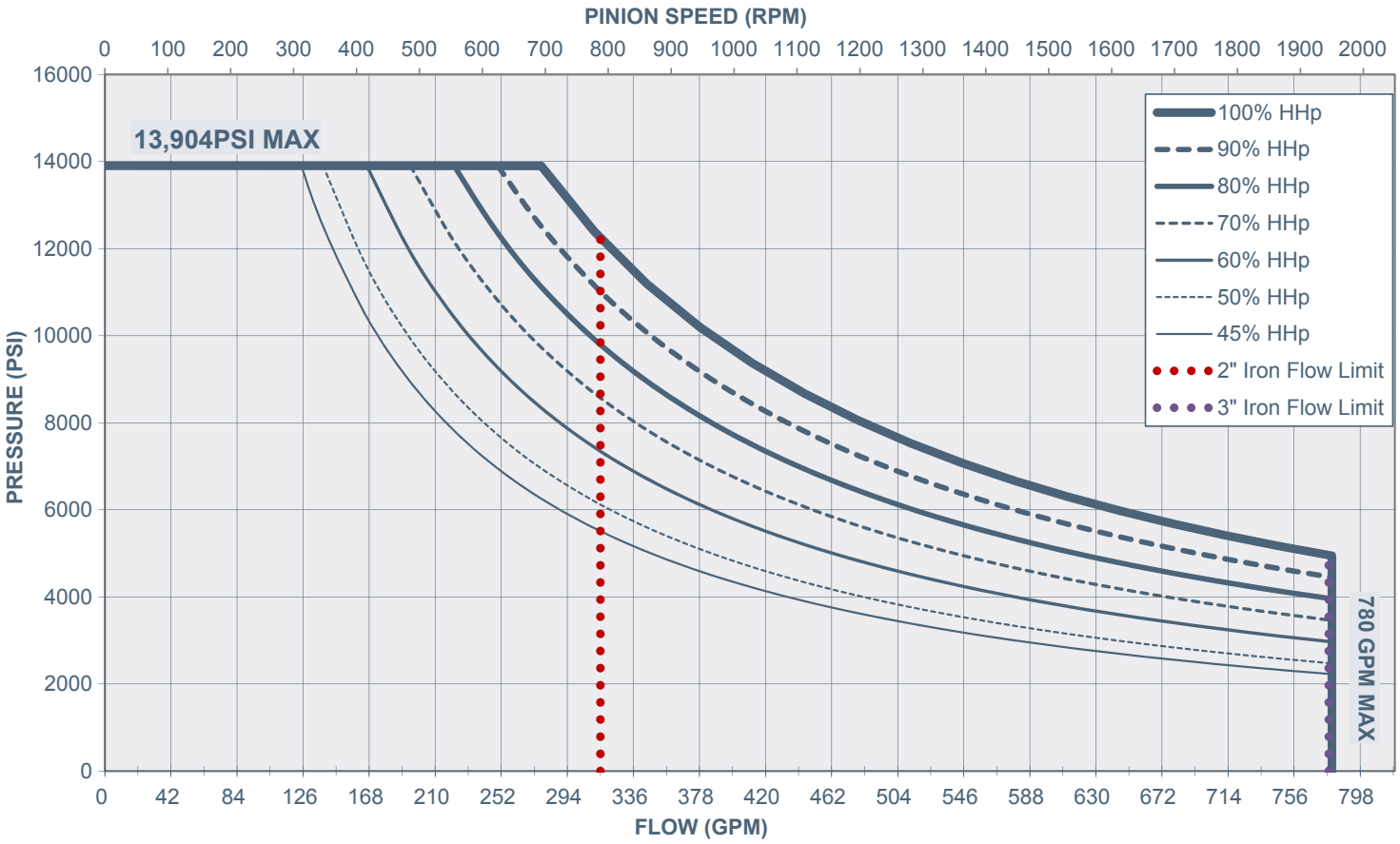


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SPM® TWS 2500 – 4.50” Plunger Horsepower Curve



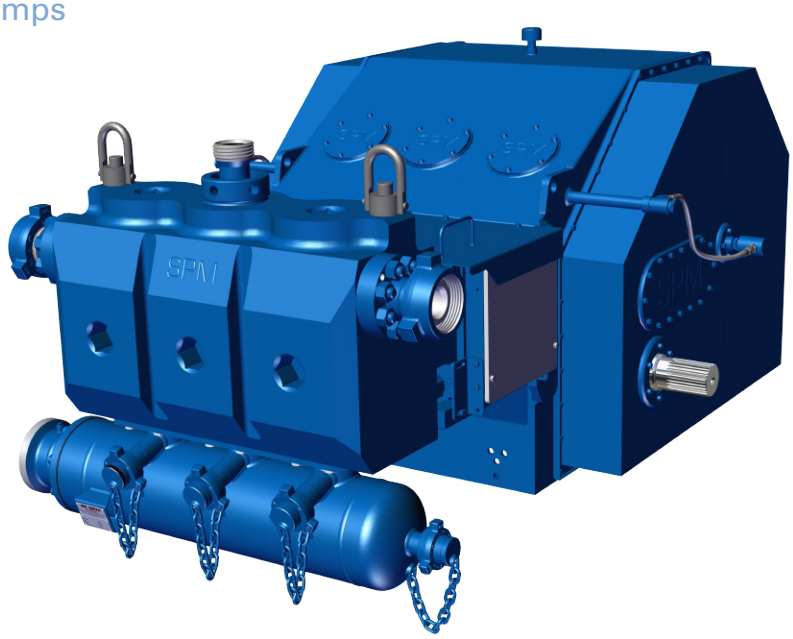
SPM® TWS 2500 – 5.00” Plunger Horsepower Curve



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SPM® TWS 2250 Frac Pump

Intermittent Duty Pumps



The SPM® TWS 2250 frac pump offers great pressure and flow ratings in a smaller package than the large quintuplex pumps available in the market. Standard plunger sizes include four inch, four and half inch and five inch. They are also available in three and three quarters, five and a half and five and three quarters.

Features and Benefits

- Established through long history in the field
- Light weight package
- Available with DSS manifold and an array of fluid end sizes and configurations

Applications: Fracturing

Maximum Brake Horsepower Input ..... 2250 BHP (1,678 kW)
Maximum Rod Load Capacity ..... 238,570 lb_f (1,061 kg)
Stroke Length ..... 8" (203.2 mm)
Gear Ratio 6.353:1
Approximate Length ..... 89.9" (2,284 mm)
Approximate Width ..... 59.8" (1,519 mm)
Approximate Height ..... 44.3" (1,125 mm)
Approximate Weight (Dry) ..... 11,750 lb (5,330 kg)

Note: Pump dimensions and weights are approximate. For full detailed drawings, please contact Weir.

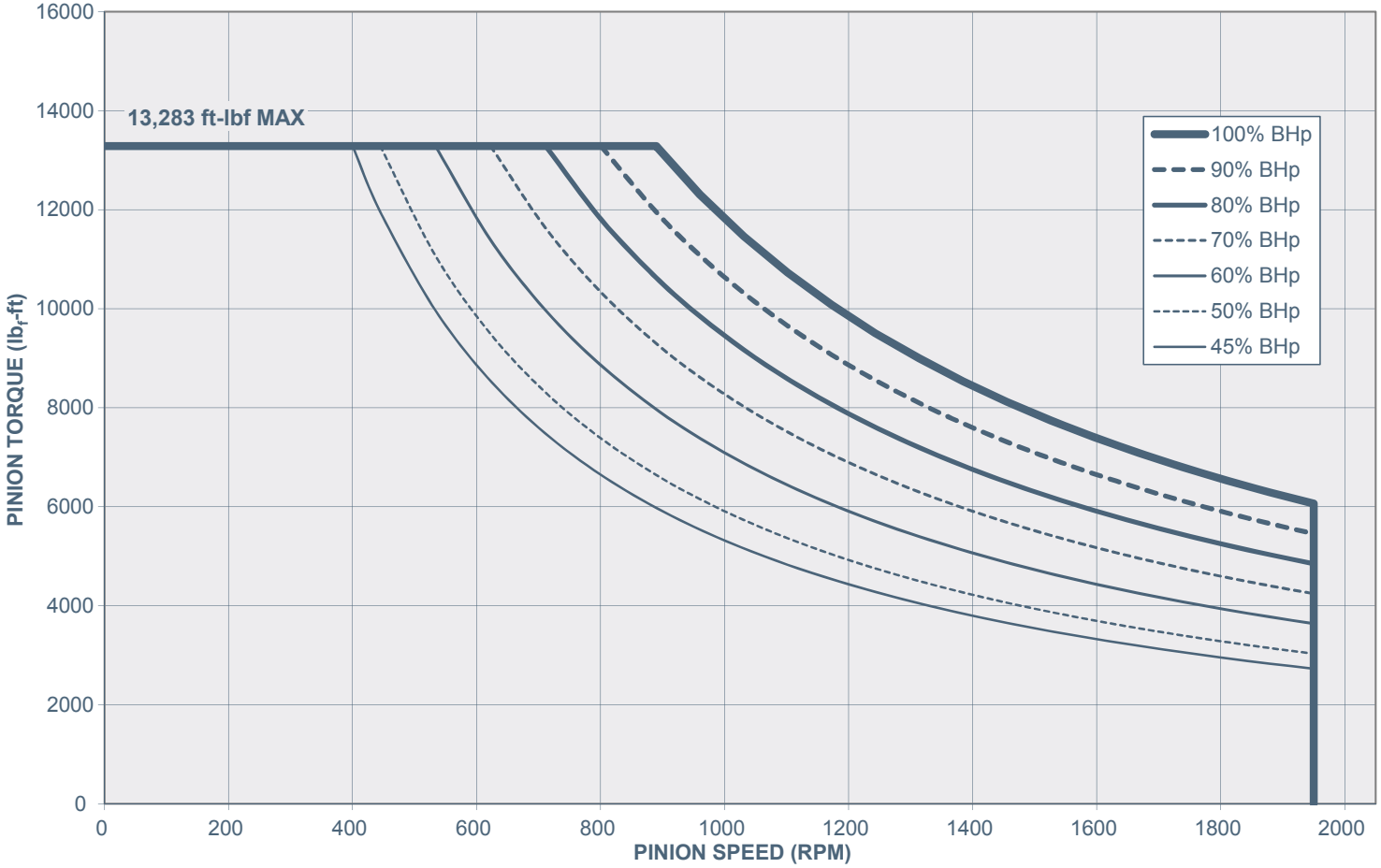
TWS 2250 Pump–Performance Chart[1,2]

Plunger Diameter in (mm)	Displace Per Rev gal/rev (liter/rev)	Displacement at Pump Strokes per Minute/Pinion RPM											
		50 gpm (lpm)	318 psi (Mpa)	140 gpm (lpm)	890 psi (Mpa)	182 gpm (lpm)	1155 psi (Mpa)	223 gpm (lpm)	1420 psi (Mpa)	265 gpm (lpm)	1685 psi (Mpa)	307 gpm (lpm)	1950 psi (Mpa))
4 (101.6)	1.31 (4.9)	65 (247)	18985 (131)	183 (692)	18985 (131)	237 (898)	14626 (101)	292 (1104)	11895 (82)	346 (1311)	10024 (69)	401 (1517)	8661 (60)
4 ½ (114.3)	1.65 (6.3)	83 (313)	15000 (103)	231 (876)	15000 (103)	300 (1137)	11557 (80)	369 (1398)	9399 (65)	438 (1659)	7920 (55)	507 (1920)	6843 (47)
5 (127)	2.04 (7.7)	102 (386)	12150 (84)	286 (1081)	12150 (84)	371 (1403)	9361 (65)	456 (1726)	7613 (52)	541 (2048)	6415 (44)	626 (2370)	5543 (38)
Input Power: BHP (kW)		803 (599)		2250 (1678)		2250 (1678)		2250 (1678)		2250 (1678)		2250 (1678)	

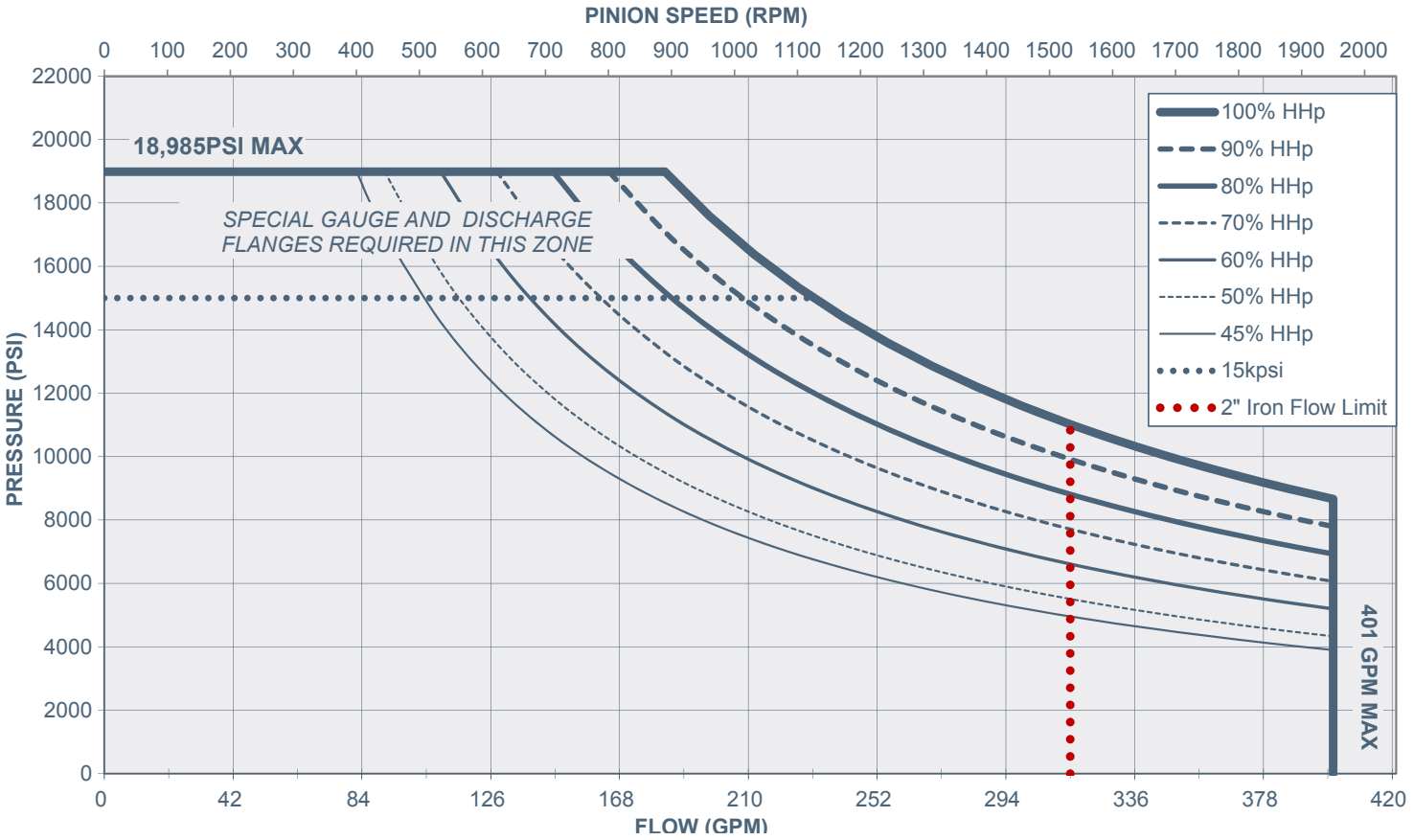
[1] Based on 90% ME and 100% VE–Intermitten Service Only.
[2] Pumps operating in excess of 15,000 psil require special gauge and discharge flanges. Contact SPM Engineering for information.

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SPM® TWS 2250 Pinion Torque Curve

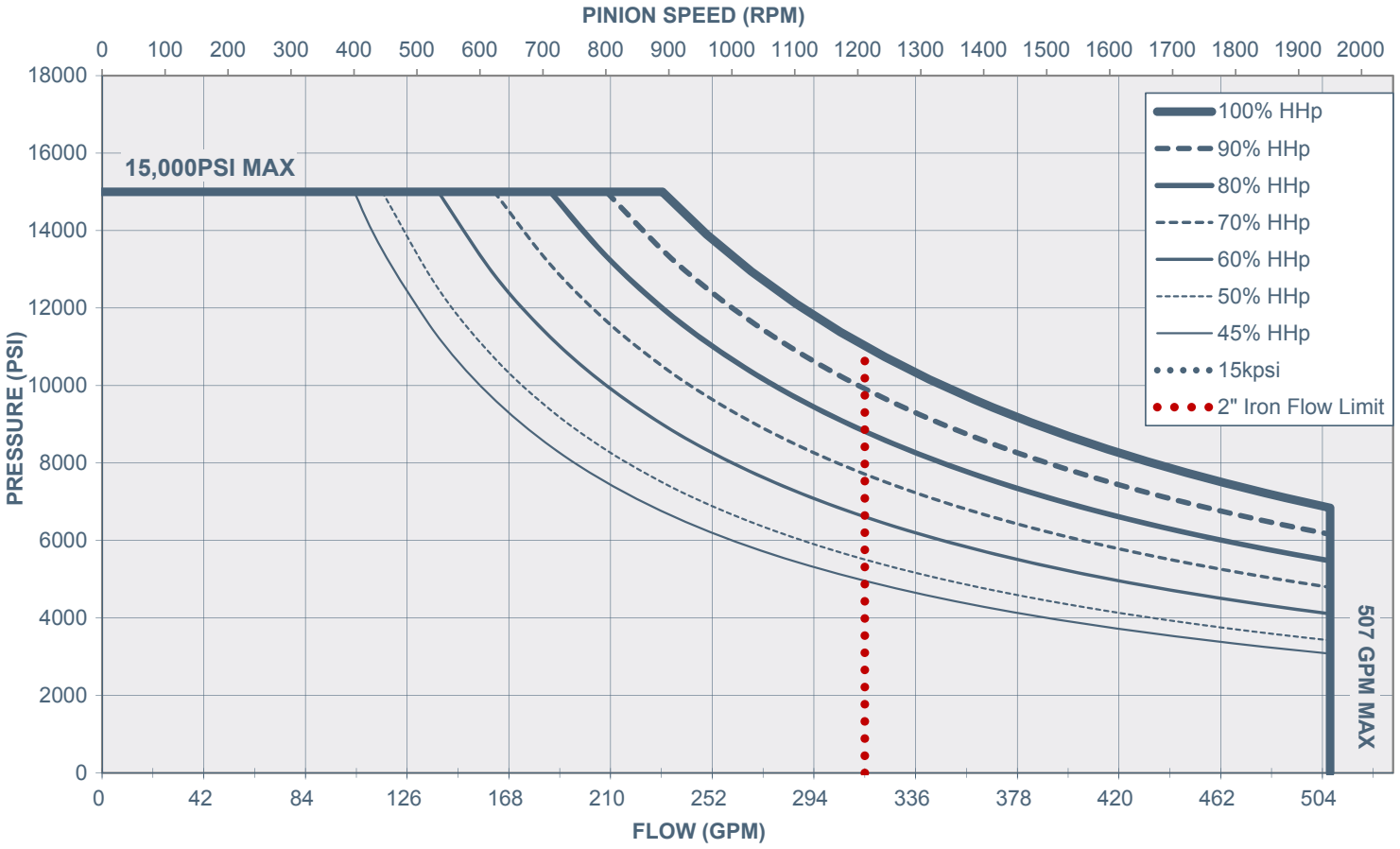


SPM® TWS 2250 4.00" Plunger Horsepower Curve

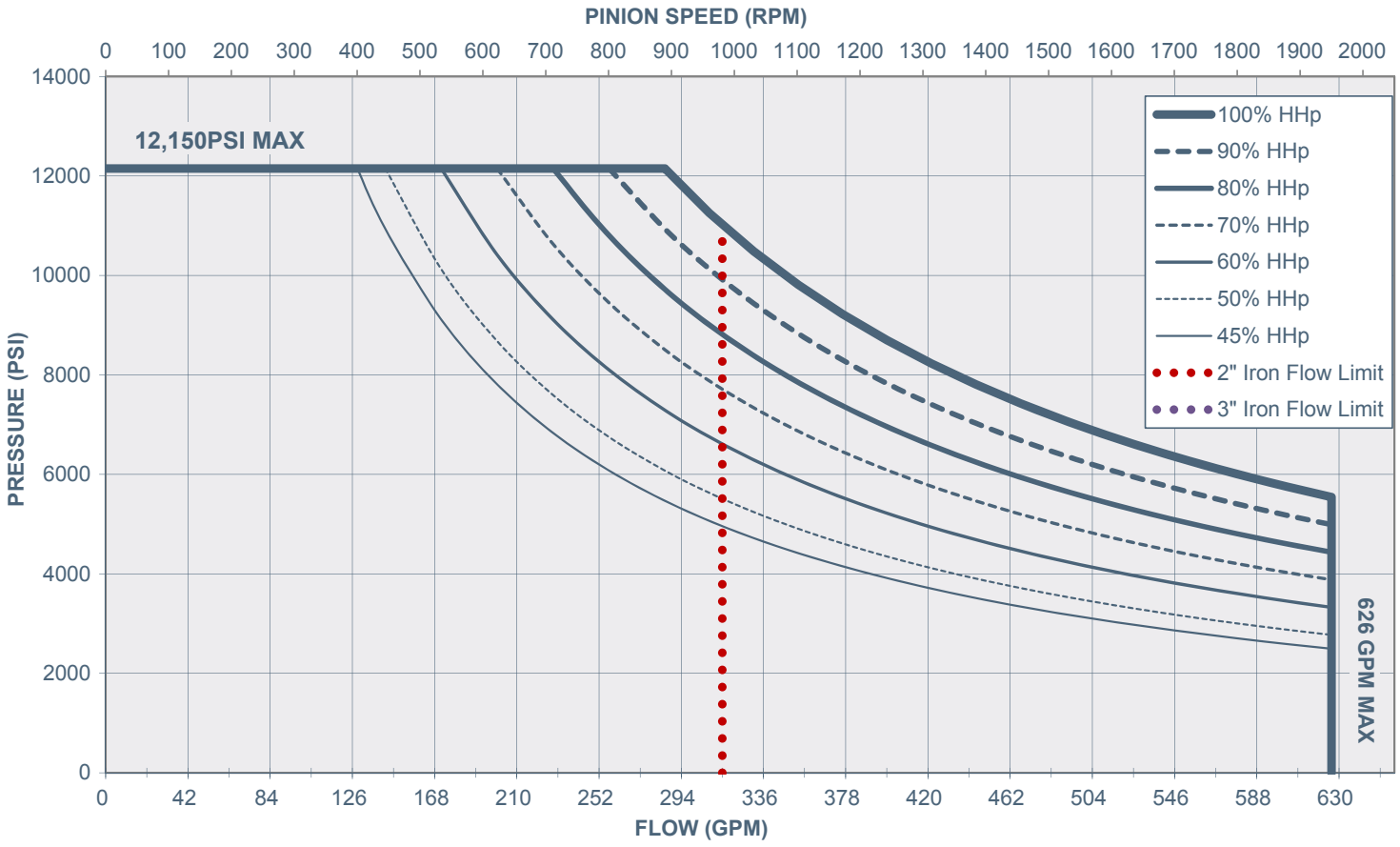


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SPM® TWS 2250 4.50” Plunger Horsepower Curve



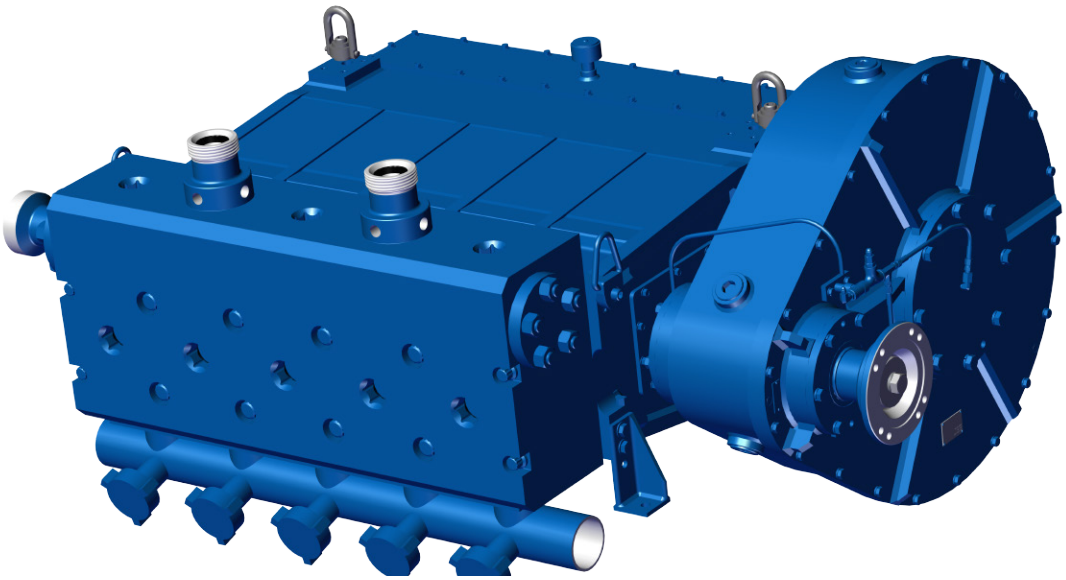
SPM® TWS 2250 5.00” Plunger Horsepower Curve



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SPM® QWS 1000S Frac Pump

Intermittent Duty Pumps



The SPM® QWS 1000S HD pump is specifically engineered to reduce downtime due to maintenance while improving rod load and high pressure capabilities.

The Heavy Duty design is built with quick and practical maintenance in mind, while supplying 6% higher rod load at pressures of 15,000 psi utilizing a 3" plunger and 20,000 psi utilizing a 2.5" plunger. The QWS 1000S HD pump has been designed to eliminate contamination from pumping media into the power end, lengthening pump component life. Retrofit kits are available for customers currently operating QWS 1000S pumps, helping them make the transition to the QWS 1000S HD pump. Customers are able to update their units to the latest technology without the capital investment of a complete new unit.

This pump is offered certified by DNV, ABS, CE and/or ISO.

Features and Benefits

- 6% higher rod load compared to SPM® QWS 1000S
- Eliminates contamination into power end, extending life
- Lighter weight than SPM® QWS 1000S

Applications: Cementing, acidizing, gravel packing, snubbing

Maximum Brake Horsepower Input	1000 BHP (746 kW)
Maximum Rod Load Capacity	106,029lbf (472 kg)
Stroke Length	6" (152.4 mm)
Gear Ratio	4.610:1
Approximate Length	50" (1,270 mm)
Approximate Width	73" (1,854 mm)
Approximate Height	24" (609 mm)
Approximate Weight (Dry)	7,040 lb (3,193 kg)

Note: Pump dimensions and weights are approximate. For full detailed drawings, please contact Weir.

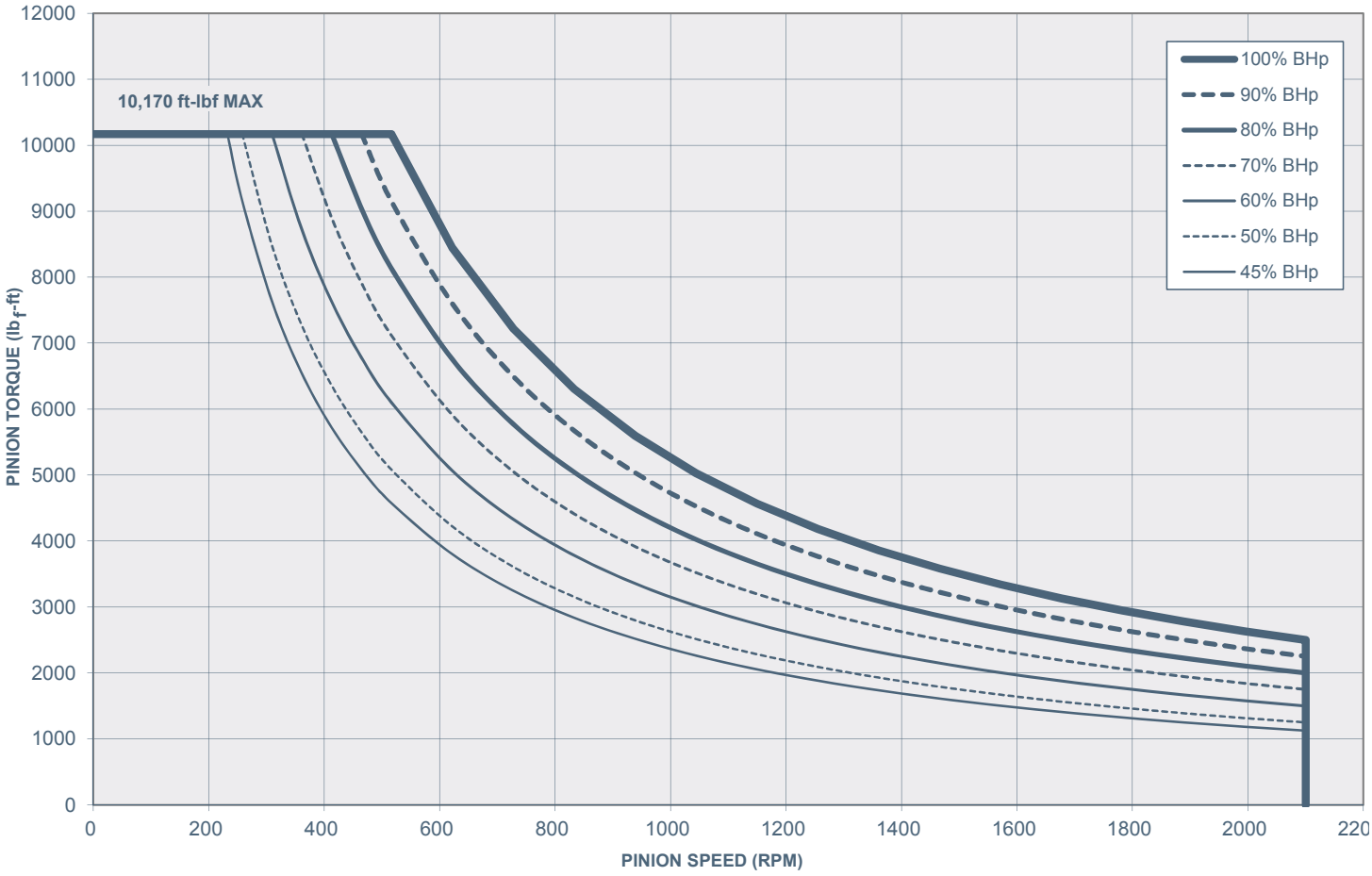
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QWS 1000S & QWS 1000S HD Pump–Performance Chart[1,2]

Plunger Diameter	Displace Per Rev	Displacement at Pump Strokes per Minute/Pinion RPM											
in (mm)	gal/rev (liter/rev)	50 gpm (lpm)	231 psi (Mpa)	112 gpm (lpm)	516 psi (Mpa)	198 gpm (lpm)	912 psi (Mpa)	284 gpm (lpm)	1308 psi (Mpa)	370 gpm (lpm)	1704 psi (Mpa)	456 gpm (lpm)	2100 psi (Mpa))
2 ½ (63.5)	0.64 (2.4)	32 (121)	21600 (149)	71 (270)	21600 (149)	126 (478)	12227 (84)	181 (685)	8527 (59)	236 (892)	6546 (45)	290 (1099)	5312 (37)
2 ¾ (69.9)	0.77 (2.9)	39 (146)	17851 (123)	86 (327)	17851 (123)	153 (578)	10105 (70)	219 (829)	7047 (49)	285 (1079)	5410 (37)	351 (1330)	4390 (30)
3 (76.2)	0.92 (3.5)	46 (174)	15000 (103)	103 (389)	15000 (103)	182 (688)	8491 (59)	261 (986)	5921 (41)	339 (1284)	4546 (31)	418 (1583)	3689 (25)
3 ½ (88.9)	1.25 (4.7)	62 (236)	11020 (76)	140 (530)	11020 (76)	247 (936)	6238 (43)	355 (1342)	4350 (30)	462 (1748)	3340 (23)	569 (2154)	2710 (19)
4 (101.6)	1.63 (6.2)	82 (309)	8438 (58)	183 (692)	8438 (58)	323 (1222)	4776 (33)	463 (1753)	3331 (23)	603 (2283)	2557 (18)	743 (2814)	2075 (14)
4 ½ (114.3)	2.07 (7.8)	103 (391)	6667 (46)	231 (876)	6667 (46)	409 (1547)	3774 (26)	586 (2219)	2632 (18)	764 (2890)	2020 (14)	941 (3561)	1639 (11)
Input Power: BHP (kW)		446 (333)		1000 (746)		1000 (746)		1000 (746)		1000 (746)		1000 (746)	

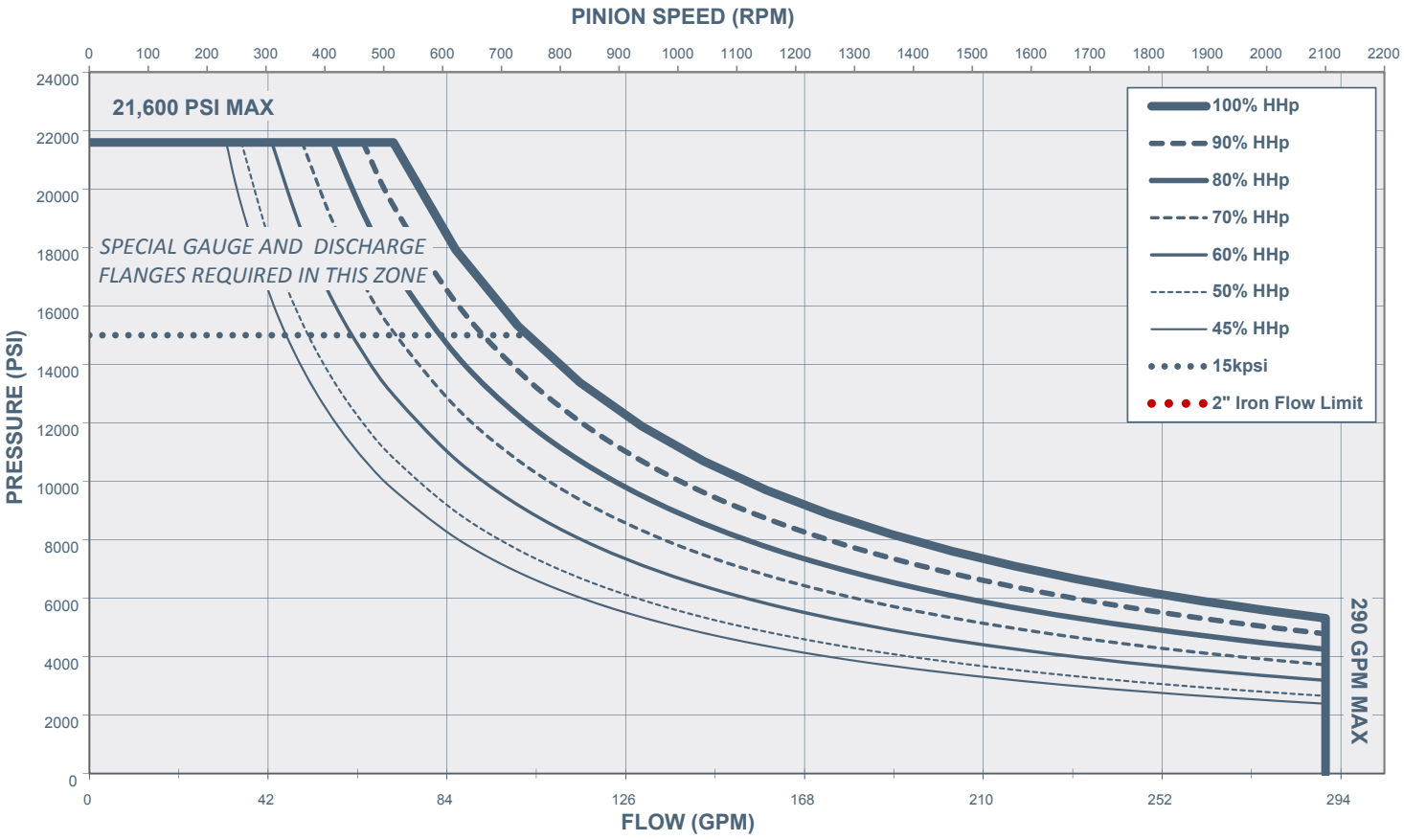
[1] Based on 90% ME and 100% VE–Intermitten Service Only.
[2] Pumps operating in excess of 15,000 psil require special gauge and discharge flanges. Contact SPM Engineering for information.
Cells highlighted in blue are are intermediate zones where erosion is more prevalent when 3" iron is used (MAX 778 GPM/2945LPM)

SPM® QWS 1000 Pinion Torque Curve

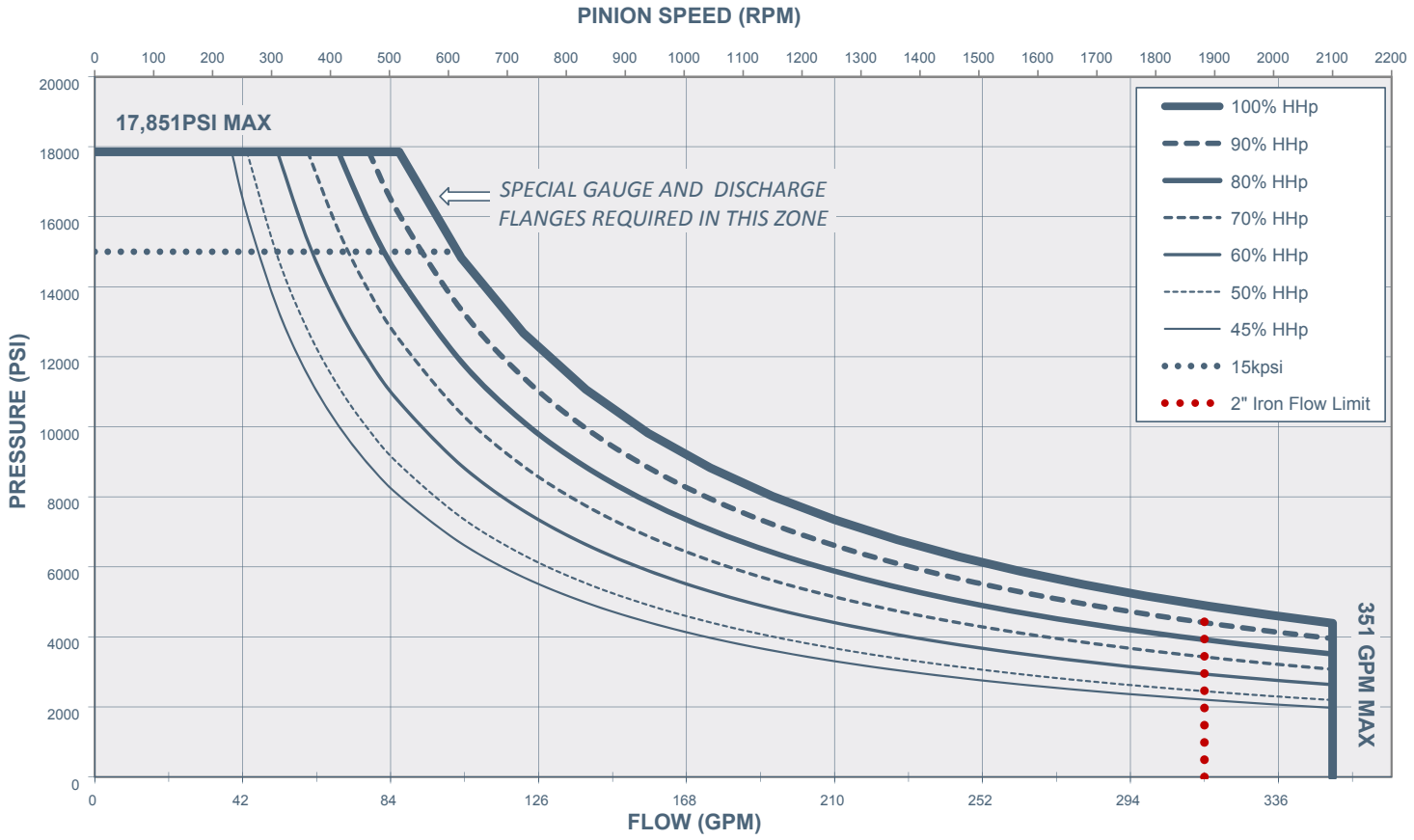


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SPM® QWS 1000S & QWS 1000S HD 2.50” Plunger Horsepower Curve

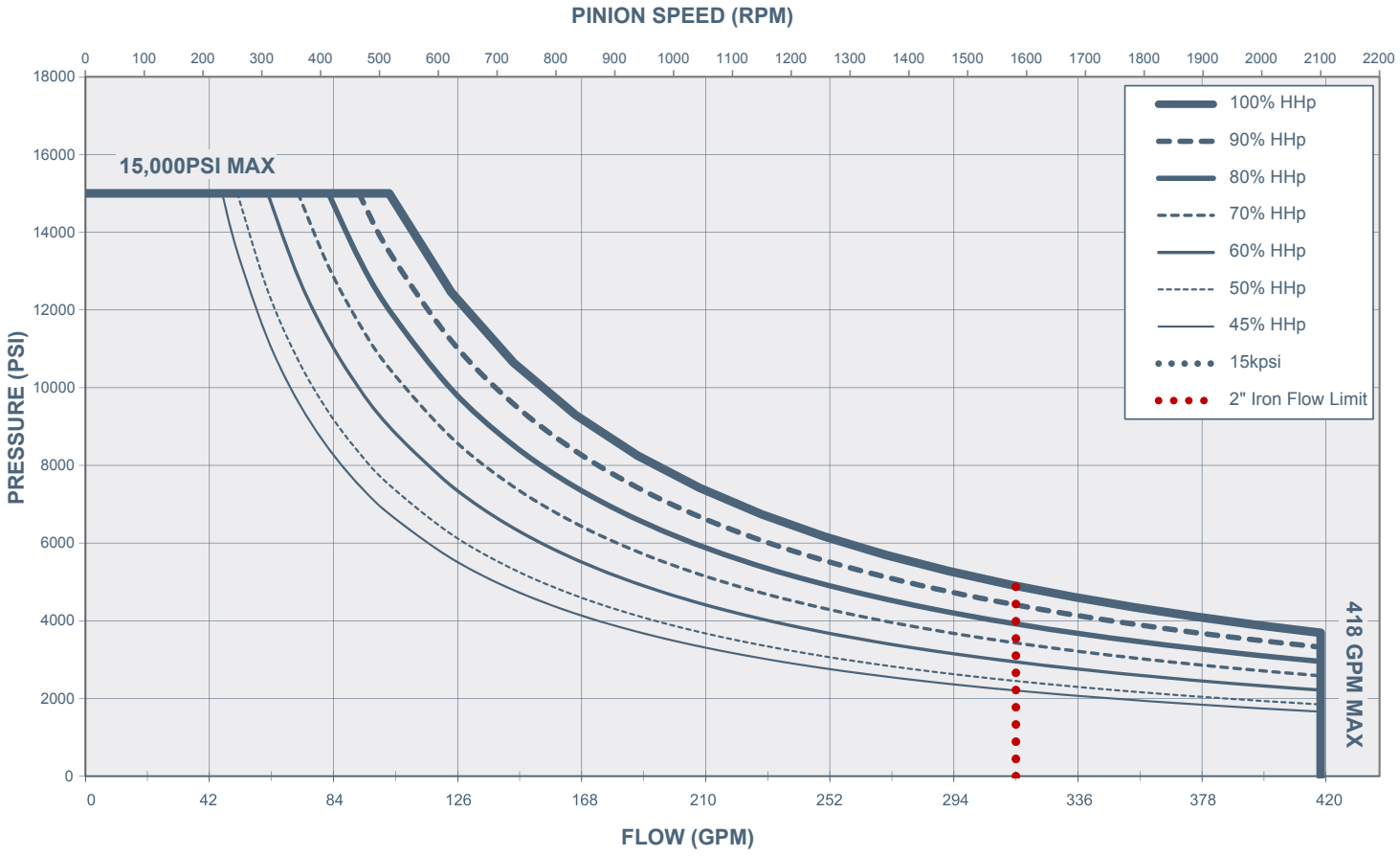


SPM® QWS 1000S & QWS 1000S HD 2.75” Plunger Horsepower Curve

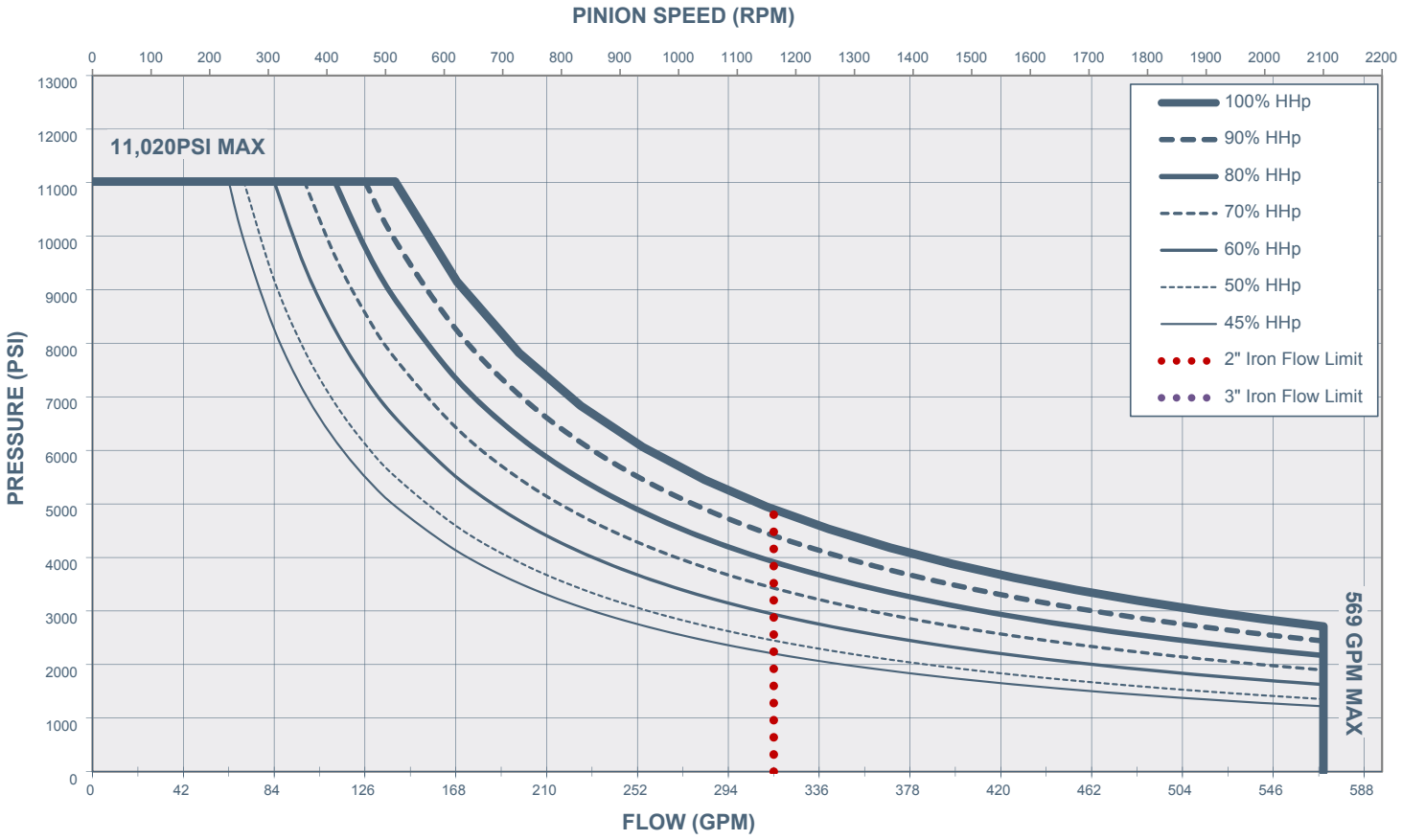


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SPM® QWS 1000S & QWS 1000S HD 3.00” Plunger Horsepower Curve

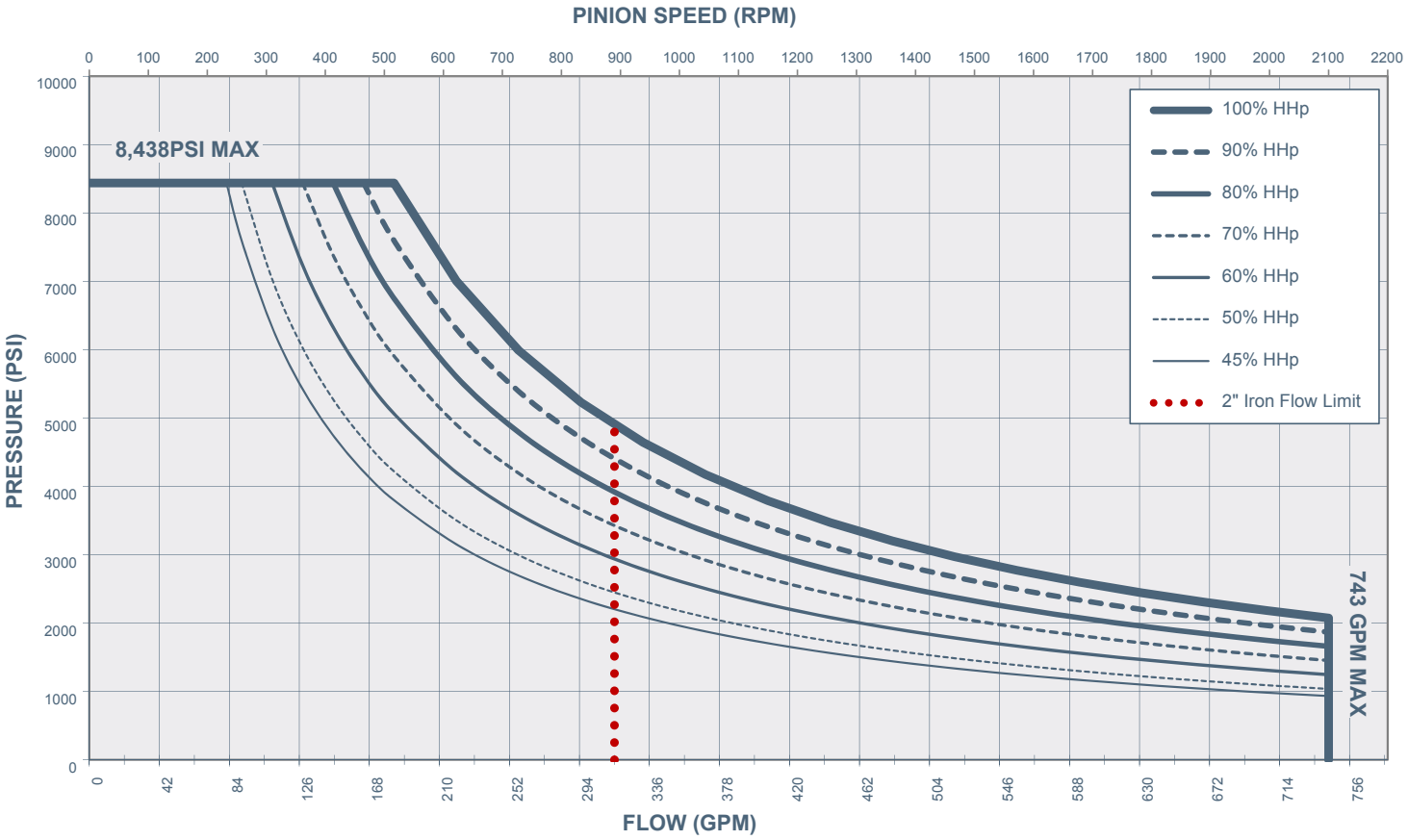


SPM® QWS 1000S & QWS 1000S HD 3.50” Plunger Horsepower Curve

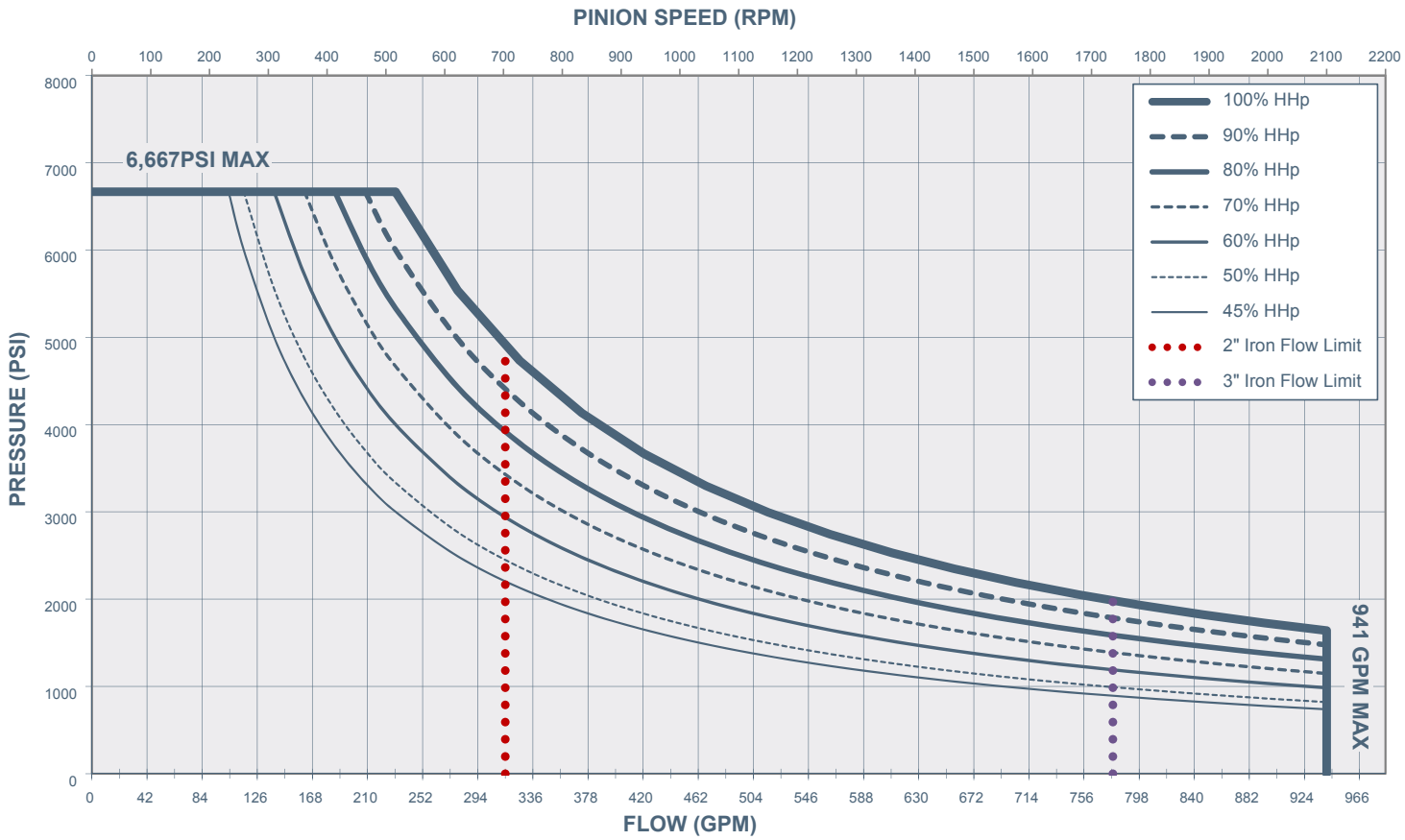


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SPM® QWS 1000S & QWS 1000S HD 4.00” Plunger Horsepower Curve



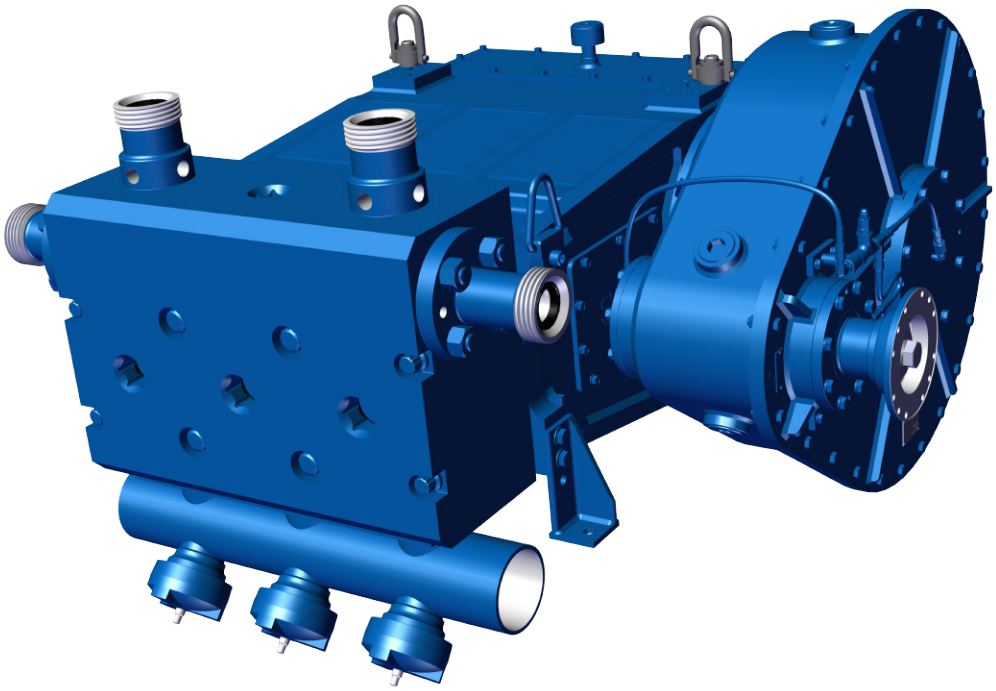
SPM® QWS 1000S & QWS 1000S HD 4.50” Plunger Horsepower Curve



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SPM® TWS 600S HD Well Service Pump

Intermittent Duty Pumps



The SPM® TWS 600S HD pump is specifically engineered to reduce downtime due to maintenance while improving rod load and high pressure capabilities. The heavy duty design is built with quick and practical maintenance in mind, while supplying 6% higher rod load at pressures of 15,000 psi utilizing a 3" plunger and 20,000 psi utilizing a 2.5" plunger. The TWS 600S HD pump is designed to eliminate contamination from pumping media into the power end, extending pump component life. Retrofit kits are available for customers currently operating TWS 600S pumps, helping them make the transition to the TWS 600S HD pump. Customers are able to update their units to the latest technology without the capital investment of a complete new unit.

This pump is available certified by DNV, ABS, CE, and/or ISO.

Features and Benefits

- 6% higher rod load compared to SPM® TWS600S
- Eliminates contamination into power end, extending life
- Lighter weight than SPM® TWS600S

Applications: Cementing, acidizing, gravel packing, snubbing

Maximum Brake Horsepower Input	600 BHP (447 kW)
Maximum Rod Load Capacity	106,029lbf (472 kg)
Stroke Length	6" (152.4 mm)
Gear Ratio	4.610:1
Approximate Length	50" (1,270 mm)
Approximate Width	53" (1,346 mm)
Approximate Height	24" (610 mm)
Approximate Weight (Dry)	4,600 lb (2,086 kg)

Note: Pump dimensions and weights are approximate. For full detailed drawings, please contact Weir.

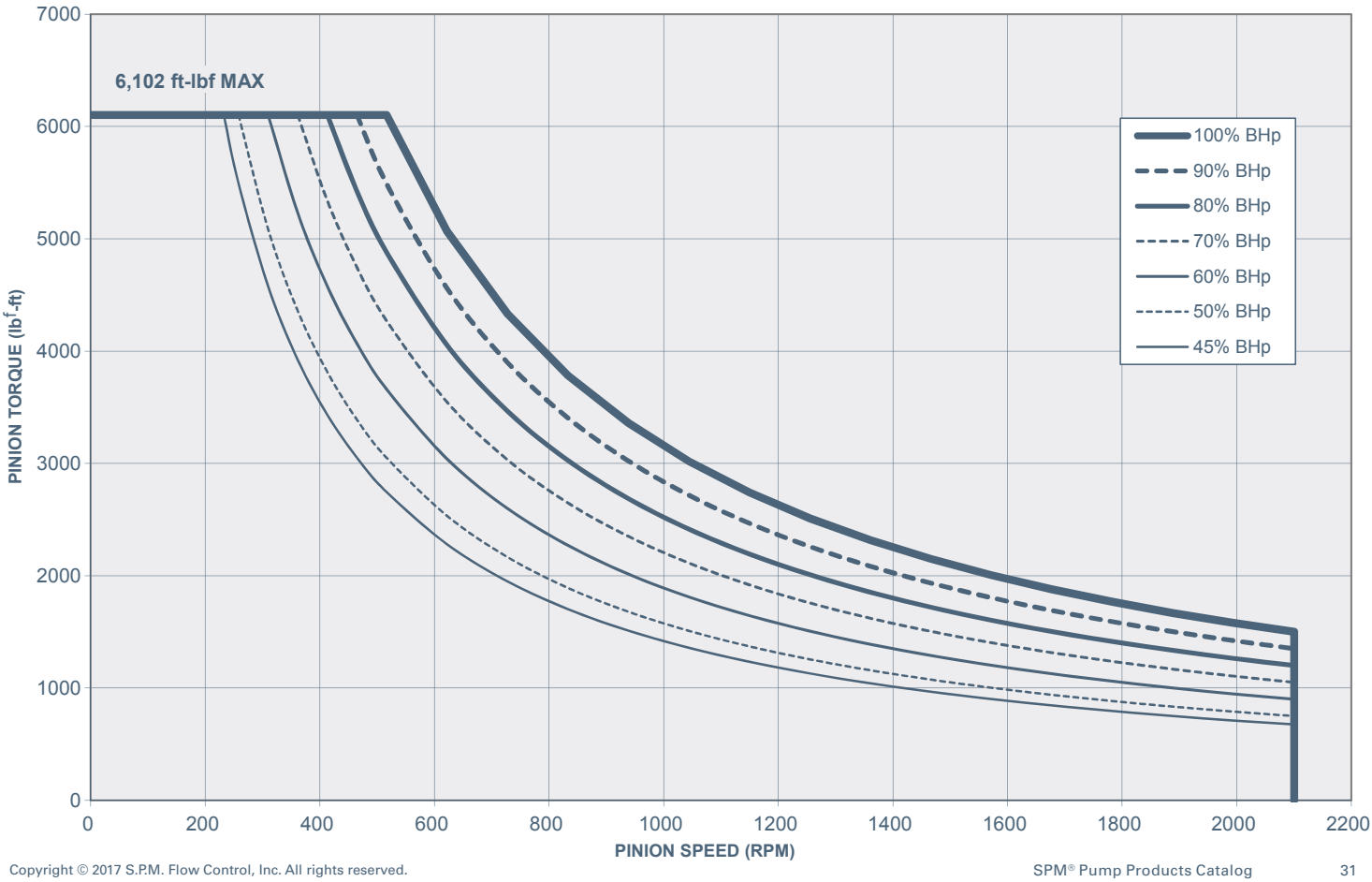
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TWS 600S & TWS 600S HD Pump–Performance Chart[1,2]

Plunger Diameter in (mm)	Displace Per Rev gal/rev (liter/rev)	Displacement at Pump Strokes per Minute/Pinion RPM											
		50 gpm (lpm)	231 psi (Mpa)	112 gpm (lpm)	516 psi (Mpa)	198 gpm (lpm)	912 psi (Mpa)	284 gpm (lpm)	1308 psi (Mpa)	370 gpm (lpm)	1704 psi (Mpa)	456 gpm (lpm)	2100 psi (Mpa))
2 ½ (63.5)	0.38 (1.4)	19 (72)	21600 (149)	43 (163)	21600 (149)	76 (278)	12227 (84)	109 (411)	8527 (59)	141 (535)	6546 (45)	174 (659)	5312 (37)
2 ¾ (69.9)	0.46 (1.8)	23 (88)	17851 (123)	52 (196)	17851 (123)	92 (347)	10105 (70)	219 (829)	7047 (49)	171 (648)	5410 (37)	211 (798)	4390 (30)
3 (76.2)	0.55 (2.1)	28 (104)	15000 (103)	62 (234)	15000 (103)	109 (413)	8491 (59)	131 (497)	5921 (41)	204 (771)	4546 (31)	251 (950)	3689 (25)
3 ½ (76.2)	0.75 (2.8)	37 (142)	11020 (76)	84 (318)	11020 (76)	148 (562)	6238 (43)	156 (592)	4350 (30)	277 (1049)	3340 (23)	342 (1293)	2710 (19)
4 (101.96	0.98 (3.7)	49 (185)	8438 (58)	110 (415)	8438 (58)	194 (733)	4776 (33)	278 (1052)	3331 (23)	362 (1370)	2557 (18)	446 (1688)	2075 (14)
4 ½ (114.3)	1.24 (4.7)	62 (235)	6667 (46)	139 (525)	6667 (46)	245 (928)	3774 (26)	352 (1331)	2632 (18)	458 (1734)	2020 (14)	565 (2137)	1639 (11)
Input Power: BHP (kW)		268 (200)		600 (447))		600 (447)		600 (447)		600 (447)		600 (447)	

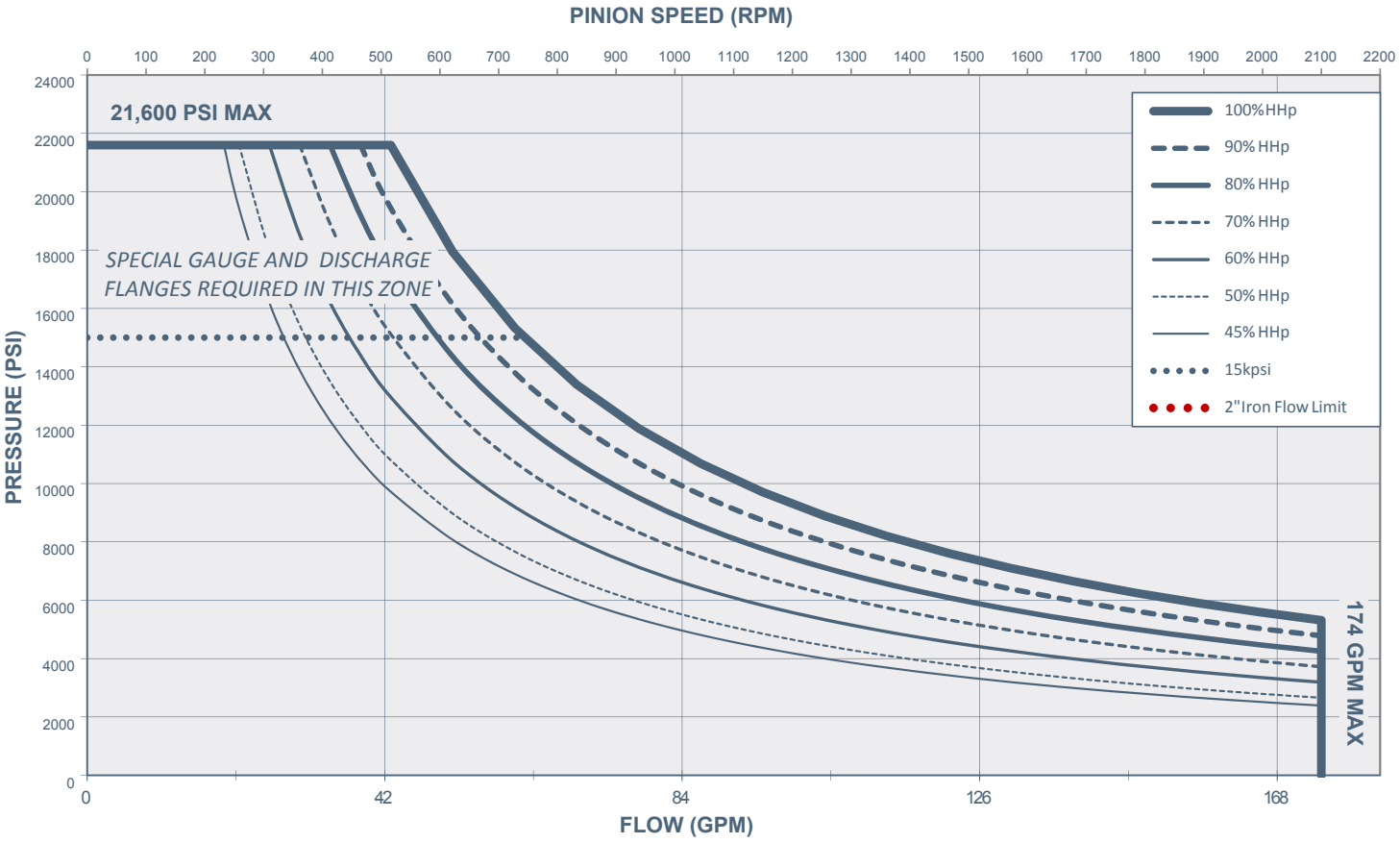
[1] Based on 90% ME and 100% VE–Intermitten Service Only.
[2] Pumps operating in excess of 15,000 psil require special gauge and discharge flanges. Contact SPM Engineering for information.

SPM® TWS 600S Pinion Torque Curve

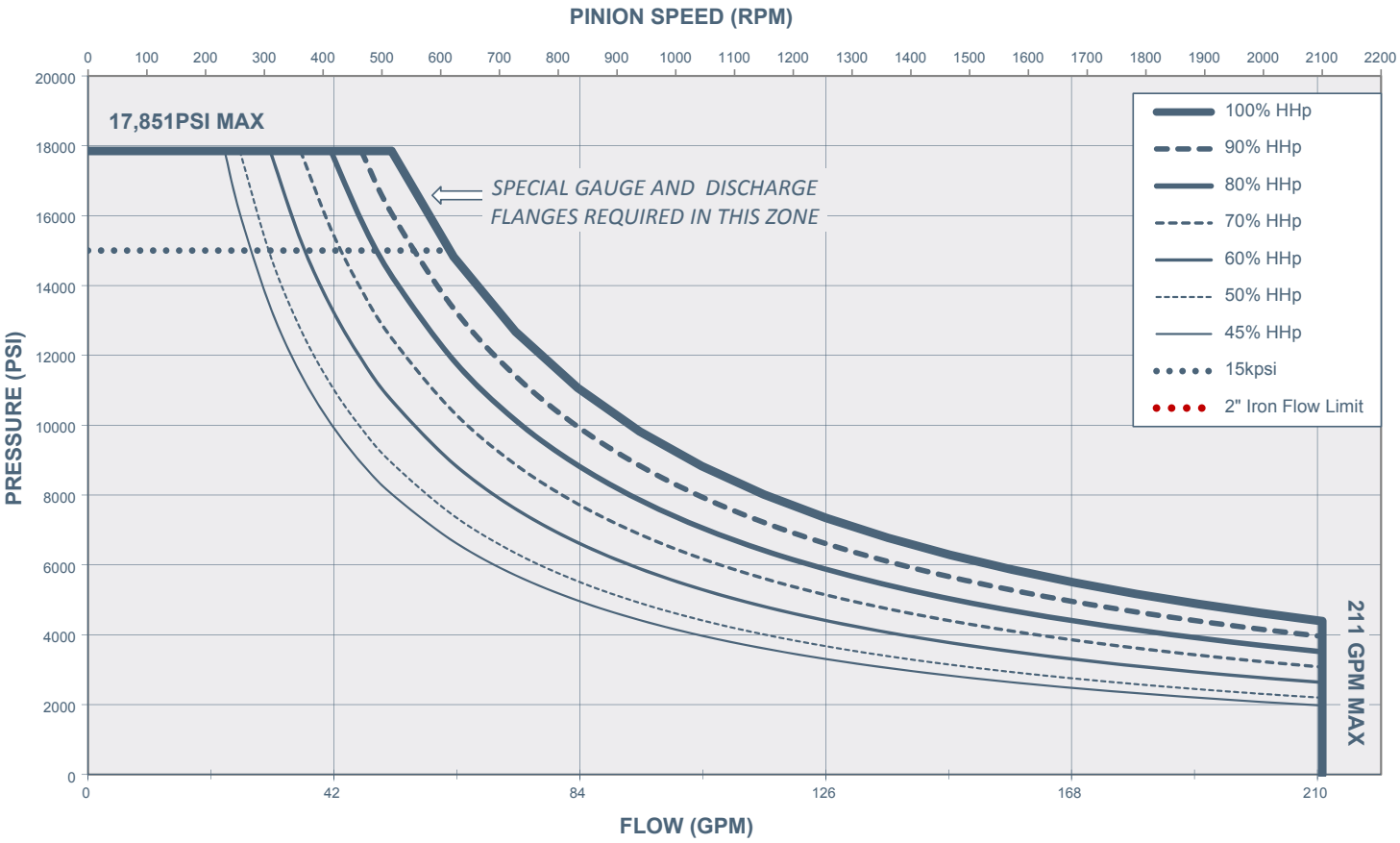


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SPM® TWS 600S & TWS 600S HD 2.50” Plunger Horsepower Curve

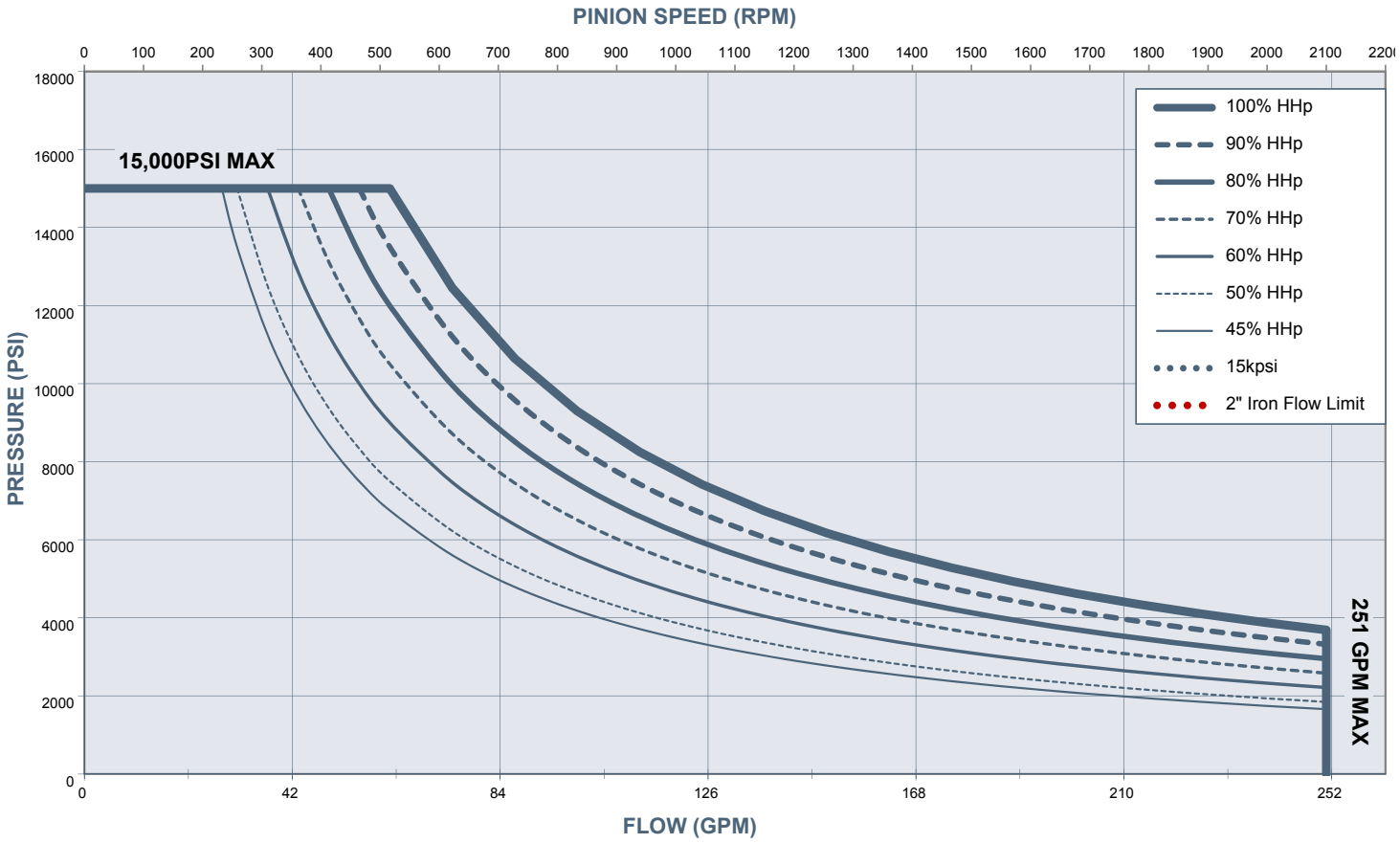


SPM® TWS 600S & TWS 600S HD 2.75” Plunger Horsepower Curve

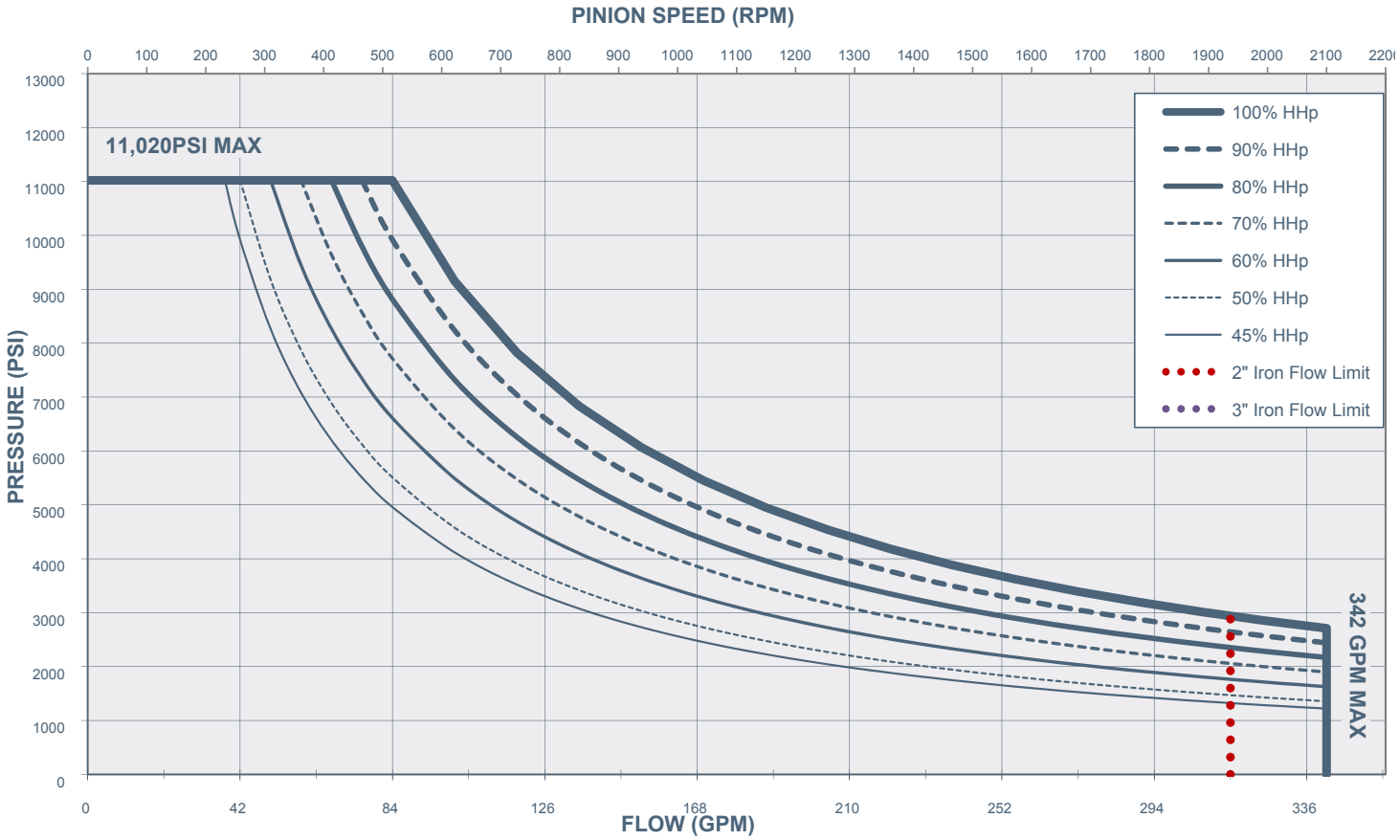


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SPM® TWS 600S & TWS 600S HD 3.00” Plunger Horsepower Curve

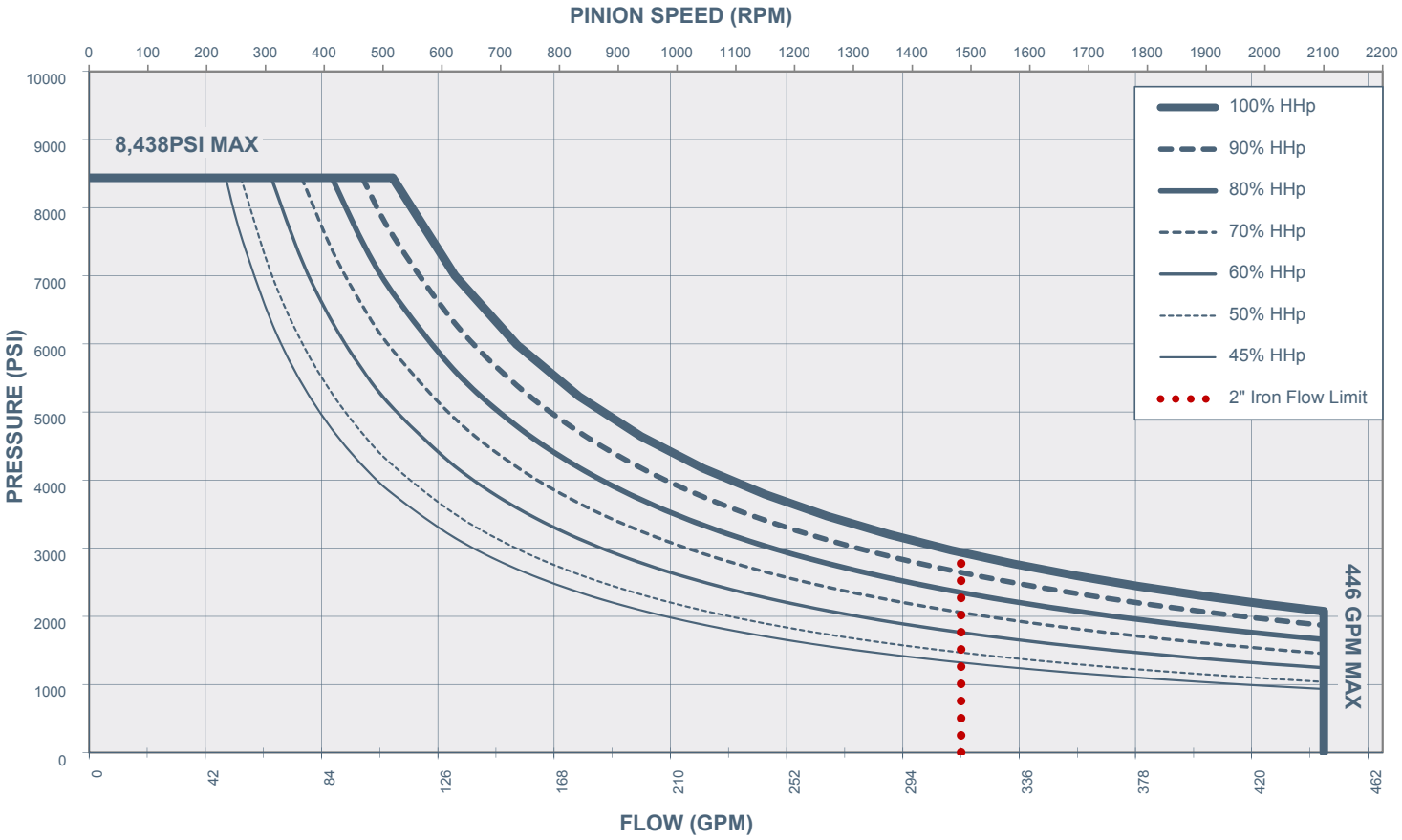


SPM® TWS 600S & TWS 600S HD 3.50” Plunger Horsepower Curve

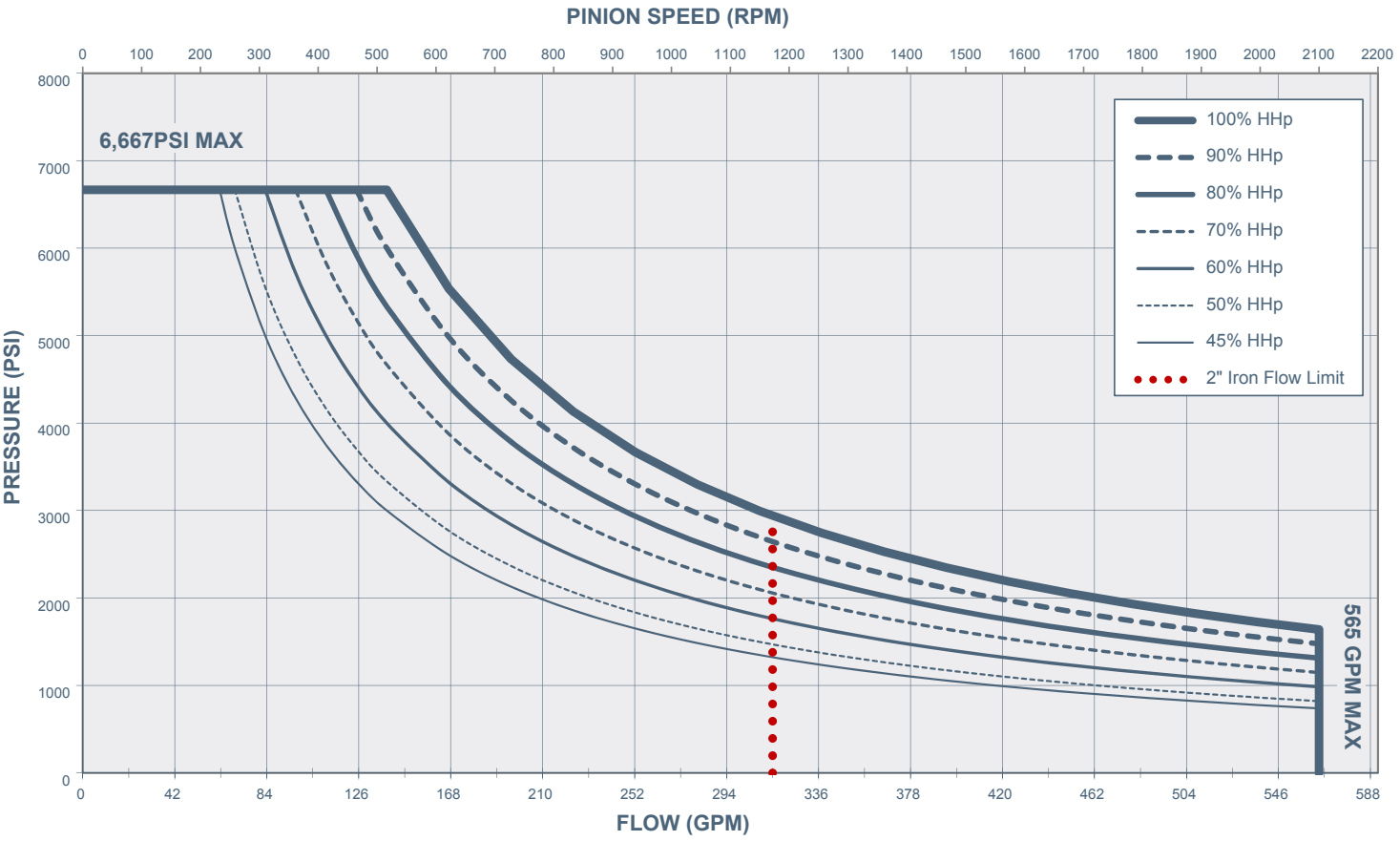


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SPM® TWS 600S & TWS 600S HD 4.00” Plunger Horsepower Curve

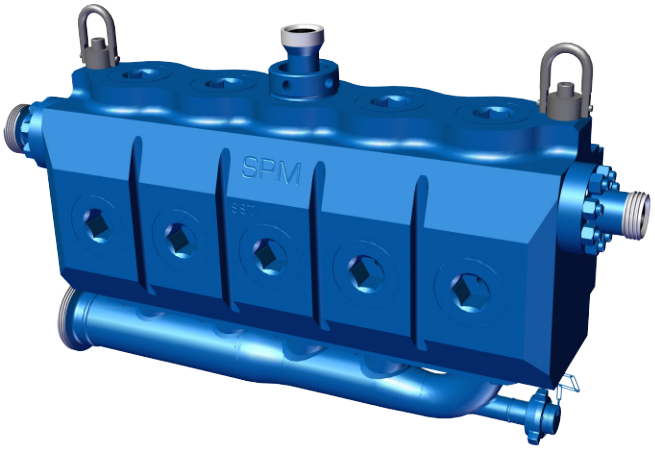


SPM® TWS 600S & TWS 600S HD 4.50” Plunger Horsepower Curve



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SPM® Fluid Ends



The oil and gas industry continually evolves. Drilling operations have become more focused on combining increased output with efficiency; all while driving costs down. Weir SPM® fluid ends come in carbon-steel and stainless steel, with options that focus on your pressure-pumping needs. From styles that can be retrofit to designs with optimized weights and standardized consumables, SPM® fluid ends offer best in class performance and increased product life.

New Challenges

Our Conventional Carbon SPM® Fluid Ends – Weir's legacy fluid ends – have been a hallmark for quality in the industry for years. With a design that contains a proprietary modified carbon mix, this offering continues to provide high performance capabilities. We recognized that in order to continue our legacy, he following market changes had to be addressed:

- Trend towards unconventional wells
- Multi stage hydraulic fracturing – leading to longer pumping times
- High-pressures required by shale drilling

Through testing and product analysis, we were able to identify critical root causes of fluid end failure:

- Fatigue cracks propagating from the intersecting bores
- Fatigue cracks propagating from the suction valve seat deck
- Corrosion pitting

Our immediate response was to develop solutions through geometric advancements. By transitioning from a grooved to groove-less suction valve retainer, we significantly reduced cracking at the suction valve retainer. **This development was the catalyst that led Weir to deliver patented SPM® Duralast® Fluid End Technology to the market in 2011.**

Advanced Technology

Duralast®

Duralast® technology was designed as an engineered solution to the challenges of drilling deeper, farther, and in harsher environments. These innovative fluid ends help to lower operational costs and increase productivity leading to improved fatigue life and reduced stress concentrations.
Duralast® fluid end technology addresses:

- **Cross bore cracking** – offset suction and discharge bores reduce stress concentrations
- **Valve seat deck cracking** – a new angled valve seat integrates with the fluid end to reduce stress loads
- **Corrosion pitting** – when Duralast® technology is applied to our proprietary stainless steel blend, fluid ends resist corrosion and work with the technology to deliver greater than 5x the life of conventional SPM® fluid ends.

SPM® Duralast® fluid ends are field tested and perform particularly well under high pressures in the harshest environments. This technology is designed to be one of the longest lasting fluid ends of its type on the market with transferable features applicable to any fluid end size or pump type.

- Exceptional performance above 12,000 psi
- Significant reductions in stress level > 30%*
- Improvement in fatigue life > 50%*
- 2X run life using standard material*

* when compared to conventional SPM® fluid ends without Duralast™ technology

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SPM® Stainless Steel

Corrosion cannot be resolved through geometry. Through extensive research and material testing, Weir sought to determine ideal properties required for today's pressure pumping applications. From chemistry to forging to heat treat, our industry-leading engineering team developed a proprietary stainless steel that extends fluid end life.

This proprietary stainless steel is optimized in every way to give longevity to fluid ends that face harsh operating conditions. This custom material has undergone extensive validation in the field and consistently provides a greater than 3x life improvement in the conventional offerings and up to 5x with Duralast® technology compared to non-stainless steel fluid ends. This significantly reduces total ownership cost and non-productive time (NPT) for customers. Our stainless steel is available for both SPM® legacy fluid ends and Duralast® fluid end configurations.

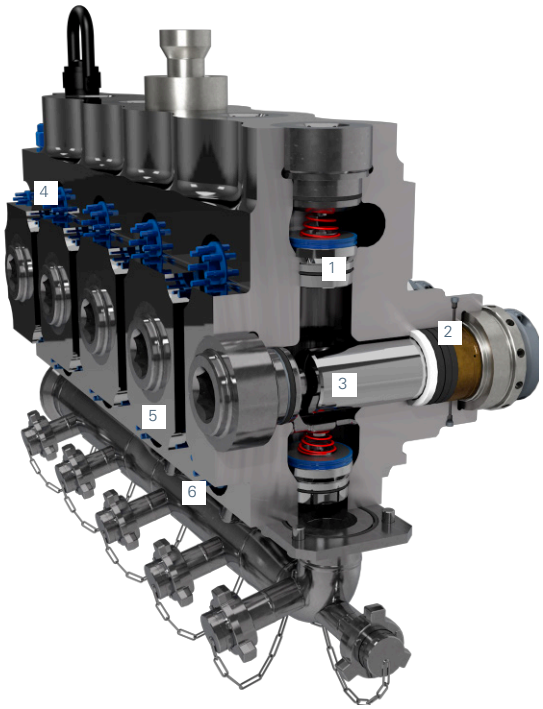
TOGETHER proprietary stainless steel provides corrosion resistance while Duralast® Technology educes peak stresses.

Driving Innovation

Weir cross-functionally drives innovative technology by:

- Utilizing industry experts, leading academics and internal Weir engineering experts
- Fundamental research into cavitation
  - Materials, geometry, fluid dynamics, etc. that affect the damage, that is inflicted by cavitation
  - Research is extended into developing hardware capable of reducing/ eliminating cavitation
- Advancements in auto-frettage: SPM® fluid ends are manufactured with life cycle enhancing "auto-frettage" processing. This economical process counteracts the harmful effects of cyclic stress and delays the corrosion-related fatigue cracking that occurs in high-pressure fluid cylinders. Weir's state-of-the-art auto-frettage process results in a fluid cylinder with long fatigue life expectancy at a fractional increase in cost.

- Fatigue and corrosion testing
- Tight process control for critical parameters.
- Commercially available
- Proprietary stainless steel material developed
- Proprietary weld repair process developed (do we want to mention this?)



1. SPM® 2.0 Valve and seat
2. SPM® Packing
3. SPM® Plungers
4. SPM® Supernuts
5. SPM® Duralast® SS fluid end
6. SPM® Zoomie manifold

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Supporting Products

SPM® DSS Manifold



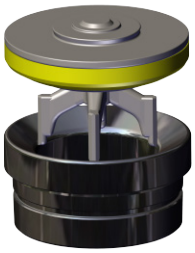
- Minimizes acceleration pressure losses
- 285 PSI Working Pressure
- Operating temps down to 32F
- Lighter and smaller than competitors
- Field maintenance no longer required through adhered in liner

SPM® 2.0 Valves and Seats



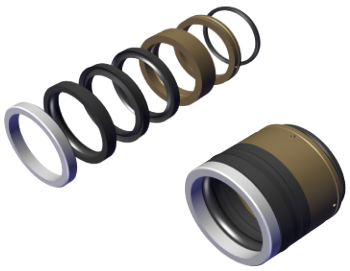
- Reduced total cost of ownership
- Vapor fraction and vorticity significantly reduced
- Increased impact resistance
- Reduced max stress and strain
- Improved flow characteristics
- 2 years of research and development validated through in-house and field testing

Novatech® Valves and Seats



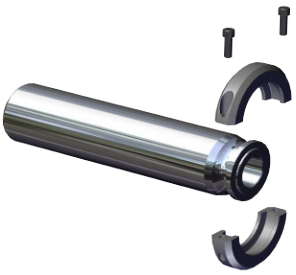
- Low cost and superior performance
- Urethane is poured directly around machined serrations to anchor the insert to the valve
- Process adds no additional stresses to the insert
- Increased resistance to abrasion and extrusion
- Minimizes insert movement, leakage and separation from valve
- Manufactured as a one-piece valve body for enhanced strength over those with an independent retainer plate

SPM® Packing



- High quality product with simplified selection and improved availability
- Utilize Tier 1 suppliers for the best quality, performance and service
- Readily available through our network of service centers strategically located near major shale plays worldwide
- Ability to implement stocking policies for customers

SPM® Plungers



- Optimized surface finish to extend the life of the plunger and packing
- Automated coating and fusion process of proprietary Ni and TC blends for increased production quality control
- Advanced manufacturing provide a consistently high quality product
- Optimized chamfers in critical locations for easy installation and removal

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