W Series Pumps

Installation and Service Instructions

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Ingersoll Rand

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W Series Model Number System

	Pump Series	Wetted Material of Construction	Gear & Bearing Material	O-Ring Material	Displacement mL/rev			Driven Magnet Torque	Designated Motor Requirements	Motor Series	Pump Size	Drive Magnet Torque	Motor & Drive	
	W	H	E	V	.	5	7	G	—	W	D	G	F	I
Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14

Pos. 1 - Pump Series

GG = Water Treatment

Pos. 2- Wetted Material of Construction

S= 316 Stainless Steel
H = Hastelloy C276
T = Titanium

Pos. 3 - Gear and Bearing Material

P = PPS (Polyphenylene Sulfide)
E= PEEK (Polyetheretherketone)

Pos. 4 - O-Ring Material

V= Viton
T = PTFE
E = EPR

Pos. 5 - 6 - 7 - Displacement ml/rev.

.11 = nominal 6 GPH@3500 RPM
.19 = nominal 10 GPH@3500 RPM
.23 = nominal 12 GPH@3500 RPM
.38 = nominal 20 GPH@3500 RPM
.57 = nominal 30 GPH@3500 RPM
.68 = nominal 36 GPH@3500 RPM
.80 = nominal 42 GPH@3500 RPM
.99 = nominal 52 GPH@3500 RPM
1.2 = nominal 63 GPH@3500 RPM
1.3 = nominal 68 GPH@3500 RPM
1.6 = nominal 84 GPH@3500 RPM
2.0 = nominal 105 GPH@3500 RPM
2.3 = nominal 121 GPH@3500 RPM
2.6 = nominal 137 GPH@3500 RPM
5.3 = nominal 279 GPH@3500 RPM
8.0 = nominal 421 GPH@3500 RPM
12.0 = nominal 650 GPH@3500 RPM

Pos. 8- Driven Magnet Torque

G = 65 oz/in Required for .11, .19, .23, .38, .57, .68, .80 sizes
X = 240 oz/in Required for .99, 1.2, 1.3, 1.6, 2.0, 2.3, 2.6, 5.3 and 7.9
W = 460 oz/in Required for 8.0 and 12. sizes

Hastelloy & Titanium Magnets = Welded Construction

Pos. 9 to 14 is for Motor and Drive Only.

Pos. 9 - Dash

"-" = Designates Motor Requirement

Pos. 10 - Port Type

W= Water Treatment

Pos. 11 - Pump Size (Ref: Pos. 5-7)

D = 0.11 through 2.3
T = 2.6 and 5.3
W = 8.0 and 12.0

Pos. 12 - Drive Magnet Torque

G = 65 oz/in Required for .11, .19, .23, .38, .57, .68, .80 sizes
X = 240 oz/in Required for .99, 1.2, 1.3, 1.6, 2.0, 2.3, 2.6, 5.3 and 7.9
W = 460 oz/in Required for 8.0 and 12. sizes

Pos. 13 – 14 Motor and Drive

See W-Series Motor and Drive options

Service Pak Option

Add "SP" in front of the model number, followed by positions 1 through 8 of pump model. Example: SPWHEV1.2X

Service Pak Consists of:

Gears, Bearings, O-Rings, Lubricant, and Instructions

Frequently Asked Questions

What is cavitation?

Cavitation describes the phase change from liquid to gas (boiling) that occurs in a device when the inlet pressure is too low for a given fluid at a given temperature. Since the vapor bubbles take up more volume than the liquid, a reduction of fluid flow occurs. As these vapor bubbles move from the inlet area of a pump toward an area of higher pressure, the bubbles collapse back to a liquid phase, and at the moment of collapse (implode), a powerful shock wave develops within the liquid. This shock wave can blast particles off of nearby solid surfaces, creating pits or caves. Over time this pitting can cause a catastrophic failure.

How much do the magnetic couplings slip?

The magnetic coupling designs used by Ingersoll Rand products are the synchronous drive type, which means the motor shaft and the pump shaft turn at the same speeds. There are matching magnetic poles on the drive and driven magnets and these "lock" together during normal operation. If the torque load exceeds the strengths of the magnets, they will decouple, an event that usually results in the pump shaft deceleration then stopping completely while the motor shaft continues to rotate. Usually the motor must be completely stopped before the magnetic coupling re-engages and once again "lock" together.

Why is suction pressure important?

All pumps rely on external pressure to push fluid into the inlet. This "suction" pressure can come from ambient air pressure on the fluid or from the "head" of fluid above the suction port and must also push the fluid between the teeth in a gear pump. As the fluid moves into these areas, friction losses can drop the pressure even lower. If the absolute pressure drops below the vapor pressure of the fluid at that temperature, cavitation occurs.

How much pressure will the pump develop?

Gear pumps, like all positive displacement pumps move fluid from the inlet to the discharge without inherently developing head (pressure). The discharge pressure that does develop is solely dependant on the restriction downstream of the discharge piping.

What is vapor locking?

Vapor locking is when a pump fills with enough vapor or gas to cause the pump to stop pumping. Vapor is a compressible fluid compared to incompressible fluids such as water. Some positive displacement pumps require pressure to function properly. For example, a diaphragm pump must build enough pressure and vacuum inside the diaphragm chamber to open and close check valves inside the pump. When the diaphragm chamber fills with too much vapor, the vapor is compressed and cannot build enough pressure to actuate the valves causing vapor locking.

Why does the Ingersoll Rand magnetically coupled external gear pump resist vapor locking?

The Ingersoll Rand magnetically coupled external gear pump contains no valves allowing vapors to flow through the pump. The pump also is very compact and has a very small pumping chamber that allows little room to collect vapors. The Ingersoll Rand external gear pump is capable of pumping fluids with less than 0.3 centipoise viscosity. When the pump becomes partially filled with vapor or vapor enters the pump, the gears mix the vapor with the fluid resulting in a lower viscosity vapor liquid mixture. The pump will pump this mixture without vapor locking since it does not have to open any valve.

Why should an Ingersoll Rand magnetically coupled external gear pump not be oversized for metering?

An Ingersoll Rand magnetically coupled external gear pump is designed to operate up to 4000 or 5000 RPM depending on the model and displacement. Reduced performance is an indication of a need for maintenance. Over sizing the pump may allow a worn pump to continue operate causing additional damage possibly resulting in leakage. If a large speed range turn down is not required, size the pump to operate toward the higher speed range. Example - preferred 2500 to 3500 RPM; not preferred 500 to 1500 RPM.

Can I use an Ingersoll Rand external gear pump with viscosities above 2000 cps?

Ingersoll Rand pumps operate very well above 2000 cps viscosity. Essentially, if the fluid can flow into a pump, Ingersoll Rand has a solution for you. The Ingersoll Rand external gear pumps are manufactured with high precision and the internal clearances are normally very small to provide very little flow loss when pumping low viscosity fluids at pressures up to 250 psi (17 bar). High viscosity applications require the internal clearances to be adjusted to match the viscosity of the fluid. This reduces the power required to drive the pump and raises the decoupling pressure limit. To determine if an Ingersoll Rand pump can be used in your high viscosity application, send your information to Ingersoll Rand Pump Group (Ingersoll Randpump@Ingersoll Rand.com).

Can I use an Ingersoll Rand external gear pump above its maximum differential pressure rating?

The pressure limit for each Ingersoll Rand pump is established with water as the fluid, which has no real lubricating properties and has a relatively low viscosity. The bearing load, flow characteristic, or the magnet decoupling torque then determines the pressure limit. A pump cannot operate above the magnet decoupling torque. However, the bearing load limits and flow characteristics change with higher viscosity lubricating fluids, which provide more lubrication and reduce slip. To determine if an Ingersoll Rand pump can be used in your high viscosity application, send your information to Ingersoll Rand Pump Group (Ingersoll Randpump@Ingersoll Rand.com).

What is a positive displacement pump?

A positive displacement pump has a constant volumetric displacement such as gallons per revolution or milliliters per revolution. A centrifugal and turbine pump uses the centrifugal force to propel the fluid causing movement. Examples of positive displacement pumps include peristaltic, vane, piston, and gear pumps. A positive displacement pump is usually more efficient resulting in less driving power and less heat transferred into the fluid. A positive displacement pump has very little fluid slip allowing pumping at high differential pressures with very little flow loss. As with many positive displacement pumps, the Ingersoll Rand external gear pumps are self priming.

Why are positive displacement pumps self-priming and centrifugal pumps are not?

A centrifugal pump uses the centrifugal force to propel the fluid causing movement. The centrifugal force depends on the fluid mass to cause fluid motion and build pressure. Because air has virtually no mass, a centrifugal pump cannot build a vacuum to prime unless it is full of liquid. A positive displacement pump, such as an Ingersoll Rand external gear pump, has a set volumetric displacement. This allows the gear pump to pump at very low viscosities, even air, which ultimately builds a vacuum that draws fluid into the pump.

Can an Ingersoll Rand magnetically coupled external gear pump be used for metering?

Ingersoll Rand external gear pumps are ideal for metering and often have much lower cost with greater accuracy and more features compared to typical metering pumps. Ingersoll Rand external gear pumps are precision positive displacement pumps. They produce very accurate and repeatable constant flow under constant pressure and speed. They also produce very accurate predictable flow under variable pressure and speed. The accuracy is proportional to the accuracy of the driving device. A driving device with accuracy better than +/- 0.25%, such as the Ingersoll Rand Digital Variable Flow Drives, will produce essentially the same +/- 0.25% accuracy with an Ingersoll Rand pump. Also, an Ingersoll Rand external gear pump maintains constant flow performance over thousands of hours maintaining long-term accuracy.

What is the difference between NPSH and NPIP?

NPSH is Net Positive Suction Head and NPIP is Net Positive Inlet Pressure. They are the same thing except NPSH is measured in head such as feet or meters and NPIP is measured in pressure such as psi or bar. NPIP was originated for positive displacement pumps. When converted to the same units, NPSH and NPIP are the same values.

How can Ingersoll Rand magnetically coupled external gear pumps perform given their compact size?

Ingersoll Rand external gear pumps are compact, ranging from 1.6 inch diameter to 3 inch diameter and lengths from 1 to 3 inches excluding magnetic coupling and motor. The compact size is a result of the internal gear design allowing higher rotational speed without sacrificing performance or life. The high rotational speed displaces more fluid in a small package size. The design results in low fluid velocities providing good NPSHR values. The high rotational speeds also require less torque reducing the magnetic coupling size.

What kind of life can be expected from an Ingersoll Rand external gear pump?

Ingersoll Rand magnetically coupled 316 stainless steel external gear pumps can be expected to operate over 20,000 hours in good applications. The Ingersoll Rand P - Series is constructed with an engineered polymer and can be expected to last over 10,000 hours in many applications. The long life is possible through the absence of dynamic seals, low bearing loads, and no sliding surfaces.

How can a pump operating at 2 pole speed have longer life than slower speed pumps?

Most pumps operate at much slower speeds than a 3500 RPM 2 pole motor. Ingersoll Rand external gear pumps are designed to operate up to 4,000 or 5,000 RPM, depending on the model. Life is proportional to bearing load and linear distance of rotation. Ingersoll Rand external gear pumps are designed with compact gears that generate low bearing loads and low linear distance of rotation. Linear distance of rotation is the total distance an object, such as a car tire, will travel when rolled on a flat surface. As an example, a two-inch diameter gear operating at 1750 RPM for

10,000 hours will result in the same linear distance of rotation as a one-inch diameter gear operating at 3500 RPM for 10,000 hours, a total of 5.5 X108 feet.

What is the difference between rotational speed (such as RPM) and fluid velocity?

Pumps are rated by the rotational speed in RPM, however, the fluid velocities are the combination of rotational speed and the outer fluid diameter. A pump operating with lower fluid velocity will generally have improved life, lower NPSHR (inlet losses), higher efficiency, and lower noise. A pump operating at 1200 RPM with a 6 inch diameter will have a 26.2 ft/second fluid velocity and a 1 inch diameter operating at 5000 RPM will have a 21.8 ft/second fluid velocity.

Why is fluid velocity important?

Pumps with higher efficiency and lower NPSHR provide better overall performance. Too much pressure loss at the inlet will cause cavitation or boiling of the fluid. As a basic rule, the pressure loss is proportional to the square of the fluid velocity. Higher fluid velocities in any pumping chamber cause increased pressure loss reducing pump efficiency increasing heat transferred to the fluid and requiring more driving power. An example is a 6 inch diameter pumping chamber at 1000 RPM will have 1.7 times the pressure loss as a 1 inch diameter at 5000 RPM.

Can I pump thin fluids with an Ingersoll Rand external gear pump?

Ingersoll Rand magnetically coupled rotary external gear pumps perform well with thin fluids. As a general rule, pump performance is fine down to 0.3 cps viscosity, however, they are also applied on thinner fluids. Low viscosity fluids can be difficult for many types of pumps as a result of slip and wear. Slip is the fluid that flows (slips) from the discharge side of the pump back to the inlet. The Ingersoll Rand gear pump design minimizes slip and wear. They are constructed with a minimal number of high precision parts providing less internal slip paths. Ingersoll Rand pumps are designed to operate at two-pole motor speed, 3500 RPM, reducing the slip to displacement ratio. The Ingersoll Rand external gear pump design minimizes gear and bearing loads allowing the pumps to operate on fluids with minimal lubrication. To determine if an Ingersoll Rand pump can be used in your high viscosity application, visit ingersollrand.com/pumps

Magnetically Coupled External Gear Pump Description

Ingersoll Rand Magnetically Coupled External Gear Pumps operate by moving fluid between two spur or helical type gears (see Figure 3 below). The Ingersoll Rand W-series is magnetically coupled and contains no dynamic seals. The pump is sealed with static O-ring type seals. There are only two moving parts in the magnetically coupled external gear pump, driven magnet - driving gear assembly and driven gear, rotating on five bearings. This simplicity and precision design provides better than 1% repeatable accuracy.

The W-series is designed to operate at high rotational speed (RPM) while maintaining a low fluid velocity. The high rotational speed design reduces the magnet torque requirement reducing the shaft loading and pump size. The higher rotational speed requires less displacement reducing the gear sizes lowering the fluid velocity. The Ingersoll Rand W-series fluid velocity typically equals or is less than lower speed pump designs. This results in low NPSHR, typically less than 5 feet at two pole speed at 1 cps.

Fluid Slip

Slip is the movement of the fluid from the discharge side of the pump back to the suction side of the pump as a result of the differential pressure in the system. Slip occurs naturally in rotary gear pumps. It shows as a decrease in performance of the capacity of the pump. As differential pressure increases, slip can also increase As speed increases, the amount of slip and decrease, due to the velocity of the fluid creating resistance to the slip at higher speed. Slip is also dependent upon viscosity of the fluid; the higher the viscosity, the less slip occurs. The closer the tolerances between rotating and stationary components in the fluid chamber, the less slip also occurs.

The magnetically coupled external gear pump design features close tolerances, minimizing slip through the fluid chamber. In some cases, "slip" may be experienced in the opposite configuration of the above referenced condition. If the system has a fully flooded suction and a low discharge, fluid may slip through the pump from suction to discharge when in idle mode. In order to prevent slip of this type, installation of a pressure regulating valve on the discharge side of the pump is recommended to simulate a pressure which prevents movement of fluid through the pump when it is not in operation.

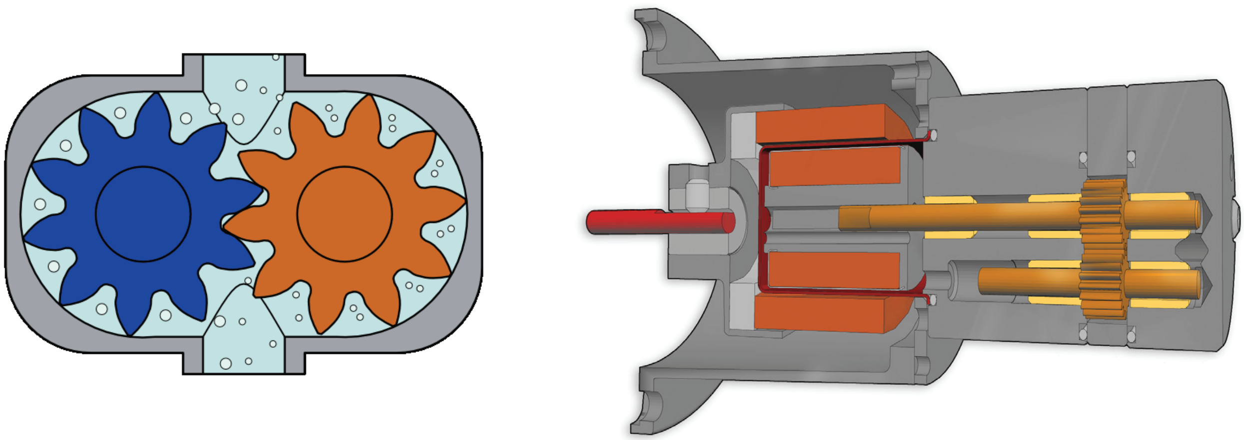
Accuracy

Ingersoll Rand Magnetically Coupled External Gear Pumps have repeatable accuracy to better than 1% for most applications. When installed in a closed loop system with a flow meter or residual feedback, the accuracy is dependent on the flow meter or residual sensor. When installed in an open loop, the accuracy is dependent on the speed control. Typically the speed can be controlled within +/- 1 RPM.

Cutaway and Principle of Operation

- Fluid enters the pump
- Fluid is contained and moved by the rotating gears
- Fluid exits the pump
- Pressurized fluid is contained by the gears; gear tips, gear mesh, and end clearance
- Some of the fluid slips back to the inlet through the bearings and past the gears

Figure 1. Cutaway and Principle of Operation



Features and Benefits

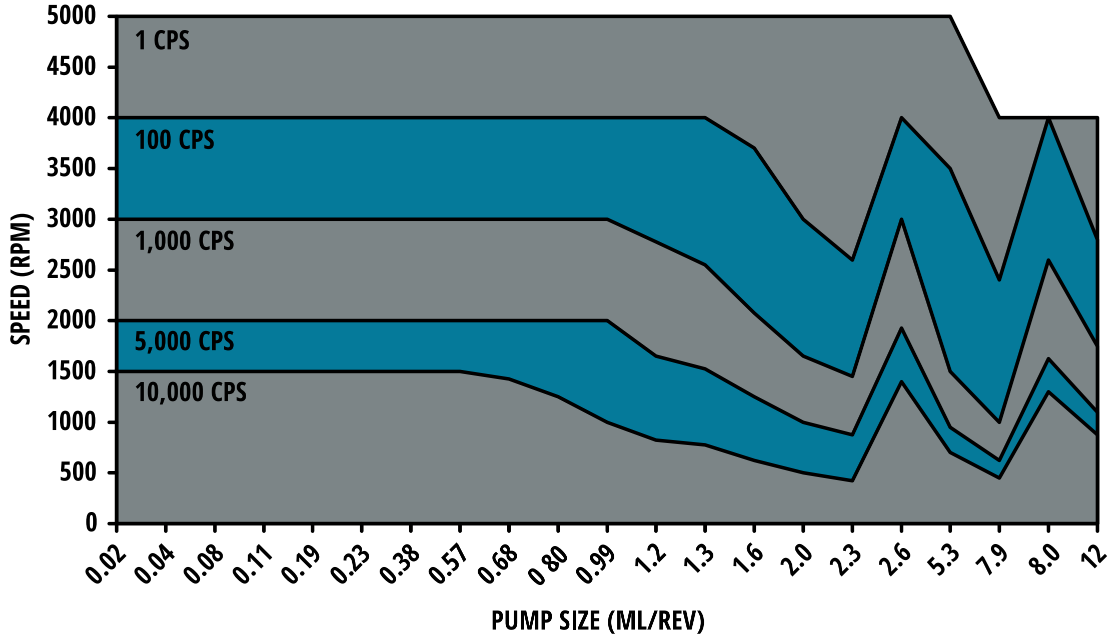
FEATURES	BENEFITS
Magnetically Coupled	Leak Free
Valveless	No Vapor Trapping
External Gear	Low Shear and Low NPSHR
Smooth, Non-pulsing Flow	Flow Meter Friendly
Positive Displacement	Self Priming and No Pulsation Dampener Required
Robust Design	Long Life – Typically 10,000 to 20,000 hours
High Rotational Speed Design	Long Life – Typically 10,000 to 20,000 hours
Precision Design	Metering Accuracy to +/- 1% with Appropriate Drive & Feedback
Fluid Slip Internal to Pump	Exceptional Turn down 100:1 with Standard Motors & Controllers
	Overcomes Vapor Locking
Simple, Non complex Assembly	Field Reparable, Easy and Quick

W Series Pump Model

Pump Displace-ment	Theoretical Flow 3500 RPM, 0 PSI (Bar)		Cont Max. Speed	Max. Differential Pressure @ 1 cps Viscosity				Max. Temperature		Max. Magnet Size
				Intermittent		Continuous				
ml/rev	GPH	LPH	RPM	PSI	BAR	PSI	BAR	°F	°C	G/X/W
.11	6	22	5000	250	17.2	250	17.2	350	177	G
.19	10	38	5000	250	17.2	250	17.2	350	177	G
.23	12	46	5000	250	17.2	250	17.2	350	177	G
.38	20	76	5000	250	17.2	250	17.2	350	177	G
.57	30	114	5000	250	17.2	250	17.2	350	177	G
.68	36	136	5000	250	17.2	200	13.8	350	177	G
.80	42	160	5000	250	17.2	200	13.8	350	177	G
.99	52	198	5000	200	13.8	140	9.7	350	177	X
1.2	63	239	5000	200	13.8	140	9.7	350	177	X
1.3	69	259	5000	175	12.1	125	8.6	350	177	X
1.6	84	319	5000	150	10.3	100	6.9	350	177	X
2.0	105	399	5000	150	10.3	100	6.9	350	177	X
2.3	121	459	5000	150	10.3	100	6.9	350	177	X
2.6	137	519	5000	250	17.2	150	10.3	350	177	X
5.3	279	1057	5000	145	10	100	6.9	350	177	X
7.9	416	1576	4000	95	6.6	70	4.8	350	177	X
8.0	422	1596	4000	150	10.3	150	10.3	350	177	W
12.	632	2394	4000	120	8.2	100	6.9	350	177	W

Recommended Maximum Speed D, T, and W Series

Figure 2. Maximum Speed



Note: *Recommended pump speed is 3600 - 700 RPM.*

Pump Selection

Ingersoll Rand W-series chemical metering pumps should be sized to operate within their design operating speed range. The Ingersoll Rand Pump Selection Software is recommended to assist in sizing a pump for each specific application. Refer to the Recommended Maximum Speed Chart below for viscosities higher than 1 cps. The typical speed range recommendation for 1 cps fluid is 700 to 4000/5000 RPM depending on the pump displacement, motor, and controller. Lower RPM speeds are possible with inverter duty motors. Try to avoid over sizing the pump for the application. If a large speed range turn down is not required, size the pump to operate toward the higher speed range.

Example: Preferred 2500 to 3500 RPM; not preferred 500 to 1500 RPM.

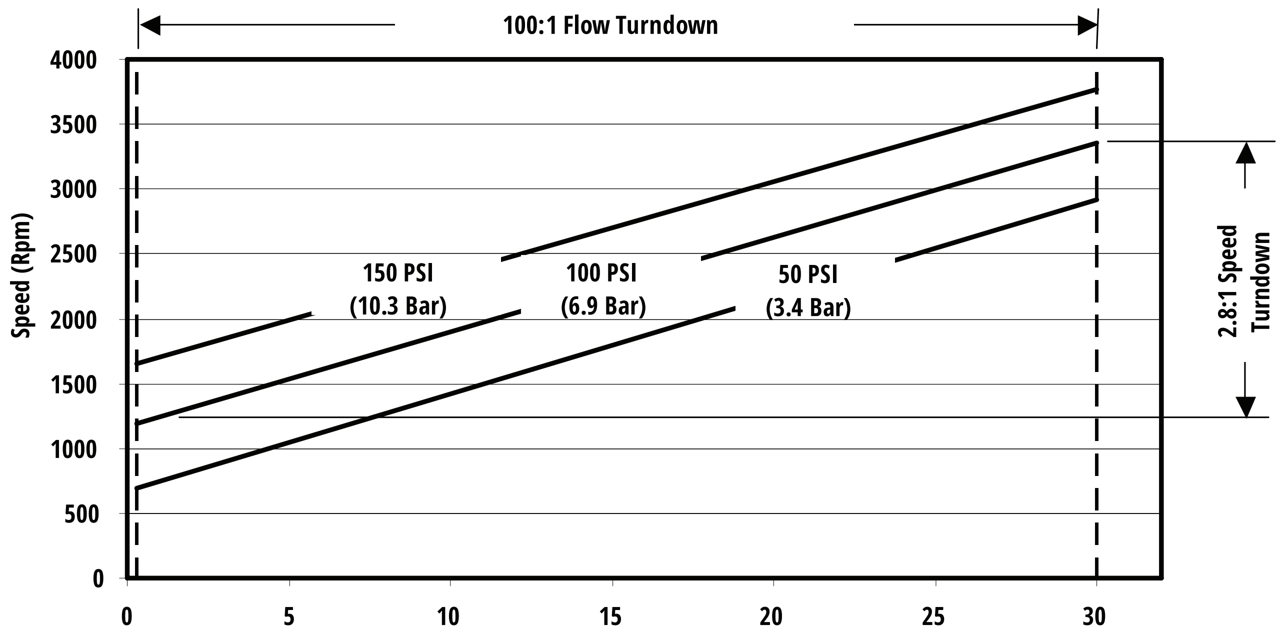
Refer to the Pump Head Guides, Ingersoll Rand Chemical Compatibility Guide, or equivalent to select the pump material for each specific chemical.

W Series Material of Construction

COMPONENT	MATERIAL
Wetted Metal	316 Stainless Steel, Hastelloy C, or Titanium
Gears and Bearings	PPS (polyphenylene Sulfide) or PEEK (Polyetheretherketone)
O-Rings	Viton
Driven Magnet	Welded 316 SS, Hastelloy C, or Titanium Encapsulated Samarium Cobalt

Ingersoll Rand W-Series Theoretical Performance .68 Displacement, 1 CPS Water

Figure 3. Theoretical Performance



Note: *For this application, the 0.68 ml/rev displacement pump at 100 psi (6.9Bar) differential pressure, achieves a 100:1 flow turn down with a 2.8:1 speed turn down.*

Motor and Controller

- Match the pump head to the motor and the controller
- A variable frequency drive with an AC 3 phase motor is recommended
- DC motors perform but have less enclosure options and require periodic replacement of brushes
- Preferred Motor: 4 pole 1750/1450 full load speed 60/50 Hz Operated up to 3600 RPM
- Typical Motor Turn down (Non inverter duty): 4:1 (Verify with motor manufacturer)
- Typical Motor Maximum Speed Rating: 5000 RPM (Verify with motor manufacturer)
- Typical VFD Maximum Setting: 120 - 150 Hertz

Example - A 1750 RPM motor will have a typical speed range from 450 to 4500 RPM at 15 to 150 Hz.

- Variable Frequency Drive (VFD) Controller: Size 100% to 200% of motor size

Example - 1/2 horsepower motor can be driven by a 1/2 ,3/4, or 1 horsepower VFD controller.

Metering System

The Ingersoll Rand Magnetically Coupled External Gear Pump is the latest technology and is an ideal match to modern motors, controllers, and flow-meters. The smooth flow performance allows the use of standard flow-meters to provide a real time flow feedback signal to the SCADA or other control system. Basic variable frequency drives (VFD) come standard with 120 Hz maximum frequency and 4-20 mA signal following. VFD's are available with many features and options to meet most metering control needs.

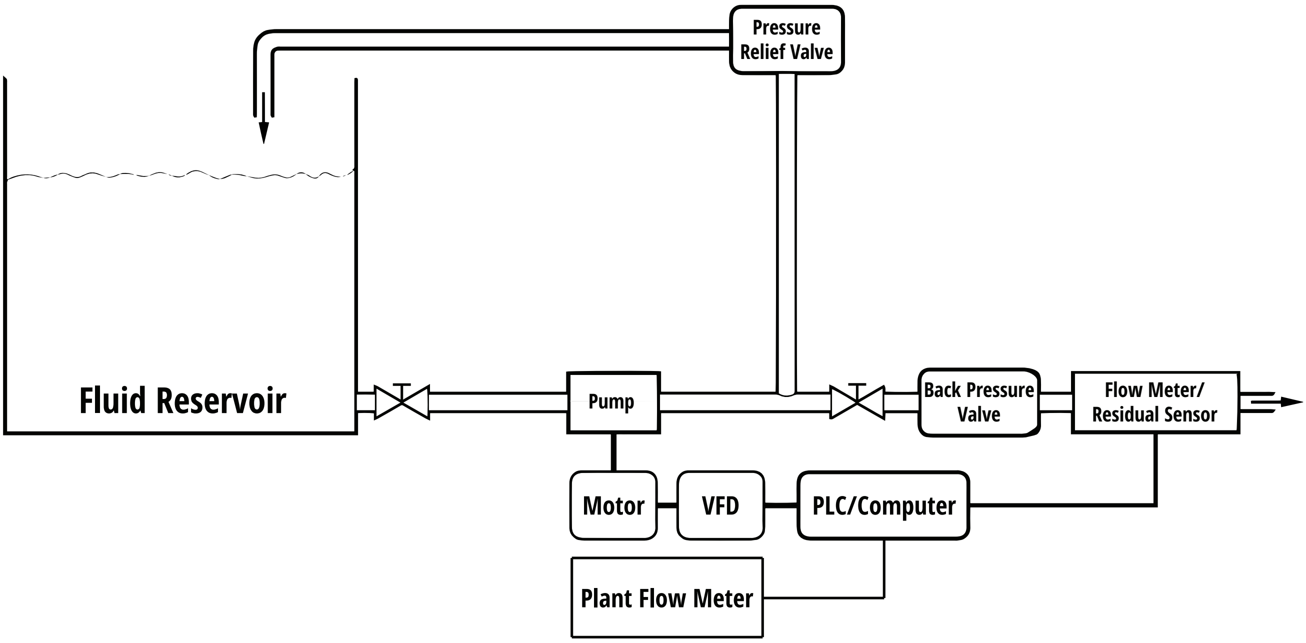
Recommended Metering Components

COMPONENT	RECOMMENDATION
Calibration Cylinder	Not Required
Back Pressure Valve[a]	Recommended for High Suction
Back Flow (Antisiphon) Valve[a]	Required for Closed Loop
3 Way Valve / Priming Valve	Preferred
Relief Valve - External	Recommended
Inlet Strainer/Filter	Preferred
Flow Meter/Residual Sensor	Required for Closed Loop
Pulsation Dampener	None Required

[a] External gear pumps are a valveless design and do not block fluid flow. All systems require some type of back flow (anti siphon) valve.

Closed Loop Control System

Figure 4. Closed Loop Control System



Installation

Safety Instructions

1. Gear pumps can produce high differential pressures that may cause system damage and expose personnel to hazards associated with an unintentional release of fluid. Exceeding design limits may cause pump to burst and may cause pump and/or motor to fail.
2. Pump head and motor & drive are designed to be operated together. Before any disassembly, disconnect power to motor and do not allow pump head to be pressurized.
3. Do not pressurize or operate pump unless the pump/motor assembly contains a complete set of correctly installed fasteners in good condition. Each threaded hole must contain a fastener.
4. Do not operate pump/motor unless it is secured in its desired location.
5. Do not modify any part of pump/motor assembly. Modification may weaken pressure containing parts and create hazards to personnel. Use only factory-authorized replacement or repair parts.
6. Do not allow pump to be subjected to an internal pressure approaching its burst pressure of 1500 psig at room temperature. Internal pressure (measured at either suction or discharge ports) should not exceed 500 psig (safety factor of 3.0). Specific codes, standards, operating practices and conditions may dictate a lower internal pressure (higher safety factor). Verify leak-tight installation of fluid connections prior to operation where leakage could be hazardous.
7. Do not exceed a fluid temperature of 350°F. Fluid temperatures above 100°F reduce the strength of pressure-containing parts. At 350°F pump burst pressure is 1000 psig.
8. The pump should not be used where the pumped fluid causes corrosion to metal pressure containing parts or attacks the pump static seals. These conditions will cause a significant reduction in the ability of the pump to contain pressurized fluid and may cause hazardous leakage.

Motor and Drive Assemblies

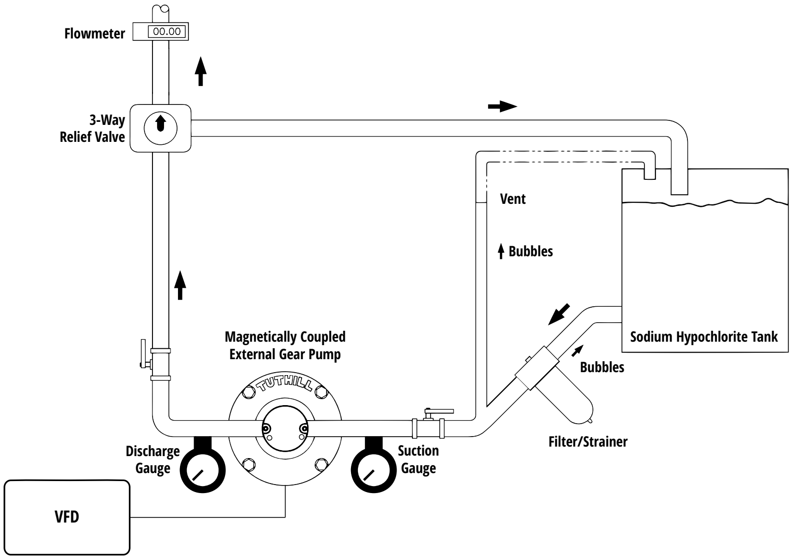
1. In normal operation electric motors may develop surface temperatures that will burn the skin.
2. Electric motors produce waste heat that must not be allowed to accumulate in the surrounding air. Unless otherwise specified, an electric motor will operate continuously without overheating at its published performance limit at an ambient (air) temperature not exceeding 104°F (40°C).
3. Electric motors that are not liquid tight should not be exposed to sprays, splashes, drips or immersion, nor should they be exposed to the weather.
4. Do not block motor ventilation openings (if present). Do not allow objects to enter motor openings.
5. Motor must be disconnected from power supply immediately if any condition prevents motor rotation.

Chemical Metering Installation Recommendations

1. Observe proper safety protocols.
2. Install the pump as close to and below the fluid source as possible.
3. Install the pump in a horizontal position if possible. The pump may be installed in a vertical position.
4. Suction & Discharge lines should be as large as the pump ports and as short as possible.
5. Size inlet lines to reduce priming time for very low flow applications.
6. If long suction runs are required, use larger tubing or piping as required to reduce restriction.
7. Ensure adequate NPSHA (NPIPA)
8. Avoid as many restrictions as possible such as valves, elbows and sharp turns.
9. Install the filter or strainer on the appropriate side of the pump. Install on inlet in process, metering, or transfer applications. Install on discharge in recirculating applications.

Sodium Hypochlorite Metering System

Figure 5. Metering System



Valves designed with vent option (hole) for sodium hypochlorite use are recommended to prevent off gassing.

Installation Recommendations

1. Always install the pump below the lowest fluid level (see Figure above).
2. Install the pump as close to the tank as possible.
3. Place the pump at the lowest point if possible.
4. Install the pump in a horizontal position if possible.
5. Do not install a Sodium Hypochlorite pump in a vertical position with the motor above the pump since this may trap vapors in the magnet containment cup.
6. Ensure there are no high places on the inlet plumbing that can trap vapor.
7. External gear pumps require clean fluid. Abrasive particles will greatly reduce pump life. An oversized inlet filter 5 to 25 micron size or equivalent is recommended. Large strainers typically act as a settling type trap due to the low fluid velocity.
8. Allow approximately 3 feet (1 meter) of discharge line before installing restrictive fittings such as valves. This allows compression of accumulated vapor improving passage of vapor bubbles through the pump

Fitting Installation

1. Select the proper size fitting according to the W-series pump displacement (see chart below).
2. Apply a paste-type thread sealant or Teflon® tape (two wraps maximum) no more than 3 threads from the end of the fitting before assembling to pump ports.
3. Hold the pump head, not the motor, to resist the wrenching torque.
4. Take care not to damage or misalign the pump head and pump/motor assembly when installing the fittings.
5. Tighten fittings no more than 5 total turns and no more than 2 turns beyond finger-tight, whichever is less.

W Series Porting

PUMP DISPLACEMENT (ml/rev)	PORT SIZE	PORT LOCATION
.11 to 2.	1/4" NPT	180 Degree Horizontal
2.6 and 5.3	3/8" NPT	Face
8.0 and 12.	3/4" NPT Suction, 1/2" NPT Discharge	Face

Operation

System Integrity

Make sure the system is intact with no open lines that will cause fluid leakage, spills, or spray.

Motor Rotation

Test the motor rotation to ensure the pump is operating in a clockwise direction facing the motor.

Priming the Pump

Ingersoll Rand pumps are capable of self-priming. It is recommended the gears are "wetted" with the pumping fluid to reduce priming time and increase vacuum. Do not dry prime against a closed valve or pressurized system. The pump may not build enough pressure to overcome the system pressure and may operate dry for an extended time resulting in excess wear.

Magnetic Coupling

Magnetic coupling makes the "zero leak" feature possible. Decoupling occurs when the two magnets are forced out of pole-to-pole alignment.

- G size Low Torque Magnetic couplings 65 oz-in (459 mNm), can operate decoupled, but is not recommended.

⚠ CAUTION

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DO NOT decouple X or W size (240 and 460 oz-in) (1695 & 3248 mNm) High Torque Magnetic couplings. Decoupling the High Torque Magnetic couplings may damage gears, bearings, and driven magnet hub.

- If the pump decouples, the motor will continue to operate close to no load speed but the gears in the pump will stop rotating.
- To recouple, stop the motor completely and restart.
- If decoupling persists, check the system for excessive pump pressure. If the pressure is within range, then check the magnetic coupling setback dimension. If this does not correct the problem, the pump will have to be disassembled, check for foreign particles wedged in the gear teeth. Disassemble and clean parts thoroughly following repair procedure. After reassembly, rotate motor fan, Pump and Motor should rotate freely with no magnet rub or internal friction.

Operating Pressure

The differential pressure across the pump should be set well below the decoupling pressure (See catalog for decoupling pressures). This will prevent inadvertent decoupling caused by transient pressure surges.

Running Dry

Extended dry running will cause permanent damage. Make certain there is fluid in the pump while in operation.

Running in Reverse

The gear pumps are designed to operate in a clockwise rotation as you face the motor. Intermittent reverse rotation is acceptable. Continuous reverse rotation (counter-clockwise) may cause premature failure. Consult the factory if the primary pump rotation is counter clockwise.

Flushing

Pump should be flushed when not in use.

Calibration

In an open loop system, the pump needs to be calibrated over the range of operation. A back pressure valve is recommended for an open loop system to maintain a consistent back pressure to sustain the calibration. To calibrate, set the differential pressure valve above the maximum system pressure. Set the pump rotational speed and check the flow rate using a calibration cylinder or equivalent. Adjust the flow rate and controller setting, such as RPM or inverter frequency, for the desired operating condition. Repeat the controller adjustment until the desired operating conditions are achieved and record the setting. For a flow range, record the flow and controller setting at several points from the minimum to maximum desired operating flow range. Draw a curve of the controller setting against the flow rate or residual readings.

In a closed loop system, the system should be calibrated over the range of operation. No back pressure valve is needed in a closed loop system. Refer to the flow meter or residual sensor owners instructions for calibration.

Maintenance

Repairs

⚠ WARNING

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All repairs to the pump must be performed by qualified personnel. Make sure the system pressure has been relieved before attempting any repair to the pump.

Preventative Maintenance

A regular preventive maintenance schedule is recommended. This schedule should be based on the service history. A service history should be determined by checking the pump and system frequently after the initial installation and then adjust the frequency as necessary. Always check the pump for wear after every dry run occurrence excluding normal priming. Always replace the O-ring static seals after every pump disassembly. Check, clean, and replace inlet filter/strainer on a regular preventive maintenance schedule.

Service Pak

Ingersoll Rand offers a Service Pak for each pump configuration. The Service Pak includes the gear and shaft assemblies, bearings, o-rings, o-ring grease, and instructions

Product Warranty

Ingersoll Rand warrants its products against defective material and workmanship for one year from date of shipment from its Ingersoll Rand's plant. This warranty does not include products damaged by wear, tampering, improper installation, or abuse. Nor does it cover consequential damages or other losses due to pump failure.

Due to the unpredictable nature of the fluids process pumps encounter, pumps are not warranted for any specific life.

Important Shipping Information

For your protection, please read and observe the following instructions. Transportation companies assume all liability from the time of shipment is received by them until the time it is delivered to the consumer. Our liability ceases at the time of shipment. All shipments leaving our plant have been carefully inspected. If a shipment arrives with the crating or packaging damaged, have the carrier note the condition on the receipt. Check as soon as possible for concealed damage. If it is found that the shipment has been damaged in transit, please Do Not return to us, but notify and file a claim with the carrier at once.

⚠ CAUTION

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Failure to follow this procedure will result in the refusal by the carrier to honor any claims with a consequent loss to the consumer.

If UPS or Parcel Post has been damaged, retain the damaged material and notify us at once. We will file a claim. Goods may not be returned for credit unless authorized by our sales department.

Contact Information

To find an authorized distributor, visit www.IngersollRand.com/pumps under contact us.

Appendix

Service Pak Instructions

Warranty will not extend to goods altered or repaired by anyone other than the manufacturer or authorized representative

Note: *Service Paks are designed to be installed by someone familiar with precision mechanical assemblies and tools. Observe reasonable safety precautions, including the use of safety eye wear when performing the steps listed below.*

Displacement 2.6 to 12. Service Pak Instructions

Suggested Service Pak Tools

- 60130-1 Bearing Extractor Tool 60152-1 Phillips Screwdriver
- 60020-1 Bearing Installation Tool Optional Rubber Gloves.
- 60151-1 Medium Blade Screwdriver Optional Masking Tape.
- 60150-1 T Series Tool Kit (Includes all tools shown above)

Service Pak includes: 2 Gears, 4 O-Rings, 5 Bearings, Silicone Lubrication and Instruction Sheet.

Important: *To prevent damage to the Driving Gear Assembly (17) REMOVE Cap (6) BEFORE installing or removing the Magnet Screw (15). NEVER install or remove the Magnet Screw with Cap (6) in place.*

DISASSEMBLY INSTRUCTIONS

- Provide a clean surface for work area.
- Remove two Pump Mounting Screws (1) and one Pump Mounting Screw (2) and separate Pump head from Drive Housing.
- With a permanent marker mark the relative positions of the Mounting Plate (3), the Body (4), the Cavity Plate (5) and the Cap (6) orientation for ease in reassembly.

  Note: *If the Gears are not being replaced and will be reused, after removing the Cap (6) in the next step mark the Gear orientation with a marker. This will allow the Gears to reassembled in the same orientation.*
- Remove two Pump Screws (7) and three Pump Screws (8) in the Cap (6) holding the other parts in place and remove the Cap, Driven Gear Assembly (9), Cavity Plate (5) and two Dowel Pins (10).
- Remove Clamp Plate Screws (11); remove the Clamp Plate (13) and Magnet Cup (12).
- Displacements 2.6 to 5.3: Hold the Driven Magnet (14), and turn Magnet Screw (15) counter- clockwise to remove. Displacements 8.0 to 12: Pull the Driven Magnet (14) off the Driving Gear Assembly (17) shaft.
- Remove four O-Rings (19, 20, 21) from the Cap (6) and Body (4). O-Rings may be removed with a blast of compressed air or with a sharp pin.
- Complete disassembly of Body (4), Mounting Plate (3) and Driving Gear Assembly (17).
- Important: Do not nick or scar the sides of the bearing bores in the steps below.

  Note: *Mark the location of the Bearing (18) lubrication grooves with a permanent marker on the Cap (6) and Body (4) before removing the Bearings. The Bearing lubrication grooves should be as far away from the inlet (suction) port as possible.*
- Clamp the Bearing Extractor Tool in a vise and screw the Bearing (18) on the tool and gently tap with a soft mallet while supporting and pulling the Cap (6) or Body (4) to free the Bearing. Repeat process until all five Bearings are free. If necessary remove Bearings by carefully breaking out the bearing material with a small chisel and mallet. See page 3.
- Inspect all parts for damage and wear. If wear on Cap (6), Cavity Plate (5) and Body (4) is excessive rebuilding the pump may not be recommended (consult factory).

Assembly Instructions

- Clean all parts. Any foreign material clinging to the Driven Magnet (14) can be removed with masking tape.
- Align the Bearing (18) lubrication grooves with the marks made during Bearing removal in step 12.
- Using the Installation Tool press five new Bearings into the Cap (6) and Body (4). Bearings should be .002/.005 below the face of the Cap (6) and Body (4). See figure 3.
- Omit silicone lubricant if it is incompatible with your pumped fluid.

- Using alignment marks made in step 3 during disassembly carefully assemble the Mounting Plate (3) and Body (4) together with a slight twisting action until fully seated taking care not to dislodge or pinch the O-Ring.

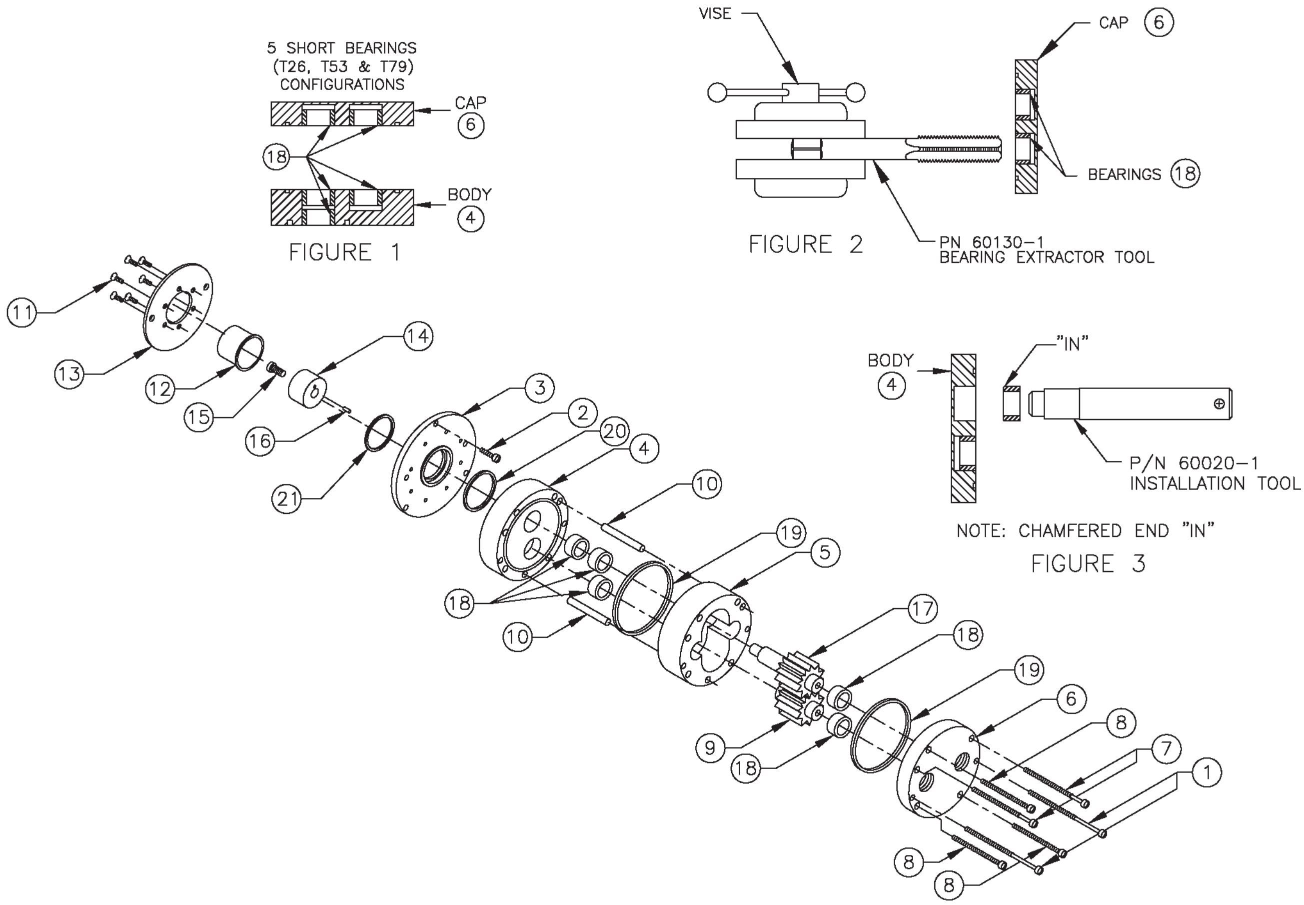
  Note: *Displacements 2.6 to 5.3: Install Driving Gear Assembly (17), Magnet Pin (16), Driven Magnet (14),and Magnet Screw (15). Hold Driven Magnet to prevent rotation and tighten Magnet Screw clockwise to 960 in/oz torque (a rubber glove can be used to facilitate holding the Driven Magnet). Displacements 8.0 to 12: Push the Driven Magnet (14) on to the Driving Gear Assembly (17) shaft. When performing the following assembly operations DO NOT apply forces to the Driven Magnet (14). Pushing or pulling the Driven Magnet may damage the Driving Gear Assembly (17).*

- Confirm the presence of the plastic plug located in the lower Dowel Pin (10) hole of the Body (4). This is to prevent the Dowel Pin from slipping out. Install two Dowel Pins into Body (4) and slip the Cavity Plate (5) onto the Dowel Pins against the Body (4) face. The Cavity Plate (5) will fit properly in only one orientation. All the Screw holes in the Body (4) and Cavity Plate must align.
- Install Driven Gear Assembly (9).
- Align Cap (6) with the Driving (17) and Driven (9) Gear Assembly shafts and Dowel Pins (10).
- Install two Pump Screws (7) and three Pump Screws (8) in Cap (6) and torque alternately to 640 in/oz.
- Rotate the Driven Magnet (14) by hand to check for any binding during rotation. The Driven Magnet should turn freely. If there is binding determine and remove cause.
- Orient Clamp Plate (13) so that protruding Pump Screws (7) are aligned with the clearance holes provided in the Clamp Plate. Install the Magnet Cup (12) and Clamp Plate with Clamp Plate Screws (11) and torque alternately to 320 in/oz.
- Assemble Pump head to Motor and Drive Housing with three Pump Mounting Screws (1 & 2). Pump/Motor assembly is now complete.

Note: *New parts may exhibit slight interference with mating surfaces. An initial "run-in" period may be required to allow the gears to seat. Rebuilt pumps may initially decouple below normal differential pressure or produce less than normal flow-rate until mating parts have fully seated during initial period of operation. Reference numbers on page 3:*

Bill of Materials Displacement 2.6 to 12.

Figure 6. Exploded View



Parts List

Pump Mounting Screw - mount pump head to housing, 2 ea.	12. Magnet Cup
2. Pump Mounting Screw - mount pump head to housing, 1 ea.	13. Clamp Plate
3. Mounting Plate (316 SST)	14. Driven Magnet
4. Body	15. Magnet Screw (2.6 & 5.3)
5. Cavity Plate	16. Magnet Pin (2.6 & 5.3)
6. Cap	17. Driving Gear Assembly
7. Pump Screw - Through cap, cavity plate & body into mounting plate, 2 ea.	18. Bearings
8. Pump Screw - Through cap & cavity plate into body, 3 ea.	19. O-Ring
9. Driven Gear Assembly	20. O-Ring
10. Dowel Pin	21. O-Ring
11. Clamp Plate Screws	

Displacement .11 to 2.3 Service Pak Instructions

Suggested Service Pak Tool

60129-1	Bearing Extractor Tool	60158-1	Medium Blade Screwdriver
60098-2	Bearing Installation Tool	60157-1	Bypass Nut Driver
60098-2	Body Bearing Installation Tool (.11 - .19 Size Only)	Optional	Rubber Gloves
60154-1	T10 Torx Driver	Optional	Masking Tape
60155-1	T15 Torx Driver	60149-1	D Series Tool Kit (Includes all tools shown above except 60098-4)
60169-1	Hex Key Wrench 9/64"		

Service Pak includes: 2 Gears, 3 O-Rings, 5 Bearings, Silicone Lubrication and Instruction Sheet.

⚠ CAUTION

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Warranty will not extend to goods altered or repaired by anyone other than the manufacturer or authorized representative.

Service Paks are designed to be installed by someone familiar with precision mechanical assemblies and tools. Observe reasonable safety precautions, including the use of safety eye-wear when performing the steps listed below.

Important: *Check the Service Pak parts you have received. Ingersoll Rand has changed the Driven Magnet to a "slip fit" design for the Driving Gear Assembly (12). This design does not require a Magnet Clamp Screw (5). If you have received a Service Pak with the "slip fit" design and your Pump has a Magnet Clamp Screw (5) design Driven Magnet (7) you will need to contact the factory and order a "slip fit" Driven Magnet (7). See pictorials at the end of these instructions.*

Disassembly Instructions (See Drawing on pg. 22)

1. Provide a clean surface for work area.
2. Remove three Mounting Screws (3) and separate Pump-Head from Drive Housing.

Note: *If the Gears are not being replaced and will be reused, after removing the Cap (16) in the next step mark the Gears orientation with a permanent marker. This will allow the Gears to be reassembled in the same orientation. Remove two cap screws (17) with a 9/64 Hex Socket Wrench. Models manufactured prior to 2001 use a T20 Torx Driver.*

3. Remove two Cap Screws (17) in the Cap (16) holding the other parts in place and remove the Cap (16), Driven Gear (13), Cavity Plate (15) and two Dowel Pins (14). If the pump is furnished with a Bypass take care not to damage the Poppet (20) sealing surface. Remove Poppet Assembly (20) from Bypass Adjusting Screw (18). Turn Bypass Nut (19) counter-clockwise 1 ½ turns. Hold Bypass Nut (19) against rotation and turn Bypass Adjusting Screw (18) counter-clockwise to remove from Cap (16).
4. Remove six Mounting Plate Screws (1) and remove the Mounting Plate (2) and Magnet Cup (4).

Note: *Instructions for "slip fit" Design. Pull the Driven Magnet (7) off the Driving Gear Assembly (12) shaft (no Screw is used in this design). Instructions for Magnet Clamp Screw Design. To prevent damage to the Driving Gear (12) REMOVE Cap (16) BEFORE installing or removing the Magnet Clamp Screw (5). NEVER install or remove the Magnet Clamp Screw (5) with Cap (16) in place. Hold the Driven Magnet (7), Magnet Clamp (6), and Magnet Hub (8) from rotation and turn Magnet Clamp Screw (5) clock-wise (left hand threads) to remove. Magnet Clamp (6) and Magnet Hub (8) are not part of a DX Driven Magnet (7).*

5. Remove three O-Rings (9) from the Cap (16) and Body (10). O-Rings (9) may be removed with a blast of compressed air or with a sharp pin.

Important: *Do not nick or scar the sides of the bearing bores in the steps below.*

6. Clamp the Bearing Extractor Tool in a vise and screw the Bearing (11) on the tool and gently tap with a soft mallet while supporting and pulling the Cap (16) or Body (10) to free the Bearing (11). Repeat process until all five Bearings (11) are removed. See Figure 1.
7. Inspect all parts for damage and wear. If wear on Cap (16), Cavity Plate (15) and Body (10) is excessive rebuilding the pump may not be recommended (consult factory).

Assembly Instructions (See Drawing on pg. 22)

1. Clean all parts. Any foreign material clinging to the Driven Magnet (7) can be removed with masking tape.

2. Body Bearing Installation for .11 and .19 size pumps only: Use installation tool 60098-4. Body Bearings (11) should be installed to .135/.145 below the face of the body (10). Install the cap bearings per step # 3.
3. Cap bearings (.11 – 2.3) and Body bearings (.23 to 2.3 only) use installation tool 60098-2. Press bearings into the Cap (16) and Body (10). Bearings (11) should be .002/.005 below the face of the Cap (16) and Body (10). See Figure 2.
4. Apply a thin coat of silicone lubricant (furnished in Service Pak) to three new O-Rings (9) and install in the Cap (16) and Body (10) O-Ring grooves. Omit silicone lubricant if it is incompatible with your pumped fluid.

Note: *Instructions for "slip fit" Design. Install Driving Gear Assembly (12); then slip fit Driven Magnet (7) on shaft (no screw required for this design). Instructions for Magnet Clamp Screw Design. Install Driving Gear Assembly (12), Magnet Hub (8), Driven Magnet (7), Magnet Clamp (6) and Magnet Clamp Screw (5). Hold Driven Magnet (7) to prevent rotation and tighten Magnet Clamp Screw (5) counter-clockwise (left hand threads) to 200 in/oz torque (a rubber glove can be used to facilitate holding the Driven Magnet (7). When performing the following assembly operations DO NOT apply forces to the Driven Magnet (7). Pushing or pulling the Driven Magnet (7) may damage the Driving Gear Assembly (12).*

5. Install two Dowel Pins (14) into Body (10) and slip the Cavity Plate (15) over the Dowel Pins (14) against the Body (10) face. The Cavity Plate (15) will fit properly in only one orientation. The Screw holes in the Body (10) and Cavity Plate (15) must align.
6. Install Driven Gear Assembly (13) with the longer shaft extension into the Body (10).
7. If pump is furnished with a Bypass, install Bypass Adjusting Screw (18) through the Bypass Nut (19) and turn clockwise until the Bypass Adjusting Screw (18) is flush with the Bypass Nut (19). Attach Poppet Assembly Spring (20) onto Bypass Adjusting Screw (18).
8. Align Cap (16) with the Driving (12) and Driven (13) Gear Assembly shafts and Dowel Pins (14). Assemble carefully and make certain the Poppet Assembly (20) goes fully into the Poppet hole and seats. See Figure 3.
9. Install two Cap Screws (17) in Cap (16) and torque alternately to 640 in/oz.
10. Rotate the Driven Magnet (7) by hand to check for any binding during rotation. The Driven Magnet (7) should turn freely. If there is binding determine and remove cause.
11. Install Magnet Cup (4) and Mounting Plate (2) with six Mounting Plate Screws (1). Turn alternately until tight to 320 in/oz.
12. Assemble Pump-Head to Motor and Drive Housing with three Mounting Screws (3). Pump/Motor assembly is now complete.
13.

Note: *New parts may exhibit slight interference with mating surfaces. An initial "run-in" period may be required to allow the gears to seat. Rebuilt pumps may initially decouple below normal differential pressure or produce less than normal flow-rate until mating parts have fully seated during initial period of operation.*

Bill of Materials Displacement .11 to 2.3

Table 1. Parts List (See Drawing on pg. 22)

1. Mounting Plate Screws	11. Bearing
2. Mounting Plate	12. Driving Gear Assembly
3. Pump Mounting Screws	13. Driven Gear Assembly
4. Magnet Cup	14. Dowel Pin
7. Driven Magnet	15. Cavity Plate
9. O-Ring	16. Cap
10. Body	17. Cap Screw

Note: *Bypass is not available in W Series or any D, P, & T Hastelloy or Titanium pumps.*

Figure 7. D Series Pumphead w/ Slip Fit Magnet

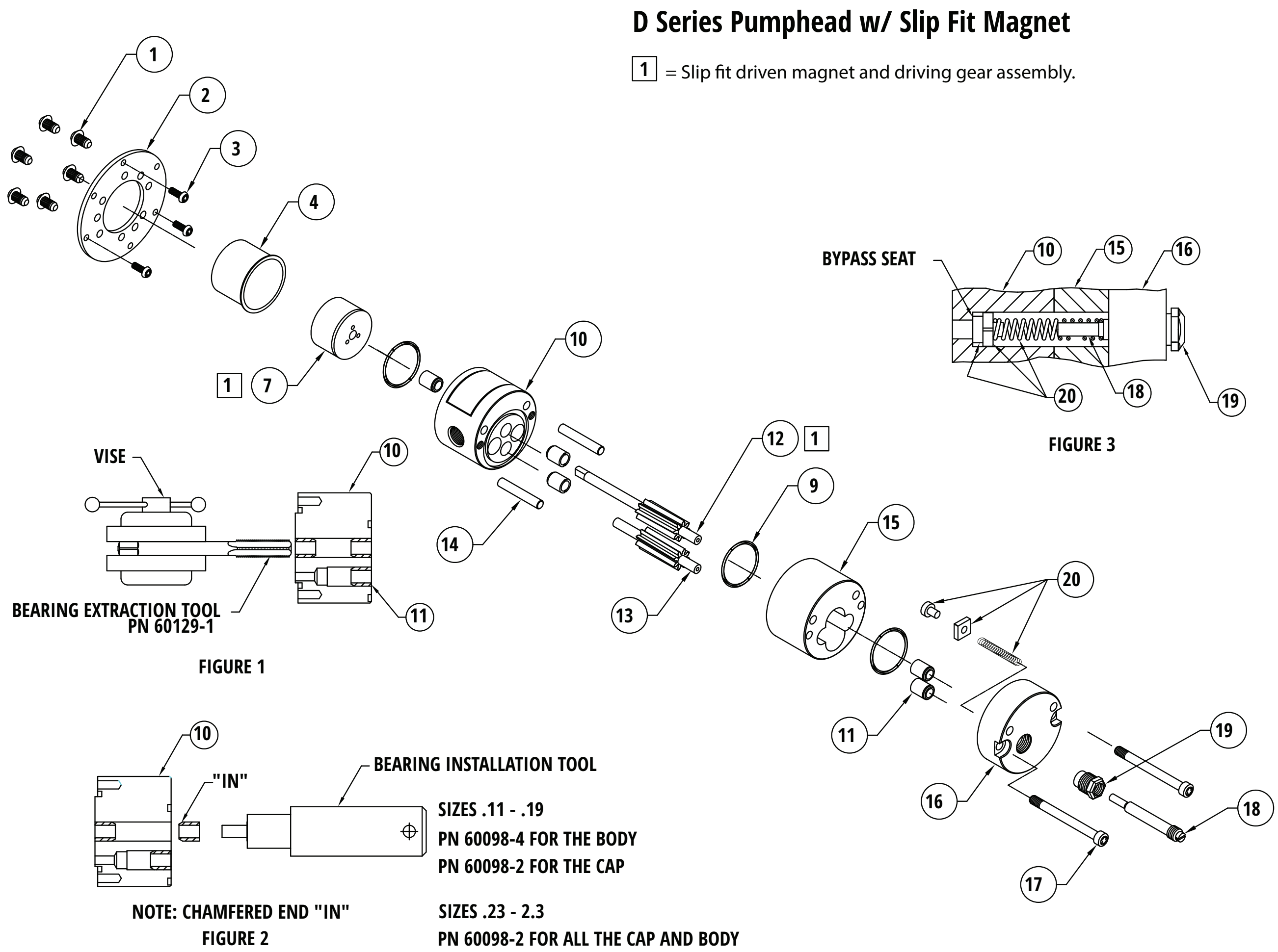
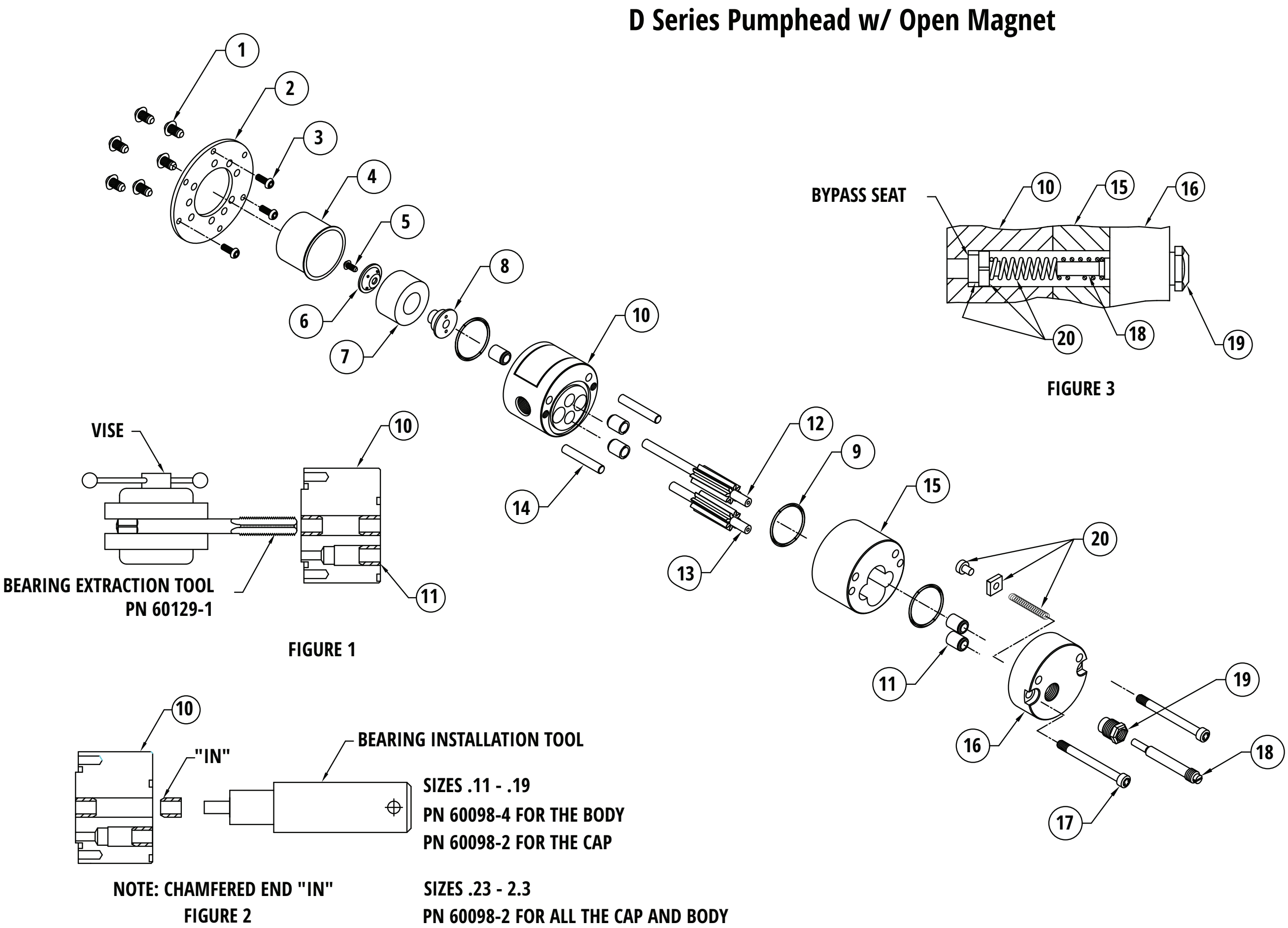


Figure 8.   D Series Pumphead w/ Open Magnet



Motor Mate Kit C-Face Assembly Instructions

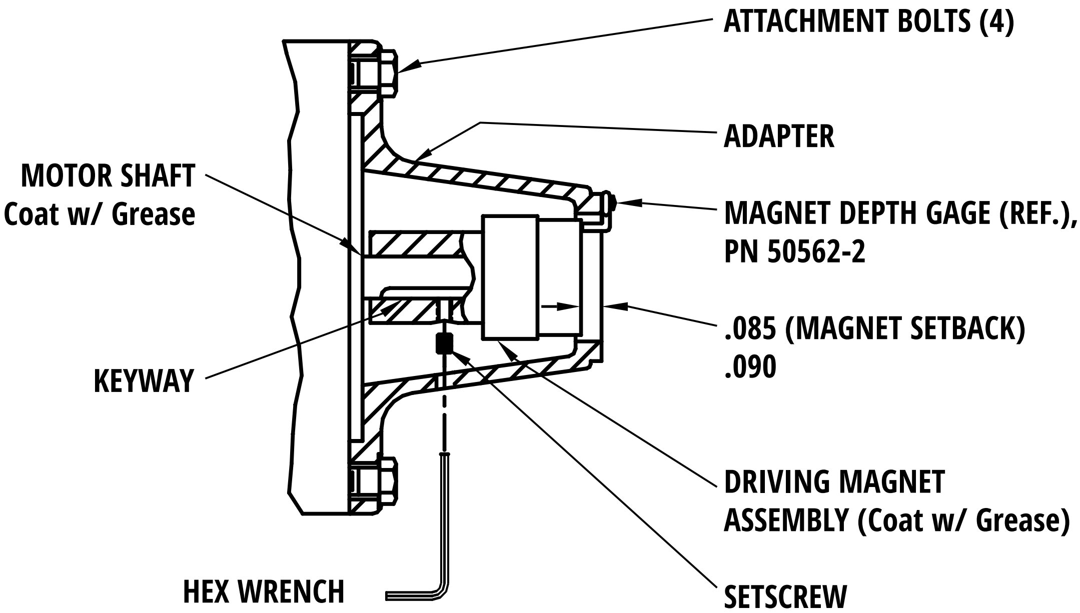
Coat the motor shaft with Dow Corning® 111 silicone grease or equivalent. Coat the driving magnet with Dow Corning® 111 silicone grease or equivalent, both on the inside and outside diameter including the magnet. The grease protects the parts from possible periodic exposure with chemicals. Install the driving magnet assembly on the motor shaft with the setscrew in line with the shaft key way (See Drawings Below). Turn the setscrew clockwise with the hex wrench so the setscrew protrudes into the key way but is not tight. Install the motor adapter and tighten the four bolts. With the shaft held in the "extended" position if necessary, slide the driving magnet assembly forward until it touches the magnet depth gage. Tighten the setscrew against the flat bottom of the key way taking care that the driving magnet position touching the magnet depth gage does not change. Remove the magnet depth gage and install the pump head to the adapter with the pump head mounting screws.

Important: *Motor rotation must be clockwise when looking at the motor shaft.*

Motor Mate Assembly Drawing Displacements .11 to 2.3

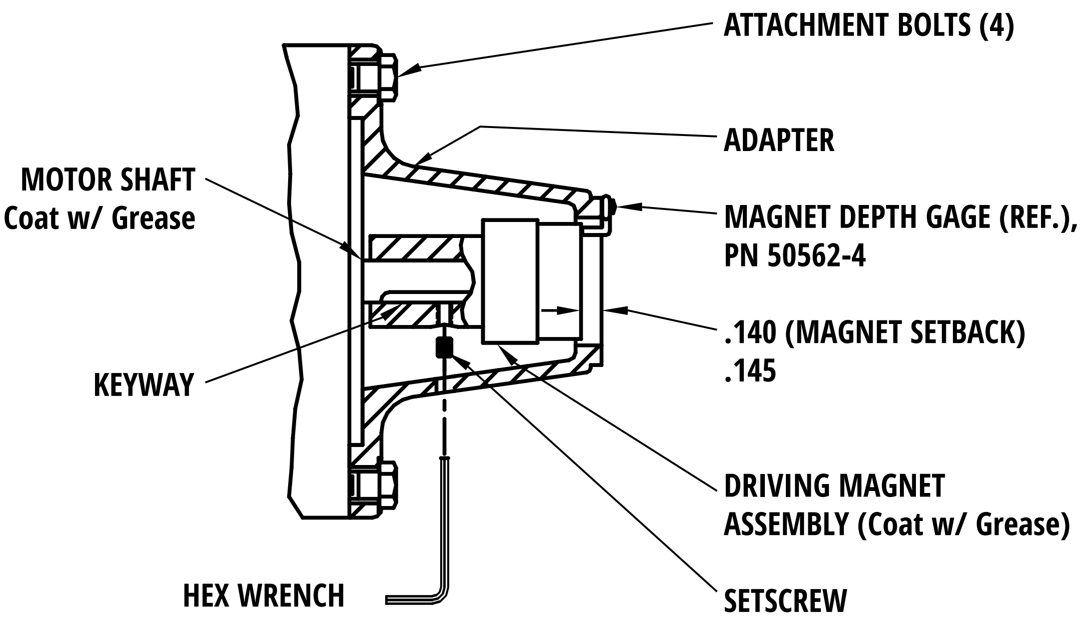
Motor Rotation - Clockwise when Facing the Shaft

Figure 9. Motor Rotation



Motor Rotation: Clockwise when Facing the Shaft

Figure 10. Motor Rotation:



Problem Solving

A problem with a system is typically not detected until after the pump has been installed and operated. As a result, the pump is the device that tests the system for proper operation. Since the problem was not discovered until after the pump was started, the pump is often faulted for what is actually a system problem. At Ingersoll Rand one of the tools we use is the 5 Why for continuous improvement.

1. Identify the Problem - The initial statement of a problem often reflects a preconceived solution take time to explore problem thoroughly.
2. Observe and Organize Information - List the symptoms and correlate to the pump, motor, or system then break the problem into smaller pieces if necessary.
3. Identify Probable Cause(s) - Identify possible causes of each symptom.
4. Confirm Root Cause - Confirm root cause with data or testing.
5. Consider Solutions - Understand the problem before implementing solution verify or test solution.
6. Implement the Solution.
7. Confirm the Solution Solved the Problem.

Problem Solving Guide

Symptom	Probable Cause	Corrective action
Low Flow	Worn Pump Parts	Replace gears and bearings
		Replace pump
	Low Viscosity	Change to higher flow pump
		Change to higher speed motor
	Motor Operating at Low RPM	hange to higher RPM motor
		Change to higher hp motor to reduce motor slip resulting in low RPM when using fractional hp motors
	Magnets Decoupled	See magnets decoupled symptom
	Pump Sized Below Required Flow	Change to higher displacement pump
High Flow	Motor Operating at High RPM	Change to lower RPM motor
		Add variable speed drive
	Pump Sized Above Required Flow	Change to lower flow rate pump
		Add relief valve
Low Vacuum	Worn Pump Parts	Replace gears and bearings
		Replace pump
Magnets Decouple	High Discharge Pressure	Lower discharge pressure
		Increase magnetic coupling torque
		Reduce relief valve pressure setting
	Discharge Pressure Spikes	Reduce or eliminate cause such as fast acting valves
		Install a relief valve to dampen spikes
	High Viscosity	Reduce viscosity by increasing fluid temperature
		Increase magnetic coupling torque
		Consult factory for gear trimming recommendations
	Drive Magnet Improperly Installed	Relocate drive magnet
	Low Inlet Pressure	Increase inlet pressure or increase magnet torque
Excessive Noise	Cavitation	Increase inlet pressure
		Replace with higher flow lower RPM pump/motor.
	High Rotational Speed	Replace with higher flow lower RPM pump/motor.
	High Pressure	Reduce pressure
		Replace with higher flow lower RPM pump/motor.
	Magnet Rub	Align pump to the motor
	System Vibration or Fluid Noise	Correct, isolate, or add noise dampening
	Motor	Repair or replace motor
	Inlet Air Leak	Eliminate air leak
	Worn Gears and Bearings	Replace gears and bearings
		Replace pump
High Amps	Inefficient Motor	Change to more efficient motor
	High Viscosity	Consult factory for gear trimming recommendations
	High Pressure	Lower pressure
		Add relief valve

Symptom	Probable Cause	Corrective action
Motor Does Not Start	Incorrect Wiring	Rewire
	No Power to Motor	Connect power
		Reset circuit breaker
	Starting Against a High Discharge Pressure	Add a pressure bypass for start-up
		Increase motor hp and magnetic coupling torque
	Motor Inoperative	Replace motor
	High Temperature Overload Tripped	Disconnect power to the motor until cool
Motor Overheats	Motor Underpowered for Application	Replace with higher power motor
	Motor Bearings Failing	Replace motor
	Operating Pressure Above Motor Rating	Reduce operating pressure
		Reduce relief valve pressure setting
		Change to higher power motor
Pump Does Not Prime	Starting Against a High Discharge Pressure	Install a bypass line for priming
	Low RPM	Increase RPM's for priming
		Change to a lower displacement higher RPM pump
	Worn Gears and Bearings	Repair with a service pak
		Replace pump head
	Restricted or High Lift on Inlet (Low NPSH)	Reduce inlet restrictions or blockage
		Install pump closer to or below fluid level
Premature Wear	Abrasives in the Fluid	Replace with abrasive resistant pump
		Add a 5 to 25 micron filter
	Excessive Pressure	Reduce pressure
	Cavitation	Increase inlet pressure
		Reduce inlet piping losses, increase port fitting ID
	Chemical Attack	Change to chemically resistant material
	Excessive Temperature	Lower temperature
		Change to high temperature material
	Foreign Particles in the Pump	Clean pump and add 5 to 25 micron filter
Motor/Pump Does Not Rotate	Pump Operating at High Temperature	Change to gears trimmed for high temperature
	Gears Exposed to Incompatible Fluid	Change to chemically resistant material
	Incorrect Motor Power Connection	Correct motor power connection
Motor/Pump Rotates Slowly	High Viscosity	Lower viscosity by increasing temperature
		Consult factory for gear trimming recommendation
		Replace with higher power motor
	High Pressure	Replace with higher power motor
		Adjust relief valve setting to a lower pressure

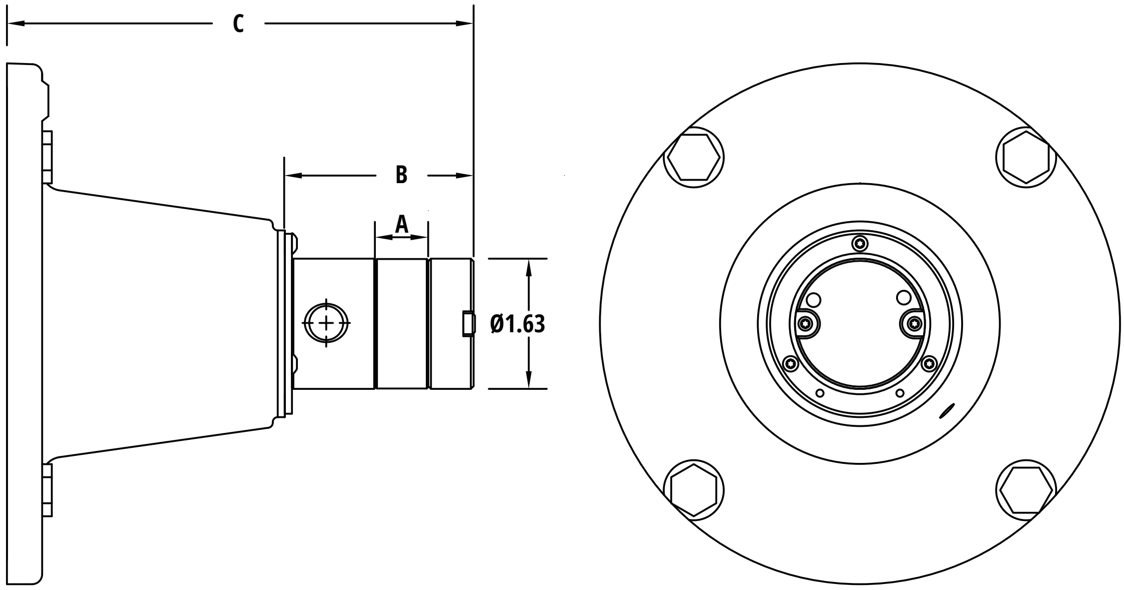
Water & Wastewater Treatment 56C Motor Mate Kit Parts List

Description	Qty	Part Numbers by Model Size			
		7187-7W	7187-4W	7187-5W	7187-8W
56C Face Adapter	1	52260-1	52260-1	52259-1	52259-1
Bolt	4	6924-1	6924-1	6924-1	6924-1
Driving Magnet Assembly	1	50908-23	50391-10	50391-11	51122-1
Allen Wrench	1	6923-1	6923-1	6923-1	6923-1
Magnet Setting Tool	1	50562-2	50562-2	50562-4	50562-4
Instruction Sheet, Motor Mate Assembly	1	70010-1	70010-1	70009-1	70009-1
Instruction Sheet, Coating	1	70174-1	70174-1	70174-1	70174-1
Dow Corning 111 Lubricant & Sealant (0.2 oz)	1	51999-1	51999-1	51999-1	51999-1

Drawing Specifications

W Series Displacements .11 to 2.3

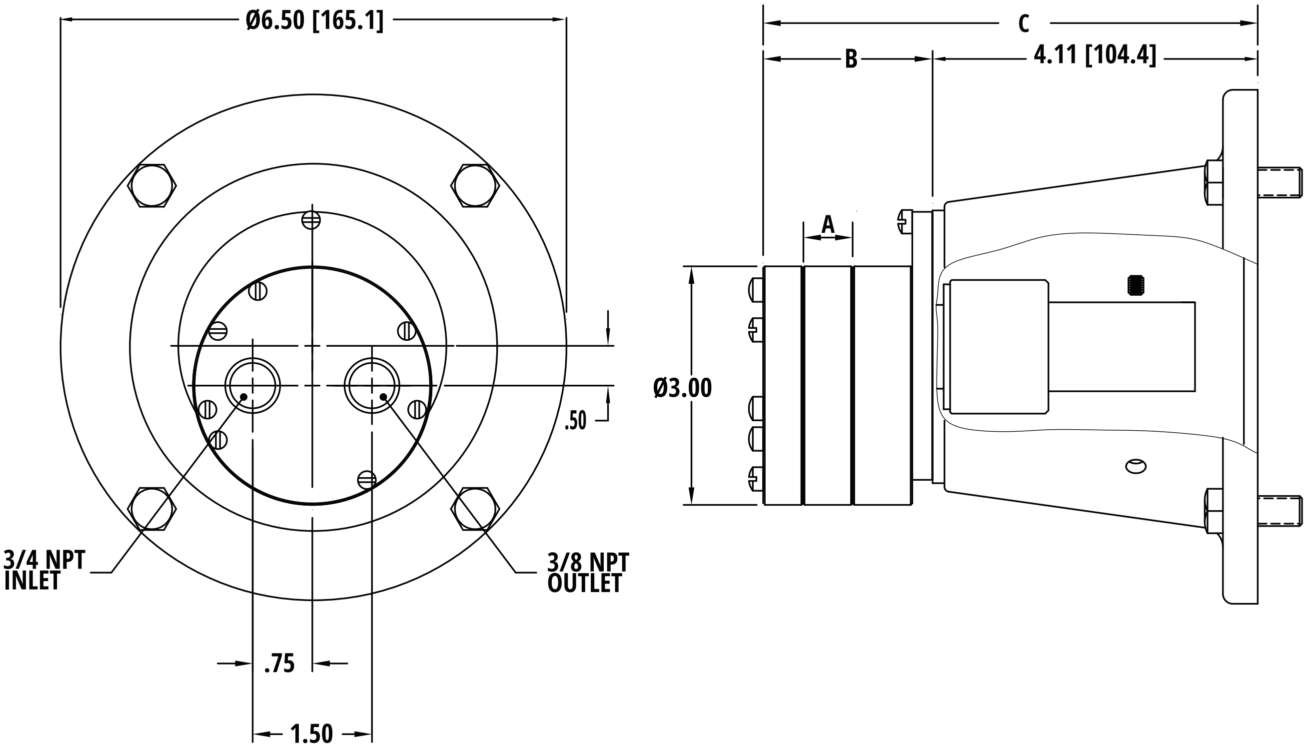
Figure 11. Displacements .11 to 2.3



Displacement	DIM A Inch [mm]	DIM B Inch [mm]	DIM C Inch [mm]
.11 & .19	0.125 [3.2]	1.83 [46.4]	5.30 [134.6]
.23 & .38	0.250 [6.4]	1.95 [49.5]	5.42 [137.7]
.57	0.375 [9.5]	2.07 [52.7]	5.54 [140.7]
.68 & .80	0.450 [11.4]	2.15 [54.7]	5.62 [142.7]
.99 & 1.2	0.657 [16.7]	2.36 [59.9]	5.83 [148.1]
1.3	0.750 [19.0]	2.45 [62.3]	5.92 [150.4]
1.6 & 2.0	0.900 [22.9]	2.60 [66.0]	6.07 [154.2]
2.3	1.000 [25.4]	2.70 [68.6]	6.17 [156.7]

W Series Displacements 2.6 to 5.3

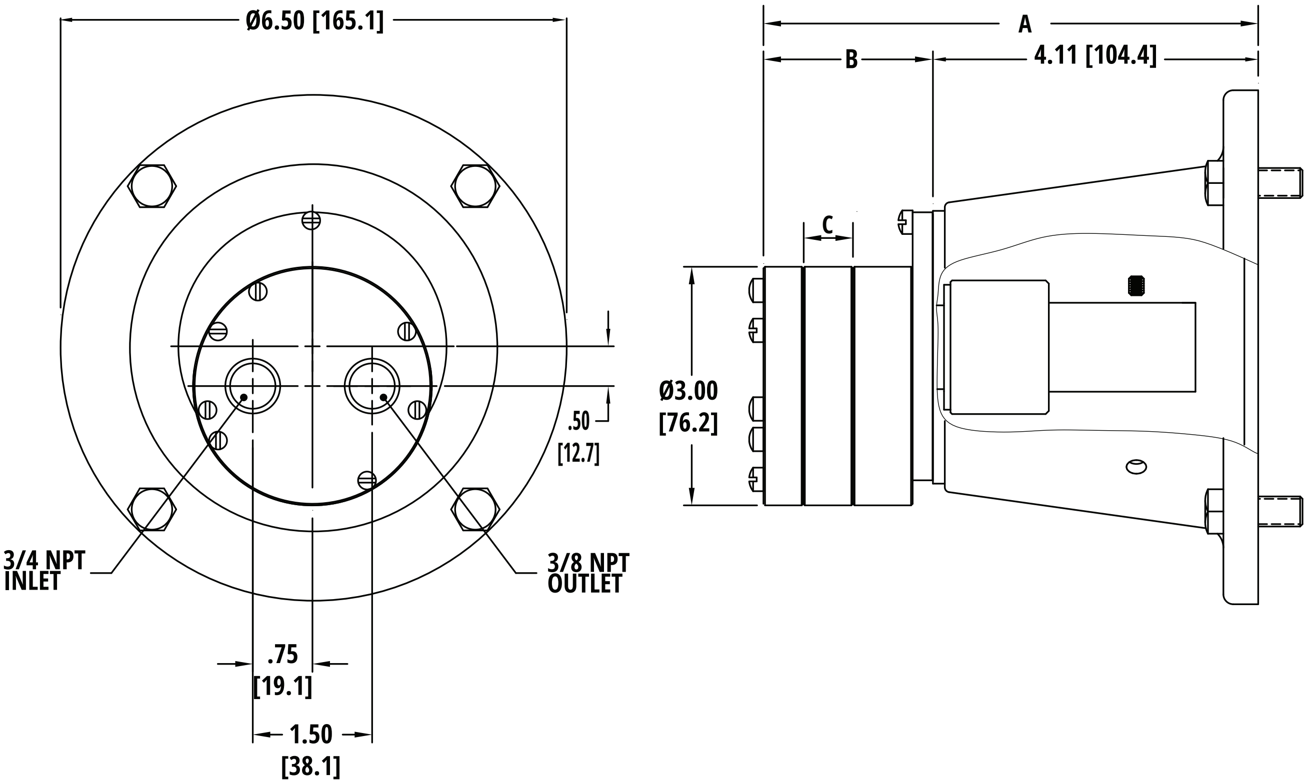
Figure 12. Displacements 2.6 to 5.3



DISPLACEMENT	DIM A Inch [mm]	DIM B Inch [mm]	DIM C Inch [mm]
2.6	.313 [7.95]	1.82 [46.2]	5.93 [150.6]
5.3	.625 [15.8]	2.12 [53.8]	6.24 [158.5]
7.9	.938 [23.8]	2.43 [61.8]	6.55 [166.4]

W Series Displacements 8.0 to 12.

Figure 13. Displacements 8.0 to 12.



Displacement	Dim A Inch [mm]	Dim B Inch [mm]	Dim C Inch [mm]
TWS8.0	7.00 [177.8]	2.65 [59.7]	.625 [15.9]
TWS12	7.32 [185.9]	2.96 [75.1]	.938 [23.8]