



G-SERIES TURBINES

3-A High Temperature Sanitary Models

- GSCPS-100-2
- GSCPS-150-2
- GSCPS-200-2
- GSCPS-100-3
- GSCPS-150-3
- GSCPS-200-3



To the owner...

Congratulations on receiving your FLOMEC® G-Series Sanitary Turbine. We are pleased to provide you with a product designed to give you maximum reliability and efficiency.

Our business is the design, manufacture, and marketing of liquid handling, agricultural, and recreational products. We succeed because we provide customers with innovative, reliable, safe, timely, and competitively priced products. We pride ourselves in conducting our business with integrity and professionalism.

We are proud to provide you with a quality product and the support you need to obtain years of safe, dependable service.

President
Great Plains Industries, Inc.

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GENERAL INFORMATION

This manual will assist you in installing and maintaining your FLOMEC G-Series Sanitary Turbine. For best results, take the time to fully acquaint yourself with all information about all components of your G-Series Sanitary Turbine. If you need assistance, contact the distributor from whom you purchased your turbine.

Product Description

FLOMEC G-Series Sanitary Turbine flowmeters are volumetric flow measurement devices. The moving fluid is used to turn a rotor, which is suspended in the flow stream. The rotating speed of the rotor is proportional to the fluid velocity or flowrate. As the blades from a spinning rotor pass by a magnetic sensor, a pulse is generated and transmitted to the readout instrument. Each pulse is equal to a given volume of liquid; therefore “x” number of pulses are equal to a gallon, litre, pound, barrel, etc.

Turbine Sizing

FLOMEC G-Series Sanitary Turbines are identified by the internal diameter of the inlet and outlet.

Model GSCPS-100-X	1 in.	(6.7-67 GPM)
Model GSCPS-150-X	1-1/2 in.	(17.7-177 GPM)
Model GSCPS-200-X	2 in.	(33-330 GPM)

Turbine flowmeters should be sized in accordance to the actual flowrate and not the process pipe size. For example, a process having a flowrate of 10-20 GPM in a 1-1/2 in. process line requires Model GSCPS-100-X turbine flowmeter.

Another important factor to take into consideration when sizing a turbine flowmeter is instantaneous flowrate. This is extremely important when sizing a turbine flowmeter where the volume is measured per hour or per day. For example, an application where the total output is 500 barrels per day, occurring in a 5-hour period; the recommended turbine flowmeter should be sized according to the instantaneous flowrate (see below):

(500 – 5) x 24 or 2,400 barrels per day, thus, requiring a 1-1/2 inch turbine flowmeter.

INSTALLATION

Turbine flowmeters are affected by both upstream and downstream process configurations. Turbine flowmeters should always be installed with a minimum of 10 pipe diameters upstream and 5 pipe diameters downstream. The only exception is the placement of the pumps, valves, etc., on the upstream end. When this occurs, 20 diameters of straight pipe should be used. The direction of flow is indicated by the arrow on the turbine. All turbine flowmeters are designed to measure flow in only one direction.

Check the items below once the turbine flowmeter is installed in the process line. This will ensure a successful start-up.

1. Check the interconnection cable between the turbine flowmeter and readout device.

2. Make sure that the new or correct K-factor is entered into the readout device.

NOTE: *The K-factor is printed on the turbine body. The calibration report included with the product provides several points along the flow curve.*

Turbine flowmeters can be installed in the horizontal or vertical position. When installing a turbine flowmeter in the vertical position, it is important that the direction of flow be up through the turbine flowmeter.

A spool should be installed in place of the turbine flowmeter during initial start-up of a new process line. The process line should be purged, thus eliminating any solids contained in the line. Once this is completed, the spool can be removed and the turbine flowmeter installed.

Whenever possible, use 20 straight pipe diameters upstream and downstream of the turbine flowmeter. The length of straight pipe upstream and downstream of the turbine flowmeter can be reduced with the use of flow straighteners or straightening vanes. A minimum of 10 straight pipe diameters upstream and 5 downstream are required.

NOTE: *Control valves should always be installed downstream of the turbine flowmeter.*

The turbine flowmeter should be installed in a location where the process line will remain full of liquid at all times. Otherwise, when the process line becomes empty and a valve is opened, the high velocity fluid hitting the turbine flowmeter rotor can cause severe damage.

When there is entrained air in the process line, an air eliminator should be used. This entrained air causes air pockets and these air pockets will cause the rotor to spin at a faster rate than liquid, thus resulting in incorrect readings, which results in an overstatement of actual flowrate and volume. This condition can damage the flowmeter.

In process lines where particulates are present, a filter/strainer should be used. Refer to the table below for the recommended mesh size.

Turbine Flowmeter Size	Mesh Size
1 inch	40
1-1/2 inch	18
2 inch	14

⚠ WARNING
If liquid being measured by sleeved bearing turbine flowmeters contains large solids, install a filter or strainer.
Without the use of a filter or strainer, damage can occur to the internal components.

MAINTENANCE

Cleaning Procedures

G-Series Sanitary Turbines are designed to be compatible with commercially accepted methods of both CIP (Cleaned-In-Place) mechanical cleaning as well as intermittent SIP (Steam-In-Place) cleaning methods.

If CIP or SIP cleaning methods are not available, manual COP (Cleaning-Out-of-Place) methods can be used.

Care must be taken during system start-up, chemical cleaning, air purge or steam-cleaning processes to ensure that the turbine rotor does not over speed as damage can result to the rotor and/or bearing. Maximum allowable over range for G-Series Sanitary Turbines is 125% of maximum rated flowrate for intermittent periods.

A minimum fluid velocity of 5 foot per second (1.5 meter per second) must be maintained during the CIP process to ensure adequate cleaning.

Reference: 3-A Accepted Practices for Permanently Installed Product and Solution Pipelines and Cleaning Systems Used in Milk and Milk Product Processing Plants, Number 605-XX as amended for procedures and recommended flowrates.

The following flowrates are recommended by the 3-A Recommended Practices 605-XX to achieve 5 FPS or 1.5 MPS in the respective Sanitary Tube size:

O.D.	I.D.	FLOWRATE
1.0 in. 2.5 cm	.875 in. 2.22 cm	9.4 GPM 35.6 LPM
1.5 in. 3.8 cm	1.375 in. 3.50 cm	24 GPM 90.8 LPM
2.0 in. 5.1 cm	1.875 in. 4.75 cm	43 GPM 163 LPM

Temperature limit for the magnetic pickup is limited to 248° F. Therefore, it is important to remove the pickup from the product during SIP procedures. Internal components of the G-Series Sanitary Turbine must be limited to less than 285° F (140° C). The temperature and pressure rating of gaskets and clamps used in the installation must also be taken into consideration when determining cleaning parameters.

Minimum requirements for effective sterilization with SIP cleaning are to maintain 250° F (121° C) at the coldest point in the system for a minimum of 30 minutes. This requires a minimum of 15.3 psig (106 kPa) saturated steam pressure. Normal recommended maximums for SIP cleaning on G-Series meters is 285° F (140° C) and 39 psig (269 kPa) saturated steam pressure.

Disassembling the Turbine

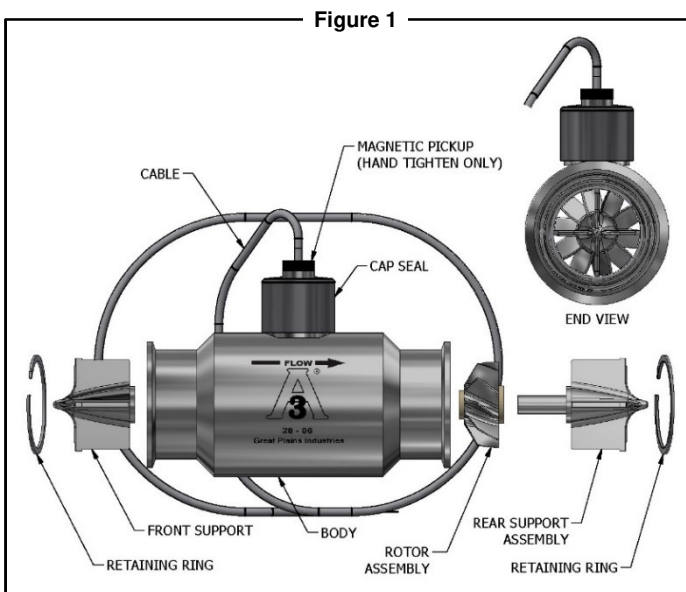
1. Remove the magnetic pickup.
2. Ensure that the process line is depressurized and empty prior to removal of the turbine flowmeter. Remove the turbine flowmeter from the process line.
3. Using a small screwdriver or similar tool, insert it into the radius notch of the retaining ring on the outlet end, pull away from the groove and up, removing the retaining ring from outlet end of the turbine flowmeter. This will allow the rear support assembly and rotor to slide out of the turbine flowmeter body.
4. Remove the rear support assembly and rotor assembly before proceeding to remove the front support.

NOTE: To remove the front support at the inlet end of the turbine flowmeter, repeat the previous retaining ring and support removal operation.

5. Once the turbine flowmeter is taken apart, inspect the turbine flowmeter body for signs of wear or defects. The body bore should be smooth and show no evidence of wear.

NOTE: Do not install a new replacement kit into a turbine flowmeter body that shows significant signs of wear.

6. Examine the rotor assembly for broken and/or bent blades. Remove any foreign matter.
7. Examine the supports for signs of deterioration, such as wear marks and/or burrs along the outer edge of the support vanes.
8. When the rotor assembly or the supports show any sign of deterioration, a new replacement kit should be installed. Do not install a new replacement kit into a defective turbine flowmeter body.



Replacement Kits

A replacement kit is comprised of all the internal component parts within the turbine flowmeter. A replacement kit consists of the following:

Parts Description	Quantity
Rotor Assembly	1
Support (Front)	1
Support Assembly (Rear)	1
Retaining Ring	2

FLOMEC Sanitary Turbine supports are not identical in design. The rear support assembly has a shaft that supports the rotor; the front support does not.

Notice that the direction of flow is displayed on the body of the turbine flowmeter. This is important when installing the supports and rotor and it also denotes the direction in which the turbine flowmeter was calibrated.

1. Install the front support placing a vane between the notches in the turbine flowmeter body. Install a retaining ring to keep the support in place.
2. Place the rotor assembly on the shaft of the uninstalled rear support assembly.

NOTE: *FLOMEC Sanitary Turbine rotors are tapered on one end. The tapered end should be installed facing the front support (see Figure 1).*

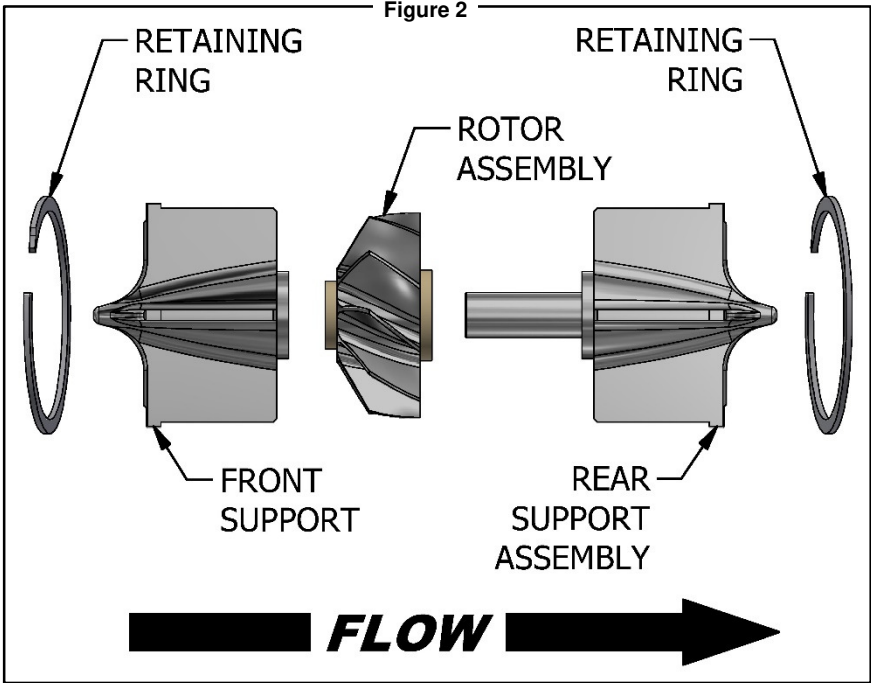
3. Hold the turbine flowmeter body with the rear (outlet) end down, and slide the rotor assembly and rear support assembly into the turbine flowmeter body. Make sure the vane is placed between the notches.
4. Once the rear support assembly is in place, install the retaining ring.
5. Blow into the turbine flowmeter to ensure the rotor spins freely.

NOTE: *Installation of the replacement kit is complete and the turbine flowmeter can be reinstalled into the process line.*

6. Install the magnetic pickup. **HAND TIGHTEN ONLY.**
7. Enter the new K-factor supplied with the replacement kit into the electronic readout device. (Refer to the calibration report.)

NOTE: *All internal replacement kits are factory calibrated and are supplied with a five point calibration certificate.*

Figure 2



Replacement Kits for Sanitary Turbine Flowmeters (GSCPS)

Size	Flow Range (Gallons Per Minute)	Model	Part No.
1 in.	6.7 - 67 GPM	GSCPS-100-X	81008074
1-1/2 in.	17.7 - 177 GPM	GSCPS-150-X	81508074
2 in.	33 - 330 GPM	GSCPS-200-X	82008074

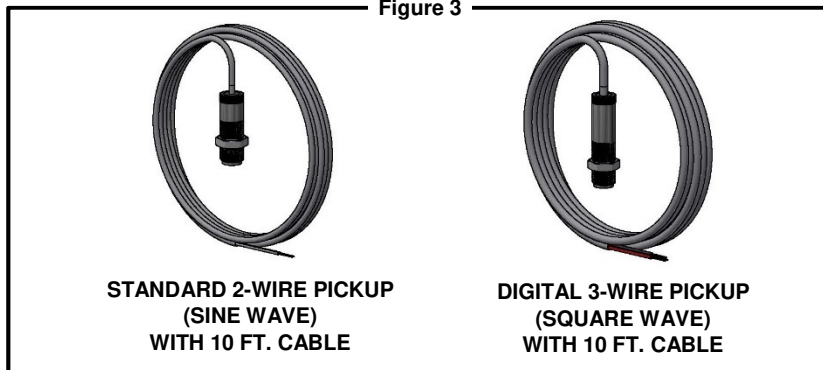
Magnetic Pickups

GSCPS-XXX-X meters come with factory installed pickups.

When choosing a magnetic pickup for output to customer-supplied equipment select either a standard 2-wire (Sine Wave) or a digital 3-wire (Square Wave) output as your signal type.

- Standard Sine Wave (2-wire) does not require external power for the sensor, and can be used with battery powered displays.
- Digital Square Wave (3-wire) requires external power to power the sensor.

Figure 3



Selection Guide for 1 in. 1-1/2 in., 2 in. Turbine Meters

Magnetic Pickup Type	Part No.	Application	Cable Type
Standard With Cable	81003500	Remote mount electronics. Temperature range: -100°F to +250°F. Sine wave output.	10 ft. 2-Conductor
Digital with Cable	81004500	Remote mount electronics. Temperature range: -40°F to +248°F. Square wave output, 5-32 VDC required. Signal output: 0-10V, NPN	10 ft. 3-Conductor

Figure 4

STANDARD 2-WIRE PICKUP (SINE WAVE) SHIELDED CABLE



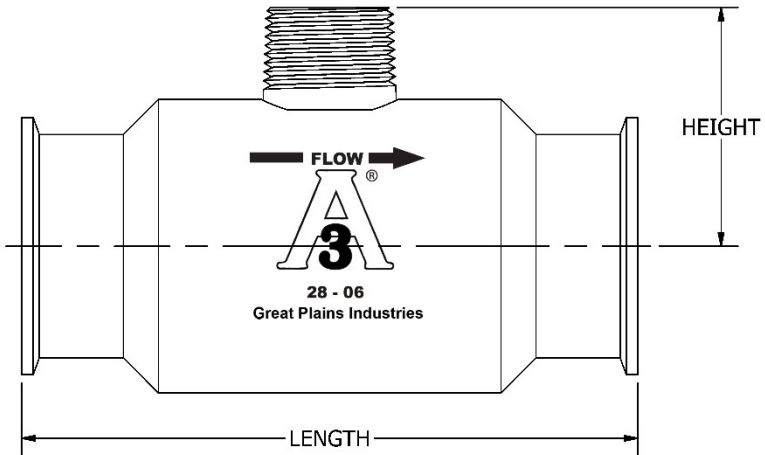
DIGITAL 3-WIRE PICKUP (SQUARE WAVE) SHIELDED CABLE



FLOW RANGES					
Size	Gallons Per Minute		Litres Per Minute		Frequency Output
	Min.	Max.	Min.	Max.	
1 in.	6.7	67	25.2	252	100 - 1000 Hz
1-1/2 in.	17.7	177	67.0	670	100 - 1000 Hz
2 in.	33	330	124.9	1249	100 - 1000 Hz

DIMENSIONS		
Size	Height	Length
1 in.	2.75	3.562
1-1/2 in.	3.00	4.594
2 in.	3.25	6.063

Dimensions are provided in inches.



TROUBLESHOOTING

Checking the Turbine Flowmeter

Remove the turbine flowmeter from the process line. **DO NOT** remove the internals at this time.

Visually inspect the internals of the turbine flowmeter. Check for particulates and/or foreign objects, which may have lodged between the rotor and the body. In the event an object is detected, simply remove the retaining ring on the outlet side of the turbine flowmeter and remove the support and rotor assembly. Once the turbine flowmeter parts are free from any foreign matter, reassemble.

NOTE: *Always ensure that a support vane is installed between the indentation marks on the body.*

Upon completion, verify the rotor spins freely, reinstall the turbine flowmeter into the process line.

If there are no signs of particulates or any other foreign matter obstructing the rotor, try blowing into the turbine flowmeter. If the rotor does not spin freely, insert a thin screwdriver or similar tool, gently so as not to damage any of the rotor blades, and turn the rotor.

There may be another cause for the rotor to drag or stop, such as incorrect bearing material used for the application. For example, non-compatibility of the bearing material with the process liquid, bearing material may not withstand the temperature of the application, etc. When there is uncertainty with respect to the selection of bearing material for a given application, contact GPI.

Before installing a new replacement kit, inspect the turbine flowmeter body for wear and damage. By placing your finger inside the turbine flowmeter body, feel for any signs of wear such as grooves, ridges, irregular spots. If such signs are evident, it is a strong possibility that the turbine flowmeter body is damaged and the installation of a new replacement kit is **NOT** recommended.

When a new replacement kit is installed inside a damaged turbine flowmeter body, the internals will be ruined after a short period of operation and will have to be discarded. In the event it is uncertain whether the turbine flowmeter body is functional, it should be sent to GPI so the I.D. dimension of the turbine flowmeter body bore can be checked. If it is found to be within tolerance, a new set of internals will be installed. This will eliminate the possibility of using and/or discarding a turbine flowmeter that shows signs of wear.

NOTE: *A good turbine flowmeter body should have a smooth inner bore free of wear signs.*

If it is determined that the turbine flowmeter body is in good condition, install a new replacement kit and reinstall the turbine flowmeter into the process line.

Troubleshooting Reference Guide		
Symptom	Probable Cause	Solution
No output is displayed or registered	Foreign matter obstructing the turbine flowmeter rotor	Refer to the Checking the Turbine Flowmeter section.
	Defective turbine flowmeter internals	Refer to the Checking the Turbine Flowmeter section.
More volume/output than displayed or registered.	Rotor may drag due to foreign matter obstruction	Refer to the Checking the Turbine Flowmeter section.
	Magnetic pickup not screwed down all the way into the turbine flowmeter body, causing it not to detect all the rotor blades as they pass.	Screw the magnetic pickup all the way down into the turbine flowmeter body. Hand-tighten only.
	Turbine flowmeter installed backwards.	Install the turbine flowmeter in accordance with the process flow direction.
	Turbine flowmeter rotor installed backwards.	Install the turbine flowmeter rotor in accordance with the process flow direction.
	K-factor is too high in electronic/readout device.	Verify K-factor used. K-factor should be decreased.
Less volume/output than displayed or registered.	Caused by entrained air in the process line.	Install an air eliminator upstream of turbine flowmeter.
	K-factor is too low in electronic/readout device.	Verify K-factor used. K-factor should be increased.

SPECIFICATIONS

Accuracy *	±0.5% of the true flow at any point within the linear range of the turbine flowmeter.
Linearity *	±0.5% of the mean K- factor throughout the linear range.
Repeatability *	±0.1% of the indicated flow throughout the linear range.
Response Time: 1 in., 1-1/2 in. & 2 in	2-5 milliseconds for step change in flowrate.
Frequency Output: 1 in, 1-1/2 in. & 2 in.	100 - 1000 Hz (Over the linear range)
Voltage Output: 1 in., 1-1/2 in., & 2 in	Approx. 100 mV @ 100 Hz to 1.0 Volt (r.m.s.) @ 1000 Hz
Maximum Overage	Up to 125% of maximum flowrate for intermittent periods.
Operating Temperature	-100° F to +225° F (-70° C to +107° C)

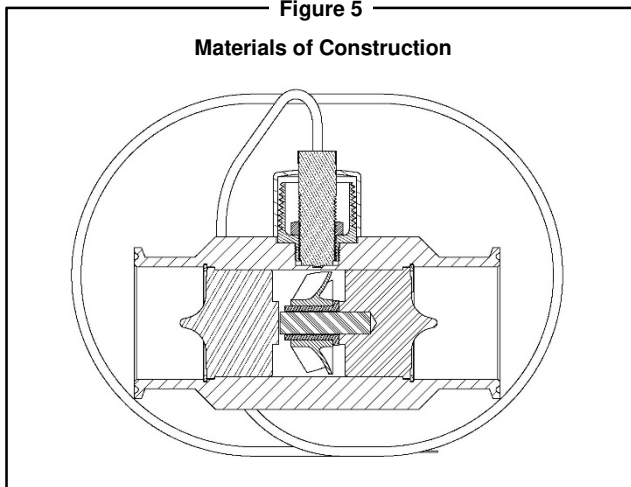
Standard Materials of Construction

Housing	316 Stainless Steel
Rotor	Nickel Plated CD4MCu Stainless Steel
Shaft	316 Stainless Steel
Rotor Supports	316 Stainless Steel
Sleeve/Thrust Bearing	PEEK
Retaining Rings	300 Series Stainless Steel

* Data based on water calibration @ 77°F (25°C).

Figure 5

Materials of Construction



FLOW RELATED FORMULAS

$$\text{GPM} = \frac{\text{Hz} \times 60}{\text{K-factor}}$$

$$\text{Hz} = \frac{\text{GPM} \times \text{K-factor}}{60}$$

$$\text{K-factor} = \frac{\text{Hz} \times 60}{\text{GPM}}$$

$$\text{Pulses Per Litre} = \frac{\text{K-factor}}{3.785}$$

$$\text{Pulses Per Barrel} = \text{K-factor} \times 42$$

$$\text{Pulses Per Cubic Meter} = \frac{\text{K-factor}}{.003785}$$

$$\text{Pulses Per Pound} = \frac{\text{K-factor}}{\text{Pounds Per Gallon}}$$

$$\text{GPM} = \frac{\text{Pounds Per Hour}}{500 \times \text{S.G.}}$$

$$\text{Pounds Per Hour} = 500 \times \text{S.G.} \times \text{GPM}$$

$$\text{Pounds Per Gallon} = \text{S.G.} \times 8.33 \text{ (Water)}$$

$$\text{BPH} = \text{GPM} \times 1.42857$$

$$\text{BPD} = \text{GPM} \times 34.286$$

$$\text{BPM} = \text{GPM} \times 0.238$$

$$\text{GPS} = \text{GPM} \times .01666$$

$$\text{GPD} = \text{GPM} \times 1440.0$$

$$\text{GPM} = \text{BPD} \times .029167$$

$$\text{GPM} = \text{BPH} \times 0.7$$

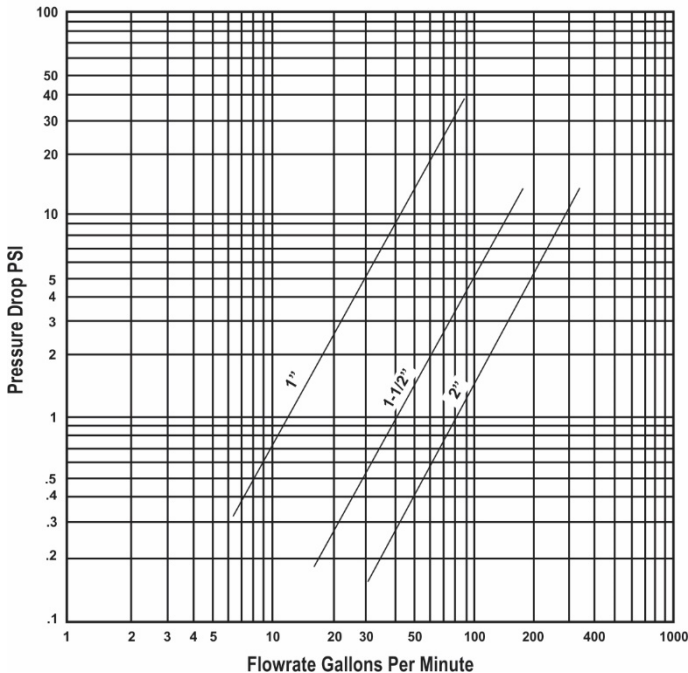
$$\text{CFM} = \text{GPM} \times .13368$$

BPH = Barrels Per Hour
BPD = Barrels Per Day
BPM = Barrels Per Minute
CFM = Cubic Feet Per Minute

GPS = Gallons Per Second
GPD = Gallons Per Day
GPM = Gallons Per Minute

PRESSURE DROP vs FLOWRATE

Pressure Drop vs. Flowrate



For estimating pressure drops on liquids other than water, use the following formulas:

$$P = [\text{VISC (CPS)}]^{1/4} \times [\text{S.G.}]^{3/4} [\text{PH O}]$$

Where: CPS = Absolute Viscosity in Centipoise
SG = Specific Gravity
PH O = Pressure Drop at the Operating Flowrate from the Chart

SERVICE

For warranty consideration, contact your local distributor. If you need further assistance, contact the GPI Customer Service Department at:

1-888-996-3837

You will need to:

- Provide the model number of your turbine.
- The serial number of your turbine.
- Specific information about part numbers and descriptions.

For warranty work always be prepared with your original sales slip or other evidence of purchase date.

RETURNING PARTS

Please contact the factory before returning any parts. It may be possible to diagnose the trouble and identify needed parts in a telephone call. GPI can also inform you of any special handling requirements you will need to follow covering the transportation and handling of equipment that has been used to transfer hazardous or flammable liquids.

CAUTION: *Do not return turbines without specific authority from the GPI Customer Service Department. Due to strict regulations governing transportation, handling, and disposal of hazardous or flammable liquids, GPI will not accept turbines for rework unless they are completely free of liquid residue.*

CAUTION: *Turbines not flushed before shipment can be refused and returned to the sender.*



FLOMEC® TWO-YEAR LIMITED WARRANTY

Great Plains Industries, Inc. 5252 E. 36th Street North, Wichita, KS USA 67220-3205, hereby provides a limited warranty against defects in material and workmanship on all products manufactured by Great Plains Industries, Inc. This product includes a 2-year warranty. Manufacturer's sole obligation under the foregoing warranties will be limited to either, at Manufacturer's option, replacing or repairing defective Goods (subject to limitations hereinafter provided) or refunding the purchase price for such Goods theretofore paid by the Buyer, and Buyer's exclusive remedy for breach of any such warranties will be enforcement of such obligations of Manufacturer. The warranty shall extend to the purchaser of this product and to any person to whom such product is transferred during the warranty period.

The warranty period shall begin on the date of manufacture or on the date of purchase with an original sales receipt. This warranty shall not apply if:

- A. the product has been altered or modified outside the warrantor's duly appointed representative;
- B. the product has been subjected to neglect, misuse, abuse or damage or has been installed or operated other than in accordance with the manufacturer's operating instructions.

To make a claim against this warranty, or for technical assistance or repair, contact your FLOMEC distributor or contact FLOMEC at one of the locations below.

In North or South America contact

Great Plains Industries, Inc.
5252 East 36th St. North
Wichita, KS 67220-3205
USA

888-996-3837

www.flomecmeters.com
(North America)

Outside North or South America contact

GPI Australia
(Trimec Industries Pty. Ltd.)
12/7-11 Parraweena Road
Caringbah NSW 2229
Australia

+61 02 9540 4433

www.flomec.com.au

The company will step you through a product troubleshooting process to determine appropriate corrective actions.

GREAT PLAINS INDUSTRIES, INC., EXCLUDES LIABILITY UNDER THIS WARRANTY FOR DIRECT, INDIRECT, INCIDENTAL AND CONSEQUENTIAL DAMAGES INCURRED IN THE USE OR LOSS OF USE OF THE PRODUCT WARRANTED HEREUNDER.

The company herewith expressly disclaims any warranty of merchantability or fitness for any particular purpose other than for which it was designed.

This warranty gives you specific rights and you may also have other rights which vary from U.S. state to U.S. state.

NOTE: In compliance with MAGNUSON MOSS CONSUMER WARRANTY ACT – Part 702 (governs the resale availability of the warranty terms).

Wichita / Sydney

GREAT PLAINS INDUSTRIES



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