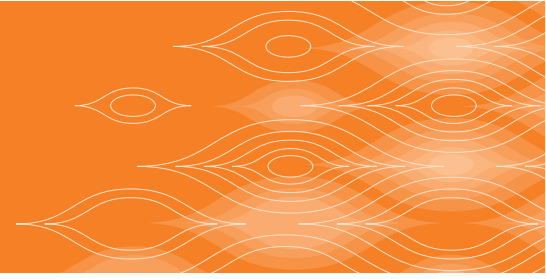


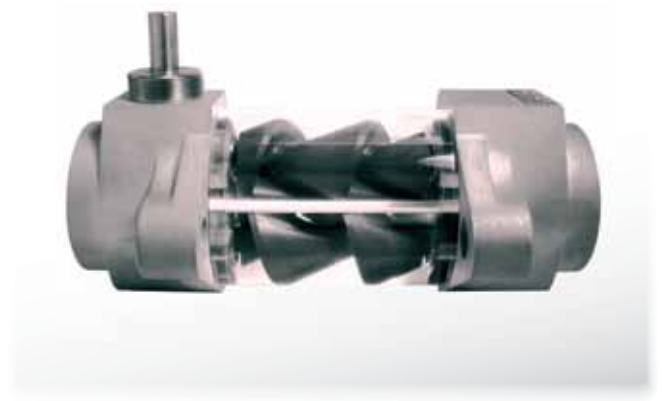


Max Machinery, Inc.



Instruction Manual Max Flow Meters

Models 241, 242, 243, 251



Please do not attempt to install or start flow meter without reading this entire manual.

Max Machinery, Inc. reserves the right to make changes to the product in this Instruction Manual to improve performance, reliability, or manufacturability. Consequently, contact MMI for the latest available specifications and performance data. Although every effort has been made to ensure accuracy of the information contained in this Instruction Manual, MMI assumes no responsibility for inadvertent errors.

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General Description

The Max 240 Series Flow Meters are positive displacement helical rotor type units capable of precise measurements over a wide range of flow rates and fluid viscosities.

The three sizes of this series (241, 242, and 243) will measure flows from 0.1 L/min to 1400 L/min. Material viscosities between 3 and 1,000,000 centipoise may be accommodated.

In a helical rotor type flow meter, a precise amount of the fluid being measured is trapped between the rotors as they turn. This motion is used to turn a gear coupled to a magnet. An external transmitter senses the motion of the magnet and converts this signal into a voltage, pulse or 4-20 mA current flow rate output. For some transmitter models, the magnet is eliminated and the motion of the gear itself is sensed.

The Max Series 240 Meters are of simple and rugged construction. They can be expected to perform superbly if treated within the confines of the design envelope. For this reason, it is important to read this manual and understand the operational requirements and limits of the meter.

Our Technical Service staff will be happy to answer any questions that this manual does not cover.



Installation

For optimum performance, install the flow meter on the discharge side of the pump, in one of the configurations shown on page 6.

The following items and conditions should be considered:

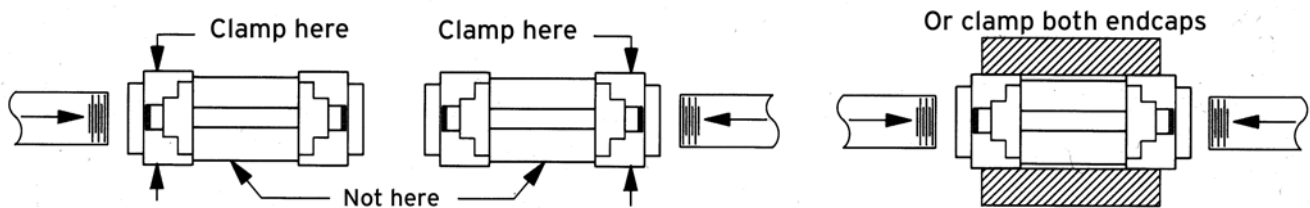
Location: Install the flow meter in a clean, dry area if possible. Avoid areas with high vibration levels.

Line and Bypass Valves: These valves allow filter cleaning or flow meter removal without completely shutting the system down and draining the lines. They are important for system start up under conditions which could damage the meter, such as: air in the lines, solid materials (at room temperature), high temperature materials, or initial line surges.

Filtration: Any dirt present in the system can jam or damage the meter. A 150 micron filter is generally recommended, although materials with very high viscosities may require a coarser filter. For bidirectional flow applications, use a filter on each side of the flow meter. Materials with fibrous or non abrasive particulate matter may have to be run without filters. Follow the recommendation of your Max Sales Engineer or consult Technical Service.

Clean Plumbing: Before installing the flow meter, clean the inside of the pipe line with compressed air or steam (especially when using new pipe). Don't use water, steam, or compressed air on the meter itself! Remove any protective covering from the flanges (if applicable).

Pipe Threading: When installing pipe to the flow meter, support the nearest end cap or both end caps (as in a vise). Don't clamp the flow meter body. This avoids possible misalignment of flow meter components when the pipe is screwed tight. Check for proper flow meter operation by rotating the timing gear through the transmitter mounting hole. It should move freely and without noise. (Applicable for units with 289 Transmitters only.)



High Temperatures: Use the "Vertical Installation" drawing. This minimizes heat transfer by vertical flow from the flow meter to the transmitter. The transmitter is the most heat sensitive element in the system and the transmitter manual should be consulted for specific limits. Optional heating fluid ports are available for the flow meter to keep it at operating temperature during standby conditions. For substances that are solid at room temperature, these ports are generally required to keep the material molten and flowing through the meter.

ANSI Flanges: Using the 241, 242 or 243 meters at pressures greater than 500 psi will also require flanges. See the specifications and bolt torque table on page 9. Max has bolt kits available for flange installations.

Precautionary Measures



Before Installing

Read entire manual before installation. If you need further information, please contact Max Machinery and ask for Flow Meter Technical Service. Mistakes can be expensive!

Install bypass plumbing around the flow meter. This is useful during start up for removing dirt and air from the plumbing or when metering high temperature materials. It also allows removing the flow meter for service without disabling the system.

Install proper filtration immediately upstream of the flow meter.

Be very careful to keep all parts clean during installation or tear down. A little dirt on a fitting or in a line (from the floor, bench, etc.) looks like a truckload on a microscopic level. Any dirt introduced into the system between the filter and meter will not be filtered out.

During Operation

Clean the filter on a regular basis

Do not pump aqueous solutions through your flow meter unless approved by Max due to potential internal galling.

Never steam clean the meter (bypass or remove the meter if necessary).

Do not blow down the meter with compressed air or gas because it will overspeed and possibly damage the meter.

Never turn on the pump in a system filled with material which is a solid at room temperature until the material has been melted completely. Use a bypass around the meter during start up.

Do not apply excessive differential pressure across meter as it will cause internal parts to fail (see pressure drop curve safe zone).

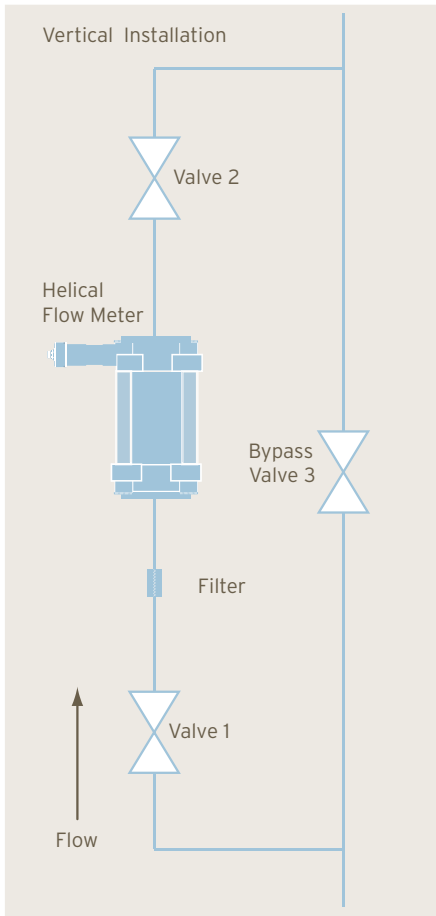
Do not over pressurize the meter. Please refer to specifications for maximum operating pressure.

Do not exceed the maximum flow rates for the material viscosity. See the pressure drop curves.

Never allow materials which may solidify in air to set up inside the flow meter. These may be impossible to remove. If the meter needs to be removed for repair and cannot be completely cleaned, plug the inlet and outlet ports at once.

Installation Configurations

Flow Rate Monitoring

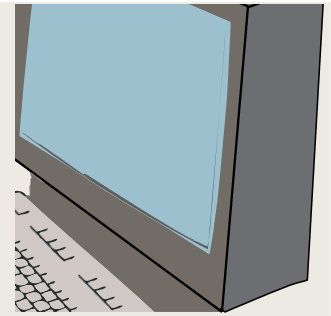


Max Indicators

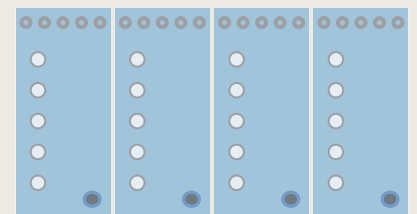


- or -

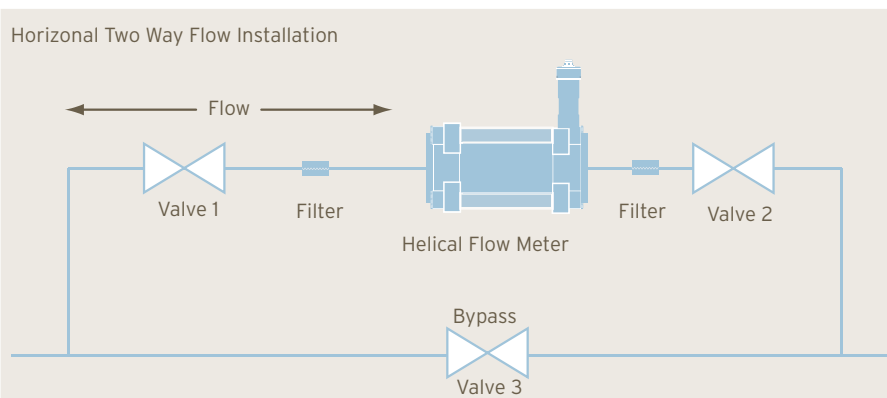
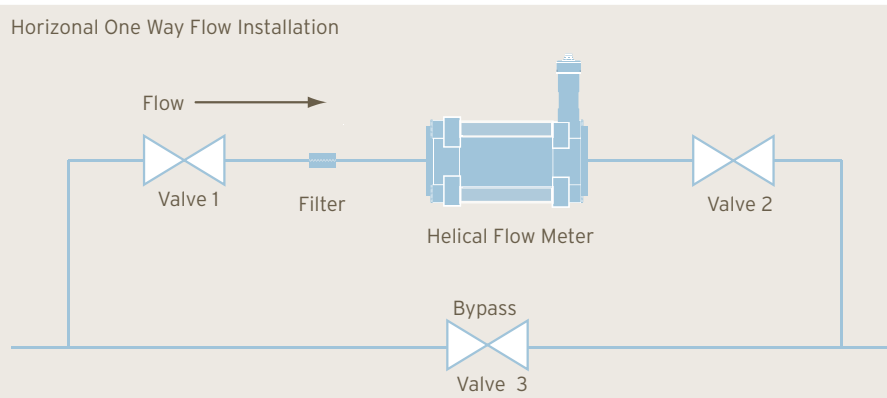
Computer Interface



- or -



Process Controller



Operation

Determine that the following parameters of your flow metering system are within specifications for the specific 240 Series Meter being used:

Maximum System Pressure	(Specifications)
Differential Pressure across meter	(Pressure Drop Curves)
Maximum Flow Rate	(Pressure Drop Curves)
Metered Fluid Temperature	(Sales specification, transmitter manual)

If the metered fluid is greater than 80°F (28°C) over ambient, see the “High Temperature Start Up” section.

With valves one and two closed, slowly open valve three (bypass) to clear the lines of foreign particles and air. Slowly open the inlet valve (# 1). Slowly open the outlet valve (# 2). Completely close the bypass valve.

No routine maintenance, cleaning, or lubrication of the flow meter is required. A routine filter cleaning schedule should be established. The system should be shut down if abnormal noises occur or if unusual differential pressures across the meter are encountered.

High Temperature Start Up: For fluids above 150°F (82°C) based on 70°F ambient, a special procedure is required to prevent thermal shock and permanent damage to the flow meter.

The warm up time is determined by the equation below:

$$\text{TIME (minutes)} = \frac{\text{connector size (in inches)} \times (\text{operating temperature (F)} - 125)}{10}$$

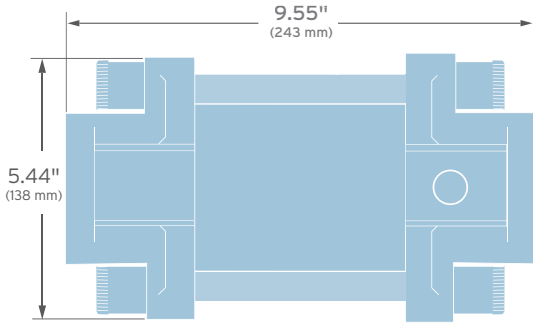
-OR-

$$\text{TIME (minutes)} = \frac{\text{connector size (in inches)} \times (\text{operating temperature (C)} - 52)}{10}$$

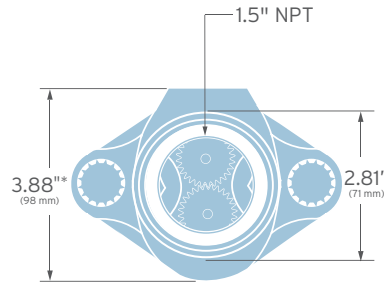
Valves one and two must be closed. Open the bypass valve (# 3) in gradual steps until the bypass piping is stabilized at operating temperature. Open valve one slightly and allow the temperature to stabilize around the flow meter. Valve one can then be opened completely. Open valve two slightly. The flow meter may make unusual noises or bind at this point. Leave the valve at this setting until normal meter operation occurs, at which point valve two can be gradually opened all the way. Slowly close the bypass valve (# 3).

Model Measurements

Model 241



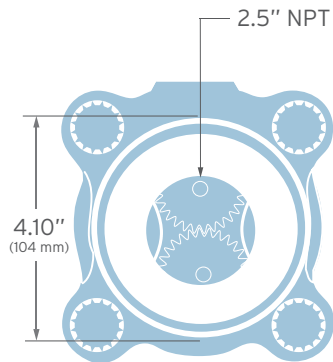
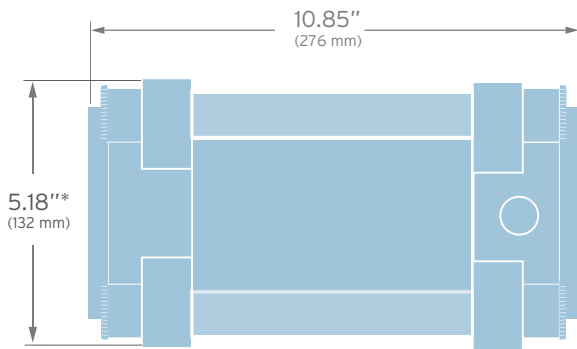
-Top View -



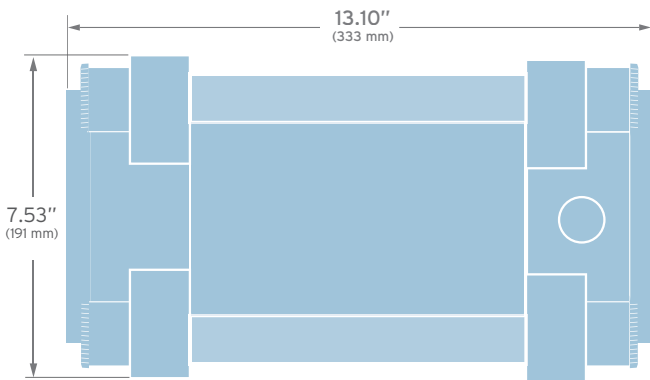
*Add 0.4" (10mm)
for high pressure body

- End view -

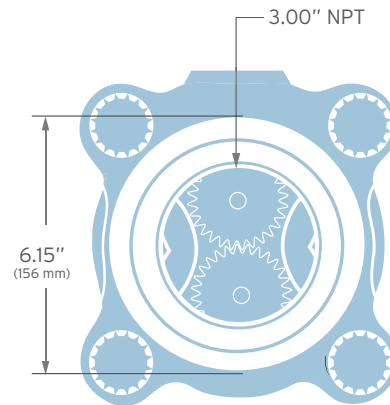
Model 242



Model 243



-Top View -



- End view -

Flange Stud Torque

240 Series Flange Stud Torque Requirements. This table shows the minimum torque required for a 2:1 tightening factor at the indicated pressures using zinc plated studs and nuts. These values were calculated using studs with a yield strength of $S_y = 75,000$ psi.

Meter (Flange)	Studs		Torque For Line Pressure (psi) ft-lb (N-m) See notes below					Absolute Max Torque ft-lb (N-m)	Stress at Max Torque (psi)*
	Qty	Size	500	1000	1500	2500	3500		
241 (600# Flange)	4	3/4-10	24 (33)	49 (67)	73 (99)			200 (271)	47,904
241 (2500# Flange)	4	1-1/8-7	37 (50)	73 (99)	110 (149)	183 (248)	256 (247)	681 (924)	47,789
242 (600# Flange)	8	3/4-10	24 (33)	47 (64)	71 (96)			200 (271)	47,904
242 (1500# Flange)	8	1-8	31 (42)	63 (86)	94 (128)	157 (213)	219 (297)	483 (656)	47,822
243 (600# Flange)	8	7/8-9	53 (72)	106 (144)	159 (216)			322 (437)	47,972
243 (1500# Flange)	8	1-1/4-7	76 (103)	151 (205)	227 (308)	378 (513)	529 (718)	965 (1310)	47,802

End Cap Torque

240 Series End Cap Stud Torque Requirements. (provided for reference only)

This table shows the minimum torque required for a zinc plated studs at the indicated pressure and tightening factor. These values were calculated using studs with a yield strength of $S_y = 75,000$ psi.

Meter	Studs		Max Pressure w/o Flange	Torque ft-lb (N-m) See notes below	Absolute Max Torque ft-lb (N-m)	Stress at Max. Torque (psi)*
	Qty	Size				
241	2	5/8-11	500	65 (88)	113 (153)	48,000
242	4	5/8-11	750	95 (129)	113 (153)	48,000
243	4	1-8	750	250 (339)	483 (656)	47,822

Notes

For unplated non-lubricated nuts and studs, multiply the above torque by 1.5.

For lubricated nuts and studs, multiply the above torque by 0.9.

For cadmium plated nuts and studs, multiply the above torque by 0.8.

*Stress in bolt calculated for thread root diameter.

Troubleshooting



Trouble	Probable Cause	Solution
No flow through meter or high pressure	Foreign particles or solid matter in meter	Flush chamber with suitable solvent
	Frozen bearings	Replace bearings
	Damaged rotors	Consult factory
Flow but no indication	Damaged transmitter	See transmitter manual
	Damaged cabling	Repair or replace
	Damaged transmitter drive	Replace drive
Flow reading inaccurate	Leaky bypass valve	Repair or replace
	Air in line	Purge air
	Pulsating flow rate	Reduce pulsation source
	Worn, chipped or corroded rotors or case	Repair or replace
	Magnetic coupling shaft slipping	Repair or replace
	Transmitter malfunction	Check transmitter
Indicator malfunction	See manual	

Repairs

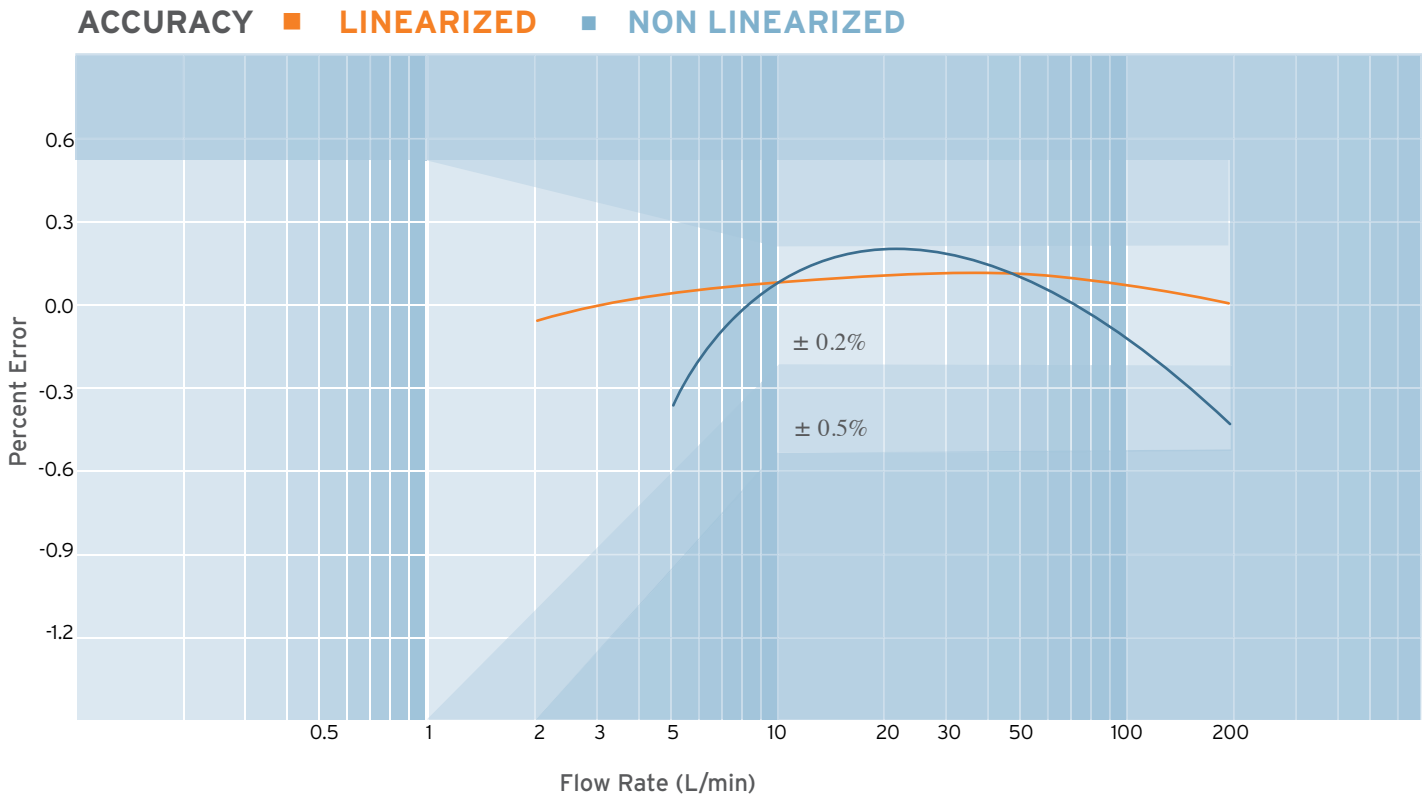


Your Max 240 Series Meter should be repaired at the factory or under the direct supervision of the Max Technical Service Department. Unauthorized repair work may damage the meter and will void the product warranty. Please make note of model and serial numbers on the flow meter before calling the factory. A return goods authorization number (RMA) will be issued if the flow meter has to be sent back for repair.

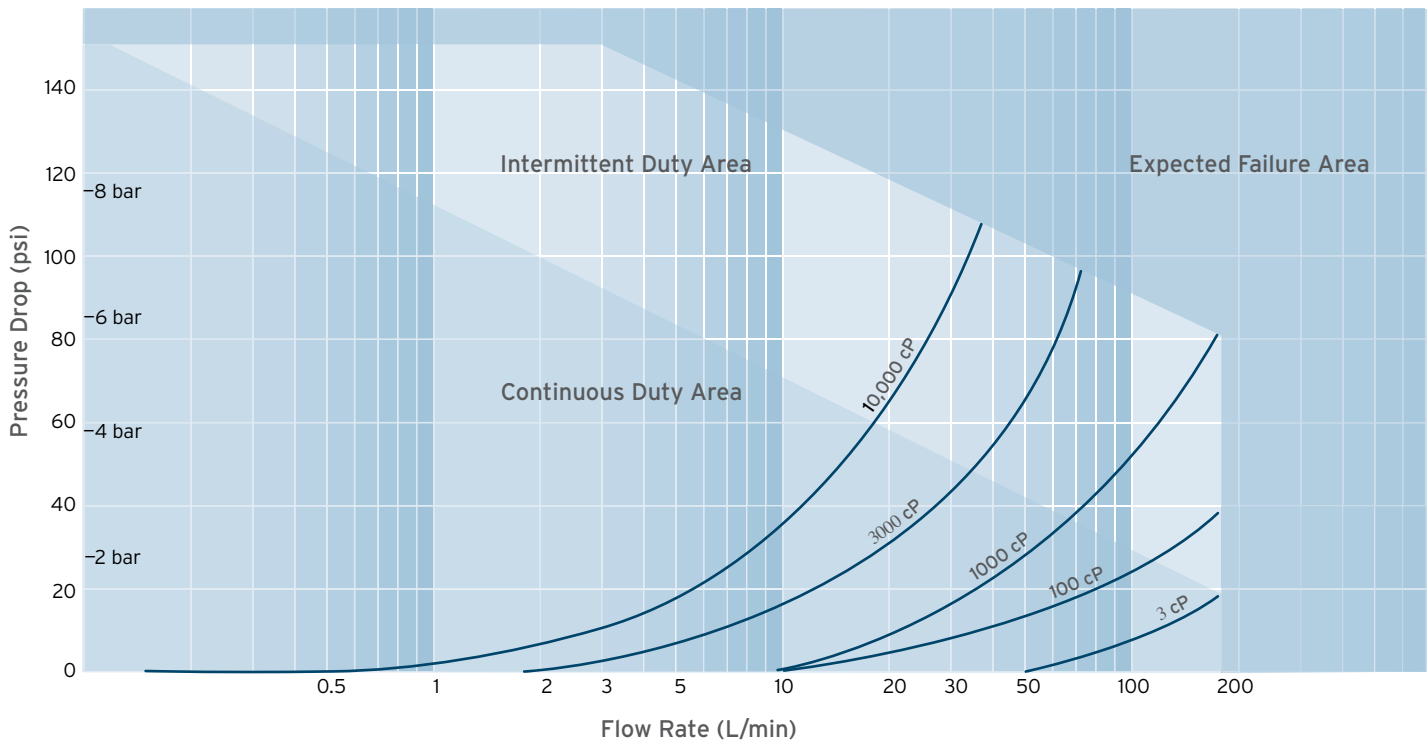
Technical Service Department
Max Machinery, Inc.
33A Healdsburg Ave
Healdsburg, CA 95448
(707) 433-2662

Performance Curves

Model 241 Flow Meter



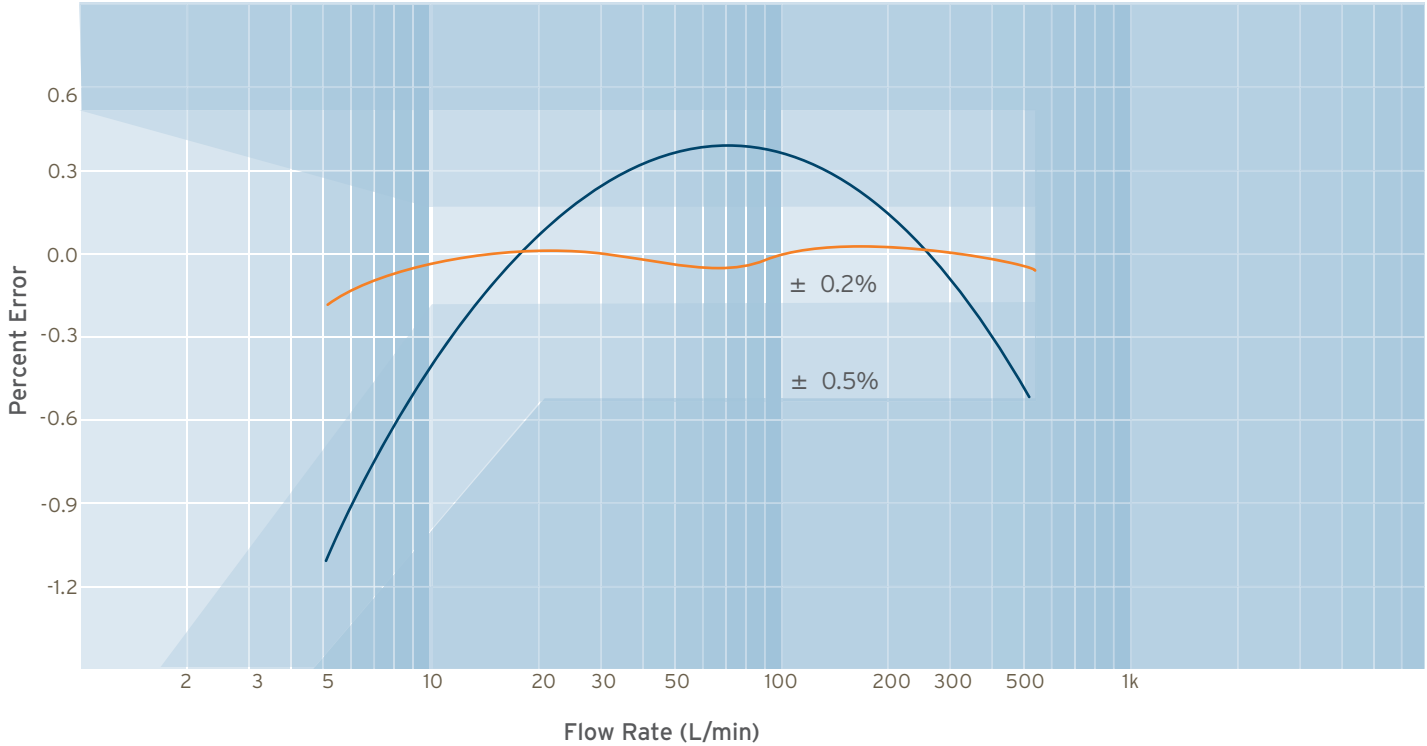
TYPICAL PRESSURE DROP (Delta P versus Flow rate for various viscosities)



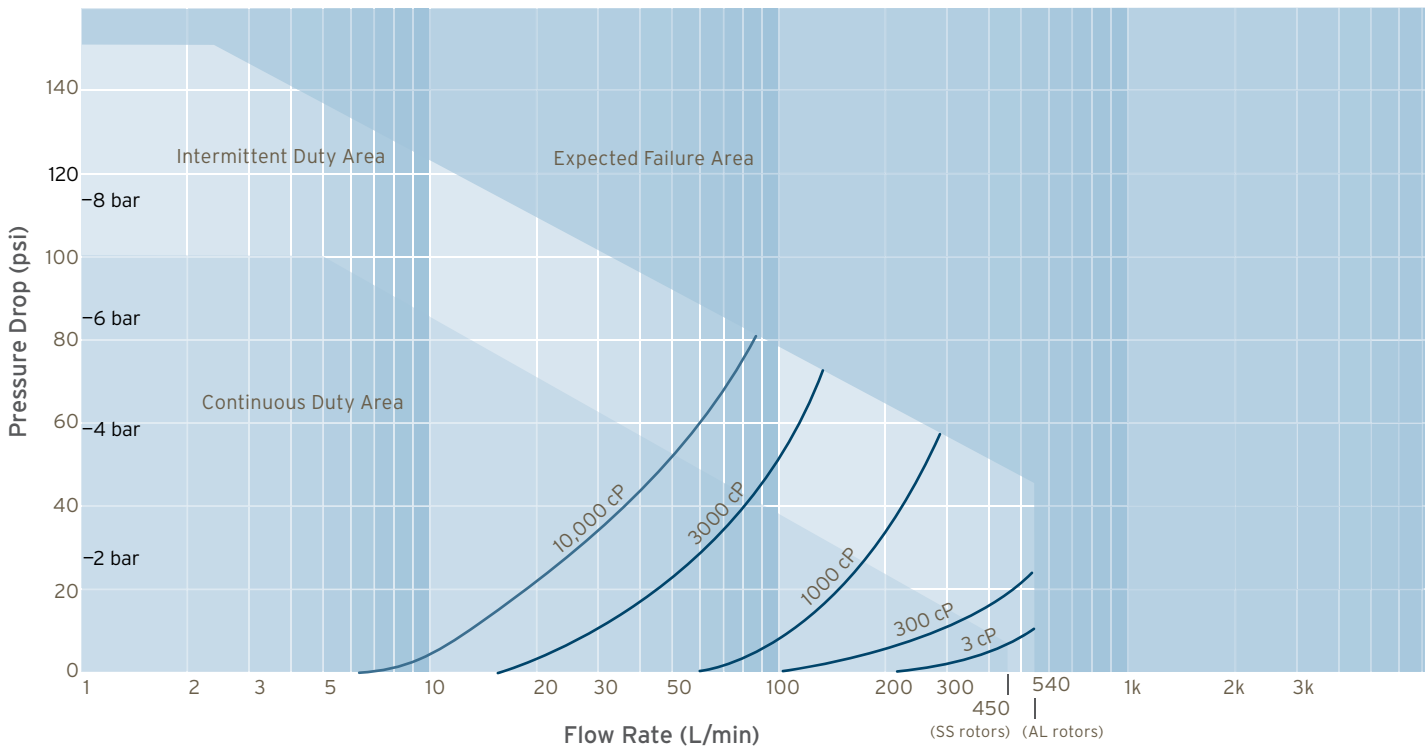
Performance Curves

Model 242 Flow Meter

ACCURACY ■ **LINEARIZED** ■ **NON LINEARIZED**



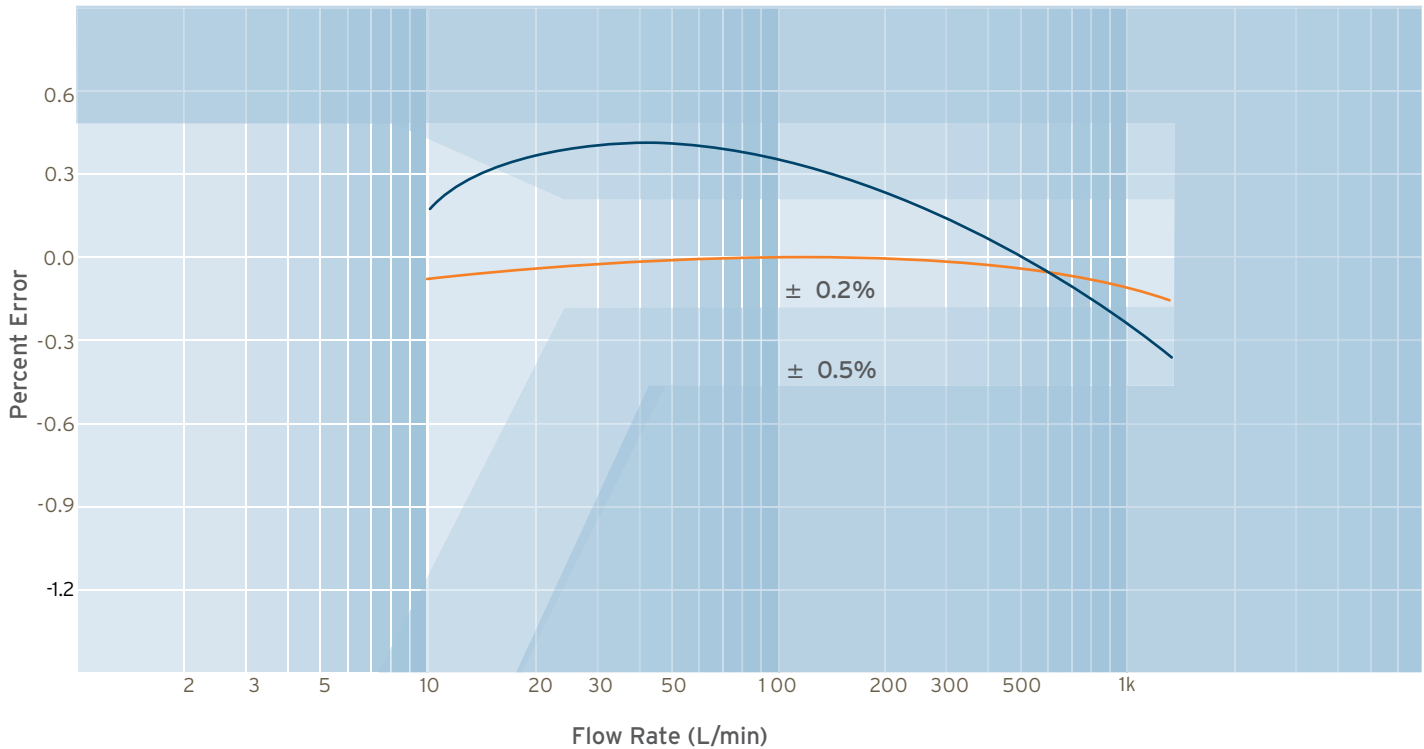
TYPICAL PRESSURE DROP (Delta P versus Flow rate for various viscosities)



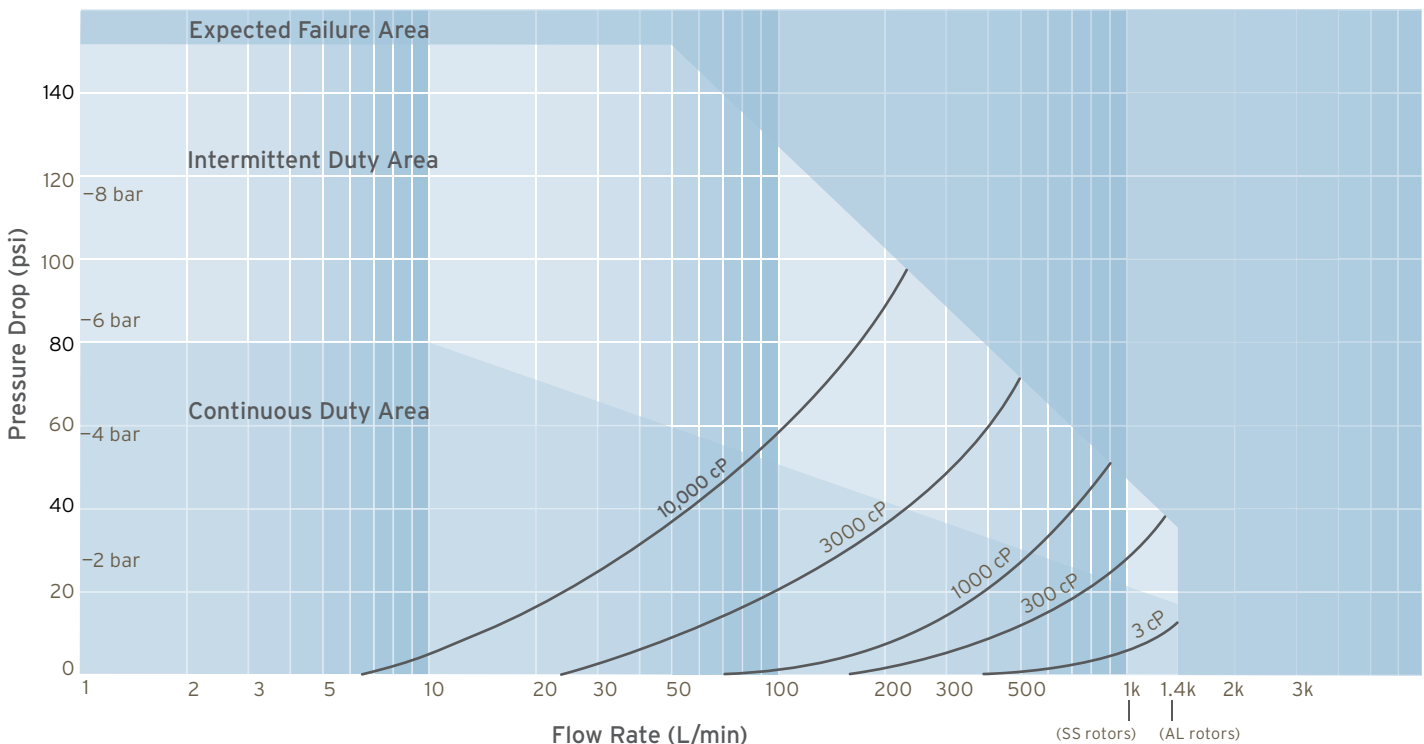
Performance Curves

Model 243 Flow Meter

ACCURACY ■ LINEARIZED ■ NON LINEARIZED



TYPICAL PRESSURE DROP (Delta P versus Flow rate for various viscosities)



Specifications

Model #	241	242	243
Maximum flow rate, L/Min ₁ gpm	189 50	540 140	1400 370
Maximum pressure, PSI			
Standard NPT	35, (500)	35 (500)	35 (500)
600 lb ANSI RF flanges	105 (1500)	105 (1500)	105 (1500)
1500 lb ANSI RF flanges	---	245 (3500)	245 (3500)
2500 lb ANSI RF flanges	245 (3500)	----	----
Pressure drop, bar, PSIG			
Operating maximum	10 (150)	7 (100)	5.3 (75)
Absolute maximum	21 (300)	15 (200)	10 (150)
100% flow, 3 CPS	1 (14)	0.7 (10)	0.7 (10)
Maximum temperature ₂	Up to 265° C (500° F)		
Recommended filtration ₃	150 micron		
Displacement, L/Rev	0.062	0.182	0.574
Weight, Kg, Lb	13.6 (30)	18.2 (40)	45.5 (100)
K-Factor, Pulses/liter ₄			
284 Transmitter	1610	549	58.8
294 Transmitter	15000	5000	1500
289-700 Transmitter	403	219	58.8
Port size			
NPT	1.5"	2.5"	3"
ANSI RF flanges	1.5" (DN40)	2.5" (DN65)	4" (DN100)

Notes:

- 1 For viscosities of 3 CPS or less, using Aluminum rotors. Derate per pressure drop curves for higher viscosites or stainless steel rotors.
- 2 Limited by meter seal material, transmitter model, orientation and ambient temp. See manual. Consult factory.
- 3 Some materials may have different filter requirements. Consult factory
- 4 Typical. See flow meter/transmitter calibration sheet for actual K-factor and accuracy data.

Model 251 Helical Flow Meter 2 to 189 liters/min

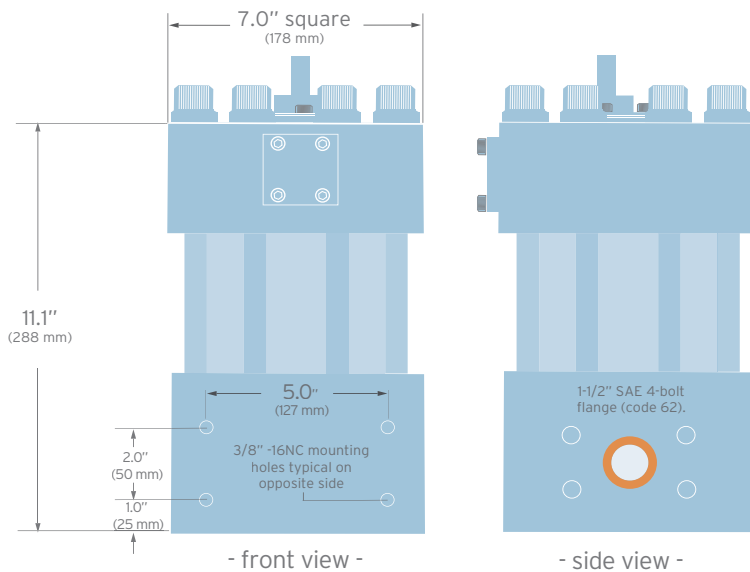
SPECIFICATIONS

Flow Range (at 3 cP)	2 to 189 liters/min. (50 GPM)
Maximum Operating Pressure	500 bar (7500 psi)
Displacement	0.062 liters/rev (0.016 gallons/rev)
Weight	40 kg (88 lbs)
Recommended Filtration	150 micron (100 mesh)
Port Size(s)	1 1/2" SAE, 4-bolt flange (code 62)
Accuracy	± 0.2% of reading with a linearized transmitter ± 0.5% of reading with a non-linearized transmitter
Fluids	Most non aqueous, organic liquids
Heat Trace	Heat traceable bodies available

MATERIALS OF CONSTRUCTION

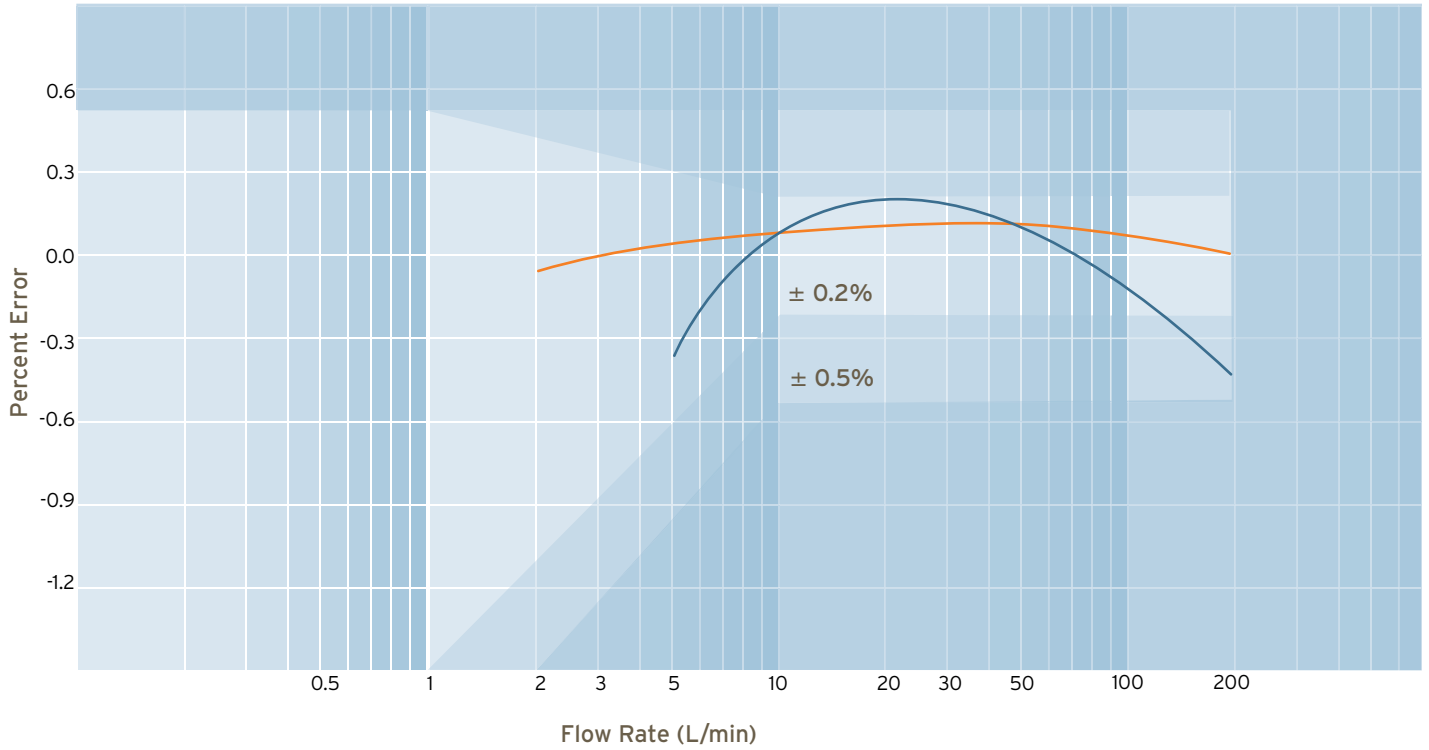
Body	Steel
Rotors	Steel, type 303 or anodized aluminum
Bearings	All ball bearings, 440C stainless steel
O Rings	Viton®- standard • Teflon®, Perfluoro elastomer

DIMENSIONS



Model 251 Flow Meter

ACCURACY ■ LINEARIZED ■ NON LINEARIZED



TYPICAL PRESSURE DROP (Delta P versus Flow rate for various viscosities)

