# M-03/G-03 Contents



# M-03/G-03 Specifications

**Maximum Capacity**

| | rpm | gpm | l/min |
|---|---|---|---|
| M/G-03-X | 1750 | 3.0 | 11.3 |
| M/G-03-E | 1750 | 2.2 | 8.3 |
| M/G-03-S | 1750 | 1.8 | 6.8 |
| M/G-03-B | 1750 | 1.1 | 4.2 |
| M/G-03-G | 1750 | 0.5 | 1.9 |

**Delivery @ max pressure***

| | revs/gal | revs/liter |
|---|---|---|
| M/G-03-X | 584 | 155 |
| M/G-03-E | 795 | 211 |
| M/G-03-S | 972 | 258 |
| M/G-03-B | 1591 | 417 |
| M/G-03-G | 3500 | 921 |

| | |
|---|---|
| **Max Inlet Pressure** | 250 psi (17.3 bar) |
| **Pressure Variable to*** | |
| Metallic Heads: | M/G-03-X: 1000 psi (69 bar);<br>M/G-03-E, S, B, G: 1200 psi (83 bar) |
| Non-Metallic Heads: | All models: 250 psi (17.3 bar) |
| **Max Temperature** | |
| Metallic Heads: | 250°F (121°C) – consult factory for temperatures above 160°F (71°C) |
| Non-Metallic Heads: | 140°F (60°C) |
| **Inlet Port*** | M-03: 1/2 inch NPT<br>G-03: 1/2 inch BSPT |
| **Discharge Port*** | M-03: 3/8 inch NPT<br>G-03: 3/8 inch BSPT |
| **Shaft Diameter** | M-03/G-03: 5/8 inch (15.88 mm);<br>D-03/G-13: 7/8 inch (22.23 mm)<br>M-23: 20 mm hollow shaft |
| **Shaft Rotation** | Bi-directional |
| **Bearings** | Ball bearings |
| **Oil Capacity** | 1 US quarts (0.95 liters) |
| **Weight** | |
| Metallic Heads: | 28 lbs (12.7 kg) |
| Non-Metallic Heads: | 19 lbs (8.6 kg) |

## Calculating Required Horsepower

$$\frac{6 \times \text{rpm}}{63{,}000} + \frac{\text{gpm} \times \text{psi}}{1{,}460} = \text{electric motor HP*}$$

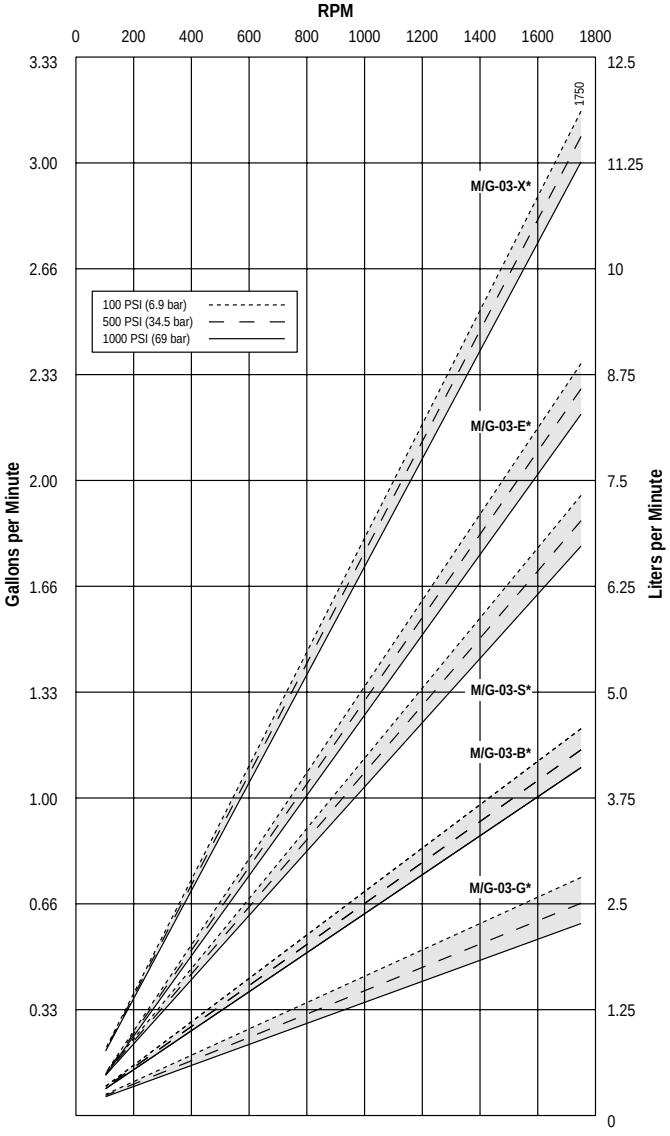
$$\frac{6 \times \text{rpm}}{84{,}428} + \frac{\text{lpm} \times \text{bar}}{511} = \text{electric motor kW*}$$

* HP and kW required for electric motors; must be at rpm used in calculation. Consult engine manufacturer for gasoline or diesel power requirements.

* Unless specifically stated, M/G-03 represents all models M-03, D-03, G-03, G-13, and M-23

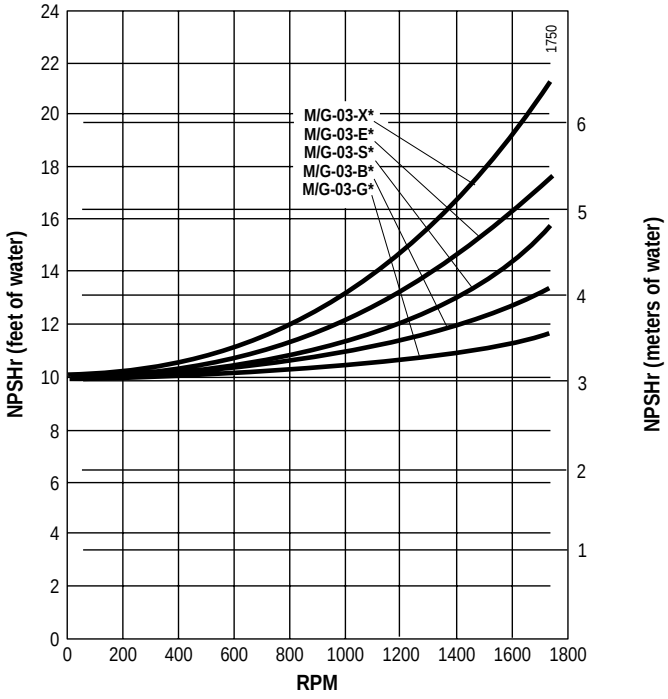
# M-03/G-03 Specifications

## Performance

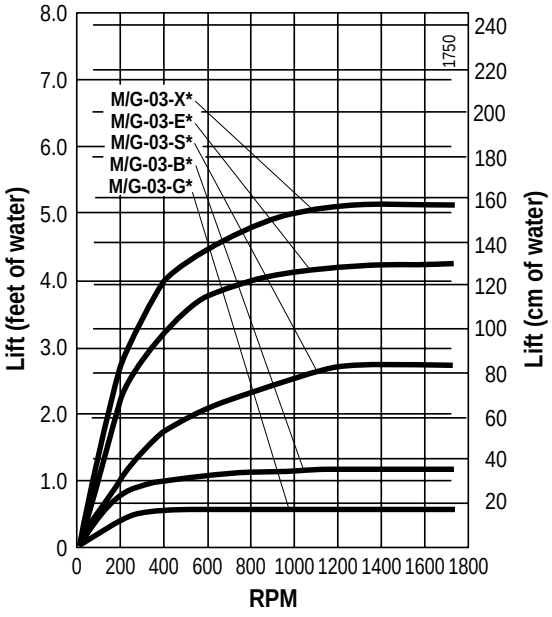



* Unless specifically stated, M/G-03 represents all models M-03, D-03, G-03, G-13, and M-23

## Net Positive Suction Head – NPSHr




## Dry Lift



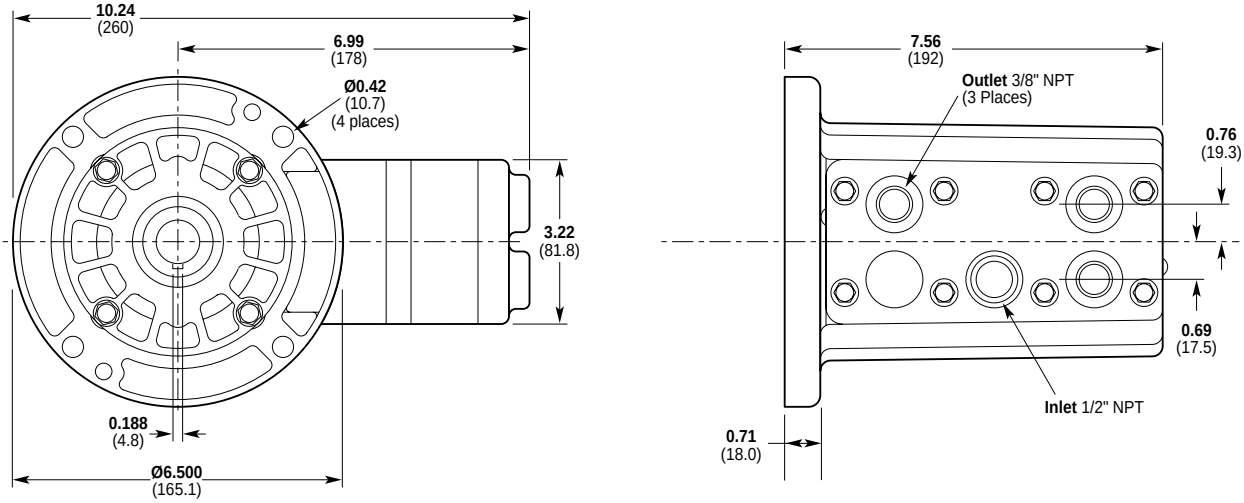
# M-03/G-03 Dimensions

## M-03/G-13 Models with Metallic Pumping Head

Brass

316 Stainless Steel

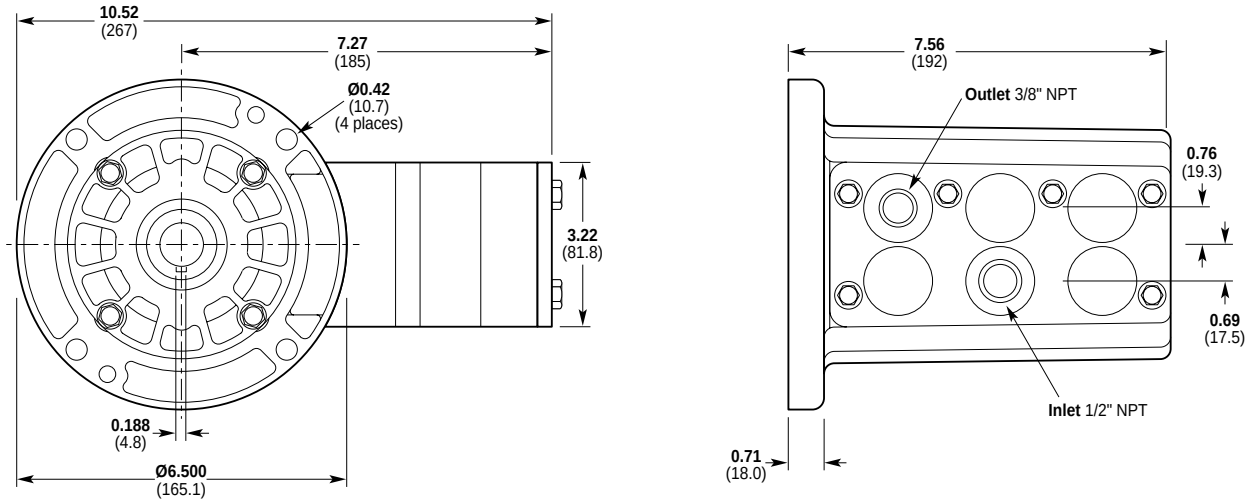
Nickel Alloy (C Series)




## M-03/G-13 Models with Non-Metallic Pump Head

Kynar®

Polypropylene



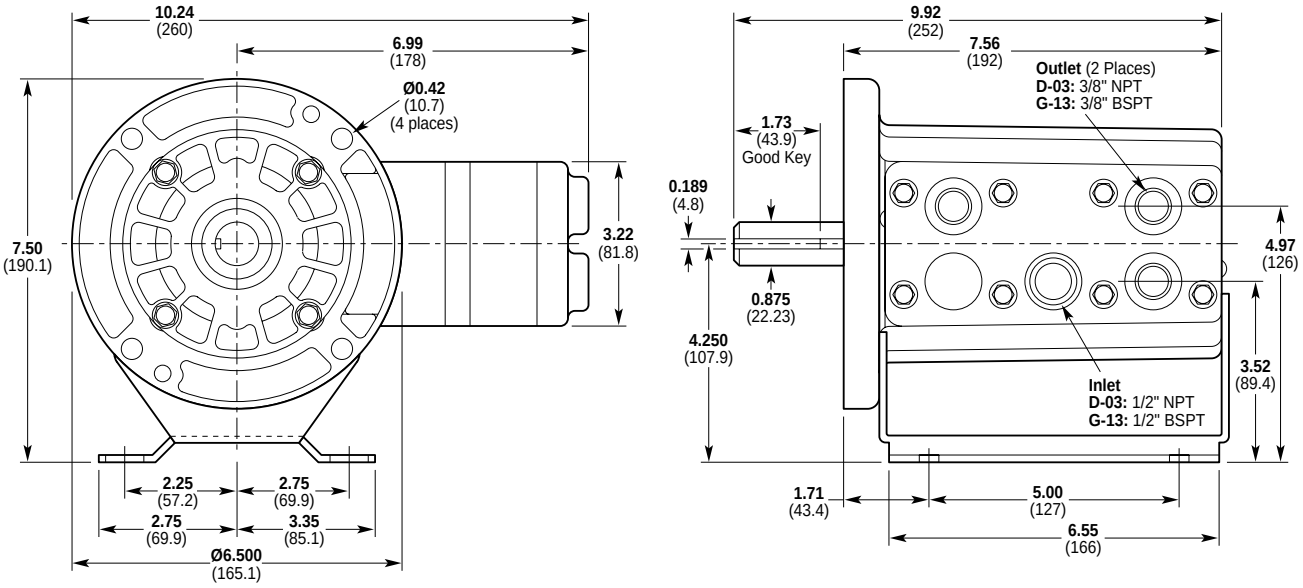
# M-03/G-03 Dimensions

## D-03/G-03 Models with Metallic Pumping Head

Brass

316 Stainless Steel

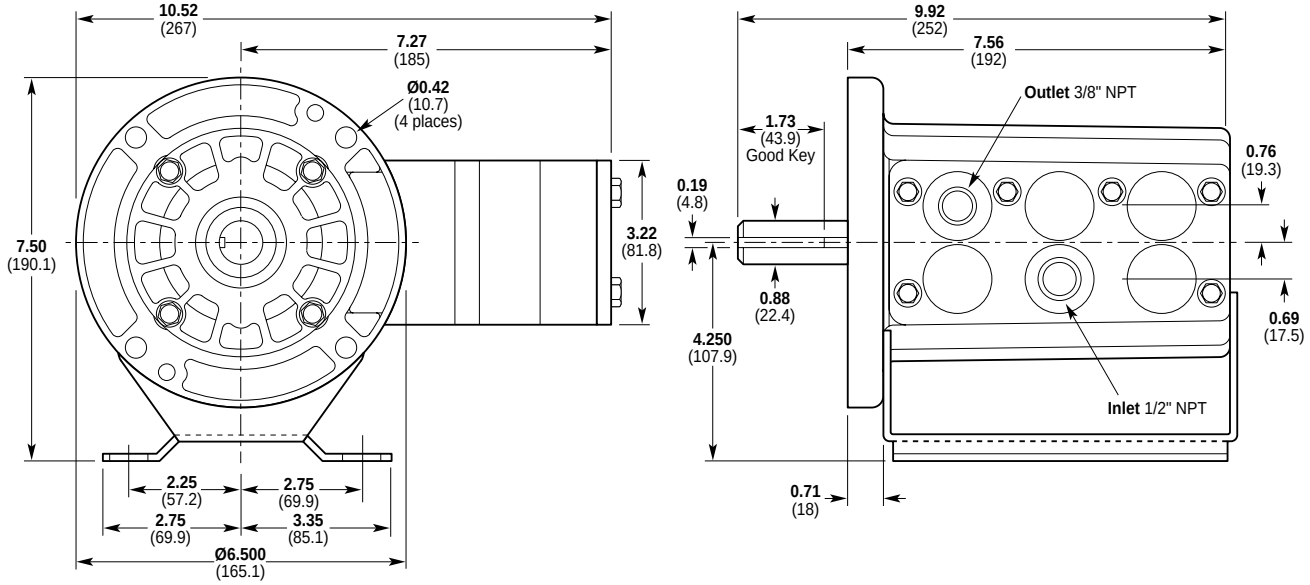
Nickel Alloy (C Series)




## D-03/G-03 Models with Non-Metallic Pump Head

Kynar®

Polypropylene



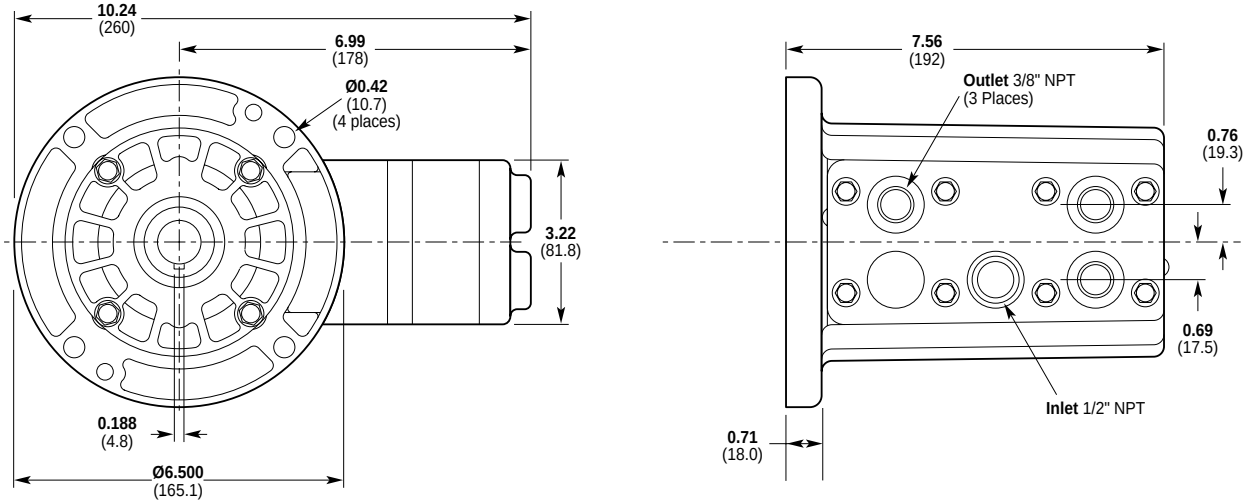
# M-23 Dimensions

## M-23 Models with Metallic Pumping Head

Brass

316 Stainless Steel

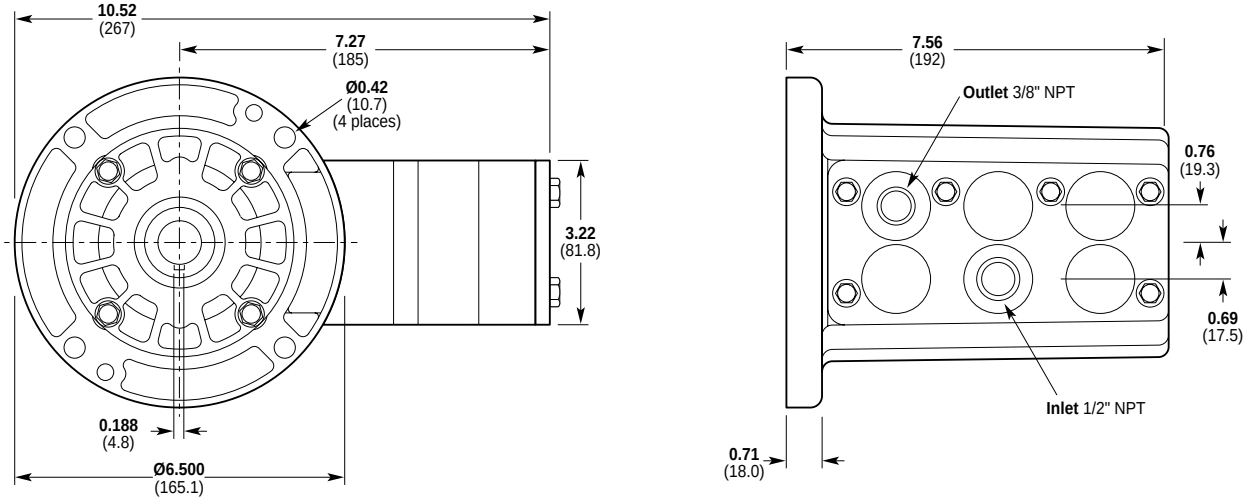
Nickel Alloy (C Series)




## M-23 Models with Non-Metallic Pump Head

Kynar®

Polypropylene



# M-03/G-03 Installation

**NOTE: The numbers in parentheses are the Reference Numbers on the illustrations in the Parts Manual.**

## Location

Locate the pump as close to the supply source as possible.

Install it in a lighted clean space where it will be easy to inspect and maintain. Allow room for checking the oil level, changing the oil, and removing the pump head (manifold, valve plate and related items).

## Mounting

The pump shaft can rotate in either direction.To prevent vibration, securely attach the pump (D-03, G-03) or motor (M-03, M-23, G-13) to a rigid base.

On a belt-drive system, align the sheaves accurately; poor alignment wastes horsepower and shortens the belt and bearing life. Make sure the belts are properly tightened, as specified by the belt manufacturer.

On a direct-drive system, align the shafts accurately. Unless otherwise specified by the coupling manufacturer, maximum parallel misalignment should not exceed .015" and angular misalignment should be held to 1 degree maximum. Careful alignment extends life of the coupling, pump, shafts, and support bearings. Consult coupling manufacturer for exact alignment tolerances.

On a close-coupled system, coat the motor shaft liberally with anti-seize.

## Important Precautions

**Adequate Fluid Supply.** To avoid cavitation and premature pump failure, be sure that the pump will have an adequate fluid supply and that the inlet line will not be obstructed. See "Inlet Piping".

**Positive Displacement.** This is a positive-displacement pump. To avoid severe system damage if the discharge line ever becomes blocked, install a relief valve downstream from the pump. See "Discharge Piping".

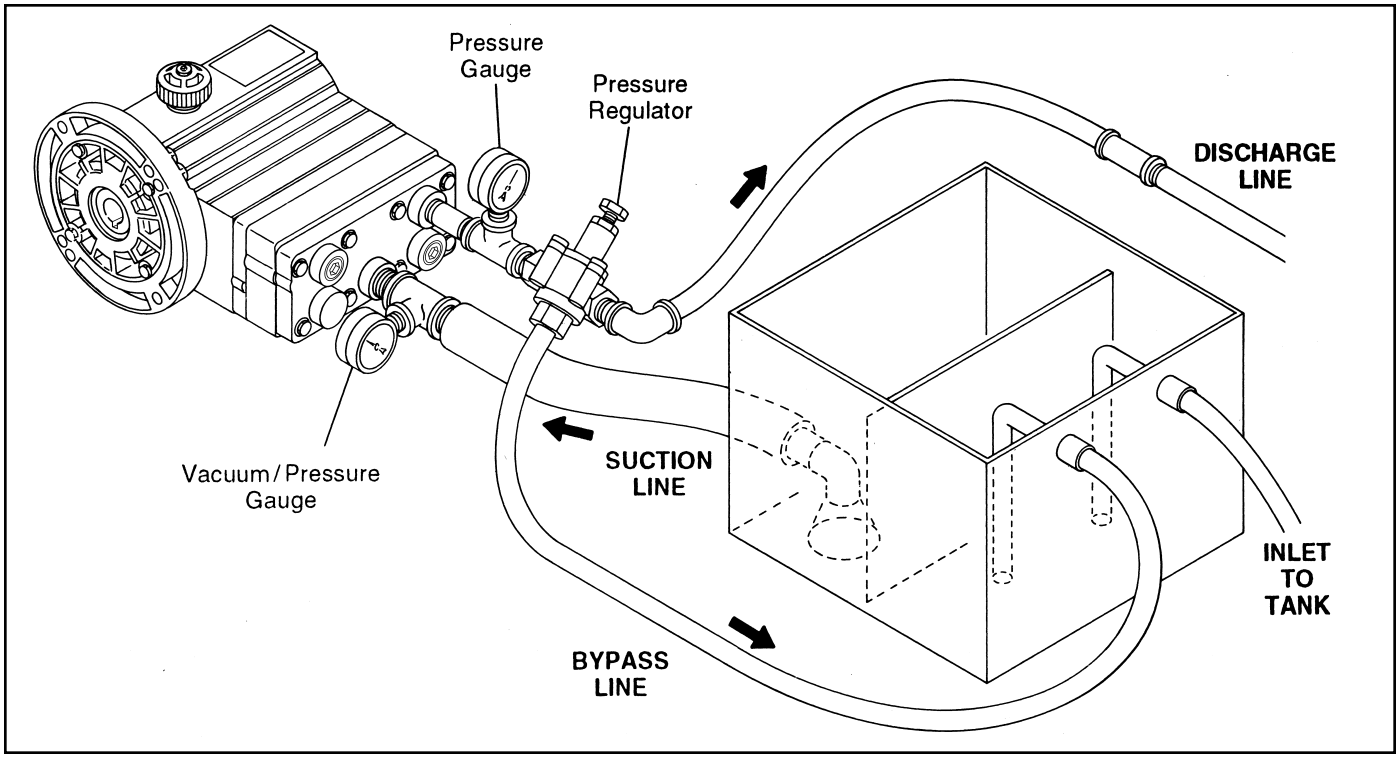
**Safety Guards.** Install adequate safety guards over all pulleys, belts, and couplings. Follow all codes and regulations regarding installation and operation of the pumping system.

**Shut-Off Valves.** Never install shut-off valves between the pump and discharge pressure regulator, or in the regulator bypass line.

**Freezing Conditions.** Protect the pump from freezing. See also the Maintenance Section.

Consult the Factory for the following situations:

- Extreme temperature applications (above 160° F or below 40° F)
- Pressure feeding of pumps
- Viscous or abrasive fluid applications
- Chemical compatibility problems
- Hot ambient temperatures (above 110° F)
- Conditions where pump oil may exceed 200° F because of a combination of hot ambient temperatures, hot fluid temperature, and full horsepower load — an oil cooler may be required



# M-03/G-03 Installation

## Inlet Piping (Suction Feed)

**Caution: When pumping at temperatures above 160° F (71° C), use a pressure-feed system.**

Install draincocks at any low points of the suction line, to permit draining in freezing conditions.

Provide for permanent or temporary installation of a vacuum gauge to monitor the inlet suction.To maintain maximum flow, vacuum at the pump inlet should not exceed 7 in. Hg at 3 gpm and 70° F (180 mm Hg at 11.4 liters/min and 21° C). Do **not** supply more than one pump from the same inlet line. With Teflon diaphragms, the inlet must be flooded.

### Supply Tank

Use a supply tank that is large enough to provide time for any trapped air in the fluid to escape. The tank size should be at least twice the maximum pump flow rate.

Isolate the pump and motor stand from the supply tank, and support them separately.

Install a separate inlet line from the supply tank to each pump.

Install the inlet and bypass lines so they empty into the supply tank below the lowest water level, on the opposite side of the baffle from the pump suction line.

If a line strainer is used in the system, install it in the inlet line to the supply tank.

To reduce aeration and turbulence, install a completely submerged baffle plate to separate the incoming and outgoing liquids.

Install a vortex breaker in the supply tank, over the outlet port to the pump.

Place a cover over the supply tank, to prevent foreign objects from falling into it.

### Hose and Routing

Size the suction line at least one size larger than the pump inlet, and so that the velocity will not exceed 1-3 ft/sec (0.3 to 0.9 m/s):

For pipe in inches: Velocity (ft/sec) = 0.408 x GPM/Pipe ID$^2$

For pipe in mm: Velocity (m/sec) = 21.2 x LPM/Pipe ID$^2$

Keep the suction line as short and direct as possible.

Use flexible hose and/or expansion joints to absorb vibration, expansion, or contraction.

If possible, keep the suction line level. Do not have any high points to collect vapor unless these high points are vented.

To reduce turbulence and resistance, do not use 90° elbows. If turns are necessary in the suction line, use 45° elbows or arrange sweeping curves in the flexible inlet hose.

If a block valve is used, be sure it is fully opened so that the flow to the pump is not restricted. The opening should be at least the same diameter as the inlet plumbing ID.

Do not use a line strainer or filter in the suction line unless regular maintenance is assured. If used, it should have a free-flow area of at least three times the free-flow area of the inlet.

Install piping supports where necessary to relieve strain on the inlet line and to minimize vibration.

## Inlet Piping (Pressure Feed)

Provide for permanent or temporary installation of a vacuum/pressure gauge to monitor the inlet vacuum or pressure. Pressure at the pump inlet should not exceed 250 psi (17.3 bar); if it could get higher, install an inlet pressure regulator. Do **not** supply more than one pump from the same inlet line.

## Inlet Calculations

### Acceleration Head

#### Calculating the Acceleration Head

Use the following formula to calculate acceleration head losses. Subtract this figure from the NPSHa, and compare the result to the NPSHr of the Hydra-Cell pump.

$Ha = (L \times V \times N \times C) \div (K \times G)$

where:

Ha = Acceleration head (ft of liquid)

L= Actual length of suction line (ft) — not equivalent length

V= Velocity of liquid in suction line (ft/sec) [V = GPM x (0.408 ÷ pipe ID$^2$)]

N= RPM of crank shaft

C= Constant determined by type of pump — use 0.066 for the M-03, D-03, M-23, G-03 and G-13 Hydra-Cell pumps

K= Constant to compensate for compressibility of the fluid — use: 1.4 for de-aerated or hot water; 1.5 for most liquids; 2.5 for hydrocarbons with high compressibility

G= Gravitational constant (32.2 ft/sec$^2$)

### Friction Losses

#### Calculating Friction Losses in Suction Piping

When following the above recommendations (under “inlet Piping”) for minimum hose/pipe I.D. and maximum length, frictional losses in the suction piping are negligible (i.e., Hf = 0) if you are pumping a water-like fluid.

When pumping more-viscous fluids such as lubricating oils, sealants, adhesives, syrups, varnishes, etc., frictional losses in the suction piping may become significant. As Hf increases, the available NPSH (NPSHa) will decrease, and cavitation will occur.

In general, frictional losses increase with increasing viscosity, increasing suction-line length, increasing pump flowrate, and decreasing suction-line diameter. Changes in suction-line diameter have the greatest impact on frictional losses: a 25% increase in suction-line diameter cuts losses by more than two times, and a 50% increase cuts losses by a factor of five times.

Consult the factory before pumping viscous fluids.

#### Minimizing Acceleration Head and Frictional Losses

To minimize the acceleration head and frictional losses:

- Keep inlet lines less than 5 ft (1.5 m) long
- Use at least 5/8 in. (16 mm) I.D. inlet hose
- Use soft hose (low-pressure hose, noncollapsing) for the inlet lines
- Minimize fittings (elbows, valves, tees, etc.)
- **Use a suction stabilizer on the inlet.**

*Loctite is a registered trademark of Loctite Corporation. Teflon is a registered trademark of E. I. DuPont de Nemours & Co. Inc.*

### Net Positive Suction Head

NPSHa must be equal to or greater than NPSHr. If not, the pressure in the pump inlet will be lower than the vapor pressure of the fluid— and cavitation will occur.

**Calculating the NPSHa**

Use the following formula to calculate the NPSHa:

NPSHa = Pt + Hz - Hf - Ha - Pvp

where:

Pt = Atmospheric pressure

Hz = Vertical distance from surface liquid to pump centerline (if liquid is below pump centerline, the Hz is negative)

Hf = Friction losses in suction piping

Ha = Acceleration head at pump suction

Pvp = Absolute vapor pressure of liquid at pumping temperature

NOTES:

- In good practice, NPSHa should be 2 ft greater than NPSHr
- All values must be expressed in feet of liquid

**Atmospheric Pressure at Various Altitudes**

| Altitude (ft) | Pressure (ft of $H_2O$) | Altitude (ft) | Pressure (ft of $H_2O$) |
|---|---|---|---|
| 0 | 33.9 | 1500 | 32.1 |
| 500 | 33.3 | 2000 | 31.5 |
| 1000 | 32.8 | 5000 | 28.2 |

## Discharge Piping

**Note: Consult the Factory before manifolding two or more pumps together.**

### Hose and Routing

Use the shortest, most-direct route for the discharge line.

Select pipe or hose with a **working pressure** rating of at least 1.5 times the maximum system pressure. EXAMPLE: Select a 1500 psi (103 bar) W.P.-rated hose for systems to be operated at 1000 psi (69 bar) gauge pressure.

Use about 6 ft (1.8 m) of flexible hose between the pump and rigid piping to absorb vibration, expansion or contraction.

Support the pump and piping independently. Size the discharge line so that the velocity of the fluid will not exceed 7-10 ft/sec (2-3 m/sec):

For pipe in inches: Velocity (ft/sec) = 0.408 x GPM/Pipe $ID^2$

For pipe in mm: Velocity (m/sec) = 21.2 x LPM/Pipe $ID^2$

### Pressure Regulation

**Install a pressure regulator or unloader in the discharge line.** Bypass pressure must not exceed the pressure limit of the pump.

Size the regulator so that, when fully open, it will be large enough to relieve the full capacity of the pump without overpressurizing the system.

Locate the valve as close to the pump as possible and ahead of any other valves.

Adjust the pressure regulating valve to no more than 10% over the maximum working pressure of the system. Do not exceed the manufacturer's pressure rating for the pump or regulator.

Route the bypass line to the supply tank, or to the suction line as far as possible from the pump (to reduce the chance of turbulence).

If the pump will be operating for a long time with the discharge closed and fluid bypassing, install a thermal protector set to trip at 140° F in the bypass line (to prevent severe temperature buildup in the bypassed fluid).

**CAUTION: *Never* install shutoff valves in the bypass line or between the pump and pressure regulator or relief valve.**

Provide for permanent or temporary installation of a pressure gauge to monitor the discharge pressure at the pump.

For additional system protection, install a safety relief valve in the discharge line, downstream from the pressure regulator.

## Before Initial Start-Up

Before you start the pump, be sure that:

- All shut-off valves are open, and the pump has an adequate supply of fluid.
- All connections are tight.
- The oil level is 3/4 in. (20 mm) from the top of the fill port
- The relief valve on the outlet of the pump is adjusted so the pump starts under minimum pressure.
- All pulleys and belts are properly aligned, and belts are tensioned according to specification.
- All pulleys and belts have adequate safety guards.

## Initial Start-Up Procedure

1. Turn on power to the pump motor.
2. Check the inlet pressure or vacuum. To maintain maximum flow, inlet vacuum must not exceed 7 in. Hg at 70° F (180 mm Hg at 21° C). Inlet pressure must not exceed 250 psi (17.3 bar).
3. Listen for any erratic noise and look for unsteady flow.
4. If the system has an air lock and the pump fails to prime:
   a. Turn off the power.
   b. Open one outlet port.
   c. Briefly restart the system and operate it until fluid comes out the outlet port.
   d. Turn off the power and reinstall the outlet port plug.
5. Adjust the discharge pressure regulator to the desired operating and bypass pressures. Do not exceed the maximum pressure rating of the pump.
6. After the pressure regulator is adjusted, set the "pop-off" safety relief valve at 100 psi (6.9 bar) higher than the desired operating pressure.6.

# M-03/G-03 Maintenance

**NOTE: The numbers in parentheses are the Ref. Nos. on the illustrations in the Parts Manual.**

## Daily

Check the oil level and the condition of the oil. The oil level should be 3/4 in. (20 mm) from the top of the fill port.

Use the appropriate Wanner Hydra-Oil brand motor oil for the application (contact Wanner Engineering if in doubt).

**Caution: If you are losing oil but don't see any external leakage, or if the oil becomes discolored and contaminated, one of the diaphragms (17) may be damaged. Refer to the Service Section. Do not operate the pump with a damaged diaphragm.**

**Caution: Do not leave contaminated oil in the pump housing or leave the housing empty. Remove contaminated oil as soon as discovered, and replace it with clean oil.**

## Periodically

Change the oil after the first 100 hours of operation, and every 1000 operating hours thereafter. When changing, remove the drain plug (60) at the bottom of the pump so all oil and accumulated sediment will drain out.

**Caution: Do not turn the drive shaft while the oil reservoir is empty.**

Check the inlet pressure or vacuum periodically with a gauge.

**Caution: Protect the pump from freezing. Refer also to the "Shutdown Procedure".**

## Shutdown Procedure During Freezing Temperatures

**Take all safety precautions to assure safe handling of the fluid being pumped. Provide adequate catch basins for fluid drainage and use appropriate plumbing from drain ports, etc. when flushing the pump and system with a compatible antifreeze.**

1. Adjust the discharge pressure regulating valve so the pump runs under minimum pressure. Stop the pump.
2. Drain supply tank; open any draincocks in system piping and collect drainage; remove plugs from manifold and collect drainage.
3. Close draincocks in system piping and replace manifold plugs.
4. Fill supply tank with enough antifreeze to fill system piping and pump.

   Note: disconnect the system return line from the supply tank and connect it to a separate reservoir.
5. Start the pump and allow it to run until the system is filled with antifreeze. Note: if the system has an airlock and the pump fails to prime, follow step 4 of the Initial Start-up Procedure to clear the air.
6. When mostly antifreeze is flowing from the system return line stop the pump. Connect the system return line back to the supply tank and circulate the antifreeze for a short period.
7. It is also good practice to change the oil in the Hydraulic End before storage for an extended period. This will remove any accumulated condensation and sediment from the oil reservoir. Drain and refill the Hydraulic End with the appropriate Hydra-Oil and operate the pump for a short period to assure smooth performance.