F-20/G-20 Contents

F-20/G-20 Specifications

Maximum Capacity			
	rpm	gpm	l/min
F/G-20-X	1750	1.00	3.79
F/G-20-E	1750	0.73	2.76
F/G-20-S	1750	0.55	2.08
F/G-20-B	1750	0.33	1.25
F/G-20-G	1750	0.20	0.76
Delivery @ max pressure			
	revs/gal	revs/liter	
F/G-20-X	1750	462	
F/G-20-E	2397	635	
F/G-20-S	3182	841	
F/G-20-B	5303	1400	
F/G-20-G	8750	2302	
Max Inlet Pressure	100 psi (6.9 bar)		
Pressure Variable to			
Metallic:	F/G-20: 1000 psi (69 bar); F/G-21/22: 1500 psi (103 bar)		
Non-Metallic:	All Models: 250 psi (17.3 bar)		
Max Temperature	250°F (121°C) – consult factory for temperatures above 160°F (71°C)		
Inlet Port	F-20: 1/2 inch NPT G-20: 1/2 inch BSPT		
Discharge Port	F-20: 3/8 inch NPT G-20: 3/8 inch BSPT		
Shaft Diameter	5/8 inch (22.23 mm)		
Shaft Rotation	Bi-directional		
Bearings	Radial ball		
Oil Capacity	1/8 US quarts (0.12 liters)		
Weight	10-15 lbs (4.5-6.8 kg)		

Calculating Required Horsepower

$$\frac{2 \times rpm}{63{,}000} + \frac{gpm \times psi}{1{,}460} = \text{electric motor HP*}$$

$$\frac{2 \times rpm}{84{,}428} + \frac{lpm \times bar}{511} = \text{electric motor kW*}$$

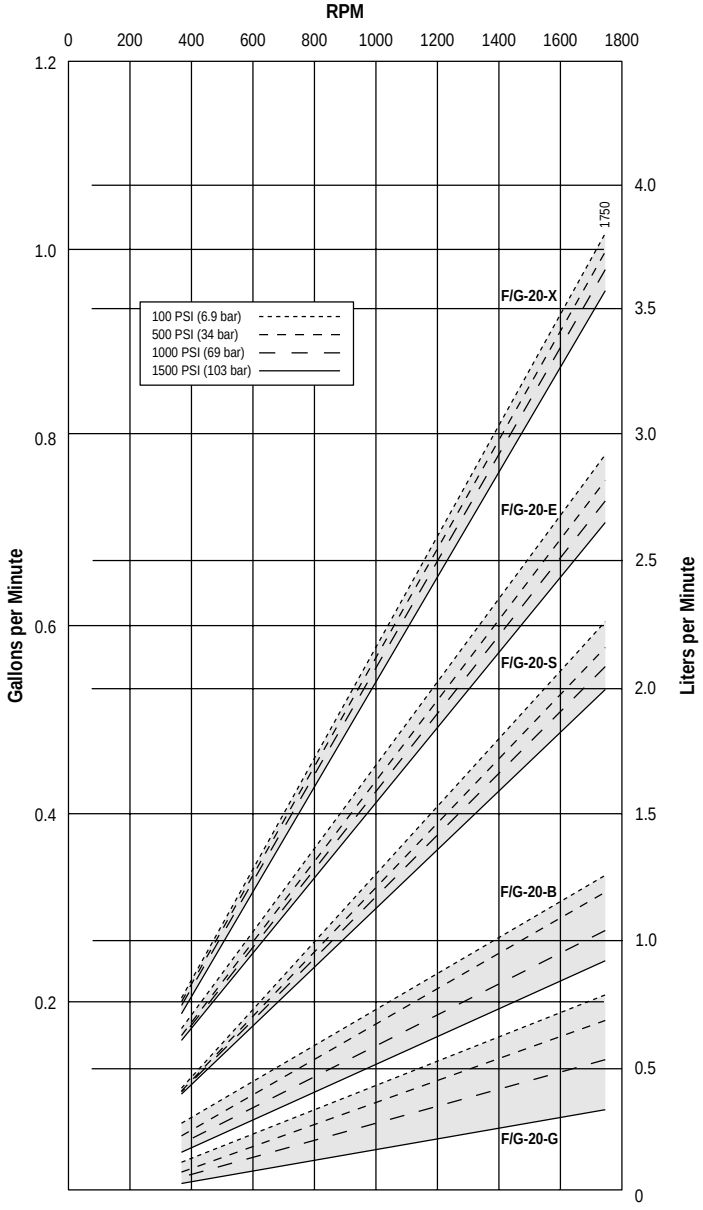
* HP and kW required for electric motors; must be at rpm used in calculation. Consult engine manufacturer for gasoline or diesel power requirements.

Note:

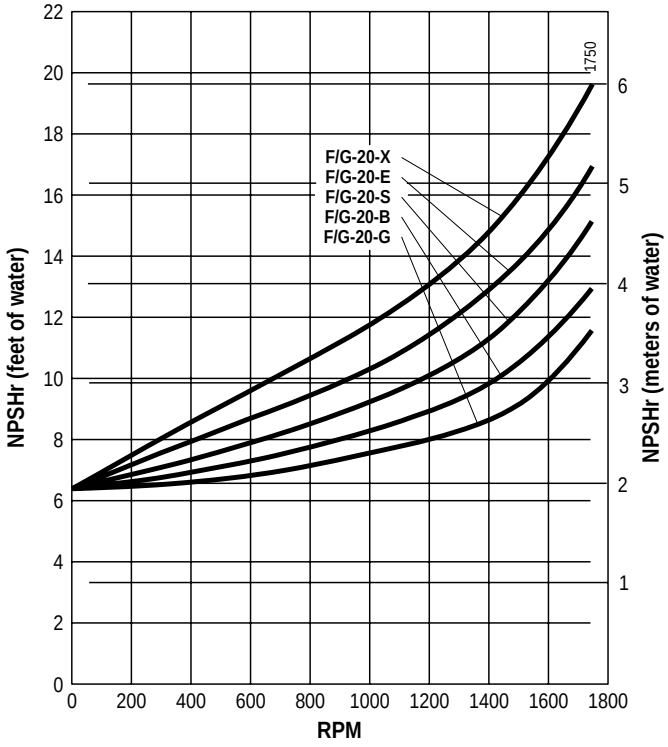
Performance and specification ratings apply to all F-20, F-21, F-22 and G-20, G-21 and G-22 configurations unless specifically noted otherwise.

F-20/G-20 Specifications

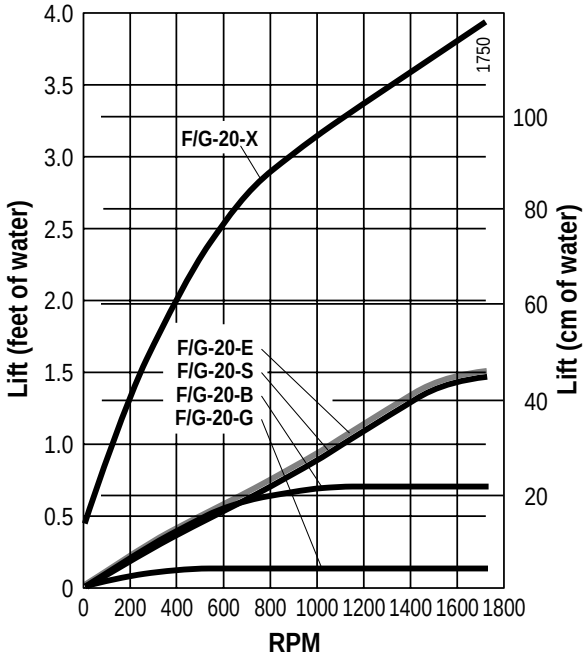
Performance



Net Positive Suction Head – NPSHr



Dry Lift



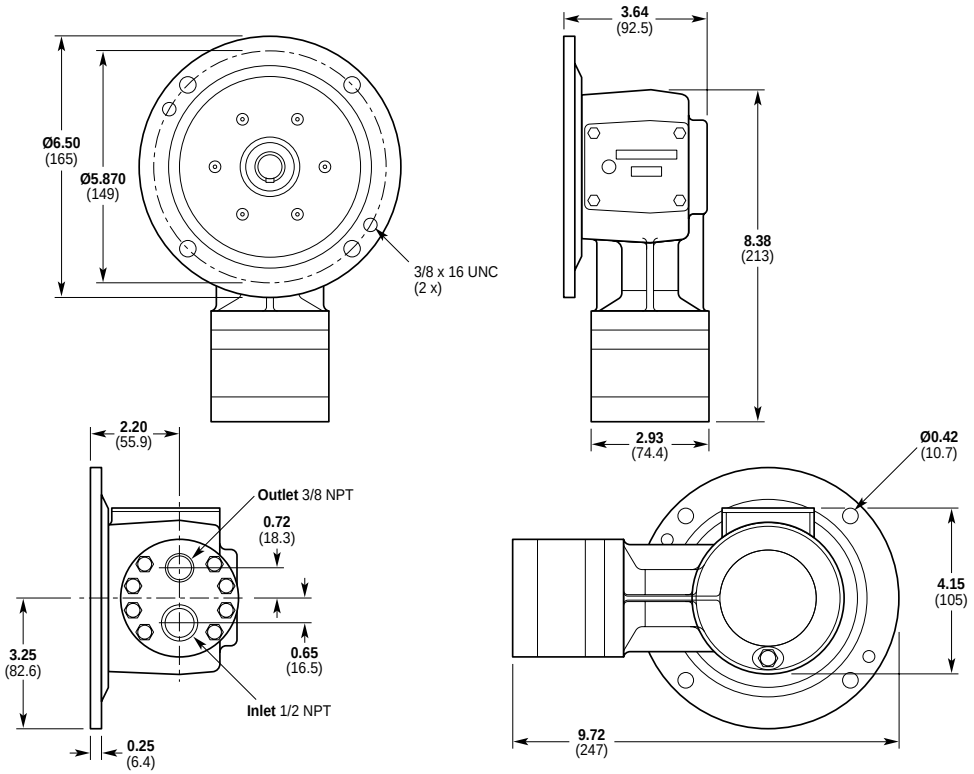
Note:

Performance and specification ratings apply to all F-20, F-21, F-22 and G-20, G-21 and G-22 configurations unless specifically noted otherwise.

F-20/G-20 Dimensions

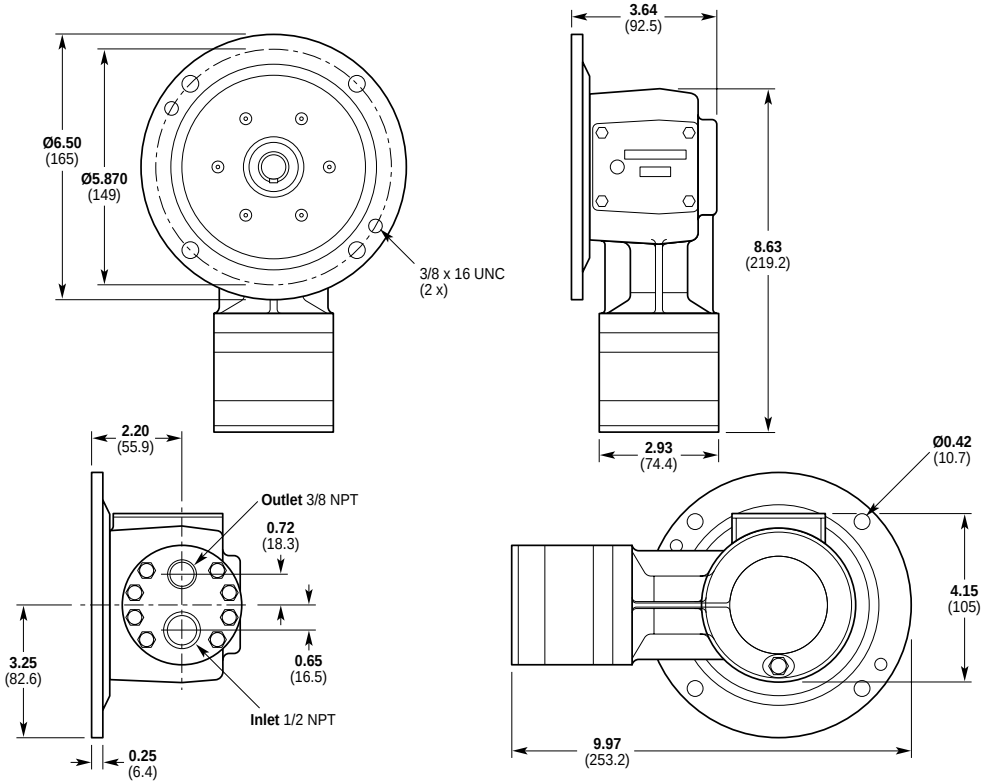
F20/G-20 Models with Metallic Pumping Head

Brass
316 Stainless Steel
Hastelloy® C



F20/G-20 Models with Non-Metallic Pump Head

Kynar®
Polypropylene



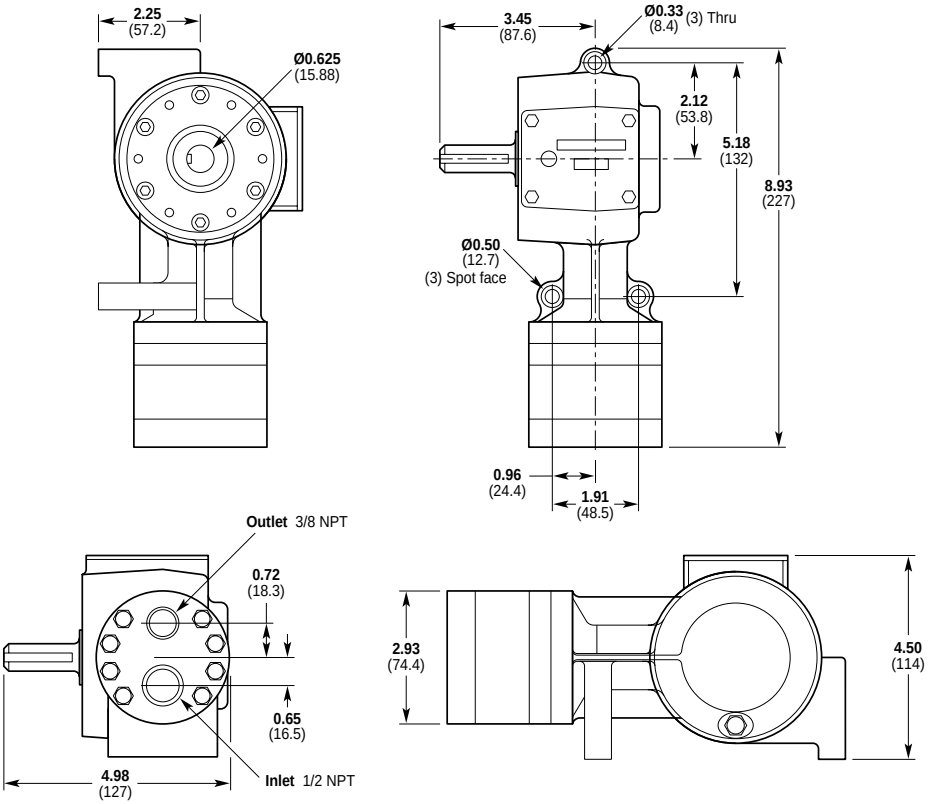
F-21/G-21 Dimensions

F21/G-21 Models with Metallic Pumping Head

Brass

316 Stainless Steel

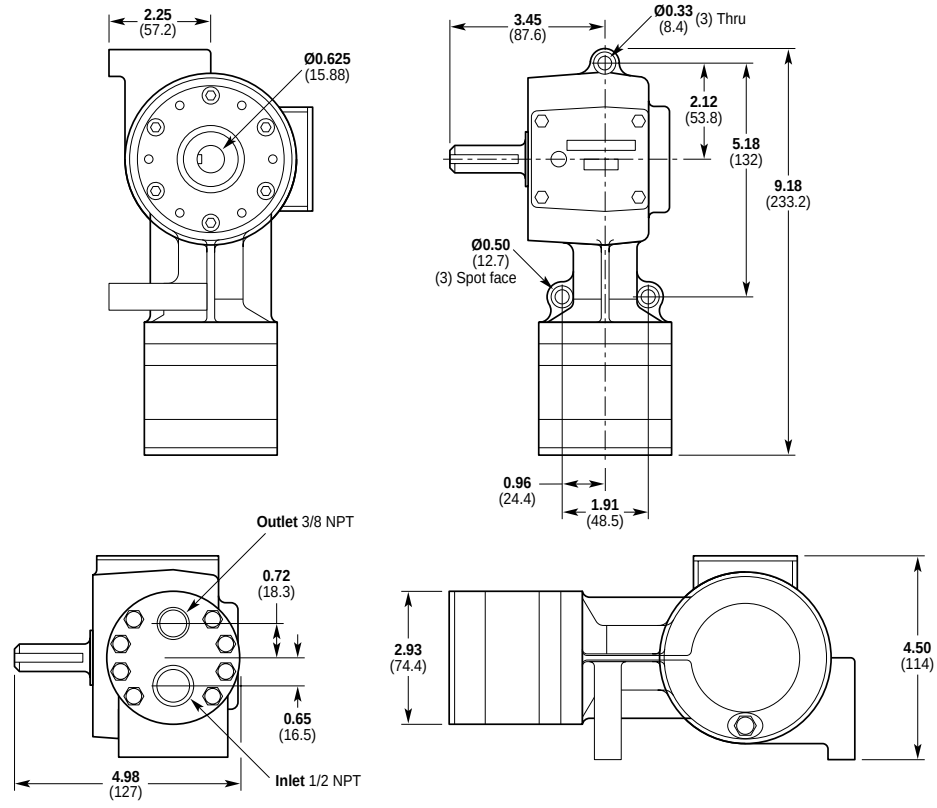
Hastelloy® C



F21/G-21 Models with Non-Metallic Pump Head

Kynar®

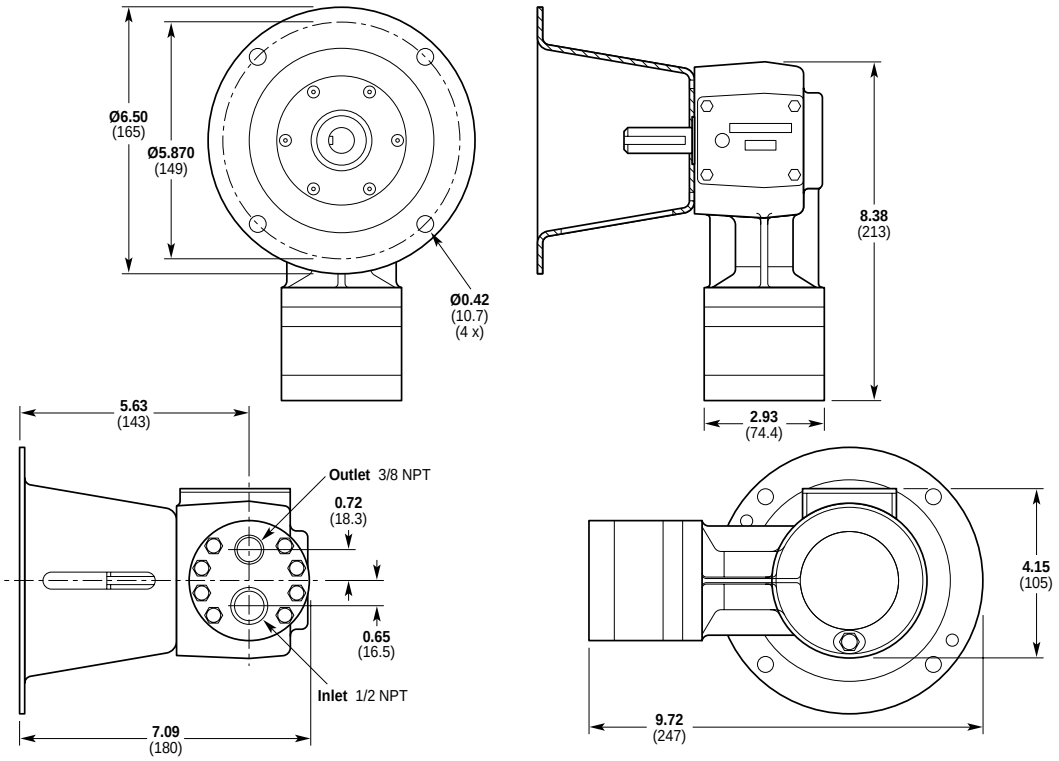
Polypropylene



F-22/G-22 Dimensions

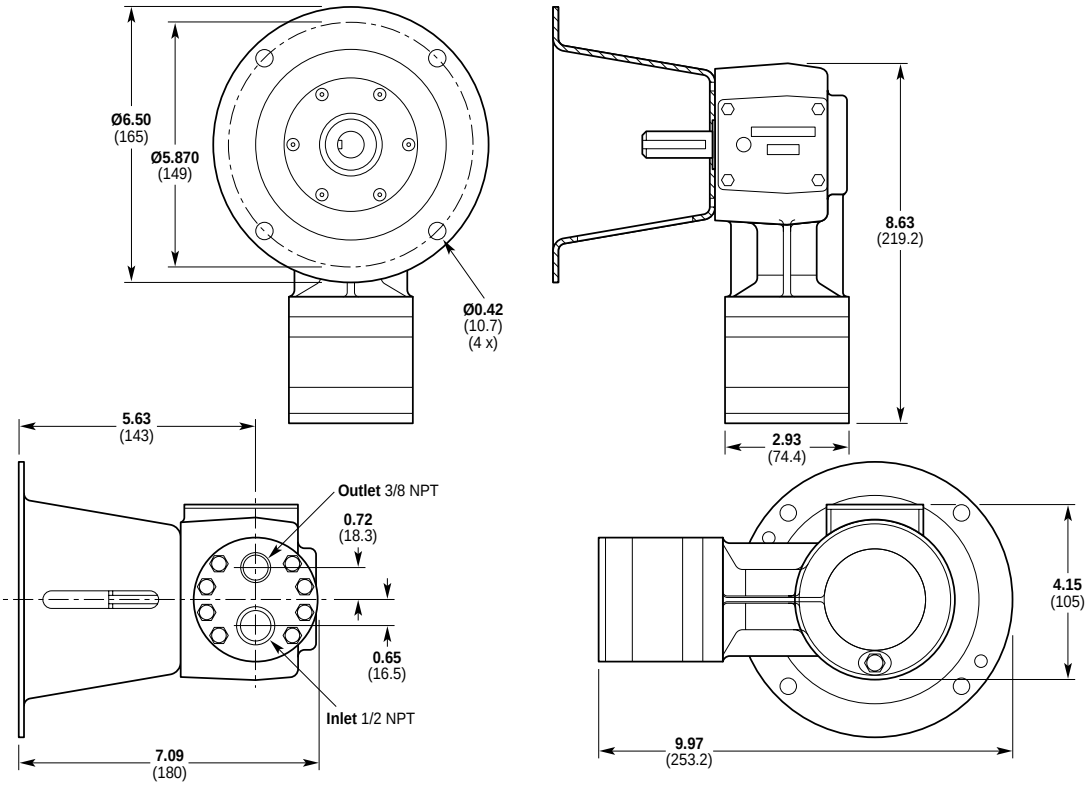
F22/G-22 Models with Metallic Pumping Head

Brass
316 Stainless Steel
Hastelloy® C



F22/G-22 Models with Non-Metallic Pump Head

Kynar®
Polypropylene



F-20/G-20 Installation

Location

NOTE: The numbers in parentheses are the Reference Numbers on the illustrations found later in this manual and in the Parts Manual.

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 manifold (3) and valve plate (21).

Mounting

The pump shaft can be rotated in either direction.

To prevent vibration, securely attach the pump or motor 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.

On a close-coupled system, coat the motor shaft liberally with Loctite® Nickel Anti-Seize #77164.

Important Precautions

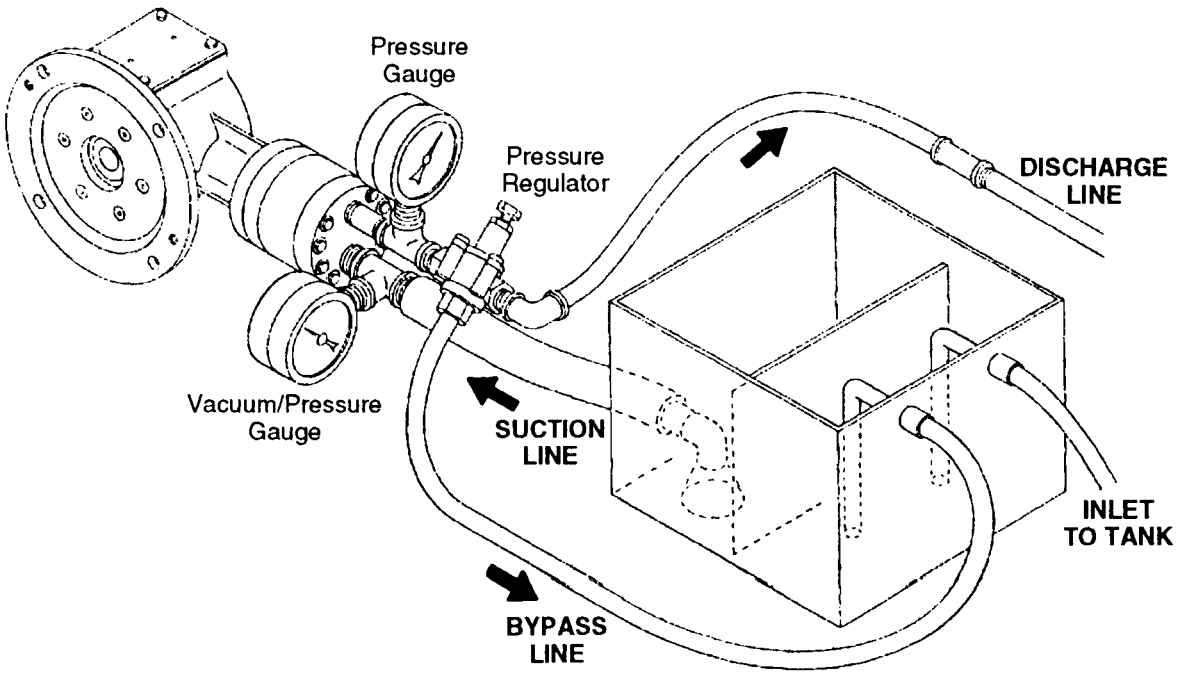
Adequate Fluid Supply. To avoid cavitation and premature pump failure, be sure that the pump will have an adequate fluid supply and that the inlet line will not be obstructed. See “Inlet Piping”.

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.



F-20/G-20 Installation

Inlet Piping (Suction Feed)

CAUTION: When pumping at temperatures above 160° F, 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. **Do not supply more than one pump from the same inlet line.**

Supply Tank

If a supply tank is used, it must be large enough. As a general rule, the tank size (in gallons) should be at least twice the flow rate (in gpm). The tank must have baffles to prevent aeration and turbulence. Also, the tank inlet and bypass inlet must be separated from the tank outlet by a baffle (see the illustration on Page 3).

Fluid Supply

The fluid supply at the pump inlet must at least exceed the flow rate required of the pump. Connect to the inlet port of the pump, marked “IN” (this is always the larger of the two ports).

Hose Size and Routing

Use the shortest, most-direct route from the supply tank to the pump. If elbows are needed, 45° are recommended. Any restrictions in the inlet piping may cause pump output to drop. The reduced flow reduces pump efficiency and may cause premature failure. **Do not install any 90° elbows in the pump inlet.**

- Use flexible noncollapsible hose between the pump and rigid piping or supply tank.
- Use the largest practical hose. The smallest permissible size is 3/4 in. I.D.
- All valves, fittings, and unions must also have 3/4 in. minimum I.D.
- Support the pump and piping independently.
- Make sure all joints are air-tight.

Minimizing Friction Losses

To minimize friction losses in the inlet piping:

- Eliminate filters
- Use as coarse a filter screen as practical for your application
- For high-viscosity materials, increase the size of the hose and all plumbing fittings to a minimum of 1 in. I.D. Use short plumbing runs.

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 100 psi; if it could get higher, install an inlet pressure regulator. **Do not supply more than one pump from the same inlet line.**

Inlet Calculations

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

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 x V x N x C) ÷ (K x 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 0.628 for the F/G-20/21/22 Hydra-Cell pump

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)

Minimizing Acceleration Head

To minimize the acceleration head:

- Keep inlet lines less than 3 ft long
- Use at least 3/4-in. 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.

F-20/G-20 Installation

Discharge Piping

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

NOTE: Single-acting pumps create a pulsing flow. Using pulsation dampening devices in the discharge line can reduce or eliminate this.

Hose and Routing

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

Connect to the outlet port of the pump, marked “OUT” (this is always the smaller of the two ports).

Select pipe or hose that meets the pressure requirements of the system. Working pressure of the hose should not exceed one-fourth of the bursting pressure.

Use about 6 ft of flexible hose between the pump and rigid piping.

Support the pump and piping independently.

Pressure Regulation

Install a pressure regulator or unloader in the discharge line, within 6 in. of the pump outlet. Bypass pressure must not exceed the pressure limit of the pump.

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, cavitation, and pump overheating).

If the pump may be run for a long time with the discharge closed and fluid bypassing, install a thermal protector 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 “pop-off” 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 reservoir beneath the reservoir diaphragm (71) is completely full. NOTE: The reservoir is filled and sealed at the factory. If you are unsure about the oil level, remove the cover (70) and slowly lift the diaphragm (71). Refer to Service Procedure #6, “Fill and Seal the Oil Reservoir”, in the Fluid-End Service Section.
- 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. Inlet pressure must not exceed 100 psi.
3. Listen for any erratic noise and look for unsteady flow.
4. Adjust the discharge pressure regulator to the desired operating and bypass pressures. Do not exceed the maximum pressure rating of the pump.
5. After the pressure regulator is adjusted, set the “pop-off” safety relief valve at 100 psi higher than the desired operating pressure.
6. Pumps fitted with Teflon diaphragms require 2 psi (0.14 bar) minimum inlet pressure.