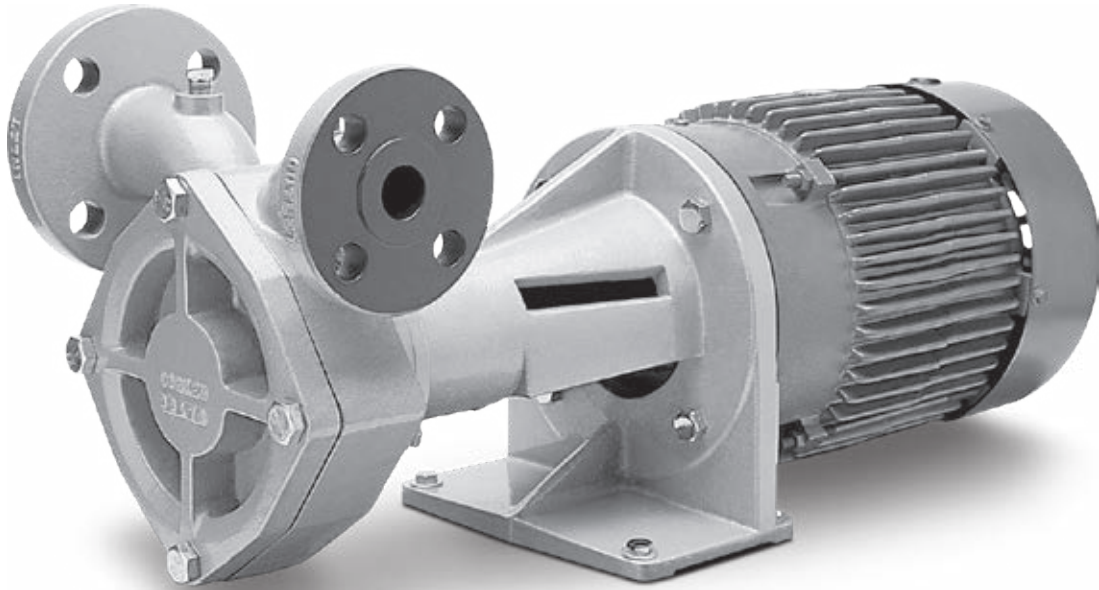


Installation Guide for Underground Tank Applications Turbine Pumps



Warning: (1) Periodic inspection and maintenance of Corken products is essential. (2) Inspection, maintenance and installation of Corken products must be made only by experienced, trained and qualified personnel. (3) Maintenance, use and installation of Corken products must comply with Corken instructions, applicable laws and safety standards (such as NFPA Pamphlet 58 for LP-Gas and ANSI K61.1-1972 for Anhydrous Ammonia). (4) Transfer of toxic, dangerous, flammable or explosive substances using Corken products is at user's risk and equipment should be operated only by qualified personnel according to applicable laws and safety standards.

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CORKEN[®]
IDEX

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Background

Because of the environmental problems caused by traditional fuels such as gasoline and diesel, the use of alternative fuels, like Liquefied Petroleum Gas (LPG), are rapidly increasing worldwide. To reduce air pollution, many governments are adopting energy policies promoting the use of LPG autogas. Since autogas is commonly used in highly populated cities, special safety measures and techniques are implemented. One of the safety measures requires the use of underground storage tanks posing many challenges for the pump.

The Challenge of Pumping LPG

Pumping a boiling liquid is also challenging. LPG is stored at its boiling point so any increase in temperature as well as any decrease in pressure will cause the product to boil and form vapor.

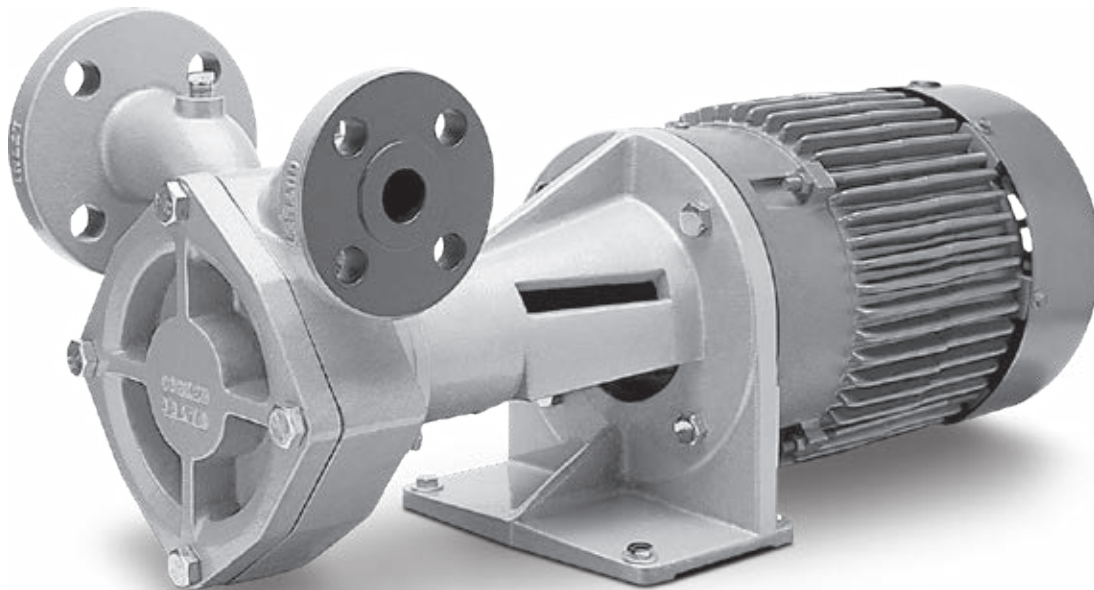
To limit the amount of vapor formation at the pump's inlet port, the design of the suction piping system is very important. For boiling liquids the net positive suction head available (NPSHA) for an aboveground tank installation is reduced to the height of the liquid level above the pump (net static suction head) minus the frictional losses. Conversely, in an underground tank installation, the pump is above the liquid level of the tank so the net

static suction head (positive) becomes net static suction lift (negative). Applications with net static suction lift will always have vapor in the liquid stream.

Over the years various methods have been used to overcome net static suction lift. They not only add complexity to the pumping system but in many cases contribute to cavitation in the pump. Some examples are listed below:

1. Method one: Using a foot valve or back pressure check valve at the end of the suction dip tube. This method is ineffective because vapor will eventually form in the dip tube after the pump is shut off. When the pump is restarted, the vapor is drawn into the pump causing cavitation.
2. Method two: Padding the storage tank using a compressor or a blanket of an inert gas.
3. Method three: Blowing down the vapor in the pump until it is primed with liquid. Since this requires venting product to the atmosphere, is not a safe practice.

In order to handle a certain amount of vapor without suffering the destructive effects of cavitation, special criteria must be incorporated in the design of LPG pumps. Corken's high differential pressure turbine pumps are designed to handle all of the pumping challenges mentioned above.



Types of LPG Pumps

Submersible Pumps

Although submersible pumps have been used with some degree of success in the LPG industry, they have the following disadvantages:

- Requires a specially constructed storage tank.
- More expensive pump.
- Dry-run tolerances are very limited so you must avoid running dry. A special and costly protection system must be implemented.
- Many submersible pump designs cannot be repaired and are basically throwaway pumps.
- The pump's well must be evacuated before removing the pump for service or replacement.
- Due to the heavy weight, the use of a crane is typically required to remove the pump from the tank's well.
- Some designs are integral pump and motor units so neither the pump nor the electric motor can be replaced separately. The complete assembly must be replaced.

Positive Displacement Pumps

Positive displacement pumps such as piston, gear, and sliding-vane are widely used in the LPG industry due to their excellent suction characteristics and vapor handling capability. However, when they run dry, severe wear, increased noise, and vibration will occur.

Regenerative Turbine Pumps

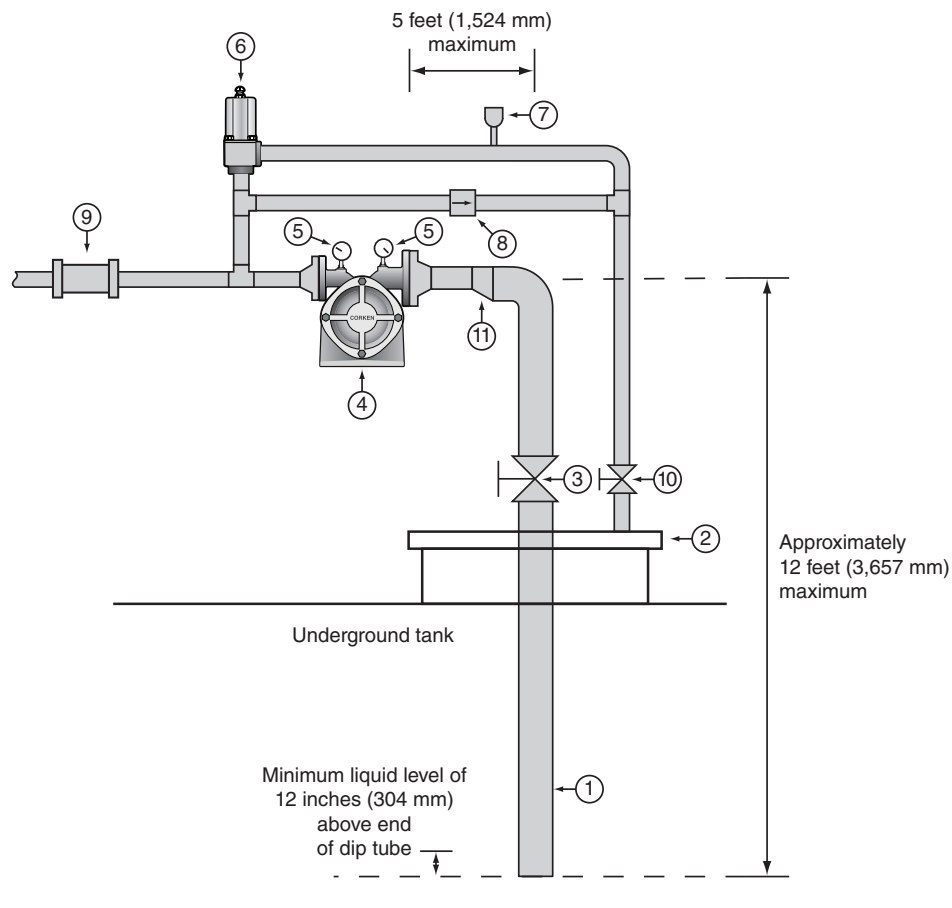
Unlike a positive displacement pump, the impeller is the only moving part and floats freely without metal-to-metal contact. Although this type of pump does not have the vapor handling capability of positive displacement pump, it does move vapor more readily and has an excellent tolerance level for running dry without noise and vibration. Since a pump on an underground tank application runs dry until it is primed with liquid, these characteristics make a regenerative turbine the pump of choice for underground tank applications.

Design Criteria for Underground Tank Applications

Minimize frictional losses:

- Pump should be as close as possible to the tanks liquid outlet connection.
- Use a minimal number of fittings and elbows.
- No strainer is necessary since the tank itself acts as a gravity collector.
- Use full-port ball valves, or low restriction valves.
- Use the minimum piping sizes listed in the bill of materials shown in diagrams 1 and 2.
- Minimize the net static suction lift to approximately 12 feet (3,657 mm).
- Use vapor eliminator valves (Corken's B166 bypass valves have this feature).
- Use back pressure check valves downstream of the pump.
- Vent the vapor eliminator on the liquid meter back to the tank and not to the bypass line.
- Limit the capacity of the pump to a maximum of 1.5% of the tank's capacity (e.g. with a 1,000 gallon (3,785 liter) tank, limit the pump to 15 gpm (56.8 L/min).

Diagram 1—Underground Tank Application

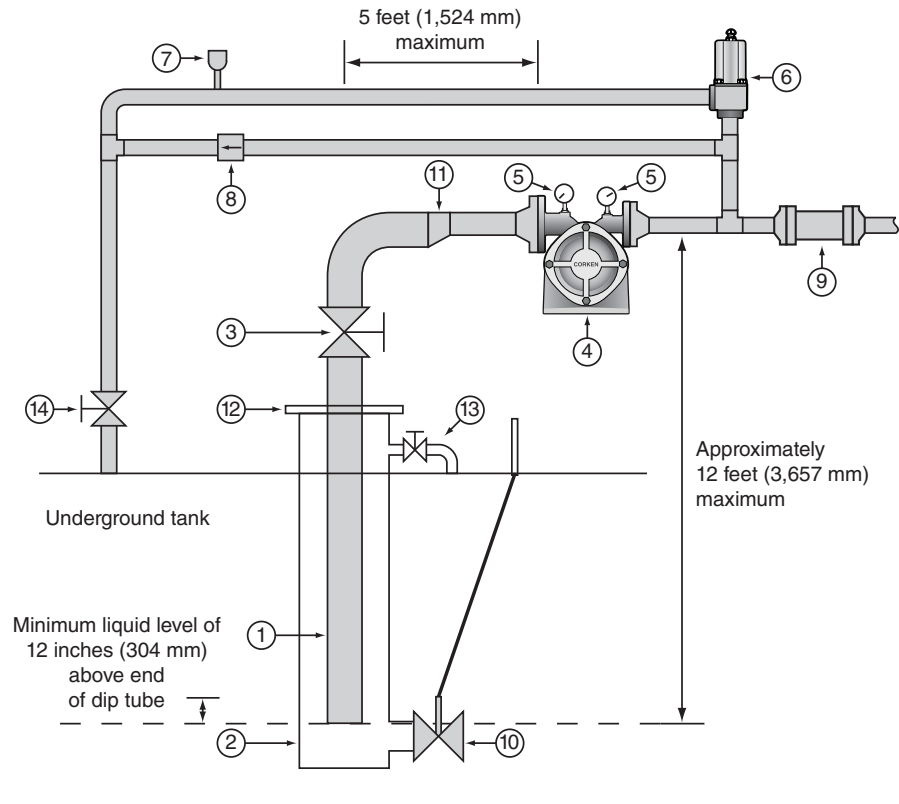


Ref. No.	Description	Size			Remarks
		FF060	FF075	FF150	
1.	Dip tube	1-1/4" NPT	2" NPT	2" NPT	Minimum pipe size: Schedule 80
2.	Man way cover				Use existing
3.	Ball valve, full port (manual or remote)	1-1/4"	2" NPT	2" NPT	Valve size
4.	Corken pump with electric motor	5 hp (4 kW)	5 hp (4 kW)	7.5 hp (5.5 kW)	Typical hp (kW)
5.	Suction/discharge pressure gauges	1/4"	1/4"	1/4"	0–400 psig (0–28 bar g)
6.	Corken B166 by-pass valve	1"	1"	1"	With spring code C 100–225 psi (6.9–15.5)
7.	Hydrostatic relief valve	1/4"	1/4"	1/4"	Set at 450 psig (31 bar g)
8.	In-line excess flow valve	1"	1"	1"	Closing flow of 10–15 gpm (37–57 L/min)
9.	Back pressure check valve	1"	1"	1"	
10.	By-pass return line's valve	1"	1"	1"	Minimum pipe size: Schedule 80
11.	Eccentric reducer or enlarger				If required

Warning:

1. No excess flow valves on the tank's liquid outlet connections are shown in these schematics. If local regulations require the use of excess flow valves, its closing flow should be approximately 1.5 times higher than the pump's rated capacity for the operational conditions.
2. Periodic inspection and maintenance of Corken products is essential.
3. Only experienced, trained and qualified personnel are to make inspection, maintenance and installation of Corken products.
4. Maintenance, use and installation of Corken products must comply with Corken instructions, applicable laws and safety standards such as NFPA 58 for LP-Gas and ANSI K6.1-1972 for Anhydrous Ammonia.
5. Transfer of toxic, dangerous, flammable or explosive substances using Corken equipment is at the user's risk. Only qualified personnel should operate Corken equipment according to the applicable laws and safety standards.

Diagram 2—Underground Tank with Manifold for Submersible Pump

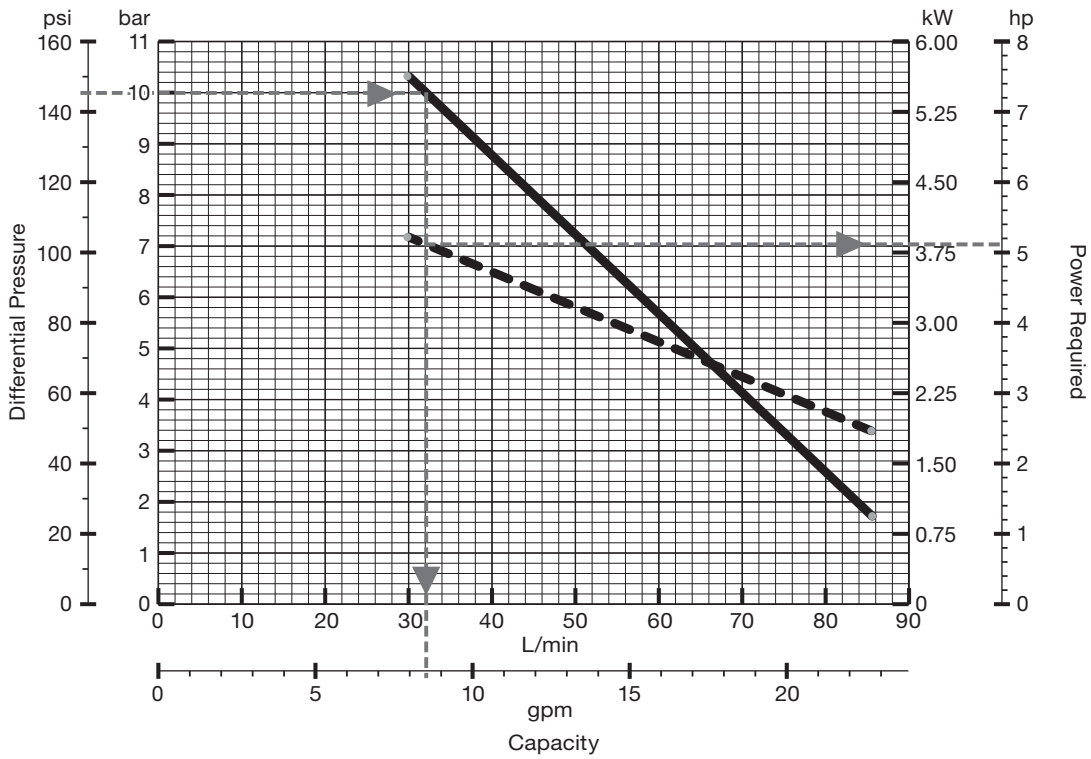


Ref. No.	Description	Size			Remarks
		FF060	FF075	FF150	
1.	Dip tube	1-1/4" NPT	2" NPT	2" NPT	Minimum pipe size: Schedule 80
2.	Manifold				Use existing
3.	Ball valve, full port (manual or remote)	1-1/4"	2" NPT	2" NPT	Valve size
4.	Corken pump with electric motor	5 hp (4 kW)	5 hp (4 kW)	7.5 hp (5.5 kW)	Typical hp (kW)
5.	Suction/discharge pressure gauges	1/4"	1/4"	1/4"	0–400 psig (0–28 bar g)
6.	Corken B166 by-pass valve	1"	1"	1"	With spring code C 100–225 psi (6.9–15.5)
7.	Hydrostatic relief valve	1/4"	1/4"	1/4"	Set at 450 psig (31 bar g)
8.	In-line excess flow valve	1"	1"	1"	Closing flow of 10–15 gpm (37–57 L/min)
9.	Back pressure check valve	1"	1"	1"	
10.	Control valve	1"	1"	1"	Minimum pipe size: Schedule 80
11.	Eccentric reducer or enlarger				If required
12.	Flange				Use existing
13.	Pressure equalizing line				Part of manifold. Must be open to operate properly
14.	Bypass return line valve				Use existing

Warning:

1. No excess flow valves on the tank's liquid outlet connections are shown in these schematics. If local regulations require the use of excess flow valves, its closing flow should be approximately 1.5 times higher than the pump's rated capacity for the operational conditions.
2. Periodic inspection and maintenance of Corken products is essential.
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Performance Curves for Model 060 Coro-Flo® Pumps¹



3450 RPM @ 60 Hz

Differential pressure:
 10.0 bar
 145.0 psi

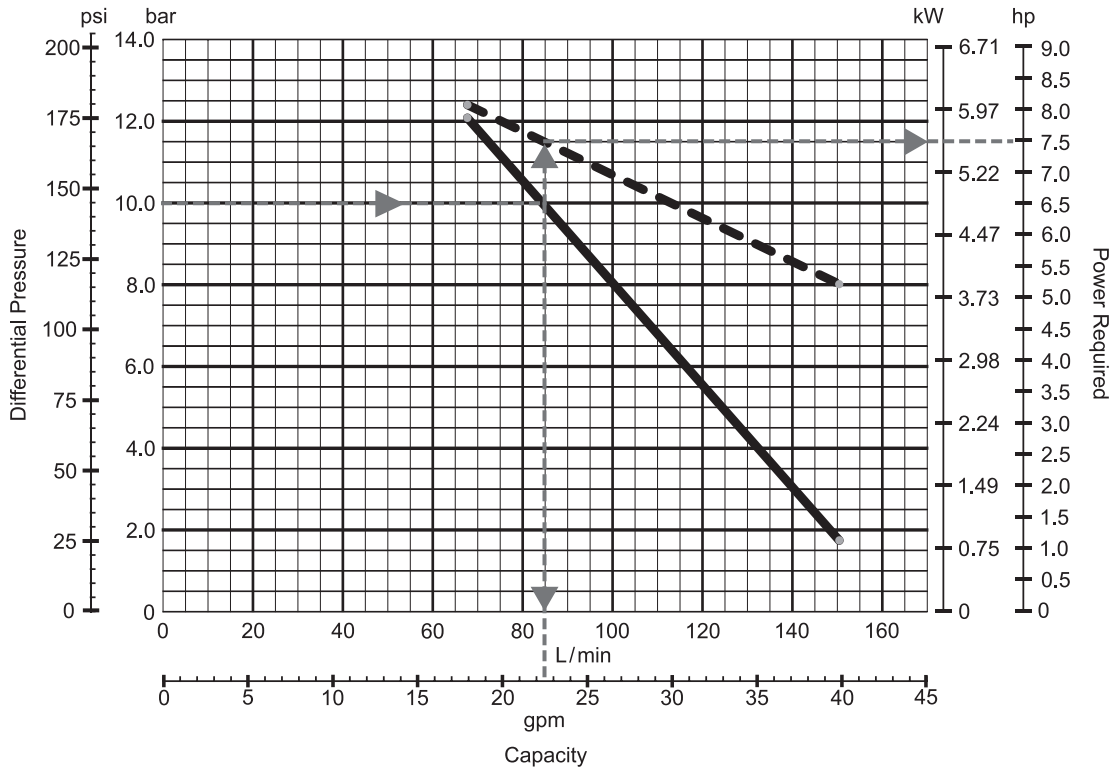
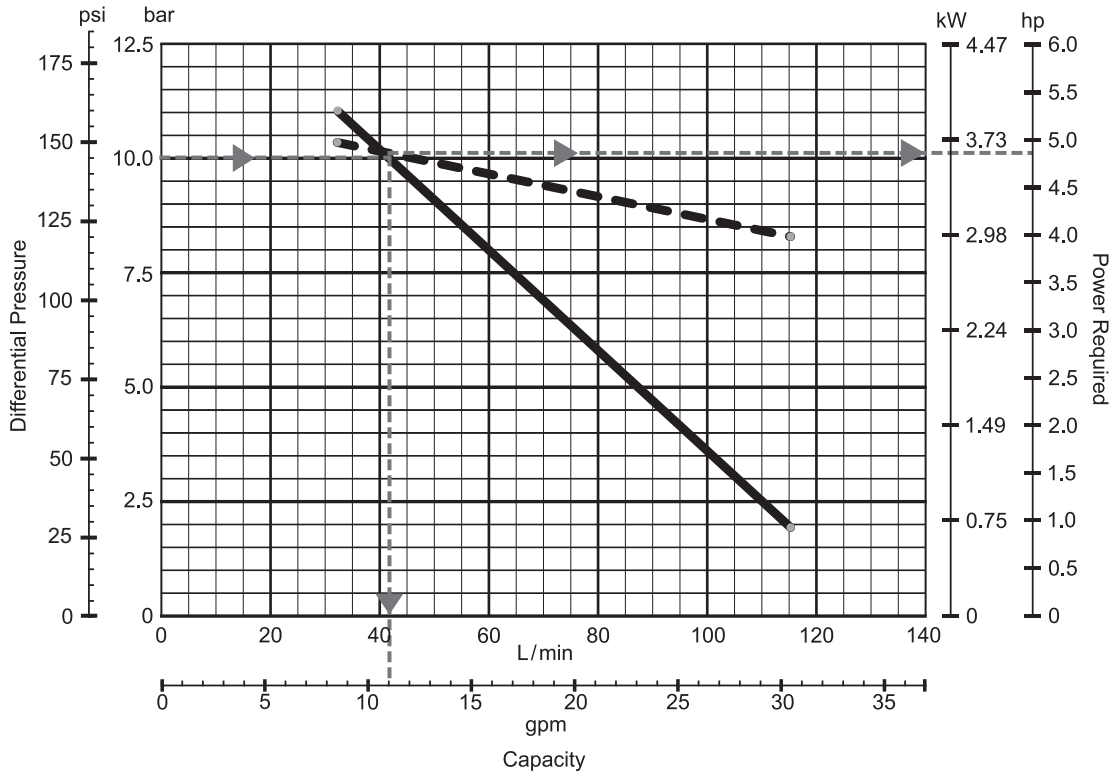
Flow:
 32.2 L/min
 8.5 gpm

Power required:
 3.8 kW
 5.15 hp

Curves based on LPG¹
 Capacity ———
 Power required - - -

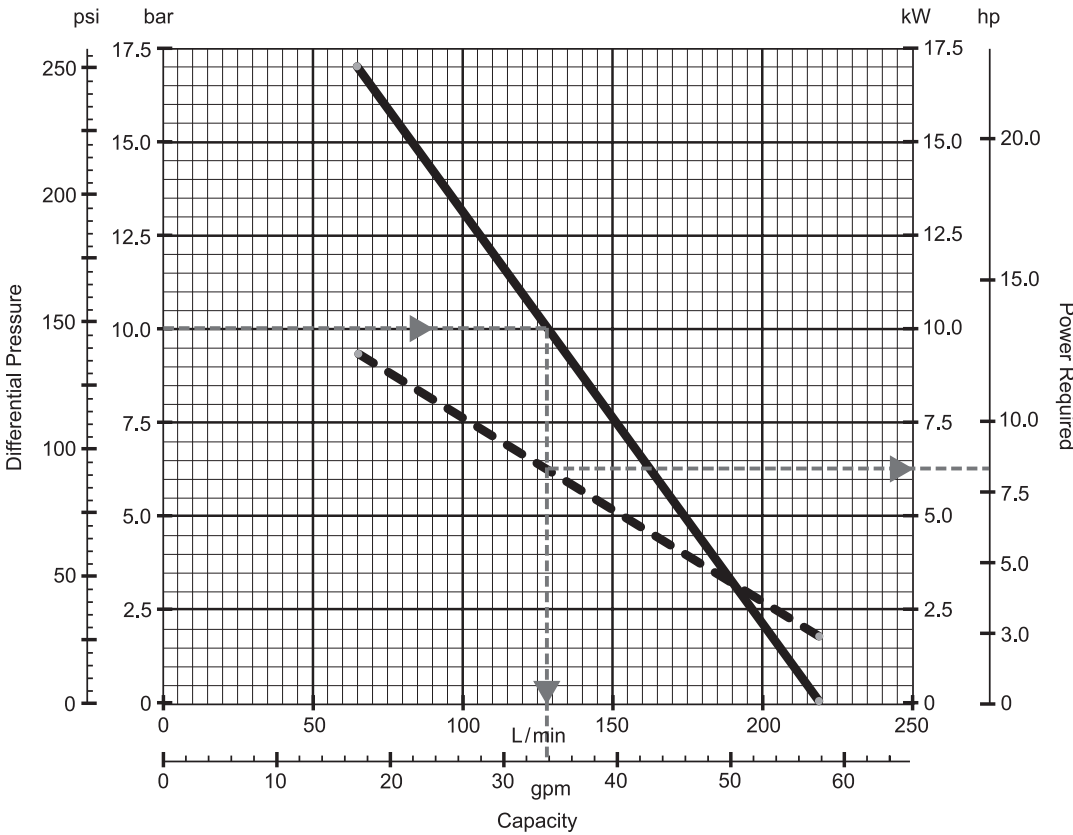
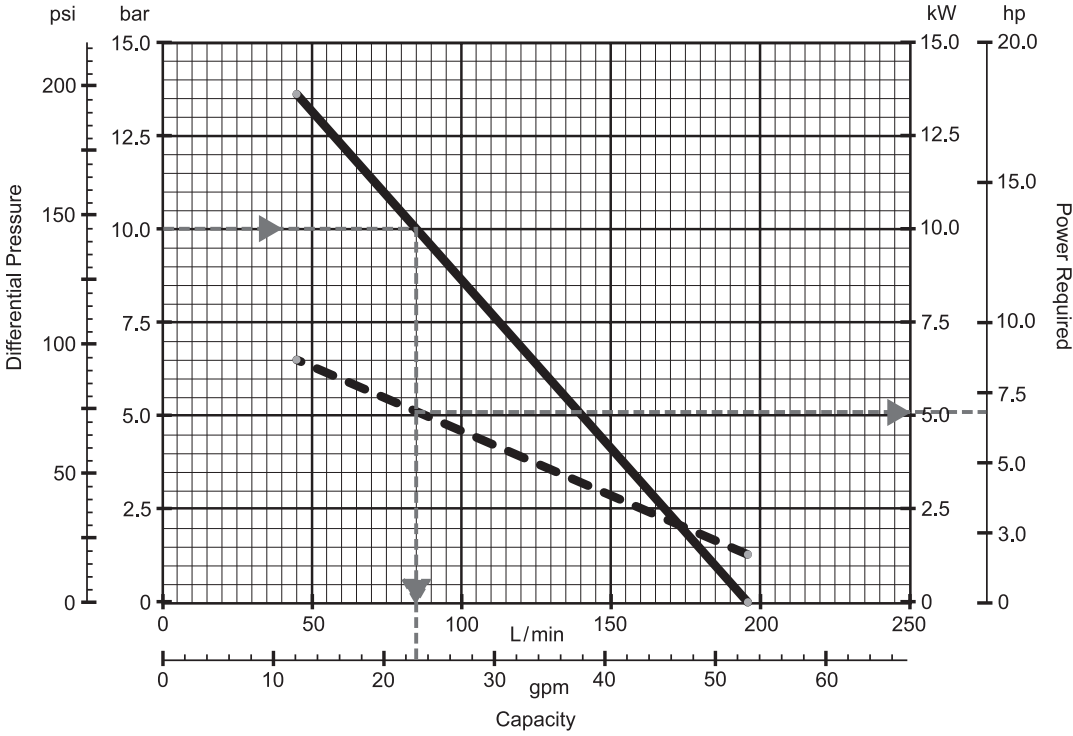
¹The performance curves are based on aboveground LPG installations. Performance curves for underground LPG tanks will vary based on the specific installation. Consult factory.

Performance Curves for Model 075 Coro-Flo® Pumps¹



¹The performance curves are based on aboveground LPG installations. Performance curves for underground LPG tanks will vary based on the specific installation. Consult factory.

Performance Curves for Model 150 Coro-Flo® Pumps¹



¹The performance curves are based on aboveground LPG installations. Performance curves for underground LPG tanks will vary based on the specific installation. Consult factory.

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