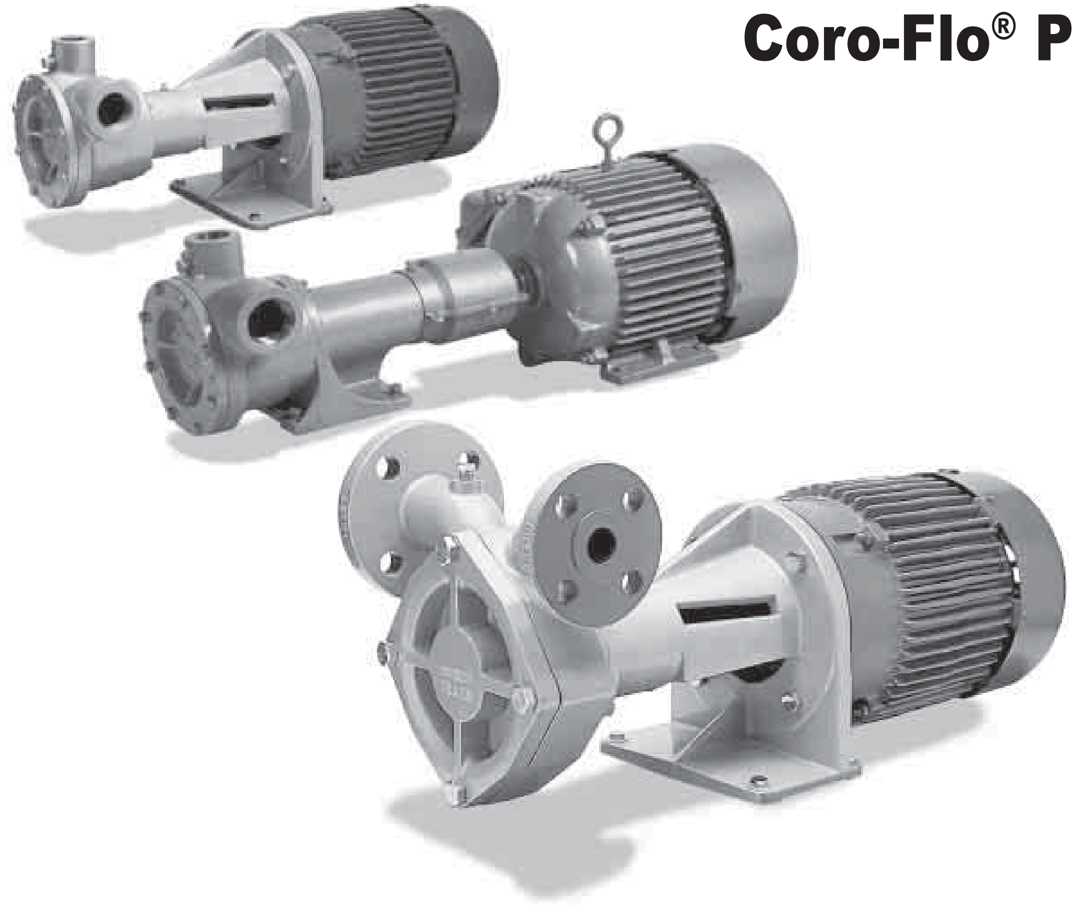
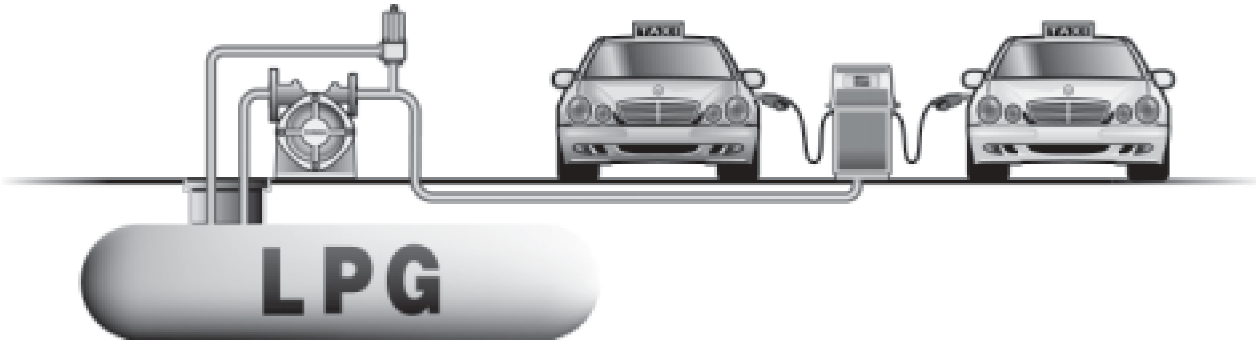
Underground Tank Applications Installation Guide

Coro-Flo® Pumps





Solutions beyond products...

CORKEN®

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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 LPG, are rapidly increasing worldwide. To reduce air pollution, many governments are adopting energy policies that promote the use of autogas. Since autogas is typically used in highly populated cities with air pollution problems, special safety measures and techniques have been implemented to improve the integrity and safety of the LPG dispensing stations. One of the techniques widely implemented is the use of underground storage tanks.

The Challenge of Pumping LPG:

The pumping of boiling liquids, like LPG and other liquefied gasses, offers a unique set of challenges to the manufactures and users of LPG pumps. Since LPG is stored at exactly its boiling point, 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 an important aspect. For boiling liquids, the net positive suction head available (NPSHA) of an installation is reduced to the height of the liquid level above the pump (net static suction head) minus the frictional losses. For an underground tank where the pump is located above the liquid level, the net static suction head becomes the net suction lift, which is negative, not positive. This means that for aboveground pumps pumping from underground tanks, the installation NPSHA will always be negative, and the pump will always handle vapor in the liquid stream.

Over the years, several methods have been used, but each one of them not only complicated the pumping system, but also in many cases contributed to cavitation in the pump. Some examples are:

1.0 The use of a "foot-valve", or a backpressure check valve at the end of the suction dip tube.

This method is ineffective: eventually vapor will be formed in the dip tube when the pump is shut-off. Upon starting the pump, this vapor will be drawn into the pump, causing cavitation.

2.0 The "Parkhill-Wade" method developed in the 1940's, using a small receiver tank with an eductor at the pump's discharge port.

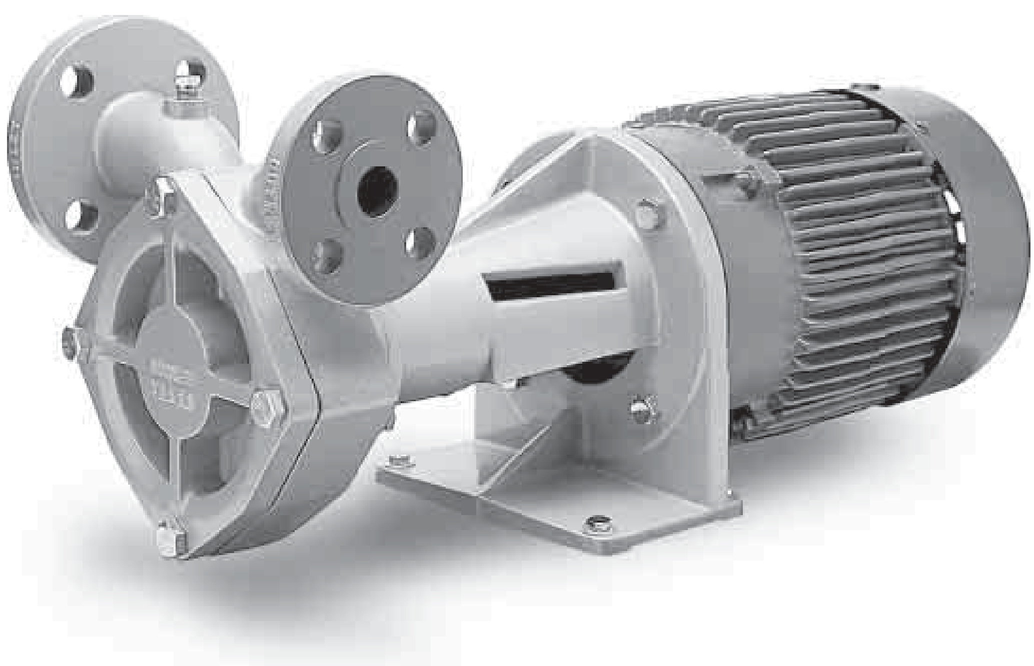
Since this system must use a pump with a higher capacity than what the application requires, the pump cavitates continuously.

3.0 Padding the storage tank using a compressor, or a "blanket" of an inert gas.

4.0 Blowing down the vapor in the pump until the pump is primed with liquid.

This requires venting product to the atmosphere, which is not a safe practice.

Special design criteria must be incorporated in the design of LPG pumps, so the pump can effectively handle a certain amount of vapor, without suffering the destructive effects of cavitation.



Types of LPG Pumps:

Submersible Pumps:

Although these types of pumps have been used with some degree of success in the LPG industry, there are many disadvantages.

- Requires a special construction storage tank
- More expensive pump
- Special and costly protection system to avoid running the pump dry. Dry-run tolerances are very limited.
- Many of these pumps cannot be repaired (i.e., throw-away pumps)
- The pump's well must be evacuated in order to remove the pump for repairs or to be replaced.
- Due to its weight, the use of a crane is typically required to remove the pump from the tank's well before servicing the pump.
- Since some of the submersible pumps are integral pump/motor units, neither the pump nor the electric motor can be replaced separately. The complete assembly must be replaced.

Positive Displacement (PD) Pumps:

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

Regenerative Turbine Pumps:

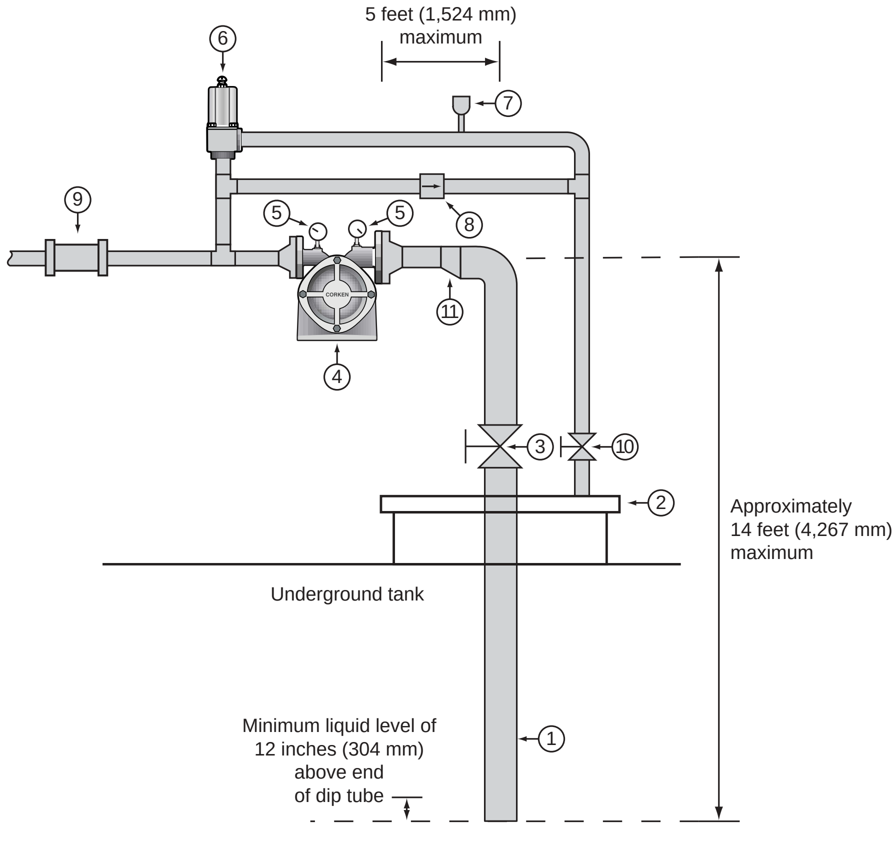
Unlike the positive displacement pumps, there is only one moving part, its impeller, which floats freely without metal-to-metal contact. Although this type of pump does not have the vapor handling capability of positive displacement pumps, they do move vapor more readily and have an excellent tolerance level for running dry without noise and vibration. Since a pump for an underground tank application will run dry until they are primed with liquid, these characteristics make the regenerative turbine pump, the pump of choice for an underground tank application.

Installation Design Criteria for Underground Tanks' 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 at least the minimum piping sizes shown in the charts for figures 1.0 or 2.0
- Minimize the net static suction lift to approximately 14 feet (4.3 m)
- Use vapor eliminator valves (Corken B166 by-pass 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, not to the by-pass line
- Limit the capacity of the pump to a maximum of 1.5% of the tank's capacity. (For example, with a 1000 gallon (3,785 liter) tank, limit the pump to 15 gpm (56.8 L/min)

1.0 Underground Tank Application



Bill of Materials

Ref. No.	Description	Size				Remarks
		Model 9, 10, 15	Model 12	Model 13, 14	Model 150	
1	Schedule 80 pipe	3/4”	1"	1-1/4"	2"	
2	Man way cover					Existing
3	Ball valve, full port	3/4”	1"	1-1/4"	2"	Manual or remote control
4	Corken pump	9,10 or 15	12	13 or 14	150	With 7.5 hp (5.5 kW) electric motor
5	1/4" NPT pressure gauge					0–400 psig (0–28 bar g)
6	Corken B166 by-pass valve 1 inch NPT					With spring code C
7	1/4" NPT hydrostatic relief valve					Set at 450 psig (31 bar g)
8	In-line excess flow valve					Closing flow of 10–15 gpm (37–57 L/min)
9	Back pressure check valve					Like Corken’s Flo-Chek valve
10	By-pass return line’s valve					Existing
11	Eccentric reducer, if required					

WARNING:

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.

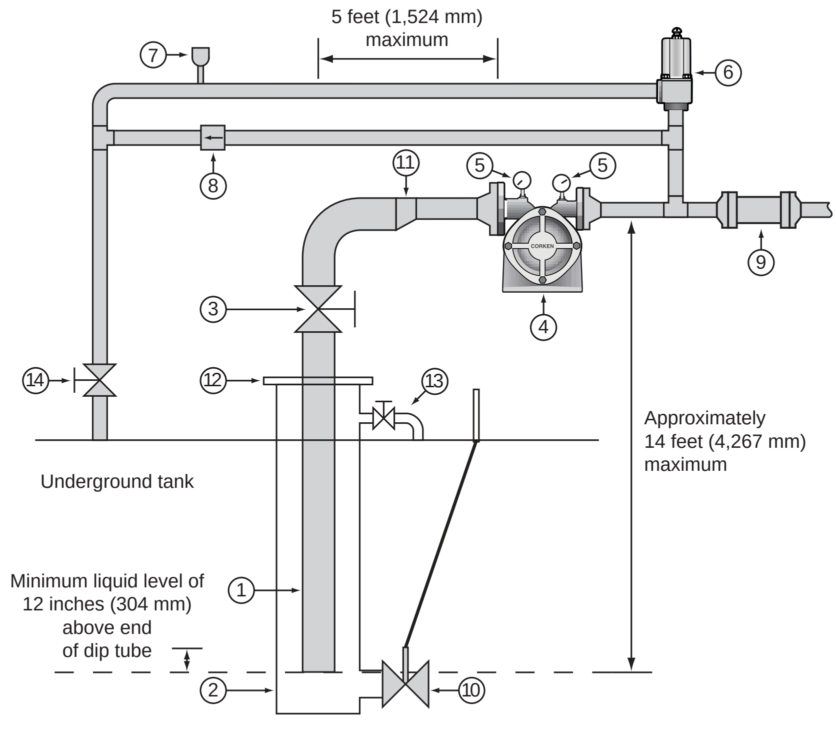
Periodic inspection and maintenance of Corken products is essential.

Only experienced, trained and qualified personnel must make inspection, maintenance and installation of Corken products.

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.

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.

2.0 Underground Tank with Manifold for Submersible Pump



Bill of Materials

Ref. No.	Description	Size				Remarks
		Model 9, 10, 15	Model 12	Model 13, 14	Model 150	
1	Schedule 80 pipe	3/4”	1"	1-1/4"	2"	
2	5" manifold					Existing
3	Ball valve, full port	3/4”	1"	1-1/4"	2"	Manual or remote control
4	Corken pump	9,10 or 15	12	13 or 14	150	With 7.5 hp (5.5 kW) electric motor
5	1/4" NPT pressure gauge					0–400 psig (0–28 bar g)
6	Corken B166 by-pass valve 1 inch NPT					With spring code C
7	1/4" NPT hydrostatic relief valve					Set at 450 psig (31 bar g)
8	In-line excess flow valve					Closing flow of 10–15 gpm (37–57 L/min)
9	Back pressure check valve					Like Corken’s Flo-Chek valve
10	2" Ball valve					Existing
11	Eccentric reducer, if required					
12	5" flange					Existing
13	Pressure equalizing line					Part of existing 5" manifold. Must be open for pump to operate properly.
14	By-pass return line’s valve					Existing

WARNING:

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.

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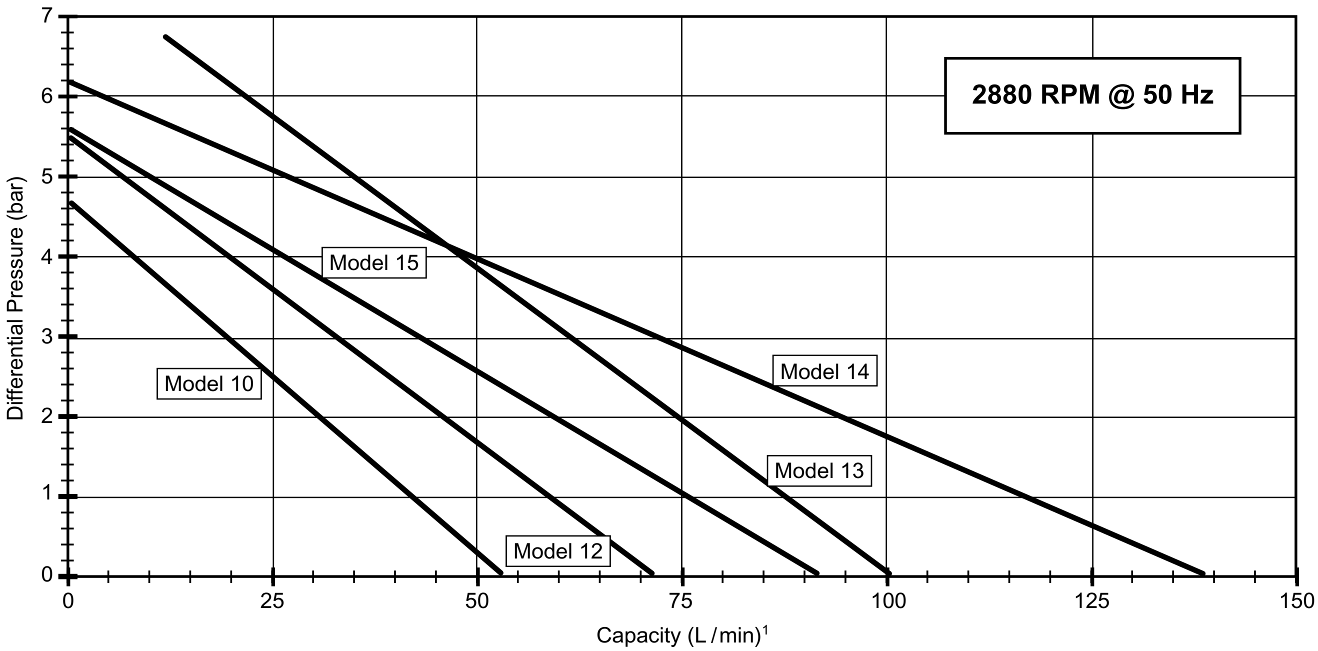
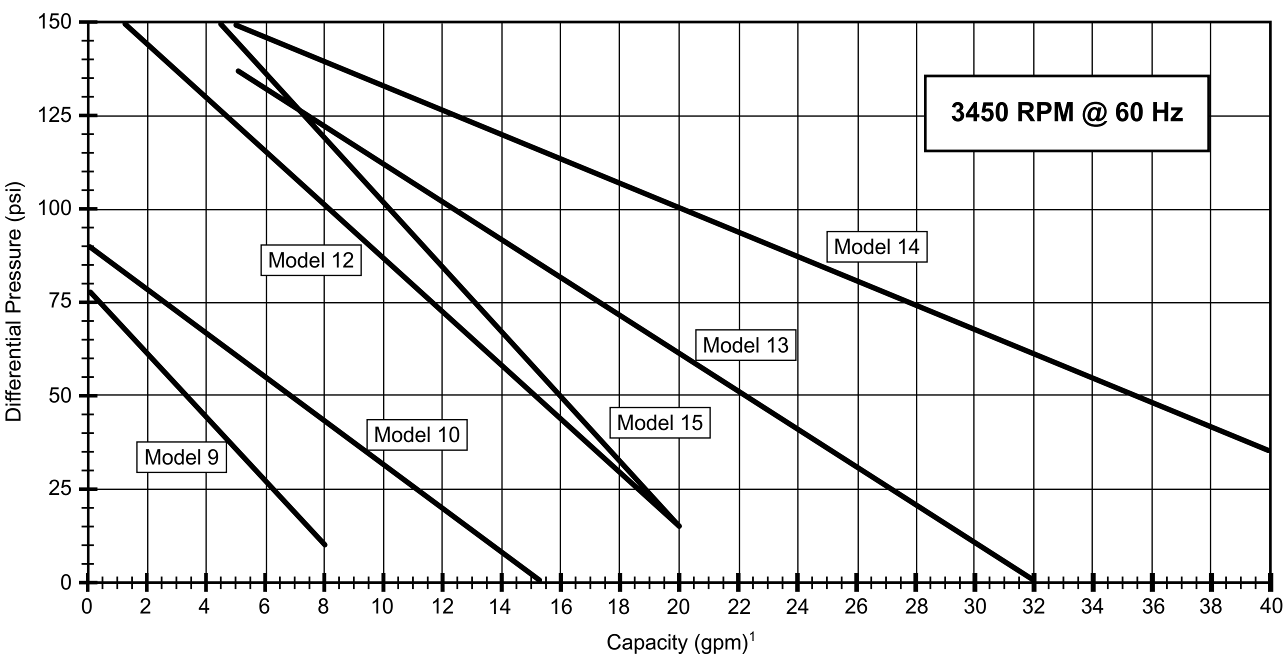
DS-/DL/F-Model Performance Curves–Differential Pressure vs Capacity

All F-, DS-, DL-Models

Flow vs. Power Required



Flow vs. Differential Pressure

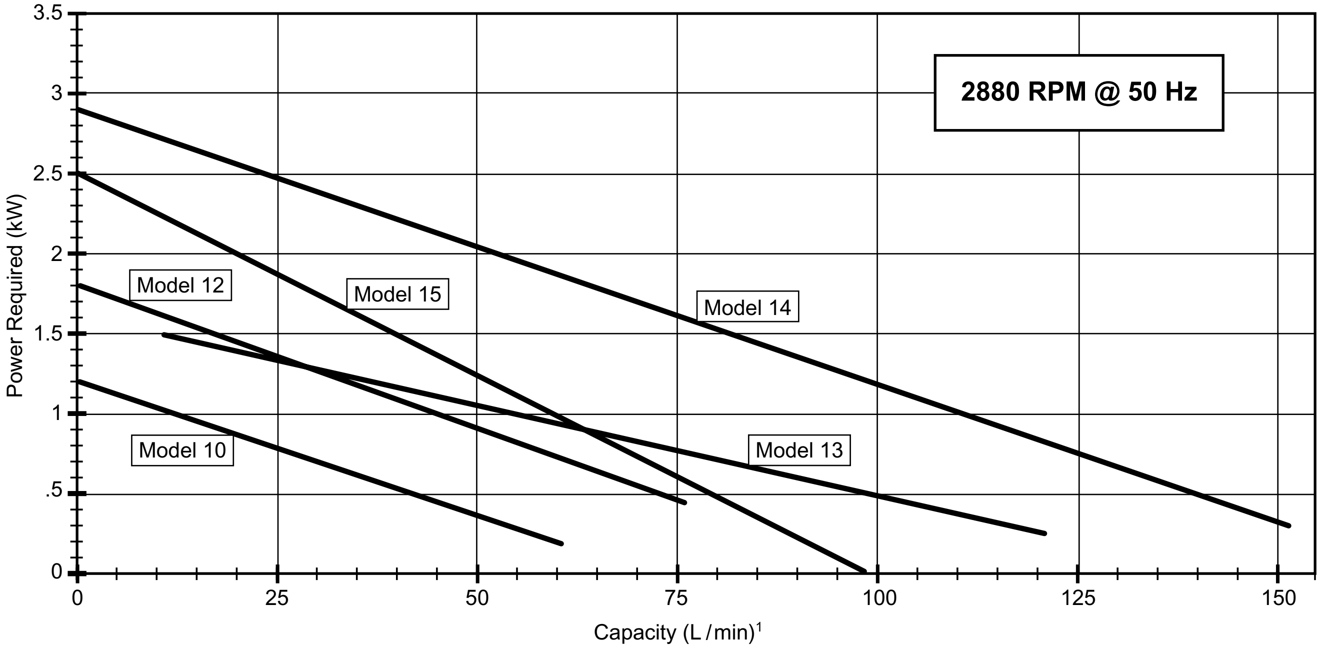


[1]The performance curves are based on aboveground LPG installations. Performance curves for underground LPG tanks will vary based on the specific installation. Consult factory.

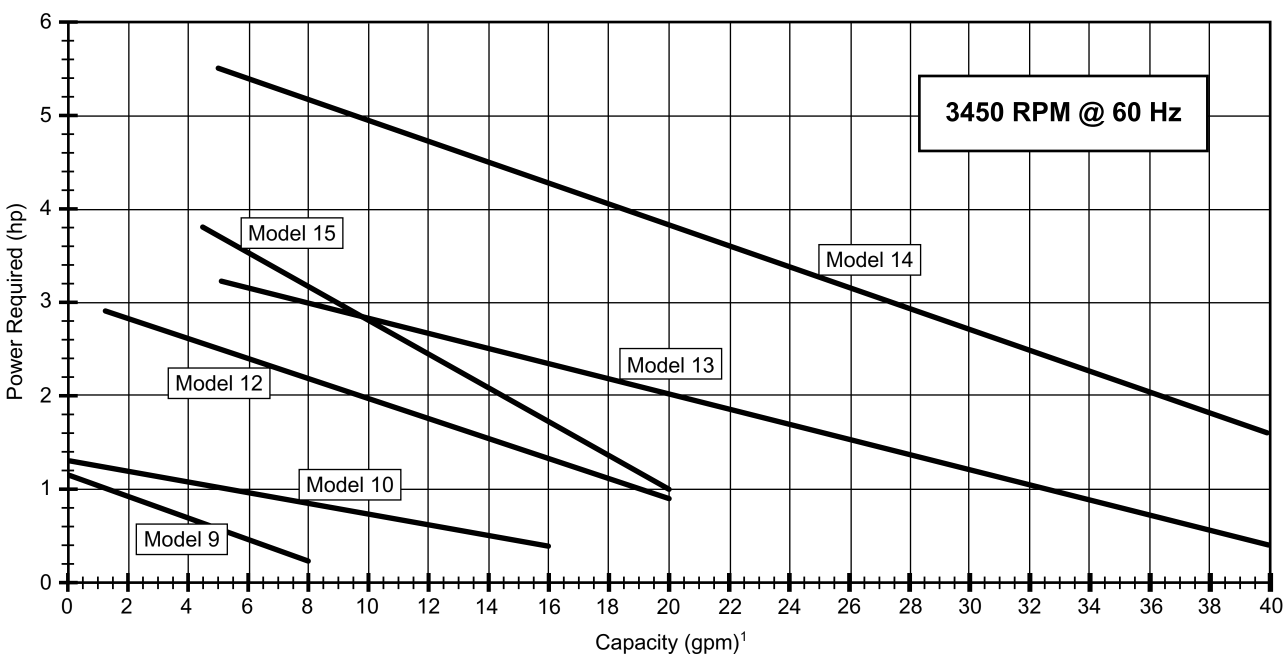
DS-/DL/F-Model Performance Curves–Power Required vs Capacity

All F-, DS-, DL-Models

Flow vs. Power Required



Flow vs. Differential Pressure



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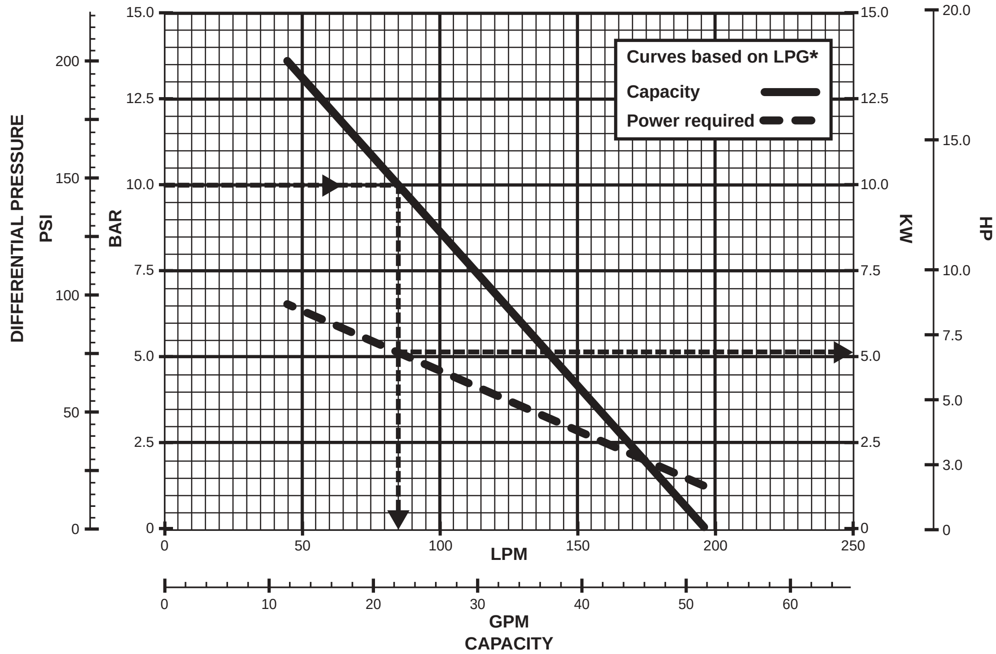
150 Model Performance Curves

Example @ 2880 RPM

Differential Pressure
10.0 bar
145.0 psi

Flow
85 L/min
22.5 gpm

Power Required
5.1 kW
6.8 hp

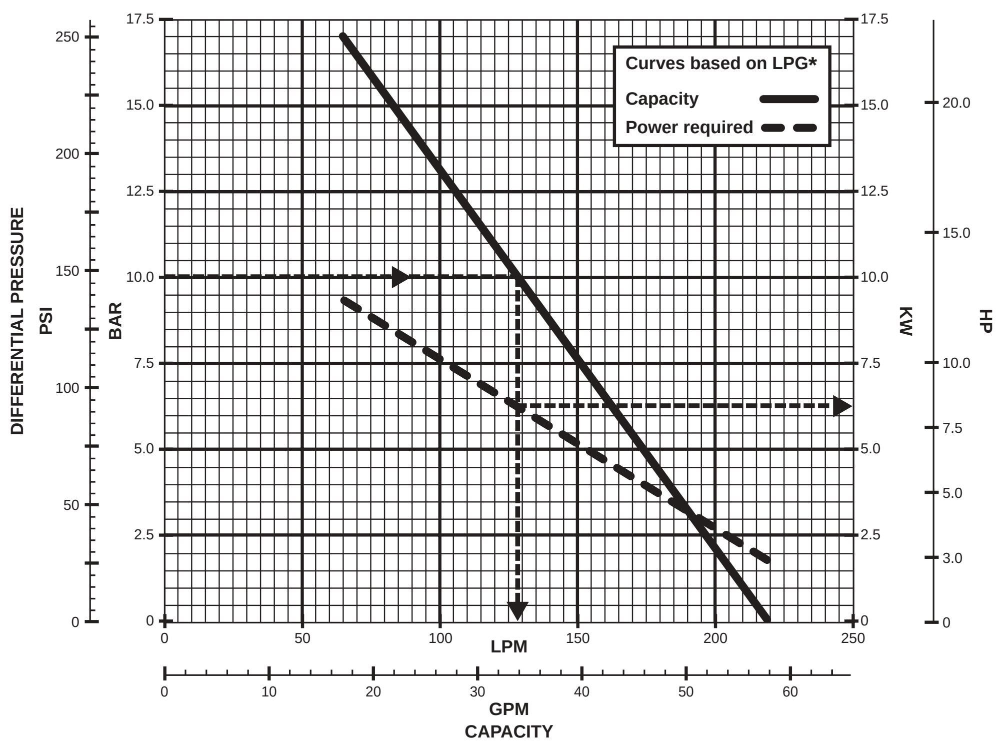


Example @ 3450 RPM

Differential Pressure
10.0 bar
145.0 psi

Flow
128 L/min
145.0 gpm

Power Required
6.3 kW
8.4 hp



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