



Hydraulic Actuation

Reliability, Flexibility, and Performance





Hydraulic Actuation Systems

Hydraulic systems for gate operation provide better performance than other actuation methods. When you specify Rodney Hunt for your hydraulic actuation needs, you are working with a company that can design, manufacture, test, and install your system for dependable “single source” quality and efficiency.

Operating Efficiency

Hydraulic actuators should be considered for any installation where multiple gates can be operated from a single system — especially when the system has unique operational requirements.

Convenience of Remote Location

Hydraulic actuators should be considered when the gates or valves are remote from the control area.

Reliability in Hazardous or Hostile Environments

If the gate and/or actuator is submerged — or must operate in a hazardous environment — hydraulic actuation is a safe and reliable option.

Emergency Actuation

In the event of a power failure, hydraulic actuators can be set to open/close automatically, or provide continued control functions.

Linear Actuation Offers Lower Maintenance

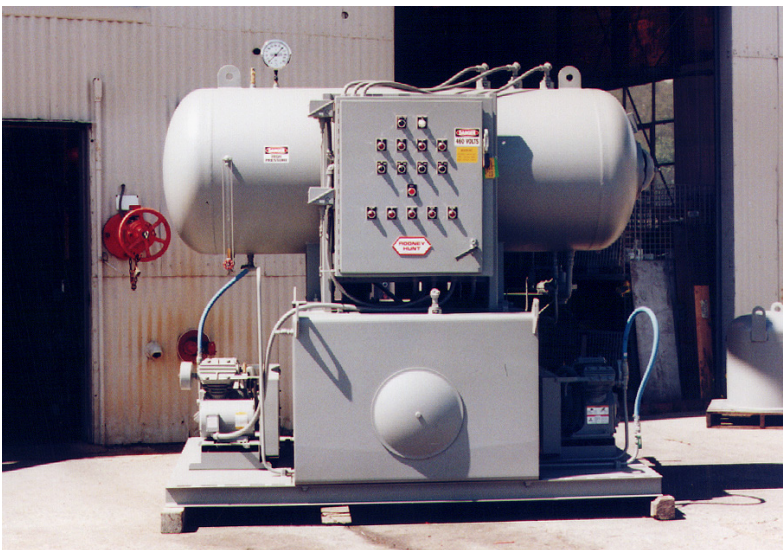
If the application requires frequent cycling, hydraulics offer a distinct advantage. Because there are no screw stems and nuts required for operation, hydraulics eliminate the wear and maintenance problems associated with rotating equipment. Low friction hydraulic cylinders offer highly efficient operation.

Variable and Adjustable Speed Control

Hydraulic actuation systems can be provided for an almost limitless variety of independent and field adjustable open/close speeds. The system can even be designed for variable open/close cycles, where the gate opens/closes part way at one speed and finishes the stroke at a different speed.

Control Panel Options

From simple push-button operation, to sophisticated programmable positioning utilizing programmable controllers where required. Integrate with input signals from level, flow, or pressure sensors (or SCADA systems). NEMA 4, 4x, 7, or 12 ratings.



Hydraulic Actuation - 20 Questions

The following represent 20 of the most commonly asked questions about the hydraulic operation of gates, hydraulic power units, and their electrical controls. Please contact Rodney Hunt Company for answers to any other questions you may have.

1. Where should hydraulic actuation be used?

Hydraulic actuation should be used for any installations where there are a number of gates that can be operated from a single system; installations where the gates and actuators must be submerged; and installations where the gates must operate in a power failure or other emergency. Hydraulic actuators are particularly desirable where equipment is to be operated frequently, where loads are high, where the speed of operation is high or must be varied during operation, and where gates are located in a hazardous area requiring explosion-proof and intrinsically-safe equipment.

2. How many gates can a single hydraulic system operate?

Any number. Practically, the number depends on the sizes of the cylinders, the type of operation, the area available for the system and controls, as well as the distance to the devices being actuated.

3. Can hydraulic cylinders be used for submerged service?

Yes. Special rod seals are used to make the cylinders suitable for use under water. The hydraulic fluid lines are brought to the hydraulic system located above the water surface. In drinking water applications, special non-toxic hydraulic fluids can be used. Also, stainless steel components are recommended.

4. For gates that operate frequently, what are the advantages of hydraulic actuation?

The major advantage of hydraulic actuation for any installation in which the gate modulates or operates frequently is that there are no threaded stems and nuts required for operation. Hydraulic systems are designed for frequent operation without the problems of actuator

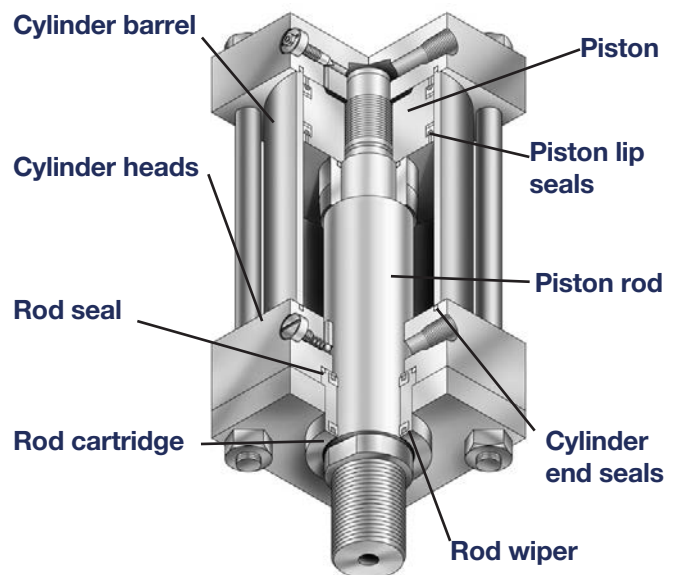
wear associated with screw stem hoists.

5. What is the speed of operation? Can it be made variable?

The linear speed of gate operation can be controlled from approximately 2" per minute to as much as 120" per minute. Speed control valves can be used to vary the speed of operation on site. Systems can be designed to allow different speeds for each direction or staged speeds in one direction.

6. How does emergency operation work during a power failure?

The most common method is to use precharged accumulators that store oil under pressure. When power fails, oil flows automatically to the cylinders causing the gates to either open or close, as required. Accumulators and systems can be configured to store and use hydraulic energy for manual operator commands or automatic operation with the use of an uninterruptable power source (UPS) or battery supported control system.



7. Why is hydraulic actuation preferred in hazardous locations?

Greater flexibility in system design and configuration makes hydraulic actuation ideal in hazardous locations. The hydraulic cylinder can be located in a hazardous area where intrinsically-safe or explosion-proof equipment is required. Electrical components to supply the fluid power are usually located in an area that is non-hazardous. Prolonged submersion is also possible.

8. What is a high-pressure hydraulic cylinder?

A typical hydraulic cylinder, designed to operate in a 2000-3000 psi system, will be constructed with a high grade steel cylinder barrel, steel head and cap, and a chrome plated stainless steel piston rod. Standard “heavy duty” hydraulic cylinders have a minimum working pressure rating of 3000 psi.

These cylinders are available with numerous mounting styles, rod end styles, diameters, and lengths to fit every application. The mounting style and dimensions of the cylinder must be carefully coordinated with the gate equipment being operated.

9. What types of cylinder position indicators are available?

The three most common types of position indication for hydraulic cylinders are: visual continuous position indication, end of travel indication, and remote continuous position indication.

Visual cylinder position indication is provided by means of a tail rod attached to the cylinder piston. The tail rod will exactly track the piston and gate movements.

End of travel indication can be accomplished either by proximity switches mounted in the head and cap of the hydraulic cylinder or by limit switches mounted external to the cylinder body. Proximity switches in the cylinder are recommended as they offer the simplest installation and most reliable operation. In both instances, an electrical contact closure at full cylinder travel can provide end of travel indication by lights installed at any desired location, local or remote.

Continuous position indication is generally accomplished using a linear transducer inserted inside the cylinder. A 4-20 mA signal is generated, corresponding to the position of the piston in the cylinder.



10. What kind of hydraulic fluids are used? Are there options?

Typically, high grade petroleum-based hydraulic oil is used in operating a hydraulic system. There are also standard non-flammable hydraulic fluids available, but they are substantially more expensive.

Biodegradable or “food grade” hydraulic fluids are available, and should be considered where gates are used to control drinking water. However, petroleum-based fluids offer superior operation characteristics.

11. Why not use air or water?

Both air and water are usually furnished at low pressures, in the range of 60-120 psi. Due to this low pressure, all required components and cylinders must be substantially larger than if a high pressure hydraulic fluid system were used. This increases the overall cost of the operating system. Water is also unsuitable at temperatures below 32 degrees F.

Also, both water and air are corrosive, requiring special and high cost cylinder and system components. many years to operate equipment.

A 2000-3000 psi system can be used to operate equipment at lower pressures by the use of pressure reducing valves for that section of the system.

12. What is recommended system pressure?

The generally accepted operating pressure for hydraulically operated gates is 2000 psi. A system pressure of 2000 psi offers a comfortable margin of safety for readily available equipment rated for 3000 psi.

The AWWA standard for Power Actuating Devices for Valves and Sluice Gates, AWWA C540, describes hydraulic actuation of valves and sluice gates. The standard covers hydraulic oil cylinders operating up to 2500 psi. The pressure allows the use of standard components that are suitable for 3000 psi with an adequate factor of safety. It also allows the use of smaller components than would be possible at lower pressures, thus reducing system costs. Hydraulic systems designed for 2000 psi to 2500 psi operating pressure have been used successfully for many years to operate equipment.

A 2000-3000 psi system can be used to operate equipment at lower pressures by the use of pressure reducing valves for that section of the system.



13. What are the basic components of the hydraulic actuation system?

Depending upon project requirements, hydraulic systems have a reservoir with the necessary filters, oil filler pipes, oil level sight gauge, a clean-out access, and the motor driven pump or pumps mounted on, or adjacent to the reservoir. The valving usually consists of a pressure relief valve to limit the maximum operating pressure of the system; directional control valves that direct the fluid to open or close the gates or valves; speed control valves to control the speed of opening and closing; and pilot-operated check or counterbalance valves to lock the piston in place to prevent drift when the directional control valves are shut off. Many other controls – along with an electrical control panel – can be provided as desired or required by the different modes of operation needed. A hand pump can be provided for reduced speed emergency operation when there is a loss of electric power.



14. How big are hydraulic power units?

Hydraulic power units are designed to be as compact as practical although their size may vary considerably depending on the functional requirements of the system. A hydraulic power unit designed to operate three (3) 60" x 60" sluice gates may typically have the envelope dimensions of 4' wide by 4' deep by 6' high. All necessary valves, motors, electrical controls, and the hydraulic reservoir will likely fit within this area. Service access should also be provided preferably from three sides. If accumulators are required, they will typically be located integrally or adjacent to the hydraulic power unit, depending on their size.

15. Can the hydraulic system be outside? How far can it be from the equipment?

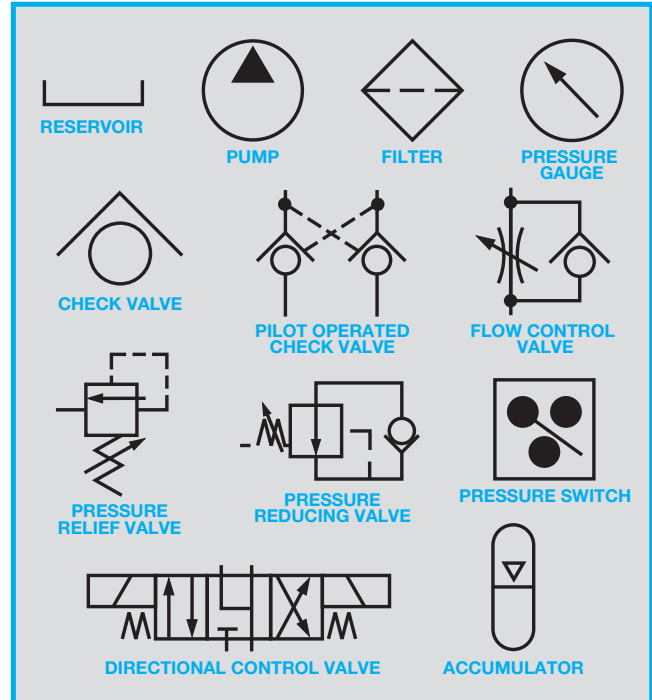
Typically, the equipment operated should be within 300 feet of the power unit. The further away the gates are from the power unit, the larger the interconnecting piping must be to keep the pressure drop at acceptable levels. Rodney Hunt has supplied hydraulic systems in which the gates were over 500 feet from the hydraulic power unit.

Hydraulic systems can be designed for installation outside, but it is preferable to locate the system indoors, or in a weatherproof enclosure. Hydraulic systems operate best when the ambient temperature for the system is between 40 degrees and 100 degrees F. Heaters can be added to heat the oil where the temperature drops below 40 degrees F, and heat exchangers can be used to cool the oil for locations where the temperature exceeds 100 degrees F.

The cylinders themselves can be located outside in areas where the temperatures are extreme.

16. What control options are there?

Almost any type of operation is available. Control of gates can range from very simple manual operation, using manually operated directional control valves located at the gate, to sophisticated process controls that automatically position multiple gates to control water level or flow.



Symbols used on hydraulic schematic diagrams

There are an unlimited number of control conditions, including simple push button operation, remote operation, gate modulation, and automatic emergency or power failure operation. Some of the more complex systems are best operated by programmable controls.

Programmable controls provide sophisticated control logic and reduce the space and labor associated with control relays and other devices. Typically, the programmable controllers are used as the base for the electrical controls because they provide a complete and very flexible package for all control logic necessary for varied control applications. Programmable controls have an important advantage in that, should operating conditions change at some point, the programmable controller can be easily re-programmed to fit new operating conditions.

17. How does power failure accumulator system work? Are there other power failure options?

Accumulators are pressure vessels which store hydraulic fluid by compressing an inert gas. In high pressure systems, the gas (normally dry nitrogen) is separated from the hydraulic fluid by either a moveable piston or rubber bladder. In low pressure systems, the gas, typically air, is not isolated from the fluid.

The hydraulic fluid is pumped into the accumulator, compressing the gas. The hydraulic oil can then be stored under pressure until required.

Accumulators can be used to actuate cylinders during electrical power failure. The oil is directed to the cylinders by manually operated or electrically controlled valves which are either de-energized upon a loss of power or operated by back-up battery electric powers.

18. How many times can a gate be operated with the accumulator system?

Accumulators can be designed to operate a gate or valve as many times as required. Typically, accumulators are designed to either open or close a gate or valve in the event of a power failure.

The pressure in the accumulator(s) is maintained by the system pumps. If the accumulator pressure drops, a pressure switch in the accumulator circuit turns the pump on, forcing oil into the accumulators and restoring the pressure. This ensures that pressurized fluid is always available in the event of a power failure.

19. How cost effective are hydraulic systems?

Hydraulic actuation systems provide the most cost effective method for providing a range of advantageous actuation features, such as: multiple gate actuation from a single source, flexibility of operating speeds, field adjustable operating speeds, operation in submersible or hostile environments, and operation in the event of a power failure.

20. What is the advantage of single-source responsibility?

Single source responsibility for the design, manufacture, testing, and installation start-up of the gates and hydraulic power system offers the consulting engineer, contractor, and end-user one source for the entire system. This has obvious advantages for coordination of system design and application, and ensures proper operation.

When specifications call for the manufacturer of the gates to design, manufacture, test, and start up the hydraulic system, as well as the gates being installed (unit responsibility), single source responsibility guarantees a properly sized and functional flow control system.





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Gates

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- Bonneted Gates
- Channel Gates
- Weir Gates
- Crest Gates (including Bascule® and Pelican® designs)
- Tainter Gates
- Slide Gates
- Roller Gates
- Hinged Crest Gates
- Bulkhead Gates
- Velocity Control Gates
- Stop Logs
- Flap Gates

Actuation

Manual, electric, and hydraulic actuation systems are available.

For more information about Rodney Hunt products or to contact a sales representative, visit the Rodney Hunt website (www.rodneyhunt.com) or call 978-633-4362