About Flow Control Industry Development & Expansion

WHAT IS A VALVE?

One of the most widely observed but least recognized type of valve is the fire hydrant. Fire hydrants are connected to municipal water supply systems. They are specialized underground valves that can be opened and closed from ground level when needed in emergency situations.

A valve is a product rarely noticed by the average person, yet it plays an important role in the quality of our life. Each time you turn on a water faucet, use your dishwasher, turn on a gas range, or step on the accelerator of your car, you operate a valve. Without modern valve systems, there would be no fresh pure water or automatic heat in your home. There would be no public utilities, and beyond wood and coal, almost no energy of any kind. Plastics would be unheard of, as would many inexpensive consumer products.

By definition, a valve is a device that controls the flow of a fluid. Today's valves can control not only the flow, but the rate, the volume, the pressure or the direction of liquids, gases, slurries or dry materials through a pipeline, chute or similar passageway. They can turn on and turn off, regulate, modulate, or isolate. They can range in size from a fraction of an inch to as large as 30 feet in diameter and can vary in complexity from a simple brass valve available at the local hardware store to a precision-designed, highly sophisticated coolant system control valve, made of an exotic metal alloy, in a nuclear reactor.

Valves can control flow of all types, from the thinnest gas to highly corrosive chemicals, superheated steam, abrasive slurries, toxic gases and radio active materials. They can handle temperatures from cryogenic region to molten metal, and pressures from high vacuum to thousands of pounds per square inch.

The valve is one of the most basic and indispensable components of our modern technological society. It is essential to virtually all manufacturing processes and every energy production and supply system. Yet it is one of the oldest products known to man, with a history of thousands of years.

THE HISTORY OF THE VALVE INDUSTRY

No one knows when the idea for the valve was born. Perhaps somewhere, sometime in the ancient past, man learned to regulate the flow of a river or stream by blocking it with large stones or a tree trunk. However it developed, the invention was almost as important as the wheel, for now man could regulate water flow. The early Egyptian and Greek cultures devised several types of primitive valves to divert water for public consumption or crop irrigation.

It is the Romans, however, who are generally recognized as the developers of comparatively sophisticated water systems. Their plumbing was advanced enough to deliver water into individual buildings, for which they developed the plug valve, or stopcock, and there is also evidence that the Romans used check valves to prevent back flow.

For centuries, throughout the Dark Ages, there were no advances in valve design. Then during the

Renaissance, artist and inventor Leonardo daVinci designed canals, irrigation projects, and other large hydraulic systems, which included valves for use in these projects. Many of his technical sketches are still in existence.

The modern history of the valve industry parallels the Industrial Revolution, which began in 1705 when Thomas Newcomen invented the first industrial steam engine. Because steam built up pressures that had to be contained and regulated, valves acquired a new importance. And as Newcomen's steam engine was improved upon by James Watt and other inventors, designers and manufacturers also improved the valves for these steam engines. Their interest, however, was in the whole project, and the manufacture of valves as a separate product was not undertaken on a large scale for a number of years.

COMMON TYPES OF VALVES

- Multi-turn Valves or Linear Motion Valves
- Quarter Turn Valves or Rotary Valves
- Self-Actuated Valves
- Control Valves
- Specialty Valves

MULTI-TURN VALVES OR LINEAR MOTION VALVES

The Gate Valve : The gate valve is a general service valve used primarily for on—off, non-throttling service. The valve is closed by a flat face, vertical disc, or gate that slides down through the valve to block the flow.

The Globe Valve : The globe valve effects closure by a plug with a flat or convex bottom lowered onto a matching horizontal seat located in the center of the valve. Raising the plug opens the valve, allowing fluid flow. The globe valve is used for on—off service and handles throttling applications.

The Pinch Valve : The pinch valve is particularly suited for applications of slurries or liquids with large amounts of suspended solids. It seals by means of one or more flexible elements, such as a rubber tube, that can be pinched to shut off flow.

The Diaphragm Valve : The diaphragm valve closes by means of a flexible diaphragm attached to a compressor. When the compressor is lowered by the valve stem onto a weir, the diaphragm seals and cuts off flow. The diaphragm valve handles corrosive, erosive and dirty services.

The Needle Valve : The needle valve is a volume-control valve that restricts flow in small lines. The fluid going through the valve turns 90 degrees and passes through an orifice that is the seat for a rod with a cone-shaped tip. The size of the orifice is changed by positioning the cone in relation to the seat.

QUARTER TURN VALVES OR ROTARY

The Plug Valve : The plug valve is used primarily for on—off service and some throttling services. It controls flow by means of a cylindrical or tapered plug with a hole in the center that lines up with the flow path of the valve to permit flow. A quarter turn in either direction blocks the flow path.

The Ball Valve : The ball valve is similar in concept to the plug valve but uses a rotating ball with a hole through it that allows straight-through flow in the open position and shuts off flow when the ball is rotated 90 degrees to block the flow passage. It is used for on—off and throttling services.

The Butterfly Valve : The butterfly valve controls flow by using a circular disc or vane with its pivot axis at right angles to the direction of flow in the pipe. The butterfly valve is used both for on-off and throttling services.

SELF-ACTUATED VALVES

The Check Valve : The check valve is designed to prevent backflow. Fluid flow in the desired direction opens the valve, while backflow forces the valve closed.

The Pressure Relief Valve : The pressure relief valve is designed to provide protection from over-pressure in steam, gas, air and liquid lines. The valve "lets off steam" when safe pressures are exceeded, then closes again when pressure drops to a preset level.

CONTROL VALVES

The Control Valve : The control valve is designed to ensure accurate proportioning control of flow. It automatically varies the rate of flow based on signals it receives from

sensing devices in a continuous process. Some valves are designed specifically as control valves.

However, most types of valves can be used as control valves, both linear and rotary motion, by the addition of power actuators, positioners, and other accessories.

SPECIALTY VALVES

In addition to these standard valve products, many valve manufacturers produce custom-designed valves and actuators for specific applications. Valves are available in a broad spectrum of sizes and materials. Each design has its own advantages, and selection of the proper valve for particular application is critical. The factors generally considered in the selection of a valve include:

- The substance to be handled and the required flow rate.
- The requirement that the valve control and/or shut off the flow in the manner demanded by the service conditions.
- The ability of the valve to withstand the maximum working pressure and temperature.
- The ability of the valve to resist attack by corrosion or erosion.
- Actuator requirements, if any.
- Maintenance and repair requirements.

COMMON TYPES OF ACTUATORS

- The Manual Actuator
- The Hydraulic and Pneumatic Actuators
- The Electric Actuator

THE MANUAL ACTUATOR

A manual actuator employs levers, gears, or wheels to facilitate movement while an automatic actuator has an external power source to provide the force and motion to operate a valve remotely or automatically. Power actuators are a necessity on valves in pipelines located in remote areas; they are also used on valves that are frequently operated or throttled. Valves that are particularly large may be impossible or impractical to operate manually simply because of the sheer horsepower requirements.

Some valves may be located in extremely hostile or toxic environments that preclude manual operation. Additionally, as a safety feature, certain types of power actuators may be required to operate quickly, shutting down a valve in case of emergency.

THE HYDRAULIC AND PNEUMATIC ACTUATORS

Hydraulic and pneumatic actuators are often simple devices with a minimum of mechanical parts, used on linear or quarter-turn valves. Sufficient air or fluid pressure acts on a piston to provide thrust in a linear motion for gate or globe valves. Alternatively, the thrust may be mechanically converted to rotary motion to operate a quarter-turn valve. Most types of fluid power actuators can be supplied with fail-safe features to close or open a valve under emergency circumstances.

THE ELECTRIC ACTUATOR

The electric actuator has a motor drive that provides torque to operate a valve. Electric actuators are frequently used on multi-turn valves such as gate or globe valves. With the addition of a quarter-turn gearbox, they can be utilized on ball, plug, or other quarter-turn valves.

VALVE SPECIFYING CHECKLIST

North American valve manufacturers will work closely with you to define your valve needs and specify the product to meet those needs. Use the list below as a guide to some of the many factors you'll need to consider in making an important valve purchase. Knowing this criteria will help the valve manufacturer or its distributor design and/or select the best valve for your particular application.

APPLICATION

- Media Being Handled **(e.g, liquid, gas, slurry or solid)**
- Corrosiveness of Media **(e.g., pH, concentration)**
- Corrosiveness of Atmosphere
- Flow **(Velocity, Capacity, Cv, Direction)**
- Pipe Size
- Media Temperature **(Maximum and Minimum)**
- Pressure **- Maximum Operating Pressure**

  - Maximum Differential Pressure

  Operation **(e.g., Manual/Automatic, On-Off/Throttling)**