Response Times

Solenoid valves are relatively quick operating compared to other types of valves against which they compete. Most open and close operations occur in fractions of a second. This compares to seconds that valves such as motor operated ball valves require. Generally speaking, solenoid valves will respond much more rapidly on a gas, particularly a low molecular weight gas, than a liquid. Liquids, due to their resistance to compression, much completely displace around a plunger or piston that is traveling through the media. In a solenoid valve this frequently means that as a piston strokes, the volume of fluid that it displaces must pass through the pilot orifice or through the sum of the bleed orifice and piston ring gap(s). This takes a relatively long length of time particularly at low pressure drops. Liquids of high viscosity such as hydraulic oils will damp motions of parts in valves and result in slowed opening and closing times than valves used on lower viscosity fluid such as gasoline or liquid nitrogen.

When a solenoid is first energized there is a time delay caused by inductance which opposes the immediate build-up of current and delays the formation of the magnetic field This time delay is small compared to the motions of the valve components. Motions of components in a solenoid valve can be divided into two distinct categories: 1) the motion of the plunger or plunger/stem assembly (in a direct lift valve this is the only valve unit motion), and 2) motion of the piston as it strokes through it's travel. The plunger motion is relatively quick, typically occurring in a matter of tens of milliseconds. The motion of the piston is relatively much slower for the reasons given in the proceeding paragraph. Times for the piston motion can range in the low hundreds of milliseconds for opening depending on valve size, fluid pressure, and viscosity. Times for closing can range from a few hundred milliseconds on up depending on valve size, pressure drop across the valve caused by fluid flow, and fluid viscosity. For large valves in the 2 to 3" range on liquids at low flowrates, closing times can be several seconds.

The 35,000 series valve was designed for rapid closing and has been tested for opening and closing times with several sizes on both air and water. It utilizes an external pilot, which produces a faster closing response than internally piloted valves. Opening times of 150 milliseconds and closing times of 100 milliseconds have been measured with several sizes on applications with gaseous media and pressure drops of 500 to 1000 psid across the valves.

A valves response time is fixed for a given application, i.e. there are no adjustments that affect the response time.

Quantitative response time data has not been generated for most of the Atkomatic valve line – consult the Sales Department at the factory for the availability of testing.

Life Cycle Capability

Atkomatic valves are a rugged and robust product that are designed to serve a wide variety of demanding applications in markets including turbine manufacturing, chemical process, electric and gas utilities, industrial gasses, metal fabrication, food processing, oil refining, cryogenic transfer, and heating and air conditioning. Within these applications these is a vast diversity of fluid types, concentrations, degree of contamination, operating pressures, fluid and ambient temperatures, coil voltages, electrical enclosure types, and cycle rates as well as valve type and size. This makes it impractical to establish any meaningful estimates of product lifetime or number of cycles that can be generally expected. This also causes the results of any testing conducted to be applicable to one specific or a very limited number of applications. Due to the limited usefulness of such testing and the expense associated with running life cycle testing over a long period of time the factory has not conducted testing to determine life cycle capability for particular applications. Additionally it has never been economically attractive for a customer to fund such a program. In all cases where life cycle capability has been a question trials in the field using the product in the application has been the preferred method of determining product duration.

In some applications, such as oil at ambient temperature, modest pressures, and low cycle rates, valves have lasted for millions of cycles and for dozens of years without difficulty. In other applications with dry gasses and high cycle rates, valves can wear after a matter of days and thousands or hundreds of thousands of cycles. Generally, liquids providing lubrication and damping of motion will allow more extended cycle life than a dry gas. Corrosive fluids and higher temperatures both act to reduce cycle life. Certain types of applications that are known to be extremely severe, such as continuous and very rapid cycle rates with non-lubricated air, will result in very limited valve life expectancy.

Many demanding applications are handled satisfactorily with periodic maintenance involving inspection and/or replacement of internal parts. Appropriate maintenance intervals are determined by field experience on an individual application basis. Standard repair kits that contain all parts subject to wear are available for all the valve series (see page 6). For the most demanding applications, high cycle plunger assemblies are also available for most valve series (see page 107).