

DESIGN SECTION DATA

Cylinder and Valve Testing

On an air system, if air is detected escaping from a 4-way valve exhaust while the cylinder is stopped, this air is either blowing by worn-out piston seals or is leaking across the spool in the 4-way valve. These two by-pass paths are shown in the figure.

Most air cylinders and valves have soft seals and should be leak tight. However, those air valves having a metal-to-metal seal between spool and body may be expected to have a small amount of by-pass.

If by-pass is noted, it is more likely to be coming through the cylinder than across the valve spool and the cylinder should be tested first.

CYLINDER TESTING

Run the piston to one end of its stroke and leave it stalled in this position under pressure. Crack the fitting on the exhaust end of the cylinder to check for air by-pass. After checking, tighten the fitting and run the piston to the opposite end of the barrel and repeat the test. Occasionally a cylinder will leak at one point in its stroke due to a scratch or dent in the barrel. Check suspected positions in mid stroke by installing a positive stop at the suspected position and run the piston rod against it for testing. Once in a great while a piston seal may leak intermittently. This is usually caused by a soft packing or O-ring moving slightly or rolling into different positions on the piston and is more likely to happen on cylinders of large bore. Pistons with metal ring seals can be expected to have a small amount of by-pass across the rings and even those "leak-tight" soft seals may have a small by-pass during break-in of new seals or after seals are well worn.

4-WAY VALVE TESTING

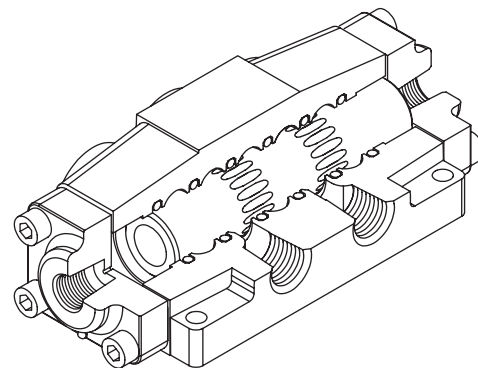
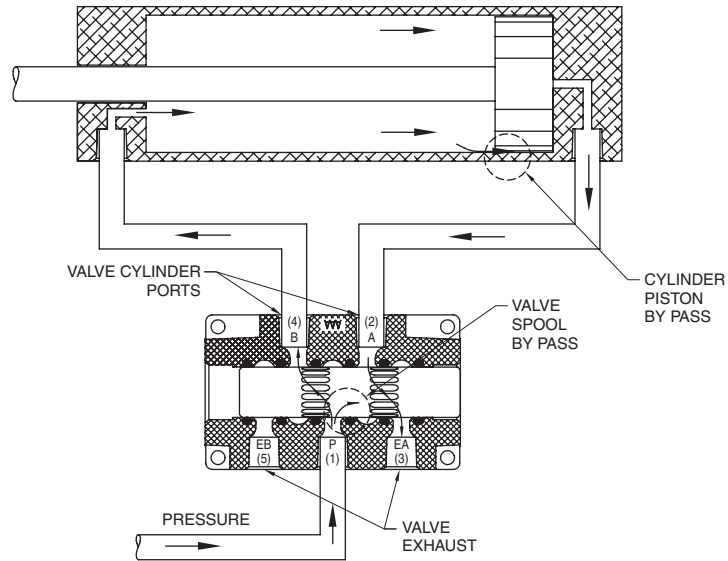
For testing 4-way valves, either air or hydraulic, it is necessary to obtain access to the exhaust or tank return ports so that the amount of by-pass can be observed. To make the test, disconnect both cylinder lines and plug these ports on the valve. Start up the system and shift the valve to one working position. Any flow out the exhausts or tank return line while the valve is under pressure is the amount of by-pass. Repeat the test in all other working positions of the valve.

INTERNALLY PILOTED SOLENOID VALVE TESTING

Standard solenoid models are assembled for "Internal Pilot" operation; that is, they derive shifting pressure for the spool from the valve inlet port. When testing an internally piloted solenoid valve, do not let air free flow through the cylinder port. This flow is normally so great, that back pressure to shift the spool can not be adequately generated. To test an internally piloted valve, either plug the cylinder port, place a muffler in the cylinder port or attach the cylinder port to a short piece of hose to generate a slight back pressure to shift the valve.

TO REPLACE O-rings

Use a sharp tool such as a pick or scribe to remove the old O-rings. Use an air hose and solvent, if necessary, to thoroughly clean out the grooves in the body. The new O-rings can be inserted with the fingers in the 1/2" and larger bodies. Install 3 O-rings from each end of the valve. For the 1/4" and 3/8" valve bodies, use a pair of tweezers with angle points, starting O-ring in groove in one side and working around. After installing O-rings, lightly grease the spool and body bore before assembly, using Magnalube®-G grease or O-ring grease. Never use oil or any other grease. If tweezers are not available, slip the spool into the bore, as a guide, to just below a groove and work the O-ring into the groove with a small rod.



Cut-away View of 1/4" Double Piloted Valve

AAA PRODUCTS INTERNATIONAL

NEMA Enclosure Classifications and Types



- Type 1:** General Purpose - intended for indoor use primarily to provide a degree of protection against contact with the enclosed parts in locations without unusual service conditions.
- Type 2:** Drip Proof - intended for indoor use primarily to provide a degree of protection against limited amounts of falling water or dirt.
- Type 3:** Rain Tight, Dust Tight and Sleet (Ice) Resistant - intended for outdoor use primarily to provide a degree of protection against windblown dust, rain and sleet; undamaged by the formation of ice on the enclosure.
- Type 3S:** Rain Tight, Dust Tight and Sleet (Ice) Resistant - intended for outdoor use primarily to provide a degree of protection against windblown dust, rain and sleet; external mechanism remains operable when ice laden.
- Type 3R:** Rain Proof, Sleet (Ice) Resistant - intended for outdoor use primarily to provide a degree of protection against falling rain and sleet, undamaged by the formation of ice on the enclosure.
- Type 4:** Water Tight and Dust Tight - intended for indoor or outdoor use to provide a degree of protection against splashing water, water seepage, falling or hose-directed water and severe external condensation; undamaged by the formation of ice on the enclosure.
- Type 4X:** Water Tight, Dust Tight and Corrosion Resistant - same as Type 4 Enclosure, but provides additional protection to resist corrosion.
- Type 6:** Submersible - intended for indoor or outdoor use to provide a degree of protection against entry of water during submersion at a limited depth (Tested to 6' for 30 minutes).
- Type 6p:** Submersible - same as Type 6 Enclosure, but provides prolonged submersion protection at a limited depth (Tested to 6' for 24 hours).
- Type 7 (A, B, C and D):** Explosion Proof, Class I, Division I, Groups A, B, C and D Hazardous Locations - designed to contain an internal explosion without causing an external hazard when installed in the indicated atmospheres and locations. Class I, Division I locations are those in which hazardous atmospheres are or may be present under normal operating conditions. These enclosures are also suitable for Class I, Division 2 locations in which hazardous atmospheres are present only in case

of accidental rupture or breakdown of equipment or abnormal operation. Type I General Purpose Enclosures may be permitted in a Class I, Division 2 location subject to the approval authority (Ref: National Electrical Code 501-3, b3).

Group designations are described in the National Electrical Code as follows:

- Group A** - Atmospheres containing acetylene.
- Group B** - Atmospheres containing hydrogen.
- Group C** - Atmospheres containing ethyl-ether vapors, ethylene or cyclopropane.
- Group D** - Atmospheres Containing gasoline, hexane, naphtha, benzene, butane, propane, alcohol, acetone, benzol, lacquer, solvent vapors or natural gas.

Type 9 (E, F and G): Dust Ignition Proof, Class II, Groups E, F and G Hazardous Locations- designed to prevent the entrance of dust and the enclosed devices do not produce sufficient heat to cause external surface temperatures capable of igniting dust on the enclosure or in the surrounding atmosphere. Class II, Division 1 locations are those in which combustible dust is or may be present under normal operating conditions. These enclosures are also suitable for Class II, Division 2 locations in which hazardous dust is present only under abnormal conditions.

Group designations are described in the National Electrical Code as follows:

- Group E** - Atmospheres containing metal dust, including aluminum, magnesium, their commercial alloys and other metals of similarly hazardous characteristics.
- Group F** - Atmospheres containing carbon black, coal or coke dust.
- Group G** - Atmospheres containing flour, starch or grain dust.

Type 12: Intended for indoor use primarily to provide a degree of protection against dust, falling dirt and dripping noncorrosive liquids.

Type 13: Intended for outdoor use primarily to provide a degree of protection against dust, spraying of water, oil and non corrosive material.

AAA PRODUCTS INTERNATIONAL

IEC/IP Environmental Protection Ratings



The degree of protection provided by an enclosure is indicated by an IP code. This code is made up of two numbers. The first number is the degree of protection against solid foreign objects. The second number is the degree of protection against water.

For example, the IP rating of IP65 designates total protection from dust and protection from water jets from any direction.

First Number: Protection against solid foreign objects.

Number	Description
0	No Protection.
1	Protected against solid foreign objects of 50mm diameter and greater.
2	Protected against solid foreign objects of 12.5mm diameter and greater.
3	Protected against solid foreign objects of 2.5mm diameter and greater.
4	Protected against solid foreign objects of 1.0mm diameter and greater.
5	Ingress of dust is not totally prevented, but dust shall not penetrate in a quantity to interfere with satisfactory operation of the apparatus or to impair safety.
6	No ingress of dust.

Second Number: Protection against water.

Number	Description
0	No Protection.
1	Vertically falling water drops shall have no harmful effects.
2	Vertically falling water drops shall have no harmful effects when the enclosure is tilted at any angle up to 15 degrees on either side of the vertical axis.
3	Water sprayed at an angle up to 60 degrees on either side of the vertical axis shall have no harmful effects.
4	Water splashed against the enclosure from any direction shall have no harmful effects.
5	Water projected in jets against the enclosure from any direction shall have no harmful effects.
6	Water projected in powerful water jets against the enclosure from any direction shall have no harmful effects.
7	Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is continuously immersed in water under standardized conditions of pressure and time.
8	Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is continuously immersed in water under conditions which shall be agreed between manufacturer and user but which are more severe than for number 7.

Rough Conversions Between Ratings.

NEMA rating	UL rating	CSA Rating	Apprx. IEC/IP rating
1	1	1	IP23
2	2	2	IP30
3	3	3	IP64
3R	3R	3R	IP32
4	4	4	IP65
4X	4X	4X	IP66
6	6	6	IP67
12	12	12	IP55
13	13	13	IP65