

System drawings shown in this bulletin are for illustration purposes only. Refrigeration systems should only be serviced by a qualified technician. Always observe proper safety procedures when servicing a refrigeration system. For more information see the latest revision of Phillips Safety Bulletin SGRV.

#### GENERAL INFORMATION

**Pressure Rating:** 300 psig (21 bar, gauge)  
**Temperature Rating:** -20°F to 240°F (-29°C to 116°C)  
**CRN:** OC10576.5CADD1

3-Way Valve Dimensions (Inches)								Wt. (lbs)
Valve	A	B	C	D	E	F	G	
3000N	3/4" FPT	5.5	8.8	9.8	4.3	2.8	4.5	20
3000AN	1-1/4" FPT	8.0	8.8	12.7	4.9	4.0	6.5	45

#### 3-WAY VALVE APPLICATIONS AND FUNCTIONALITY

The 3000N (released in 2001) and 3000AN (released in 2006) 3-Way valves are direct replacements for the old style 3000 and 3000A valves, respectively. **The function, as well as connection sizes and locations of the 3000N valves are exactly the same as those of the 3000 valves.** The internal flow path on the 3000N Series valves has replaced the external tubing on the older 3000 Series valves; and the solenoid pilot has been integrated into the main valve body.

Phillips' 3-Way valves are typically used on gas-pumped liquid transfer or recirculating systems (refer to Figure 1 beneath and Phillips Vessels and Systems book.) The valve's common port is connected to the top of the pumper drum (aka dump trap). The LP port is connected to the suction accumulator, above the level of the liquid but below the suction connection on the accumulator. High pressure gas is fed to the HP port and is used to drive liquid transfer.

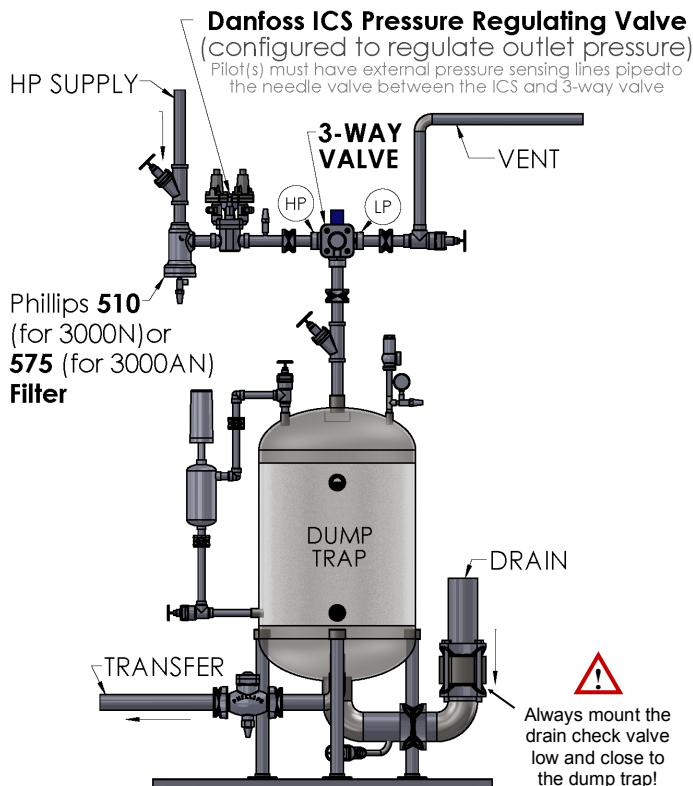
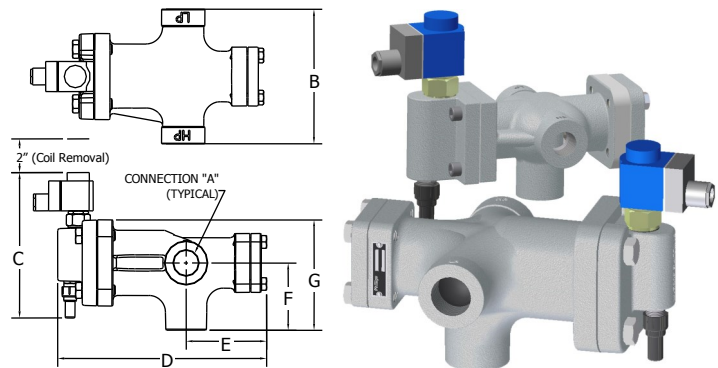


Figure 1: Typical 3-Way Valve Gas Transfer Drum Assembly



All of these valves are configured with three external ports. The high pressure port (marked "HP") is the inlet for pressurizing gas. The low pressure port (marked "LP") is the vent/equalizer port. The center "common" port is open to either the HP or LP port, depending on the position of the internal pistons, as described below.

With the 3-Way valve connected as described above, and the solenoid de-energized, the pathway between the common and LP (vent) ports is held open. This is accomplished by high pressure gas and an internal spring which holds the smaller (HP) piston closed against the HP seat. In this "vent" position, LP port open to common port, the pumper drum is allowed to vent/equalize to the suction accumulator so it can fill with liquid.

When the solenoid is energized, high pressure gas is directed internally to the space above the larger, LP, piston. This causes the pistons to move in unison, closing the LP seat and the path between the LP and common ports; while simultaneously opening the HP seat and the path between the HP and common ports. This is the transfer position. The high pressure gas, now flowing into the pumper drum through the common port, can push the liquid to another location in the system. Phillips highly recommends regulating this pressure being supplied to the 3-Way valve (please see the *Installation Guidelines & Recommendations* section for full details).

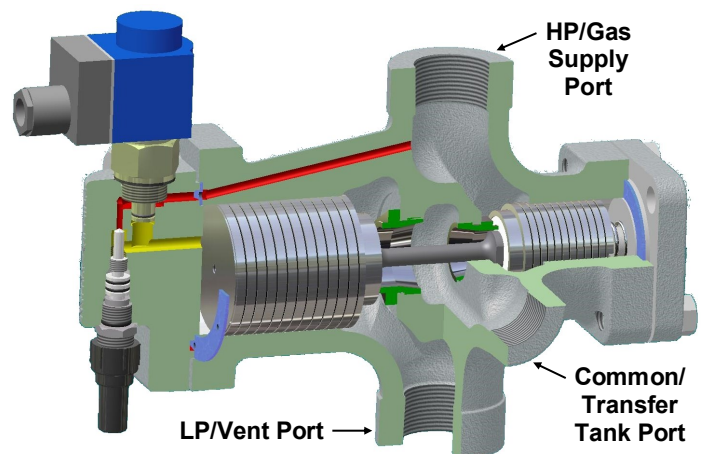


Figure 2: Section View of 3000AN Valve with Danfoss Coil



## FUNCTIONALITY CONTINUED...

The 3000N Series valves incorporate a manual opening stem located beneath the solenoid. When this stem is screwed in completely the valve will automatically switch from the vent to the transfer position when the coil is energized. Opening the stem 1/2-turn will manually cause the valve to switch from vent to manual transfer mode. **Please note that the manual stem is not a pressure bleed balance valve; the manual stem should only be used when it is necessary to manually switch the 3-Way valve to transfer mode. Excessive use of the manual stem can lead to a premature leak. Please contact our engineering department for assistance.**

In order to begin to get appreciable reverse flow through the valve the pressure in the common port must exceed the pressure on the "HP" side of the valve by about 20 psid for the smaller 3000N (3/4" connections); and by about 25 psid for the larger 3000AN (1-1/4" connections).

## INSTALLATION GUIDELINES & RECOMMENDATIONS

### Piping, Unions, and Purge Points:

It is recommended to use thread sealant (such as Teflon tape or pipe dope) on the threaded connections on the 3-Way valve and Phillips 500 series filter. When piping in the system it is recommended to use flanged unions (or petro socket weld unions) to allow for easy removal/replacement of components (contact Phillips for your flange/union needs. Be sure to have purge valves/points where required in your system (a purge point on the transfer tank and another on the filter on HP line before 3-Way valve will typically suffice).

### Strainer/Filter:

Ensure that a strainer is installed just upstream of the 3-Way valve on the HP line. A 300 $\mu$ /50-mesh to 75 $\mu$ /200-mesh strainer element is recommended [Note: mesh is the number of threads per inch;  $\mu$  (microns) is the distance between two threads ( $1\mu = 1/1000$  mm)]. We recommend using our **500-3/4 strainer for 3000N valves** and **575-1-1/4 strainer for 3000AN valves**. Please see above note about purge point on strainer and thread sealant.

### Outlet (AKA Downstream) Pressure Regulating Valve:

Typically, high pressure gas need only be about 10 psi above the liquid transfer destination pressure. This may need to be increased for long pipe distances, however unnecessarily high pressure can lead to premature valve wear. Pre-mature wear can also occur if the differential pressure across the 3-Way valve (pressure into HP port minus the pressure in the common port) is more than 40 psid. For differential pressures in excess of 40 psid, Phillips recommends utilizing a "soft start" pressure regulation method:

**For Type T transfer systems** (see following description) that have differential pressures in excess of 40 psid it is highly recommended to use a Danfoss ICS pressure regulator configured with two outlet pressure regulator pilots (for two separate set points) with electric changeover between the two set points (soft start transfer with lower pressure, then energize coil on solenoid pilot to regulate at higher downstream pressure set about 10 psid above destination pressure). Please contact factory for selection and pricing.

**For Type G & DK transfer systems** (see following descriptions) that have differential pressures in excess of 40 psid a Danfoss ICS regulator, configured for outlet pressure regulation with electric wide opening, is recommended so that you can soft start the transfer; and then energize the coil and open the valve fully to complete the transfer (please contact Phillips for selection and pricing).

- **Type A** (Gravity assisted transfer to HPR)
- **Type T** (Transfer to CPR or other intermediate pressure vessel)
- **Type DK** (Transfer to HPR through the use of an interrupting valve in the compressor discharge line)
- **Type G** (Transfer to HPR with the assistance of a through the use of a mechanical pump)

For Type A systems, there will normally not be enough pressure across the ICS valve to allow it to open (since the pressure in the transfer drum normally has to nearly equal the pressure entering the valve before transfer is able to occur). Thus, **for Type A systems, that have differential pressures in excess of 40 psid, it is recommended to use a Danfoss ICM motorized valve** set to operate in on/off mode with a slowed opening speed. The ICAD actuator can be controlled with one digital input for open/close solenoid.

Wiring diagram showing ICAD wired with one digital input for ON/OFF solenoid valve operation

Note: The ICAD motor can be programmed to open or close when the relay is closed. See parameter ;09 in programming section.

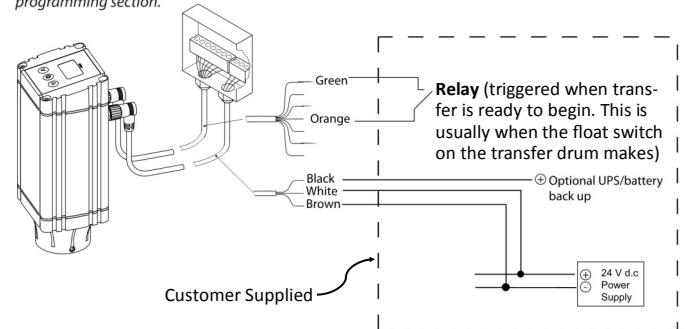


Figure 3: ICAD On/Off Solenoid Mode Wiring Diagram

In On/Off mode: there is 1 speed setting for the opening speed (parameter ;04); and a separate speed setting for the closing speed (parameter ;14). If the opening speed of the ICAD is set too slow the 3-Way valve may chatter and/or more hot gas may condense in the transfer drum than what is desirable.

ICM Size	Use With	Time required to fully open/close ICM at maximum speed setting
ICM 20-C with 3/4" conn.	3000N (3/4")	3 seconds
ICM 25-B with 1-1/4" conn.	3000AN (1-1/4")	7 seconds

As an alternative to the ICM motorized valve (for Type A systems) special solenoid valves, which can stay open with 0 psid, can be used in series to slowly pressurize the 3-Way valve/transfer drum. In this arrangement, a Danfoss EVRA 3 (very small port) can be opened first, in order to soft start the transfer; then some time later (10-60 seconds later, depending how slowly you wish to soft start the process) energize EVRAT 20(s) (use one EVRAT 20 for 3000N and two EVRAT 20's for 3000AN) operating in parallel to the EVRA3 to bring the pressure and available flow rate fully up in order to complete the transfer. Phillips can provide on-delay relays (see time delay relays beneath with base) to delay the opening of the solenoid pilot on the ICS pressure control configuration; or to delay the opening of the EVRAT 20(s) in the solenoid alternative to the motorized control for Type A systems.

Code No.	Description
OP418N1	Time Delay Relay, On Delay 120V AC, 0-60 Sec
OP418N5	Time Delay Relay, On Delay, 240V AC, 0-60 Sec
TBASE	Relay Base, Octal 8 Pin



Figure 4: OP418N1 Relay with TBASE



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## KITS AND SPARE PARTS

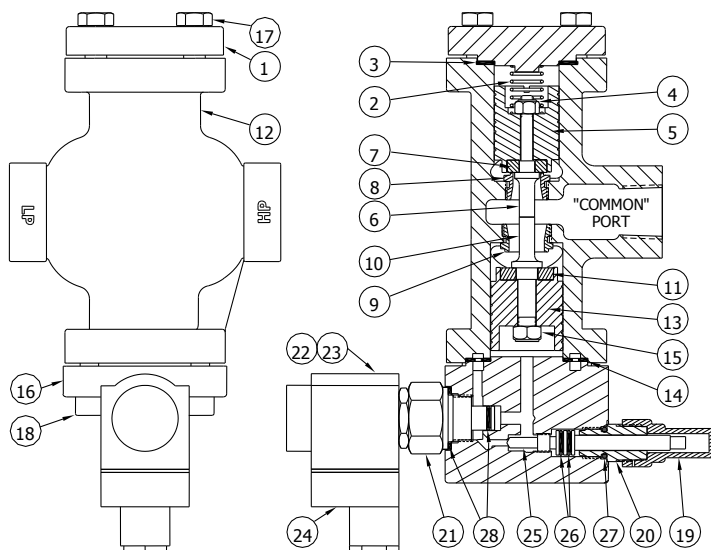


Figure 5: Spare Parts Diagram for 3-Way Valves

Item #	Description	3000N (3/4")	3000AN (1-1/4")
1	Bonnet, HP	3002JRN	3002A
2	Spring*, **	705L	705AL
3	Gasket, HP*, **	3010JR	710A
4	Lock Nut, HP*, **	3013JR	-
5	Piston, HP**	3004JR	3004A
6	Push Rod, HP*, **	3012JRL	3012A
7	Seat Disc, HP*, **	3003JR	3003A
8	Seat, HP**	3006JR	3006A
9	Seat, LP**	3006	3006B
10	Push Rod, LP*, **	3012L	3012B
11	Seat Disc, LP*, **	3003	3003B
12	Valve Body	3000N-VB	3000AN-VB
13	Piston, LP**	3004	3004B
14	Gasket, LP*, **	3010N	3010AN
15	Lock Nut, LP*, **	3013	-
16	Bonnet, LP	3002NR	3002AN
17	Cap Screw, HP (4)	577	718
18	Cap Screw, LP (4)	577N	1459
19	Seal Cap	714N	714N
20	Plug	3333NR	3333NR
21	EVM Solenoid (Includes #28)**	027B1120	027B1120
22	Coil, Solenoid, 120V/60Hz with DIN Plug	018F7991	018F7991
23	Coil, Solenoid, 240V/60Hz without DIN plug	018F7658	018F7658
24	Din Socket for Coil	042N0156	042N0156
25	Stem, Manual Opening	3017NR	3017NR
26	O-Ring (2) *, **	11-012	11-012
27	O-Ring *, **	107	107
28	Seal Kit for Solenoid*	027F0666	027F0666
-	*Replacement Parts Kit (Includes items 2, 3, 4, 5, 6, 7, 10, 11, 14, 15, 26, 27 & 28)	K3000	K3000A
-	**Rebuild Parts Kit (Includes items 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 21, 26 & 27)	K3000PS	K3000APS

K3000 & K3000PS can be used on the old style 3000 and 3000N valves.  
K3000A and K3000APS can be used on the 3000A and 3000AN valves.

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## TROUBLESHOOTING AND SERVICE TIPS

**⚠ Always have a functional strainer installed upstream of the HP port.** If experiencing pre-mature wear of valve and components, consider installing a pressure regulator with "soft start" functionality. For full details on strainer and pressure regulator recommendations please see the *Installation Guidelines & Recommendations* section). For troubleshooting help, please call our factory and fill out and submit the following form: <http://goo.gl/forms/397y4H17KN5g5LiK2>

### **Valve Appears Stuck in Transfer Mode (or partially open causing a constant leak-by from the HP port):**

Check the following: **(1)** Manual stem must be screwed inward completely and sealing well for automatic operation. **(2)** O-ring on EVM, part # 027F0666, may be worn or broken thus allowing high pressure gas to by-pass the normally closed solenoid pilot. When installing a new O-ring on pilot solenoid, be sure to clean the sealing surface well; and heavily lubricate the O-ring & pilot hole before slowly screwing in a new pilot being careful to not rough up or tear the O-ring. **(3)** Check to ensure that there is a functional strainer installed upstream of the HP port (If no strainer exists, or if strainer failed, then fault(s) #4, 5, or 6 are likely to be result of this root cause). **(4)** The Danfoss EVM pilot, part number 027B1120, may be bent or dirty causing the solenoid pilot to stay stuck open (clean or replace pilot if needed). **(5)** Dirt or debris may be preventing free piston movement (open valve, clean complete length of both pistons and bores lightly with emery cloth, lubricate & reassemble valve). **(6)** Debris, or seat / seat disc damage may be preventing one or both valve seats from sealing (open valve, inspect both seat discs and seats, clean or replace as necessary). **(7)** The spring may be broken (this would likely only result in the valve leaking-by slightly and is not likely to cause the valve to be in the full transfer mode).

### **Valve Will Not Switch Over from Vent Position When Coil is Energized:**

**(1)** Gas pressure may be too low to initiate transfer (10 psid minimum required). **(2)** Coil may be burnt out (or not as likely, the EVM may be stuck closed perhaps because of a bent tube or dirt in pilot): See if the valve can be manually forced into transfer mode by backing-out the manual opening stem 1/2-turn. If the valve switches manually, then the issue is with the coil (or less likely the pilot is stuck closed because the tube got bent or something). **(3)** If the valve could not be manually switched, via the stem, then something is obstructing flow from reaching the LP Bonnet: (a) the bypass holes in the LP Gasket may be crushed shut (b) dirt or debris may have clogged the internal channel that allows high pressure gas to flow from the HP port to the LP Bonnet. **(4)** Dirt or debris may be preventing free piston movement (open valve, clean complete length of both pistons and bores lightly with emery cloth, lubricate & reassemble valve).

### **Valve Makes a Vibrating, AKA "Machine-Gunning", Sound When Switching from Vent to Transfer Mode (and Vice-Versa):**

Check the following: Gas pressure may be too low (10 psid minimum required), and/or pistons or bores may be worn causing blow-by.

### **Valve and/or Transfer System Shakes and/or Bangs when Transfer is Initiated:**

**(1)** Check to make sure that the drain check valve is mounted low and close to the dump trap! **(2)** Differential pressure may be too great, install a "soft start" outlet pressure regulator (see the *Installation Guidelines & Recommendations* section for details).

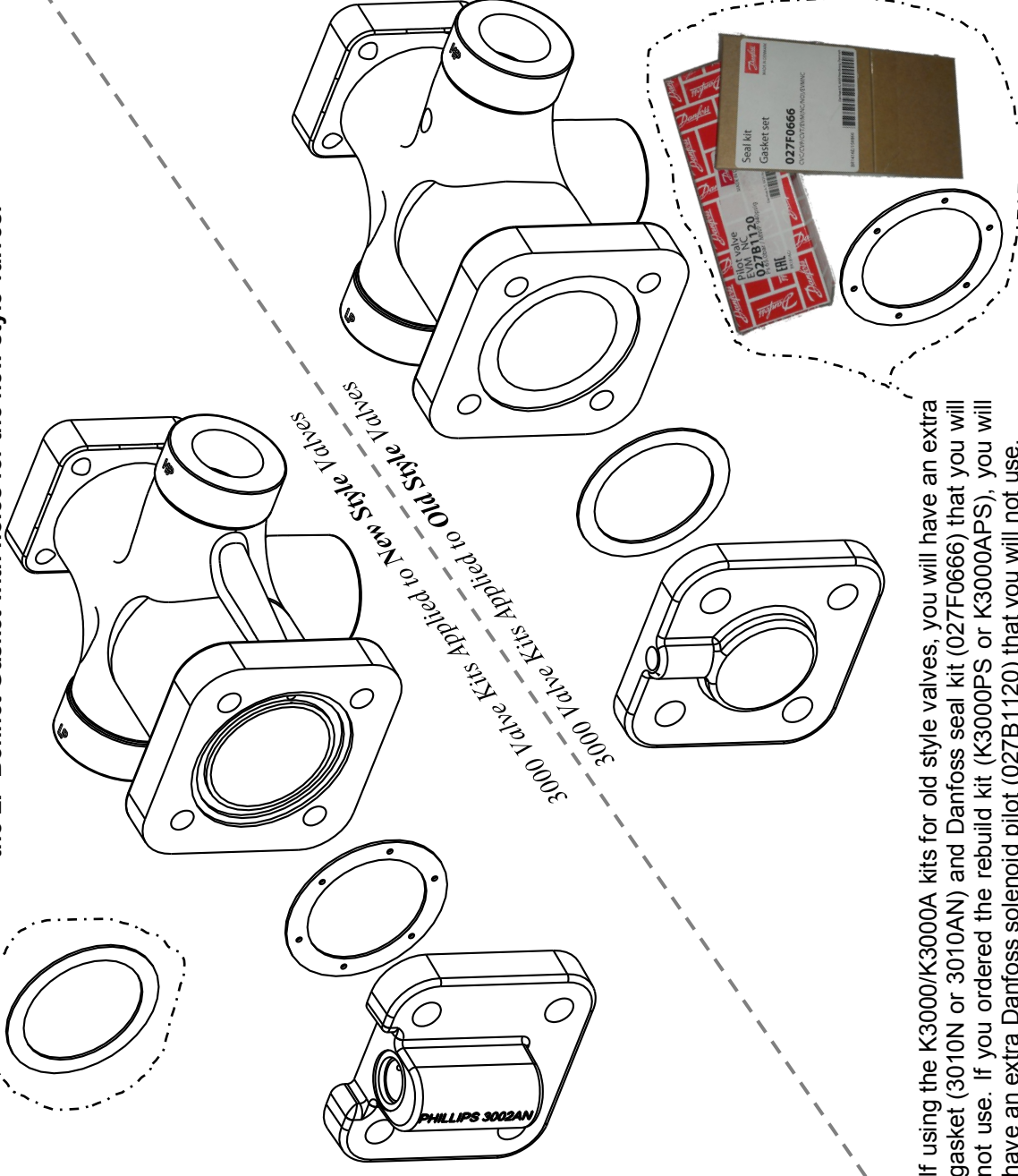




## Parts Kits for Old and New Style 3-Way Valves

The 3000N and 3000AN 3-Way valves are direct replacements for the 3000 and 3000A valves, respectively. The function, as well as connection sizes and locations of the **3000N valves are exactly the same as those of the 3000 valves**. The internal flow path on the 3000N Series valves has replaced the external tubing on the older 3000 Series valves; and the solenoid pilot has been integrated into the main valve body.

If using kits for new style valve you will have an extra gasket (3010 or 710B) that you will not need/use. **Please note that you must install the LP Bonnet Gasket with holes for the new style valves!**



OLD STYLE VALVE	NEW STYLE VALVE
<p>3000 Valve (3/4")</p>	<p>Released in 2001 to replace older style 3/4" 3000 valve</p> <p>3000N Valve (3/4")</p>
<p>3000A Valve (1 1/4")</p>	<p>Released in 2006 to replace older style 1 1/4" 3000A valve</p> <p>3000AN Valve (1 1/4")</p>
<p><b>3/4" valve kits:</b> types K3000 &amp; K3000PS can be used on the old style 3000 and 3000N valves</p> <p><b>1-1/4" valve kits:</b> types K3000A and K3000APS can be used on the 3000A and 3000AN valves.</p>	