GreenSmart Diverter Valves
Installation & Operation Guide

For

2” thru 12” Valves

complies with IPC

Important: This manual is to remain with the building throughout the life of the Diverter. Plumbing service workers doing any service to the building’s wastewater or sewage system should be notified of the presence of wastewater diverters.

This device is to be installed in accordance with all applicable building and plumbing codes.

R11092022

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INSTALLATION NOTES

Review this guide and all supplied materials completely prior to installation. The following will pertain to ALL Greensmart diverter sizes.

- Diverters may be installed in any position and will not affect flow.
- All diverters must have access for maintenance and inspection. UPC Code
- Read the label on the exterior of the actuator cover for supply voltage.
- All actuators are 24vac/dc powered and must be Class 2 compliant. UL 5085 see pg 7 for a power supply option.
- Depending on the system design, all units should be powered and cabled independently. Daisy chaining is not recommended as it could have a conflicting and faulty signal situation.
- Cabling for the actuated diverters: 16-20 gauge, 3 wire cable for the power and signal inputs. 16-20 gauge, 6 wire cable for the position output signals.
- Actuator Factory Video https://www.youtube.com/watch?v=wqfhWl5ylSM
- More technical information can be found later in this manual and Greensmart website, www.Greensmartsc.com
- For horizontal installations where the flow through the wye's branch will be for overflow or bypass to storm drain or sewer, the bypass wye arm should be elevated at 1.5" - 2.0" above horizontal for system efficiency.
- Another option would be to install the bypass wye with the arm facing away from the normal flow towards the diverter, again 1.5" - 2.0" above horizontal.
- Installations subject to debris buildup shall include a debris collection device, catchment, or filter located upstream of the valve and accessible for inspection and maintenance. UPC Code
- Inspection and maintenance of the diverter system and debris filters should be done at least every 4 months to ensure optimum performance.
- Inspection and testing of the Battery Backup Failsafe system should be done a least every 4 months to insure proper Failsafe function. See pg 14.

This manual must be kept in a dry place and available for use.
This device is to be installed in accordance with all applicable building and plumbing codes and manufacturer's guidelines.

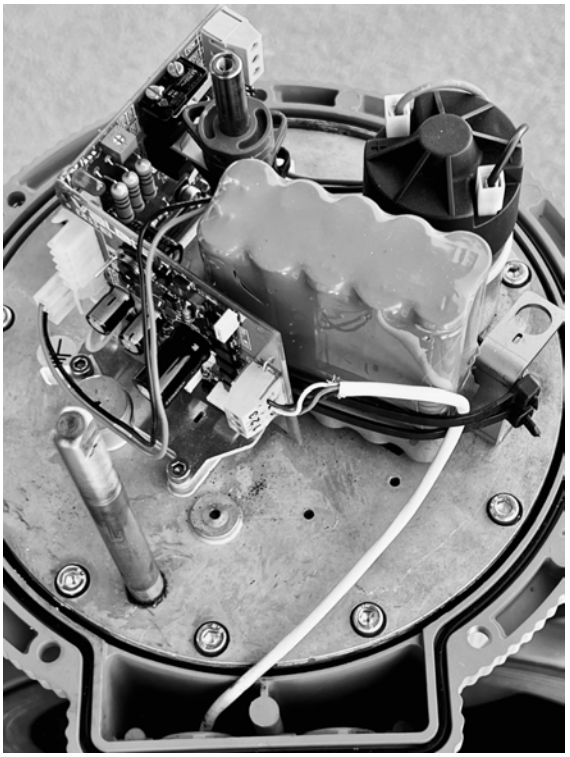
FAIL-SAFE OPERATION

- The battery-backup fail-safe model actuators provide dependable control for applications requiring automatic valve positioning during a particular event, namely, loss of power. The most common applications are diverter, main water supply, main machine/plant supply, solar switching, etc. that all require an immediate need in the event of power loss. They are offered in voltages 24V AC/DC and 100-240VAC.
- These units automatically charge the battery pack completely during normal operation, and with 20, 1.2V, Nickel Metal Hydride batteries (24 VDC), easily maneuver the valve. The battery pack has a life expectancy of over 400 charge/discharge cycles; but, when properly used, will never completely discharge. The frequency of discharge (valve operation) depends on the load (the valve torque requirements). Since the actuator must have power restored to re-establish the valve position (open or closed), there is always a charge cycle for the battery packs.
- The unit has a 5 second delay prior to the failure movement to prevent unnecessary valve positioning with sporadic power supplies; therefore, it is necessary to consider valve closing times when developing the application control.
- The battery will finish the movement during a power loss, and will regain the normal position only after power has been restored. This movement will not be interrupted until it has reached the limit of the configuration, even if power is restored during the move.
- The batteries are Nickel Metal Hydride (NiMH). They have 30% greater life expectancy than Nickel Cadmium (NiCAD), better temperature compensation, and, unlike NiCAD, are eco-friendly and non-toxic.
- Since there is no status indication nor failure feedback, it is recommended to fully charge the batteries for 24 hours prior to service. A cycle test is also recommended once per month for true fail-safe applications.
- The expected lifetime of these batteries is 5-6 years. Replacement battery packs are available in case of damage or improper connections.
- Reliability, cost-effective design, performance, and cost easily make the unit an ideal choice for most emergency situations and many control applications.

VALBIA PLASTIC ELECTRIC ACTUATOR VB030-VB270
24V AC/DC WITH BATTERY BACKUP

Main Features

- 24V 1000mAh i-Mh battery positioned in the actuator casing 0,43kg (VB060-350)
- Automatic battery recharge system trickle charge 1 chg =15mA-37.5mA
    - No extra electric wiring
- Complete recharge time of flat battery 46hrs(VB030), 27hrs(VB060-350)
- Single operation recharge time of flat battery: 6min. (VB030), 5min. (VB060), 15min. (VB110-190), 25min. (VB270-350)
- Power consumption for battery recharge: 0.52W (VB030-190), 1.3W(VB270-350)
- Battery operation after 5 seconds power failure
- 2 modes selectable (factory setup):
    - Fail to open
    - Fail to close



For inspection and testing purposes:
Checking the Failsafe for operation

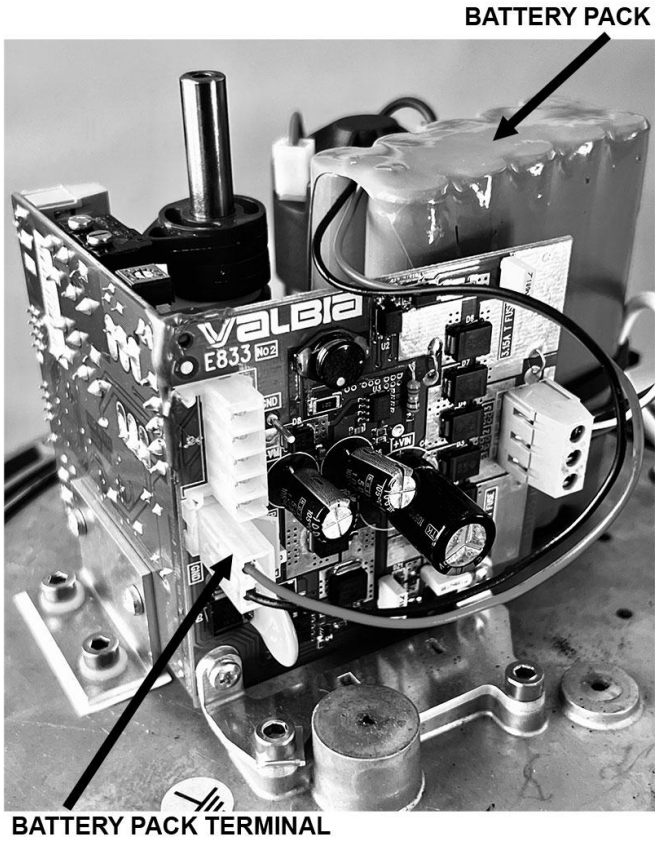
1. Observe the valve position on the indicator
2. Remove the actuator cover.
3. Remove the Common, # 2 wire from the F terminal block, or unplug the entire F block from the socket. This will disconnect power to the actuator.

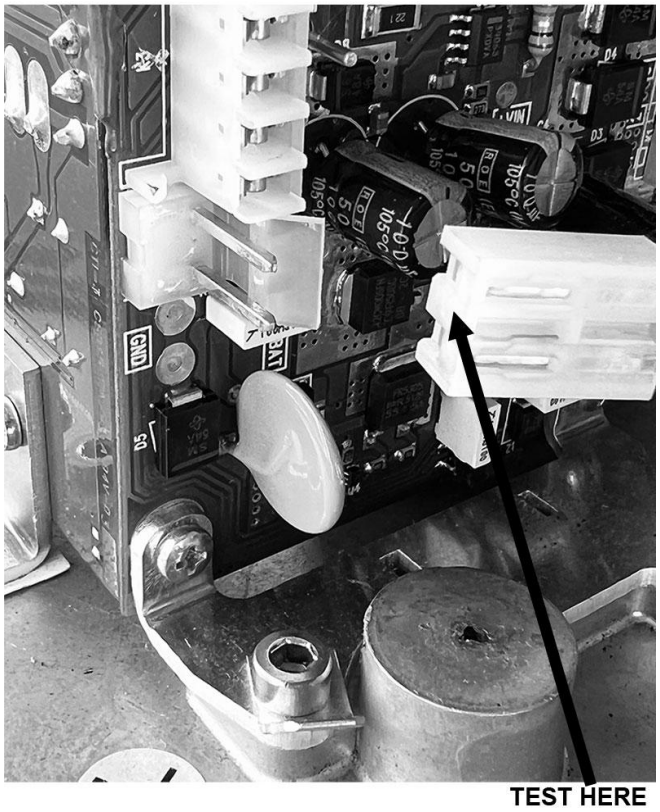
If the valve was in the Open position the Failsafe should kick in and actuate the valve to the closed position.

Checking the battery pack

1. Disconnect the battery pack wires from the logic board and test on volt meter for 24 VDC. If the stored battery voltage reads less than 20vdc replacement would be necessary. If the actuator has continuous power the battery packs should last many (5-6) years.

   See the photos.





Note: since the valve has constant power the battery pack will be constantly trickle charged.

OPTIONAL RECOMMENDED POWER SUPPLY

Honeywell

AT120A-E; AT140A-E; AT150A,B,D-F; AT160B; AT175A-D,F Transformers

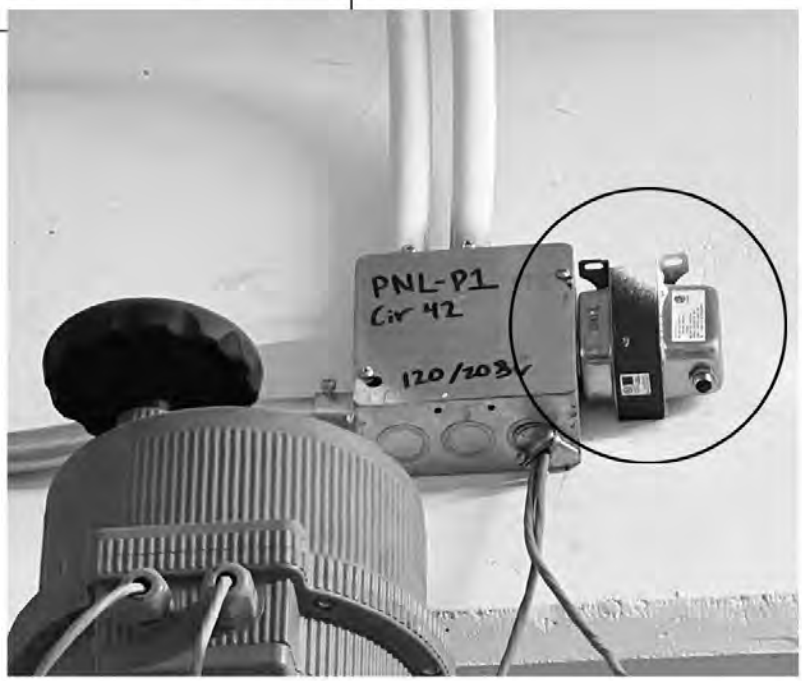
PRODUCT DATA

APPLICATION

These general purpose transformers provide power to 24 Vac circuits. They are typically used in heating/cooling control systems, but can be used in any application that doesn't exceed the load ratings.

FEATURES

- AT120 is rated at 20 VA.
- AT140 is rated at 40 VA.
- AT150 is rated at 50 VA.
- AT160 is rated at 60 VA.
- AT175 is rated at 75 VA.
- All models meet National Electrical Code Class 2 not wet, Class 3 wet transformer requirements.
- All models conform to Underwriters Laboratories Inc. Standard UL 1585.
- Color-coded leadwires for primary connections and screw terminals for secondary connections, fixed 1/4 inch (6 mm) male quick-connects or color-coded leadwires for both primary and secondary, are standard.
- Models available with stripped leadwires, leadwires with variety of terminals, or special terminations as required on both primary and secondary.
- Mounting options include clamp mounting on outlet box knockout, plate mounting, foot mounting, panel mounting, conduit/panel and a combination.
- Models available for 120V, 240V, 277V, 480V, 120/240V, 208/240V, 277/480V, 120/208/240V, 208/240/480V, or 208/277/480V supply at 60 Hz.
- "F" models include a button for manually resetting the circuit breaker.



JOB NAME:	CONTRACTOR:
JOB LOCATION:	APPROVAL:
ENGINEER:	CONTRACTOR P.O.:
APPROVAL:	REPRESENTATIVE:

SERIES VB030 - VB350

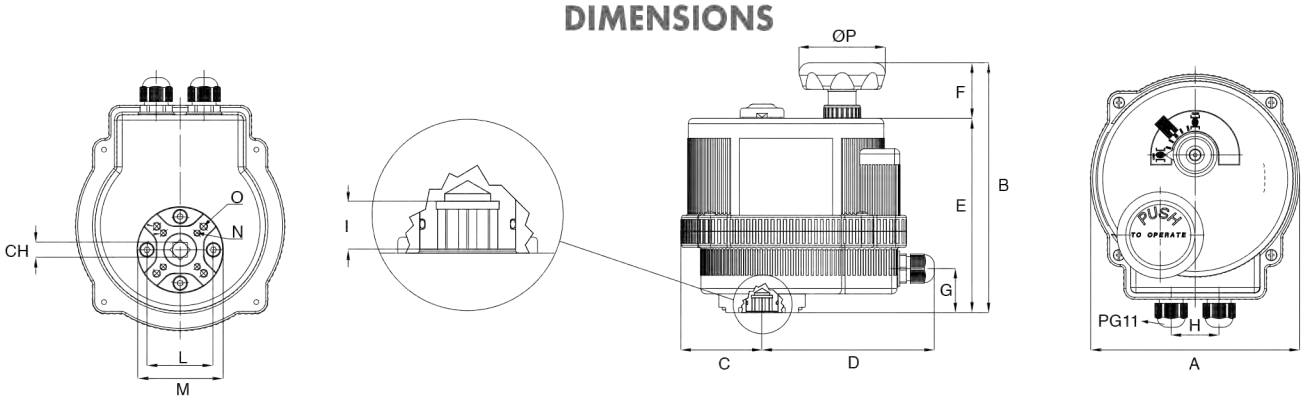
VALBIA PLASTIC ELECTRIC ACTUATOR

FEATURES

- IP67 NEMA Type 4X Housing
- 12V/24V AC/DC and 100-240V AC Models Available
- ISO 5211 with female drive
- VB030 - VB350 - 12/24V DC and 100-240V AC - 75% Duty Cycle
- High-Strength, Impact Resistant IP67 Technopolymer Housing
- Temperature Range -4°F to 131°F
- Available with On/Off (-00*), On/Off w/ Battery Backup (01*), Positioner (-02*), Potentiometer (-03*), Battery Backup w/ Positioner (-04*), and Middle Positioner (-06*)
- PG11 Electrical Connection/Optional
- 1/2" Conduit

SPECIFICATION

DIMENSIONS



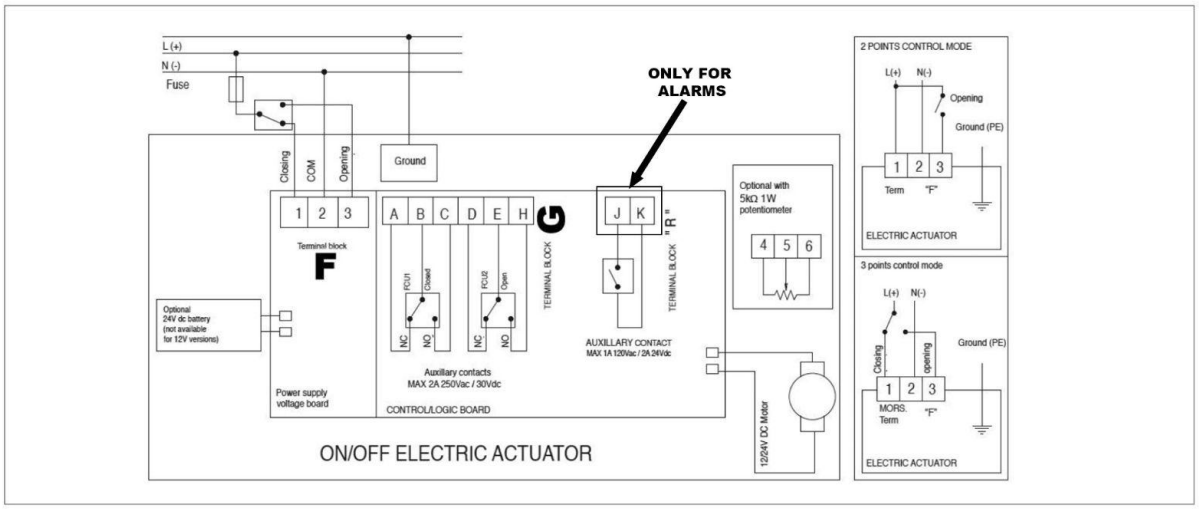
Model	ISO 5211	CH	A	B	C	D	E	F	G	H	I	L	M	N	O	ØP
VB030	F03-F05	11	6.18	7.40	2.39	5.10	5.75	1.65	1.30	1.42	0.47	1.42	1.97	10-24 UNC 2Bx0.47	1/4-20 UNC 2Bx0.51	2.56
VB060	F05-F07	14	7.28	8.46	2.66	5.77	6.81	1.65	2.01	1.42	063	1.97	2.76	1/4-20 UNC 2Bx0.59	5/16-18 UNC 2Bx0.63	2.56
VB110	F07-F10	17	8.31	9.14	3.31	6.02	7.01	2.13	2.13	1.58	0.75	2.76	4.02	5/16-18 UNC 2Bx0.75	3/8-16 UNC 2Bx0.75	4.33
VB190	F07-F10	17	8.31	9.14	3.31	6.02	7.01	2.13	2.13	1.58	0.75	2.76	4.02	5/16-18 UNC 2Bx0.75	3/8-16 UNC 2Bx0.75	4.33
VB270	F07-F10	22	8.74	9.19	3.03	6.69	7.17	2.03	2.13	1.58	0.95	2.76	4.02	5/16-18 UNC 2Bx0.75	3/8-16 UNC 2Bx0.75	4.33
VB350	F07-F10	22	8.74	9.19	3.03	6.69	7.17	2.03	2.13	1.58	0.95	2.76	4.02	5/16-18 UNC 2Bx0.79	3/8-16 UNC 2Bx0.75	4.33

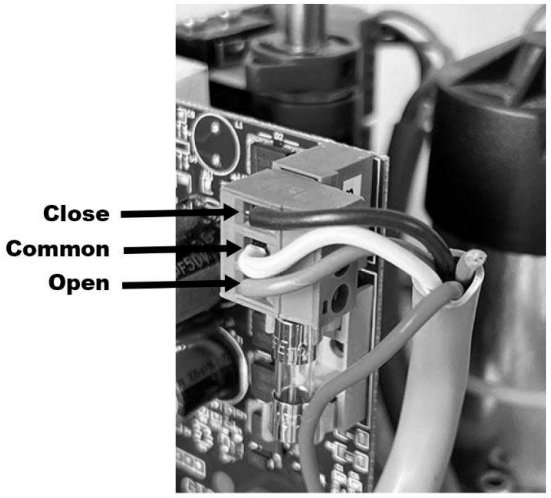
TECHNICAL DATA SERIES 85

Model	VB030	VB060	VB110	VB190	VB270	VB350
Max Working Torque	266	530	975	1680	2390	3100
Nominal Tension (V)	12V AC/DC	12V AC/DC	12V AC/DC	12V AC/DC	12V AC/DC	12V AC/DC
	24V AC/DC	24V AC/DC	24V AC/DC	24V AC/DC	24V AC/DC	24V AC/DC
	100-240V AC	100-240V AC	100-240V AC	100-240V AC	100-240V AC	100-240V AC
Working Time	8	9	27	27	50	50
Torque Limiter	Standard	Standard	Standard	Standard	Standard	Standard
Duty Rating	12V AC/24V AC 50%	12V AC/24V AC 50%	12V AC/24V AC 50%	12V AC/24V AC 50%	12V AC/24V AC 50%	12V AC/24V AC 50%
	12V DC/24V DC 75%	12V DC/24V DC 75%	12V DC/24V DC 75%	12V DC/24V DC 75%	12V DC/24V DC 75%	12V DC/24V DC 75%
	100-240V AC	100-240V AC	100-240V AC	100-240V AC	100-240V AC	100-240V AC
Protection	IP67/Type 4x	IP67/Type 4x	IP67/Type 4x	IP67/Type 4x	IP67/Type 4x	IP67/Type 4x
Enclosure	Technopolymer	Technopolymer	Technopolymer	Technopolymer	Technopolymer	Technopolymer
Rotation	90°	90°	90°	90°	90°	90°
Special Rotation	180° or 270°	180° or 270°	180° or 270°	180° or 270°	180° or 270°	180° or 270°
Manual Override	Standard	Standard	Standard	Standard	Standard	Standard
Position Indicator	Standard	Standard	Standard	Standard	Standard	Standard
Working Temp. (°F)	-4°F - 131°F	-4°F - 131°F	-4°F - 131°F	-4°F - 131°F	-4°F - 131°F	-4°F - 131°F
Heater	Standard	Standard	Standard	Standard	Standard	Standard
Aux. Limit Switches	n°2 STD (type SPDT)	n°2 STD (type SPDT)	n°2 STD (type SPDT)	n°2 STD (type SPDT)	n°2 STD (type SPDT)	n°2 STD (type SPDT)
ISO 5211	F03-F05	F05-F07	F07-F10	F07-F10	F07-F10	F07-F10
Square Drive (mm)	11	14	17	17	22	22
Special Square Drive (mm)	9-14	11-17	14-22	14-22	17	17
Fail Safe (Batt. Backup)	Upon Request	Upon Request	Upon Request	Upon Request	Upon Request	Upon Request
	Not Available for Mod 12V					
Std. Mode Positioner	Upon Request	Upon Request	Upon Request	Upon Request	Upon Request	Upon Request
Middle Position	Upon Request	Upon Request	Upon Request	Upon Request	Upon Request	Upon Request
Potentiometer	Upon Request	Upon Request	Upon Request	Upon Request	Upon Request	Upon Request
Electrical Connections	PG11	PG11	PG11	PG11	PG11	PG11
Weight (lbs.)	5.05	7.28	10.80	10.80	13.23	13.23

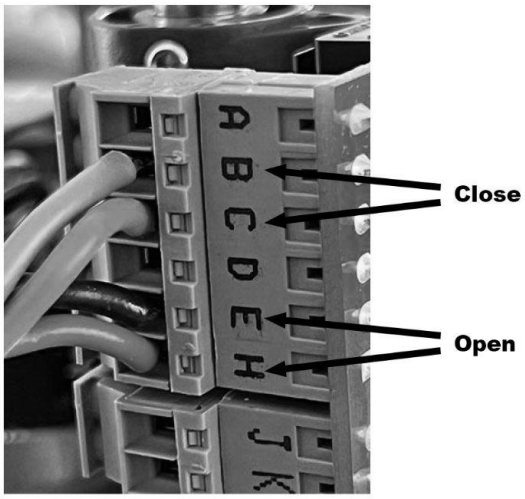
Power Consumption													
Model		VB030		VB060		VB110		VB190		VB270		VB350	
Version H	Nominal Voltage	100-240V AC											
	Absorbed Current	0.4-0.2A		0.6-0.3A		0.4-0.2A		0.6-0.3A		0.6-0.3A		0.75-0.4A	
	Absorbed Power	40-48 VA		60-72 VA		40-48 VA		60-72 VA		60-72 VA		75-96 VA	
Version L	Nominal Voltage	12V AC/DC	24VAC/DC	12V AC/DC	24VAC/DC	12V AC/DC	24VAC/DC	12V AC/DC	24VAC/DC	12V AC/DC	24VAC/DC	12V AC/DC	24VAC/DC
	Absorbed Current	2.2-1.8A	1-0.7A	3.8-2.85A	1.8-1.2A	2.2-1.8A	1-07A	3.8-2.85A	1.81-1.2A	3.8-2.85A	1.8-1.2A	4.75-3.65A	1.95-1.65A
	Absorbed Power	26.5-22 VA	24-17 VA	46-34 VA	43-29 VA	26.5-22 VA	24-17VA	46-34VA	43-29 VA	46-34 VA	43-29VA	57-44VA	47-40VA
Frequency		50/60 HZ											

ON/OFF & POSITION FEEDBACK WIRING DIAGRAMS
VB030 - VB350 24VDC

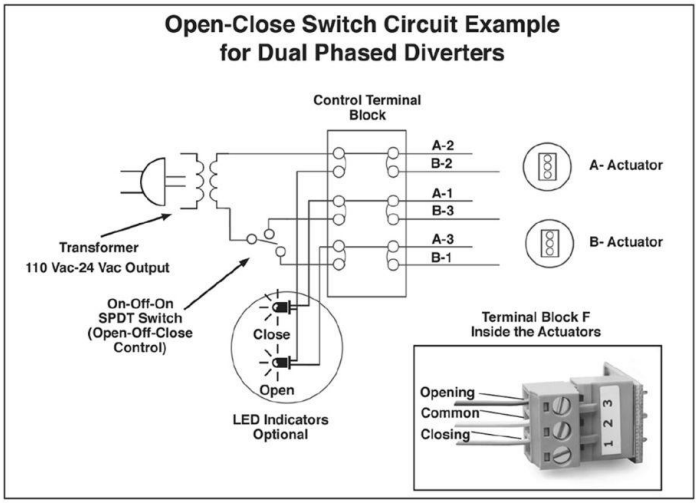




TERMINAL BLOCK F



TERMINAL BLOCK G



EXTERNAL HANDWHEEL OPERATION

On Electric Actuators

Operate the manual operation by putting pressure on the top of the handwheel and by making a small rotation to engage the handwheel. After engaging the manual operation, you can make the desired position by keeping pressure and turning the handwheel. Use the Open/Close dial for reference.

NOTE** The turning direction might be opposite of the position dial on top of the actuator.

WARNING: The handwheel for the manual override can be used only without supplied power. All power to the actuator must be disconnected or nonfunctional. Do not use tools to action the handwheel.

WARNING: Do not operate the manual override when the actuator is turning.

WARNING: For ball valves, if the actuator exceeds the stroke range by the manual Override. To reset, it is necessary to power up the actuator until it returns to the limit switch position.

Installation Flow Labeling

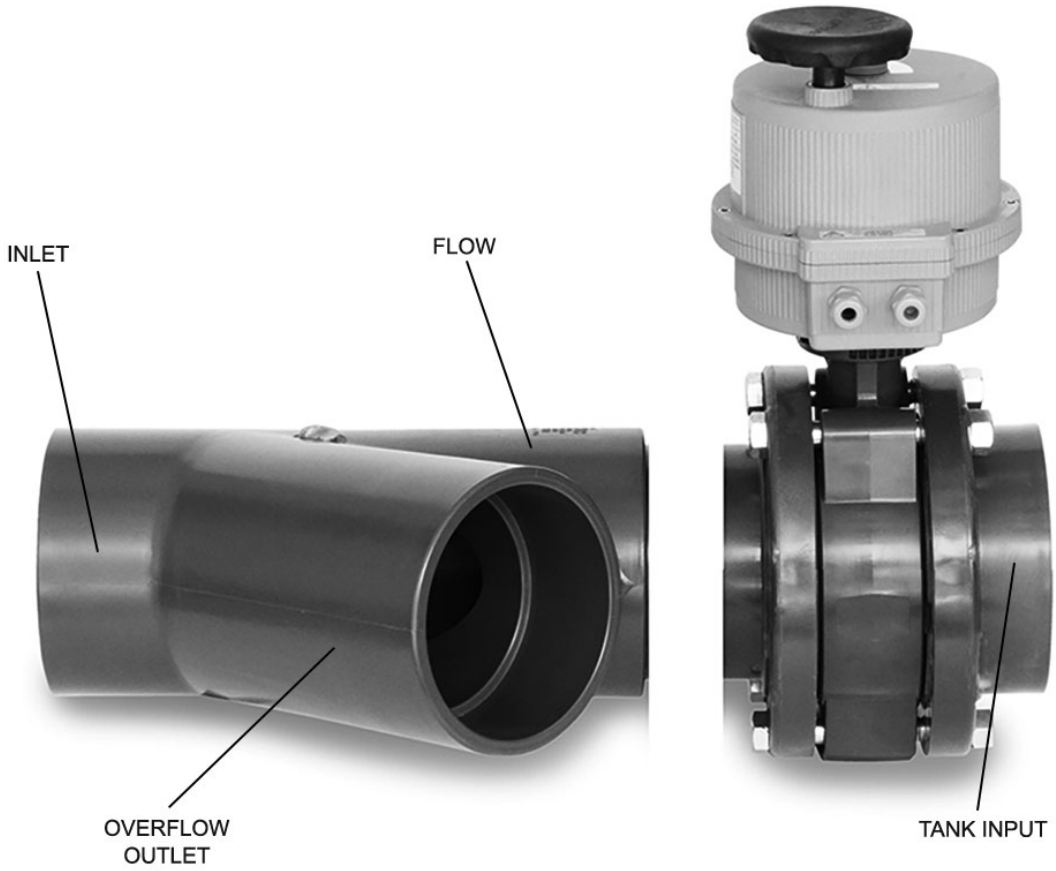
DIRECTION OF FLOW LABELING IS REQUIRED ON LARGE FLOW DIVERTER VALVE SYSTEMS.

It has been recognized that not all large flow diverter valve installations are the same. Design considerations such as: tank location, overflow elevation, and valve location result in not all installations being the same.
Note, not all installations might have the wye connected directly to the valve.

The diverter package comes with a packet of labels that must be applied to the appropriate locations at the completion of the installation BEFORE FINAL INSPECTION.

1. FLOW – Direction of flow
2. INLET
3. TANK INPUT
4. OVERFLOW OUTPUT

Example photo shows how a final installation might be labeled.



Installation Flow Labeling

DIRECTION OF FLOW LABELING IS REQUIRED ON GRAYWATER/RAINWATER DIVERTER VALVE SYSTEMS.

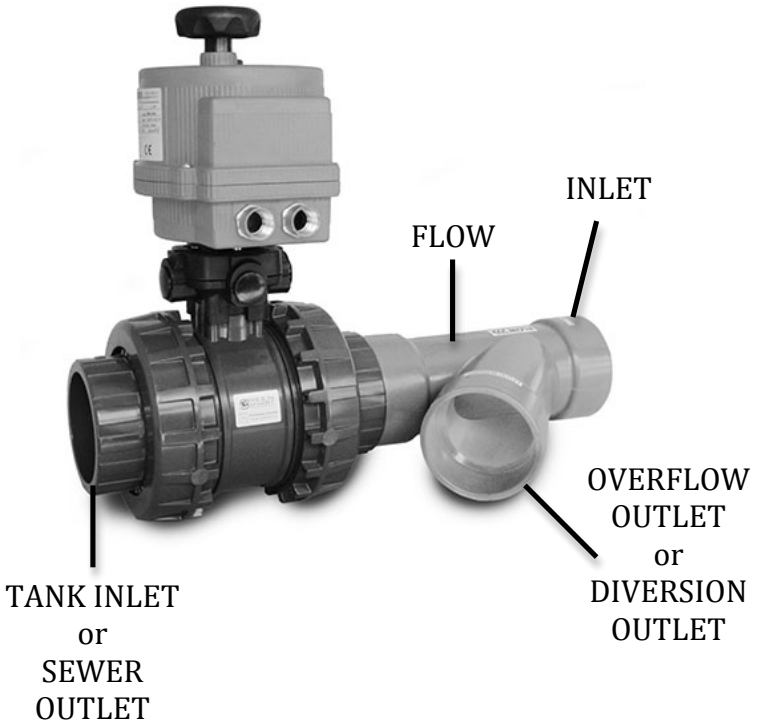
It has been recognized that not all greywater/rainwater diverter valve installations are the same. Design and installation considerations such as: greywater, rainwater, source and tank location and elevation, overflow elevation, available space and valve location result in wide variations. As a result, not all installations might have the wye connected directly to the valve. For these reasons, it is not possible to properly install all the labeling at the factory.

The diverter package comes with a packet of labels that must be applied to the appropriate locations, as per the usage and design of the system, at the completion of the installation depending on the type of system installed BEFORE FINAL INSPECTION.
The valve body will come with the GreenSmart/UPC Label installed, DO NOT REMOVE.

Label Packet Contents

1. FLOW – Direction of flow
2. INLET
3. DIVERSION OUTLET
4. SEWER OUTLET
5. TANK INPUT
6. OVERFLOW OUTLET

This is a guide only to assist in labeling locations



THIS DEVICE IS TO BE INSTALLED IN ACCORDANCE WITH ALL APPLICABLE BUILDING AND PLUMBING CODES INCLUDING CHAPTER 16 OF THE UNIFORM PLUMBING CODE.

This manual is to remain with the building through out the life of the Diverter. Plumbing service workers doing any service to the building's wastewater/ greywater sewage system should be notified of the presence of the wastewater / greywater diverters.

Read all installation instructions and manufacturers data sheets enclosed before installation of the actuator and diversion system.

IMPORTANT INFORMATION FOR ALL MODELS

- PVC & CPVC Ball Valve Material:
- ASTM 1784 NSF14/61
- Joining to be done by Solvent Cement Welding by using the appropriate primers and solvent cements per ASTM D285 or manufacturers recommendations.
- The unit can be installed in either a vertical or horizontal position with proper supports.
- The Diversion System must be accessible for service and inspection.
- The Diversion System should never be installed below-grade or below the level of the sewage waste line.
- Flow Direction should be clearly indicated.
- Installations must maintain the proper angle of slope for gravity drain drainage.
- Diversion Actuator has a manual Fail-safe feature in case of power outage.
- Always refer to the Ipex Valve Maintenance And Installation Instructions, supplied with the unit for detailed technical data or check manufacturers websites.

MARKINGS

See Fig (#1, #2, #3)

Review and make note of the labeling on the Diverter: Flow Direction, Inlet, Sewer Outlet, Diversion Outlet, UPC Shield, Model #, Material-(Molded Mark)

Labels should not be removed.

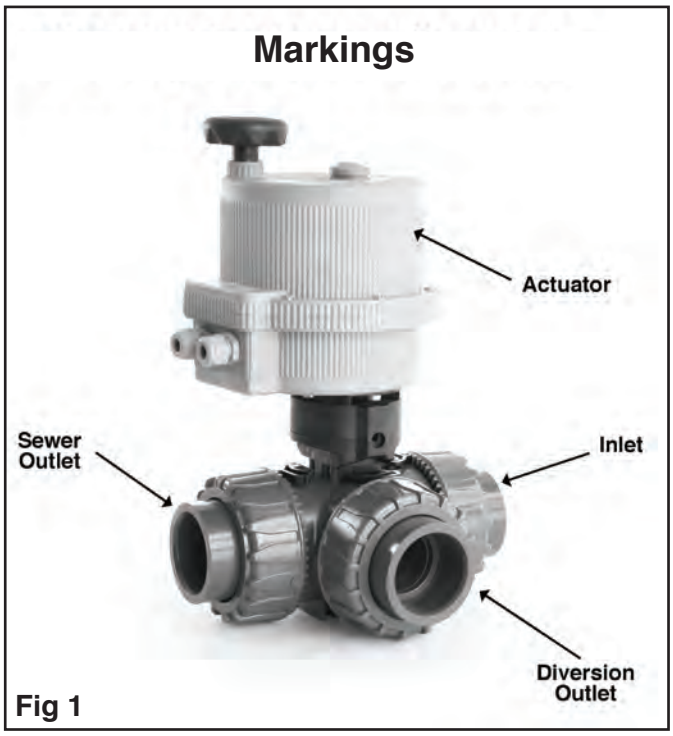


Fig 1

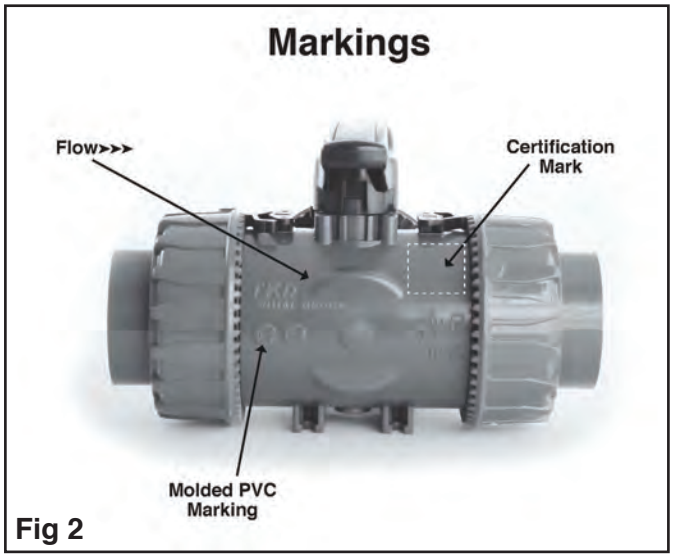


Fig 2

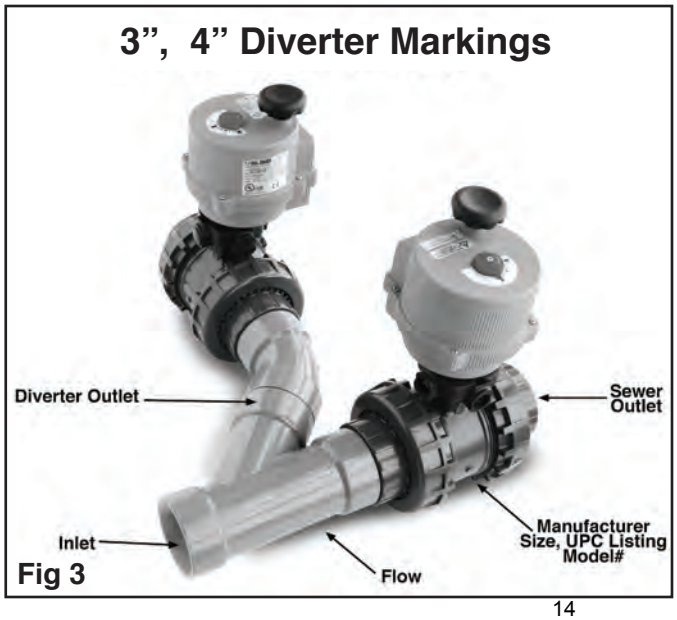


Fig 3

FE Series Large Flow Valves

Testing and Operating

The purpose of system testing is to assess the quality of all joints and fittings to ensure that they will withstand the design working pressure, plus a safety margin, without loss of pressure or fluid. Typically, the system will be tested and assessed in sub-sections as this allows for improved isolation and remediation of potential problems. With this in mind, the testing of a specific installed valve is achieved while carrying out a test of the overall system.

An onsite pressure test procedure is outlined in the IPEX Industrial Technical Manual Series, *"Volume I: Vinyl Process Piping Systems"* under the section entitled, *"Testing"*. The use of this procedure should be sufficient to assess the quality of a valve installation. **In any test or operating condition, it is important to never exceed the pressure rating of the lowest rated appurtenance in the system.**

Important points:

- Never test thermoplastic piping systems with compressed air or other gases including air-over-water boosters.
- When testing, do not exceed the rated maximum operating pressure of the valve.
- Avoid the rapid closure of valves to eliminate the possibility of water hammer which may cause damage to the pipeline or the valve.

The FE handle incorporates a locking mechanism that prevents unintentional rotation. The spring-loaded handle must be depressed to cycle the valve. A padlock can be installed through this portion of the handle as an additional safety precaution.

Please contact IPEX customer service and technical support with regard to any concern not addressed in this data sheet or the technical manual.

FE Series Large Flow Valves

Valve Maintenance

assembly

Note: Before assembling the valve components, it is advisable to lubricate the o-rings with a water soluble lubricant. **Be sure to consult the "IPEX Chemical Resistance Guide" and/or other trusted resources to determine specific lubricant-rubber compatibilities.**

Sizes 1-1/2" to 8"

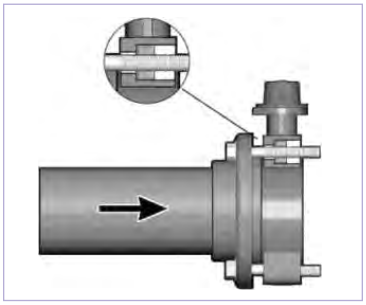
1. Insert the primary liner (15) into the valve body (11).
   Ensure that the proper holes line up with those on the body.
2. Properly fit the o-rings (9) on the nylon bushing (10) (sizes 2-1/2" to 8") then insert into the valve body from above.
3. Properly fit the disc o-rings (12, sizes 2-1/2" to 8") and anti-friction rings (13) on the disc (14), then insert into the valve liner taking care to center the holes.
4. Properly fit the o-rings (6, 7) and retaining ring (8, sizes 2-1/2" to 8") in their grooves on the shaft (6), then carefully insert into the valve body from above.
5. Fasten the shaft at the base of the valve body using the screw (17) and washer (16). Affix the cap (18) over the bolt.
6. For 8" sizes, affix the spacer pad (20) to the valve body using the screws (19), washers (21), and nuts (22).
7. For the lever handle style, affix the handle (1) using the screw (2), washer (3), and protection cap (4).
8. For the mounted gear box style, carefully place the gear box on the stem, lining up the holes. Fasten using the necessary bolts and washers.

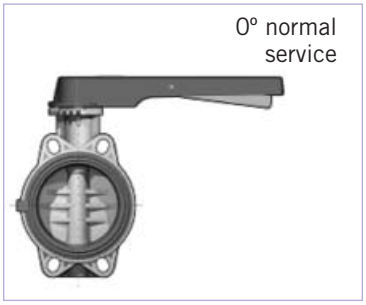
Sizes 10" to 12"

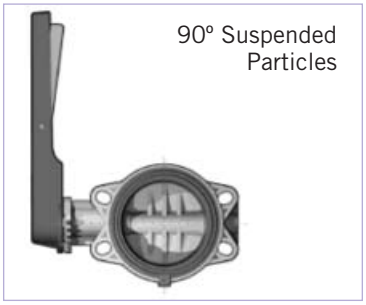
1. Insert the primary liner (7) into the valve body (1).
   Ensure that the proper holes line up with those on the body.
2. Properly fit the o-rings (4) on the upper and lower bushings (3, 5) then insert into the valve body from above and below along with the washers (2, 6).
3. Properly fit the disc o-rings (4, 9) and anti-friction rings (8) on the disc (10), then insert into the valve liner taking care to center the holes.
4. Properly fit the o-rings (17) and retaining ring (18) in their grooves on the shaft (16), then carefully insert into the valve body from above.
5. Fasten the shaft at the base of the valve body using the screw (14) and washers (11, 12, and 15). Affix the cap (13) over the bolt.
6. Carefully place the gear box on the stem, lining up the holes. Fasten using the necessary bolts and washers.

FE Series Large Flow Valves

Installation Procedures



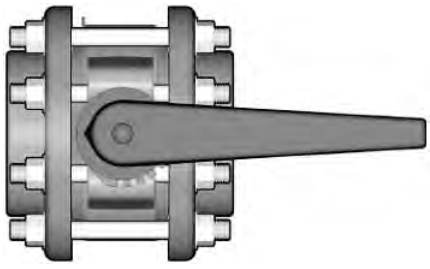




1. For the lever handle style, attach the handle (part #1 on previous pages) to the valve body (11) using the supplied bolt (2) and washer (3). Affix the cap (4) over the bolt.
2. **Ensure that the length of the bolts is sufficient for the size of valve being installed. Due to the varying designs of plastic flanges, there is no recommended minimum length. However, a length that results in at least 5 exposed threads on each side should be sufficient.**
3. Please refer to the appropriate application sub-section:
   a. For typical inline installation, ensure that the disc is in the partially closed position then carefully insert the valve into the piping system between the two flanges. Insert the bolts, washers, and nuts (if necessary), then hand tighten. **Take care to properly line up the valve and flanges as any misalignment may cause leakage.**
4. To avoid damage to the primary gasket, cycle the valve to the open position before tightening the bolts. For correct joining procedure, please refer to the section entitled, *"Joining Methods – Flanging"* in the IPEX Industrial Technical Manual Series, *"Volume I: Vinyl Process Piping Systems"*. **The bolts should be tightened in an even pattern to the nominal torque in the table below. These torque ratings are sufficient to maintain a watertight seal at the maximum rated operating pressure.**

Note: End of line installation will cause the maximum rated pressure to be reduced to the values listed in the table below. If the process media is dirty or contains suspended particles, it is advisable to install the valve in an orientation in which the shaft is not vertical (see diagrams). Over time, particles may collect at the bottom of the valve posing a threat to the seal between the disc, liner, and shaft.

Size	Nominal Bolt Torque ((ft-lbs)
1-1/2	
2	9
2-1/2	
3	13
4	
5	26
6	
8	41
10	
12	52



JOINING METHODS – FLANGING

Introduction

Flanging is used extensively for plastic process lines that require periodic dismantling. Thermoplastic flanges and factory flanged fittings in PVC and CPVC are available in a full range of sizes and types for joining to pipe by solvent welding and threading. Gasket seals between the flange faces should be an elastomeric full-faced gasket with a hardness of 50 to 70 durometer A. Neoprene gaskets are commonly available in sizes from 1/2" through to 24" range having a 1/8" thickness. For chemical environments beyond the capabilities of neoprene, more resistant elastomers should be used.

Dimensions

IPEX PVC and CPVC flanges have the same bolt hole dimensions as Class 150 metal flanges per ANSI B16.5. Threads are tapered iron pipe size threads per ANSI B2.1. The socket dimensions conform to ASTM D 2467 which describes 1/2" through 8". Flanges 1/2" to 12" are third party tested by NSF according to ASTM F 1970. Flange bolt sets are listed in Table 28.

Maximum pressure for any flanged system is the rating of the pipe or up to 150 psi. Maximum operating pressures for elevated temperatures are shown in Table 26. To elevate the pressure rating above 150psi, a full-pressure flange kit is available. Details on page 58.

Blind flanges in sizes 14" – 24" have a maximum working pressure of 50 psi

Table 26 – Maximum Pressures for Flanged Systems

Operating Temp.		Max. Operating Pressure (psi)	
°F	°C	PVC	CPVC
73	23	150	150
80	27	132	144
90	32	113	137
100	38	93	123
110	43	75	111
120	49	60	98
130	54	45	87
140	60	33	75
150	66	*	68
160	71	*	60
170	77	*	50
180	82	*	38
200	93	NR	30
210	99	NR	*

* intermittent drainage only
NR – not recommended

Installation Guidelines

The faces of IPEX flanges have a phonographic-grooved finish providing positive seal on the gasket when the bolts are properly tightened.

Once a flange is joined to pipe, use the following method to join two flanges together:

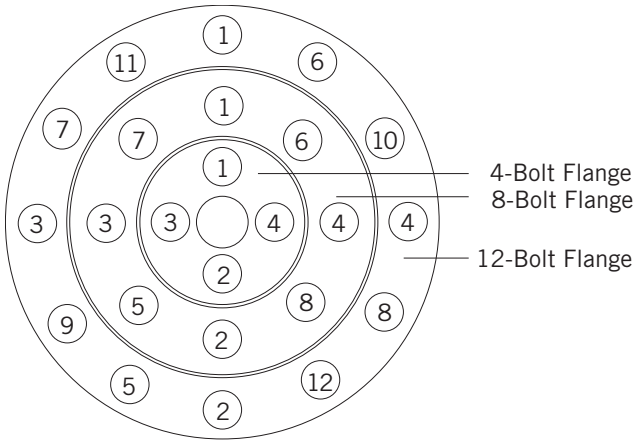
1) Make sure all bolt holes of the matching flanges are aligned.

2) Insert all bolts.

3) Make sure the faces of the mating flanges are not separated by excessive distance prior to bolting down the flanges.

4) The bolts on the plastic flanges should be tightened by pulling down the nuts diametrically opposite each other using a torque wrench. Complete tightening should be accomplished in stages using the final torque values in Table 27, Recommended Torque. Uniform stress across the flange will eliminate leaky gaskets.

   The following tightening pattern is suggested for the flange bolts.



5) If the flange is mated to a rigid and stationary flanged object or a metal flange, particularly in a buried situation where settling could occur with the plastic pipe, the plastic flange, and fitting or valve must be supported to eliminate potential stressing.

Table 27 – Recommended Torque

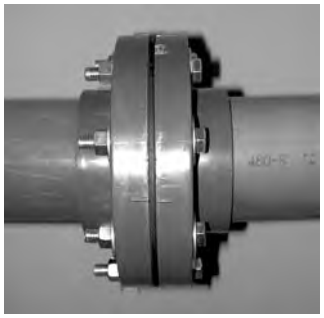
Flange Size (in.)	Recommended Maximum T Full Face/Heavy Duty Vans
1/2– 1-1/2	15
2 – 4	30
6 – 8	50
10	70
12 – 24	100

* Based on using flat-faced PVC and CPVC flanges, a full-faced neoprene gasket, and well lubricated hardware, tightened in the proper sequence and applying torque in small increments.

Table 28 - Recommended Flange Bolt Set

Pipe Size	No. of Holes	Bolt Diameter	Bolt Length
1/2	4	0.50	1.75
3/4	4	0.50	2.00
1	4	0.50	2.00
1-1/4	4	0.50	2.25
1-1/2	4	0.50	2.50
2	4	0.63	2.75
2-1/2	4	0.63	3.00
3	4	0.63	3.00
4	8	0.63	3.25
6	8	0.75	3.50
8	8	0.75	4.00
10	12	0.88	5.00
12	12	0.88	5.00
14	12	1.00	7.00
16	16	1.00	7.00
18	16	1.13	8.00
20	20	1.13	9.00
24	20	1.25	9.50

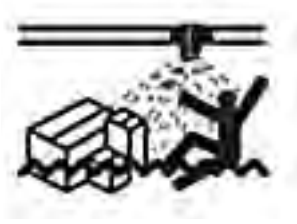
* Bolt length may vary depending on the style of flange and use of backing rings.



⚠ CAUTION

1. Do not over-torque flange bolts.
2. Use the proper bolt tightening sequence.
3. Make sure the system is in proper alignment.
4. Flanges should not be used to draw piping assemblies together.
5. Flat washers must be used under every nut and bolt head.

⚠ WARNING



Failure to install flange properly may result in joint leakage or joint failure which may cause severe injury and property damage.

JOINING LARGE DIAMETER PIPE AND FITTINGS

As pipe diameter increases, so does the difficulty in installing it. The professional installer should be able to successfully assemble large diameter pipe and fittings by following the IPEX solvent welding instructions listed in the beginning of this guide along with the following additional recommendations.

1. Use of an industrial grade, two step PVC or CPVC cement is critical to a strong joint. Contact IPEX for recommendations.

2. Use of proper size applicators is even more necessary to ensure enough cement is applied to fill the larger gap that exists between the pipe and fittings

3. Of equal importance is the use of the applicable cement for the size pipe and fittings being installed.

4. Remove all burrs from both inside and outside of the pipe with a knife, file or reamer. Burrs can scrape channels into presoftened surfaces or create hang-ups inside surface walls.
5. Increase size of joining crew:
    1. 6" - 8": 2-3 people per joint
    2. 10" - 30": 3-4 people per joint
       It is important in large diameter joining that the primer and cement be applied simultaneously to the pipe and fittings.

6. Make sure to apply a second full layer of cement to the pipe.

7. Because of the short sockets in many large diameter fittings, IT IS VERY IMPORTANT TO HAVE PIPE BOTTOMED INTO THE FITTING. It is for this reason that we recommend for assembly of sizes above 6" diameter the use of a come-a-long.

8. Large diameter pipe and fittings require longer set and cure times. *(In cold weather, a heat blanket may be used to speed up the set and cure times.)

9. Prefabricate as many joints as possible.

10. If pipe is to be buried, make as many joints as possible above ground, then after joints have cured, carefully lower into trench.

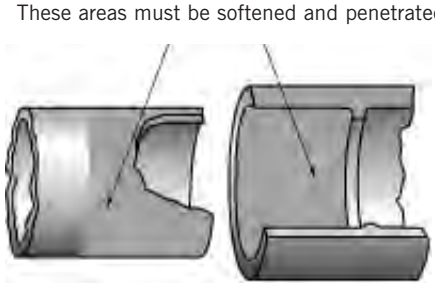
*Contact IPEX for further information: TOLL FREE 1-800-463-9572

JOINING METHODS – SOLVENT CEMENT

Basic Principles

To make consistently tight joints, the following points should be clearly understood:

1. The joining surfaces must be softened and made semi-fluid.
2. Sufficient cement must be applied to fill the gap between pipe and fittings.
3. Assembly of pipe and fittings must be made while the surfaces are still wet and fluid.
4. Joint strength will develop as the cement cures. In the tight part of the joint, surfaces tend to fuse together; in the loose part, the cement bonds to both surfaces.



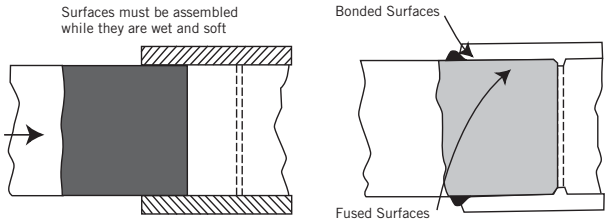
Penetration and softening can be achieved by the cement itself, by using a suitable primer, or by the use of both primer and cement. For certain materials and in certain situations, it is necessary to use a primer. A suitable primer will usually penetrate and soften the surfaces more quickly and effectively than cement alone. Additionally, the use of a primer can provide a safety factor for the installer, for he can know under various temperature conditions when he has achieved sufficient softening. For example, in cold weather more time and additional applications may be required.

Apply generous amounts of cement to fill the loose part of the joint. In addition to filling the gap, adequate cement layers will penetrate the surfaces and remain wet until the joint is assembled. To prove this, apply two separate layers of cement on the top surface of a piece of pipe. First, apply a heavy layer of cement; then alongside it, a thin, brushed-out layer. Test the layers every 15 seconds by gently tapping with your finger. You will note that the thin layer becomes tacky and then dries quickly (probably within 15 seconds); the heavy layer will remain wet much longer.

Check for penetration a few minutes after applying these layers by scraping them with a knife. The thin layer will have little or no penetration, while the heavy layer will have achieved much more penetration.

If the cement coatings on the pipe and fittings are wet and fluid when assembly takes place, they tend to flow together, becoming one cement layer. Also, if the cement is set, the surfaces beneath the pipe and fittings will still be soft. These softened surfaces in the tight part of the joint will fuse together.

As the solvent dissipates, the cement layer and the softened surfaces will harden with a corresponding increase in joint strength. In the tight (fused) part of the joint, strength will develop quicker than in the looser (bonded) part of the joint.



Cement Types

The use of a reliable cement, specifically manufactured for industrial PVC or CPVC, is critical to a good, long-lasting system and must conform to applicable ASTM standards. Review Table 20 for guidelines on cement types.

Table 20 – Cement Types

Pipe Size	Pipe Schedule	Socket Type	Cement Type
up to 6" PVC up to 4" PVC	40 80	All types	Medium-bodied fast-setting cement Use primer to soften and prepare joining surfaces
up to 12" PVC	All	All types	Heavy-bodied medium-setting cement for all schedules through 12" diameter water lines, drain lines and DWV Use primer to soften and prepare joining surfaces
up to 30" PVC	All	All types	Extra heavy-bodied slow-setting cement Use primer to soften and prepare joining surfaces
up to 12" CPVC	All	All types	Heavy-bodied medium-setting cement for pressure and non-pressure service Use primer to soften and prepare joining surfaces
up to 16" CPVC	All	All types	Extra heavy-bodied slow-setting cement Use primer to soften and prepare joining surfaces

CAUTION: Do not use or test the products in this manual with compressed air or other gases including air-over-water booster.

Handling

Solvent cements should be used as received in original containers. Adding thinners to change the viscosity of cement is not recommended. If cement is jelly-like and not free flowing, it should not be used. Containers should be kept tightly covered when not in use to stop the evaporation of the solvent.

Storage Conditions

Solvent cements should be stored at temperatures between 40°F (4°C) and 110°F (43°C) away from heat or open flame. Cements should be used before the expiry date stamped on the container. If new cement is subjected to freezing temperatures, it may become extremely thick or gelled. This cement can be placed in a warm area where it will soon return to its original, usable condition. However, if hardening is due to actual solvent loss (when a container is left open too long during use or not sealed properly after use), the cement will not return to its original condition. Cement in this condition has lost its formulation and should be discarded in an environmentally safe manner.

Safety Precautions

Solvent cements are extremely flammable and should not be used or stored near heat or open flame including pilot lights. In confined or partially enclosed areas, a ventilating device should be used to remove vapors and minimize inhalation. Capping one end of a pipeline during construction may lead to an accumulation of flammable cement vapors inside the system. Nearby sparks may ignite these vapors and create a hazardous incident. If it is required to cover the pipe ends, use an air-permeable cloth that will prevent excessive amounts of dirt from entering the pipeline while permitting cement vapors to escape to the atmosphere. Alternatively, flushing the line with water will also remove all vapors after the cement has properly cured.

Containers should be kept tightly closed when not in use, and covered as much as possible when in use. Protective equipment such as gloves, goggles and an impervious apron should be used. Do not eat, drink or smoke while using these products. Avoid contact with skin, eyes or clothing. In case of eye contact, flush repeatedly with water. Keep out of the reach of children. Carefully read the Material Safety Data Sheets (MSDS) and follow all precautions.

⚠ WARNING

During the curing of the solvent cement joints, vapors may accumulate inside the pipeline, especially should one end of the line be capped. Nearby sparks from welders or torches may inadvertently ignite these vapors and create a hazardous incident. Attention should be given to removing all vapors using air-blowers or water flushing prior to capping one end of an empty pipeline.

⚠ CAUTION

Cement products are formulated for specific material types. To avoid potential joint failure, DO NOT USE PVC cement on CPVC components.

Solvent Welding Instructions for PVC & CPVC Pipe & Fittings

Solvent Welding with Primer

Step 1 Preparation

Assemble proper materials for the job. This includes the appropriate cement, primer and applicator for the size of piping system to be assembled. See Tables 23 and 24 for guidelines to estimate the amount of cement required.

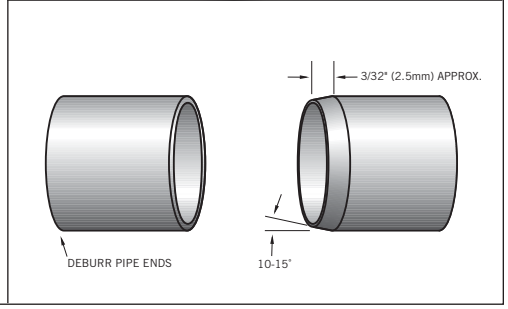
Step 2 Cut Pipe

Pipe must be cut as square as possible. (A diagonal cut reduces bonding area in the most effective part of the joint.) Use a handsaw and miter box or a mechanical saw.

Plastic tubing cutters may also be used for cutting plastic pipe; however, some produce a raised bead at the end of the pipe. This bead must be removed with a file or reamer, as it will wipe the cement away when pipe is inserted into the fitting.

Step 3 Deburr Pipe Ends

Use a knife, plastic pipe deburring tool, or file to remove burrs from the end of small diameter pipe. Be sure to remove all burrs from around the inside as well as the outside of the pipe. A slight chamfer (bevel) of about 15° should be added to the end to permit easier insertion of the pipe into the fitting. Failure to chamfer the edge of the pipe may remove cement from the fitting socket, causing the joint to leak. For pressure pipe systems of 2" and above, the pipe must be end-treated with a 15° chamfer cut to a depth of approximately 3/32" (2.5mm).



Step 4 Clean Pipe Ends

Remove all dirt, grease and moisture. A thorough wipe with a clean dry rag is usually sufficient. (Moisture will retard cure, dirt or grease can prevent adhesion).

Step 5 Check Fit

Check pipe and fittings for dry fit before welding together. For proper interference fit, the pipe must go easily into the fitting one quarter to three quarters of the way. Too tight a fit is not desirable; you must be able to fully bottom the pipe in the socket during assembly. If the pipe and fittings are not out of round, a satisfactory joint can be made if there is a "net" fit, that is, the pipe bottoms in the fitting socket with no interference, without slop.

All pipe and fittings must conform to ASTM and other recognized standards.

Step 6 Select Applicator

Ensure that the right applicator is being used for the size of pipe or fittings being joined. The applicator size should be equal to half the pipe diameter. It is important that a proper size applicator be used to help ensure that sufficient layers of cement and primer are applied.

Step 7 Priming

The purpose of a primer is to penetrate and soften pipe surfaces so that they can fuse together. The proper use of a primer provides assurance that the surfaces are prepared for fusion.

Check the penetration or softening on a piece of scrap before you start the installation or if the weather changes during the day. Using a knife or other sharp object, drag the edge over the coated surface. Proper penetration has been made if you can scratch or scrape a few thousandths of an inch of the primed surfaces away.

Weather conditions can affect priming and welding action, so be aware of the following:

- repeated applications to either or both surfaces may be necessary
- in cold weather, more time may be required for proper penetration
- in hot weather, penetration time may be shortened due to rapid evaporation

Step 8 Primer Application

Using the correct applicator, aggressively work the primer into the fitting socket, keeping the surface and applicator wet until the surface has been softened. More applications may be needed for hard surfaces and cold weather conditions. Re-dip the applicator in primer as required. When the surface is primed, remove any puddles of primer from the socket.

Step 9 Primer Application

Next, aggressively work the primer on to the end of the pipe to a point 1/2" beyond the depth of the fitting socket.

Immediately and while the surfaces are still wet, apply the appropriate cement.

Step 10 Cement Application

Stir the cement or shake can before using. Using the correct size applicator, aggressively work a full even layer of cement on to the pipe end equal to the depth of the fitting socket. Do not brush it out to a thin paint type layer, as this will dry within a few seconds.

Step 11 Cement Application

Aggressively work a medium layer of cement into the fitting socket.

Avoid puddling the cement in the socket. On bell end pipe do not coat beyond the socket depth or allow cement to run down into the pipe beyond the spigot end.

Step 12 Cement Application

Apply a second full, even layer of cement on the pipe.

Step 13 Assembly

Without delay, while the cement is still wet, assemble the pipe and fittings. Use sufficient force to ensure that the pipe bottoms in the fitting socket. If possible, twist the pipe a quarter turn as you insert it.

Step 14 Assembly

Hold the pipe and fitting together for approximately 30 seconds to avoid push out.

After assembly, a joint should have a ring or bead of cement completely around the juncture of the pipe and fitting. If voids in this ring are present, sufficient cement was not applied and the joint may be defective.

Step 15 Joint Cleaning

Using a rag, remove the excess cement from the pipe and fitting, including the ring or bead, as it will needlessly soften the pipe and fitting and does not add to joint strength. Avoid disturbing or moving the joint.

Step 16 Joint Setting & Curing

Handle newly assembled joints carefully until initial set has taken place. Allow curing to take place before pressurizing the system. (Note: in humid weather allow for 50% more curing time.)

For initial set and cure times, refer to Tables 21 and 22.

Table 21 – Initial Set Schedule for IPEX Recommended PVC/CPVC Solvent Cements *

Temperature Range (°F)	Temperature Range (°C)	Pipe Size (in)				
		½ to 1¼	1½ to 2	2½ to 8	10 to 14	≥ 16
60 to 100	16 to 38	2 minutes	5 minutes	30 minutes	2 hours	4 hours
40 to 60	4 to 16	5 minutes	10 minutes	2 hours	8 hours	16 hours
0 to 40	–18 to 4	10 minutes	15 minutes	12 hours	24 hours	48 hours

* The figures in the table are estimates based on laboratory tests for water applications (chemical applications may require different set times). In damp or humid weather allow 50% more set time.

Note 1: Due to the many variables in the field, these figures should be used as a general guideline only.

Note 2: Initial set schedule is the necessary time needed before the joint can be carefully handled.

Table 22 – Joint Cure Schedule for IPEX Recommended PVC/CPVC Solvent Cements *

Temperature Range (°F)	Temperature Range (°C)	Pipe Size (in) & system operating pressure							
		1/2 to 1 1/4		1 1/2 to 2		2 1/2 to 8		10 to 14	> 16
		<160 psi	160 – 370 psi	<160 psi	160 – 315 psi	<160 psi	160 – 315 psi	<100 psi	<100 psi
60 to 100	16 to 38	15 min	6 hr	30 min	12 hr	1 1/2 hr	24 hr	48 hr	72 hr
40 to 60	4 to 16	20 min	12 hr	45 min	24 hr	4 hr	48 hr	96 hr	6 days
0 to 40	–18 to 4	30 min	48 hr	1 hr	96 hr	72 hr	8 days	8 days	14 days

* The figures in the table are estimates based on laboratory tests for water applications (chemical applications may require different set times). In damp or humid weather allow 50% more cure time (relative humidity over 60%).

Note 1: Due to the many variables in the field, these figures should be used as a general guideline only.

Note 2: Joint cure schedule is the necessary time needed before pressurizing the system.