

# Ace Heaters

## Packaged Storage Water Heater

### Water-to-Water System

## Operating and Maintenance Manual



*Photo shown may vary from actual model.*

*Designed and Manufactured in  
Accordance with  
ASME Code Section VIII, Div 1*



## Table of Contents

---

### Page

- 3 Operating and Installation Instruction**
- 4 The Packaged Storage Water Heater Name Plate and Model Number**
- 5 The Parts of the Packaged Storage Water Heater**
  - How it works
- 7 Receiving your Packaged Storage Water Heater**
  - General Installation Instruction
- 10 Before Start-up**
  - Installation and hook-up
  - Start-up instructions
  - Safety features
  - Operation of storage water heater
- 14 Trouble-shooting Guide**
- 15 Maintenance Instruction**
  - Removing the tube bundle
  - Packaged Storage Water Heater component weights
  - Gasket installation
  - Tube bundle and bonnet installation
  - Preventive maintenance
  - Replacement parts
  - Material Safety Data Sheet
  - Contact Us
- Warranty**
- Manufacturers Cut-Sheets** (*Disclaimer: Some parts may vary from actual model*)

## **Operating and Installation Instructions (Pneumatic / Self-Contained)**

---

Congratulations on your purchase of a new Ace Packaged Storage Water Heater. In this book, we have included installation and maintenance instructions that, if followed, will provide you with many years of service from your new unit. Also included are instruction manuals for each of the controls furnished with the heater. Please read them carefully. They should be helpful in both the installation and service of this unit. Keep these instructions with the heater for future reference.

The Ace Packaged Storage Water Heater is of rugged construction, yet of simple design. The heater uses steam (or water) from a boiler to heat domestic hot water in the tank. The storage heater's temperature control system enables it to control the heated water within the tank at the desired temperature. This close control is accomplished by placing the temperature control element directly in the constant flow path of the circulated domestic water. The integral circulator constantly recirculates water over the heat exchanger.

Lined Packaged Storage Water Heaters feature construction with rust free austenitic stainless fittings and copper tubes for all domestic water contact surfaces, providing a high quality, low maintenance and an extremely cost effective domestic water heating package.

The heat exchanger tubes are rolled and flared into a carbon or stainless steel tube sheet. Each storage heater is constructed and stamped in accordance with Section VIII of the ASME Code, which is stamped on the vessel nameplate.

Experience in the field has proven that the Ace Packaged Storage Water Heater, if properly applied and maintained, will give many years of efficient, dependable and economical service.

## The Packaged Storage Water Heater Nameplate And Model Number

### The Packaged Storage Water Heater Nameplate

The following illustration is an accurate depiction of the nameplate found on the Packaged Storage Water Heater.

- A. NB or serial number
- B. Shell pressure
- C. Shell temperature
- D. Tube pressure
- E. Tube temperature
- F. Min. Atmospheric Pressure
- G. Atmospheric temperature
- H. Serial number
- I. Year built
- J. Model number
- K. Capacity
- L. Square feet
- M. Job number



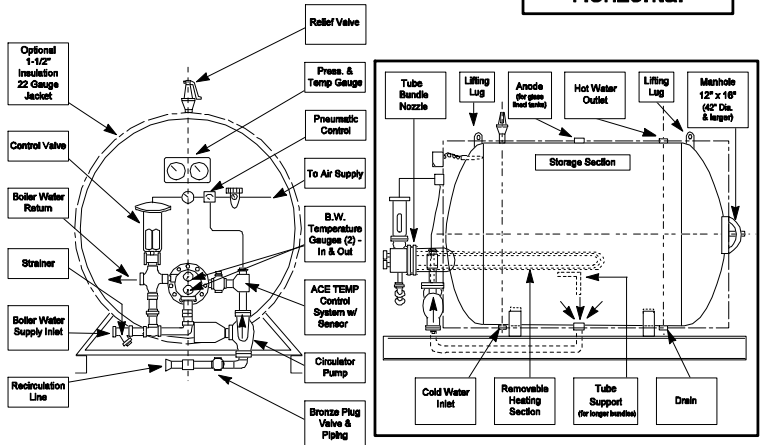
### The Packaged Storage Water Heater Model Number

**P H G 72 10 - G - 2. 1066 S A**

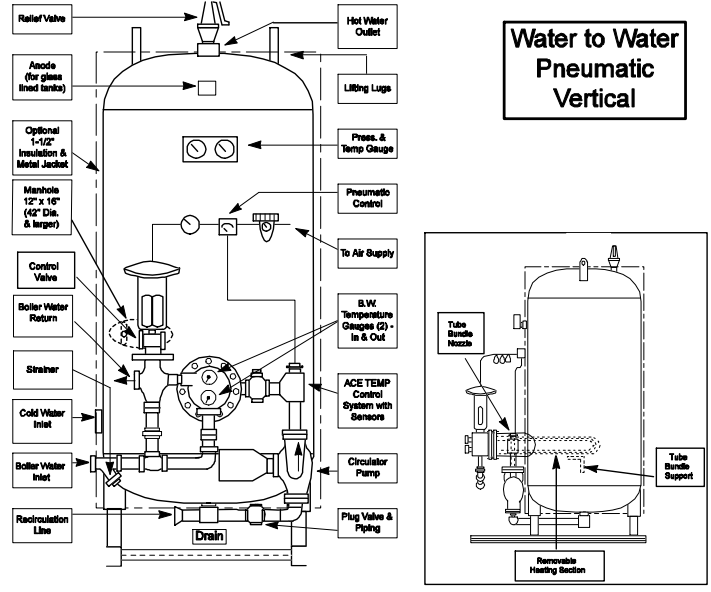
- P = Packaged
- H = Type (H = Horizontal, V = Vertical)
- G = Tank Design Pressure (G = 125, J = 150)
- 72 = Tank Diameter
- 10 = Shell Length in feet
- G = Lining Code (G = glass, K = pre-krete, U = unlined, C = cement, X = special, S = stainless)
- 2. = # of Passes
- 1066 = Coil model number (10 = diameter, 66 = length)
- S = Heating medium (S = steam, W = water, H = hi-temp water)
- A = Valve control (A = pneumatic, S = self-contained, P = pilot-operated)

# Parts of the Packaged Storage Water Heater (Pneumatic / Self-Contained)

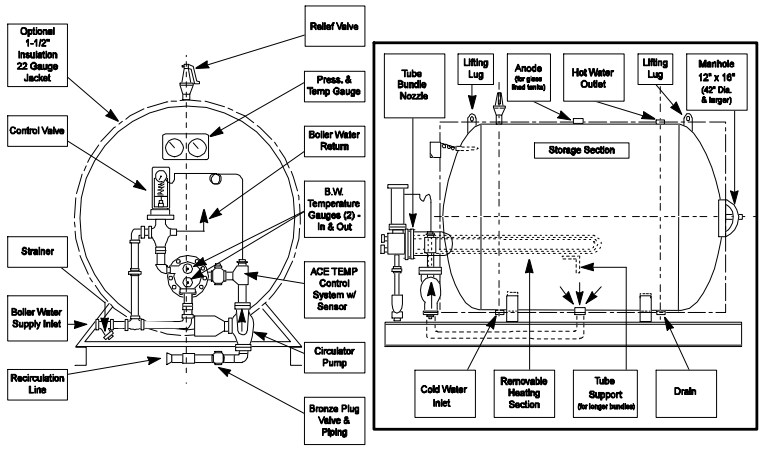
**Water to Water Pneumatic Horizontal**



**Water to Water Pneumatic Vertical**



**Water to Water Self-Operating Horizontal**



**Water to Water Self-Operating Vertical**

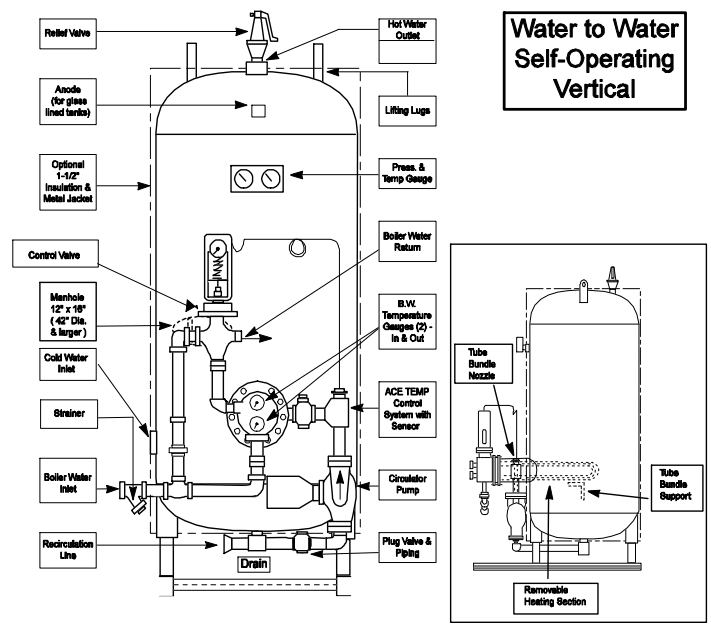


Diagram may vary from actual model

## **How It Works!**

The Packaged Storage Water Heater is designed to heat domestic hot water using existing plant steam or hot water. The control valve regulates the heating medium through the tube bundle.

As there is a demand for domestic hot water, the temperature control bulb will sense the drop in water temperature. The temperature bulb sends a signal to the control valve to open and allow steam or hot boiler water into the heat exchanger tube bundle. As the steam or hot water passes through the tubes, the domestic water in the tank is heated.

The circulator constantly circulates the domestic water over the heat exchanger coil, contributing to the heat transfer.

## Receiving Your Packaged Storage Water Heater

---

**Check Equipment Received.** Inspect the unit for any shipping damage. Make sure you have received all loose parts, such as listed on the “Bill of Lading”. Larger strainers and valves, usually 2-1/2” and above, are shipped loose. Note any damages or shortages on the bill of lading prior to signing it. If the unit is received damaged or missing parts, it is your responsibility to notify the shipping company and file a freight claim. Ace Heaters cannot send replacement parts for freight damaged or missing equipment as warranty items. Permission to return goods must be received from the factory prior to shipping. Goods returned without a Returned Goods Authorization number will not be accepted. Purchased parts are subject to replacement only under the manufacturer’s warranty. The warranty does not include the cost for labor, removal, or installation of the warranted part.

### General Installation Instruction



**NOTE:** *All electrical and piping installation should only be accomplished by qualified personnel following all applicable local, and state codes required for their installation.*

**Code Requirements:** It is very important that your installation comply with all federal, state and local codes as well as meet good industry practices as shown in publications issued by ASME, AGA, UL, ASHRAE, ABMA, etc.

**Placement:** The storage heater was either fabricated as a vertical or horizontal unit. It should be installed on a solid foundation, preferably a concrete pad. Provide adequate clearance for normal inspection and maintenance purposes and allow tube pull clearance to remove the exchanger for servicing. A minimum clearance of 24” is recommended from all accessories for ease of maintenance. Make sure the heater is level, from side to side and front to back. Use metal shims if necessary.

**Piping:** All piping to and from the heater must be provided with adequate supports and expansion compensation so that pipe stresses are not transmitted to the unit. The relief valve and the double-safety solenoid valve, if supplied, should be piped to a safe drain.

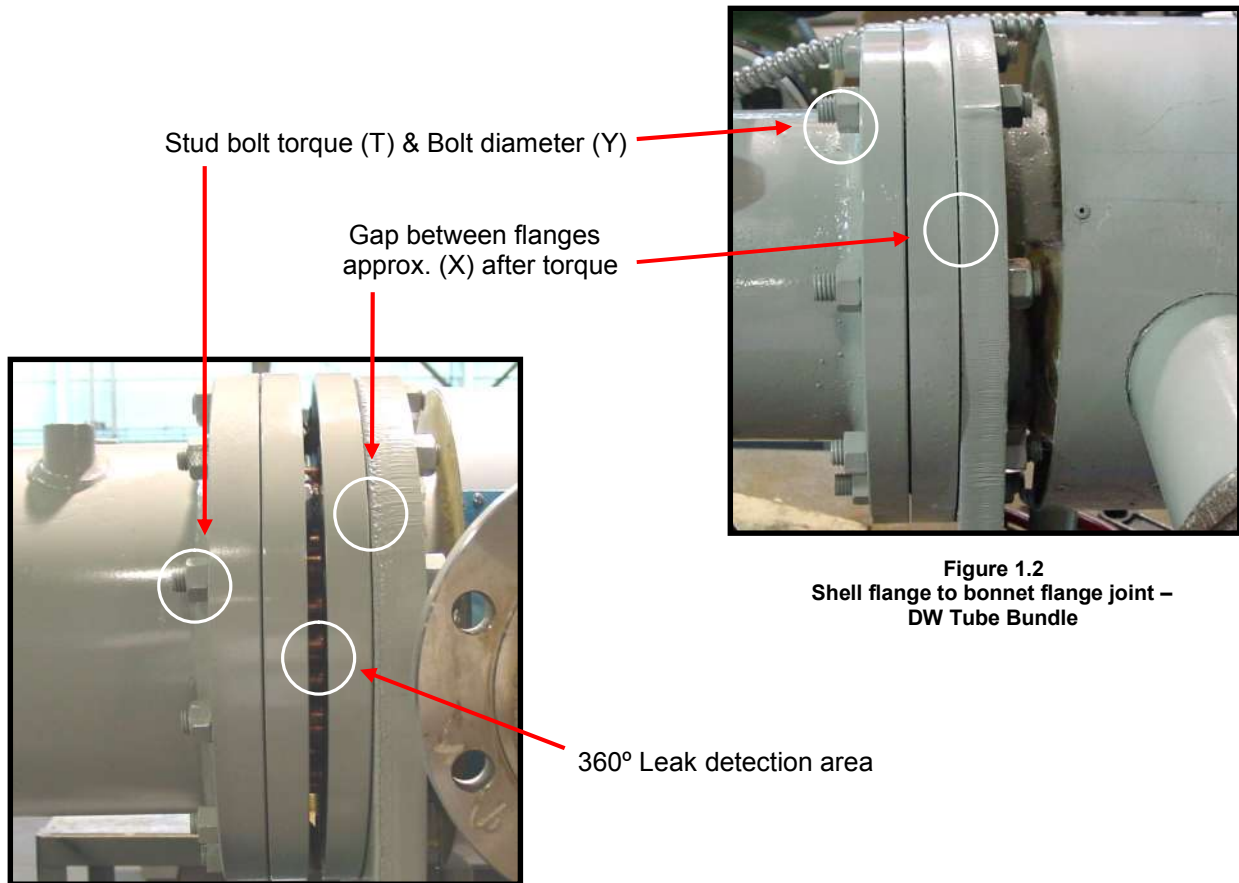
**Stud Nuts:** During shipment, the bonnet and shell flange nuts may loosen and should be re-tightened before start-up. Tighten these nuts to the torques specified later in this manual. After the unit has been in operation for a few days, check and retighten. Note: Bolting is independent on the bonnet and shell-side flanges through the use of a threaded tube sheet flange(s). Therefore, stud bolt nuts must be re-tightened on both sides. See Figure 1.1 for single wall bolting arrangement and Figure 1.2 for double wall bolting arrangement.

**Torque's:** The following are recommended bolt torque requirements

Bolt Size	Min Torque	Max Torque
1/2"	45 ft.lb	60 ft.lb
5/8"	90 ft.lb	120 ft.lb
3/4"	150 ft.lb	200 ft.lb
7/8"	240 ft.lb	320 ft.lb
1"	368 ft.lb	490 ft.lb
1 1/8"	533 ft.lb	710 ft.lb
1 1/4"	750 ft.lb	1000 ft.lb
1 1/2"	1200 ft.lb	1600 ft.lb

**Notes:**

- \* Spray each stud bolt and nut generously with penetrating oil before re-torque.
- \*\* Gasket thickness before compression. All partition gaskets are 1/8" in width before compression. All gaskets expand twice their width after compression.
- \*\*\* These are recommended torque values. Stud bolts must not be stressed above 60% of their yield strength.



**Figure 1.1**  
Shell flange to bonnet flange joint –  
SW Tube Bundle

**Figure 1.2**  
Shell flange to bonnet flange joint –  
DW Tube Bundle



**Water Connections:** Pipe cold domestic water in, hot out, and drain according to the cover drawing.

**Steam Piping:** Check the steam supply pressure. The steam supply pressure should not exceed the maximum pressure specified on the control valve, relief valve, or vessel nameplate.

**Condensate:** The condensate outlet of the steam trap is to be connected to condensate return line.

**Relief Valve:** The relief valve discharge must be piped to a floor drain to eliminate the potential of scalding burns. The drain line must be the same size as the relief valve outlet and have a downward slope to insure proper drainage. The drain line termination should be visible to see discharge. Check the relief valve nameplate. The unit's operating pressure cannot exceed that listed on the relief valve.

**Electrical:** Standard units only require power to the circulation pump. If optional electrical equipment such as a safety solenoid is included, power is to be wired according to the wiring diagram. Verify the electrical supply using a voltmeter. The voltage tie-in leads are indicated on the wiring diagram. This unit contains sensitive control components and should be protected by a suitable commercial grade surge protection device. The Packaged Storage Water Heater must be installed in accordance with the National Electric Code and in accordance with all state and local codes.

**Water Treatment:** We, the manufacturer of your packaged storage water heater, wish to call to your attention the necessity for a sound approach to proper water treatment. The packaged storage water heater uses boiler steam or hot water as its heating medium. On steam systems, boiler makeup water continuously introduces contaminants; scale forming solids, corrosive minerals and oxygen, which can cause corrosion or scale formation inside the packaged Storage Water Heater tube bundle. Whenever appreciable amounts of raw makeup water are continuously added to your system, we recommend that the problem be brought to the attention of a qualified water consultant. Proper treatment will insure longer product life and reduced maintenance.

## Before Start-up

---

### Installation and Hook-up

- 1 Place tank in location desired, and level tank carefully to insure levelness of heating coil loops which are installed in the tank. Provide sufficient clearance in front to permit removal of the tube bundle.
- 2 Remove temporary pipe plugs and caps from all tapping and discard. Inspect and clean all openings.
- 3 Install cold water supply line to bottom connection marked Cold Inlet on drawing. Install a gate valve and union for supply shut-off as desired.
- 4 Install hot water supply line to service from top connection marked Hot Outlet on drawing. A valve at this connection is desirable but not necessary.
- 5 Install relief valve(s) in top connection of tank, and pipe relief valve outlet(s) to a safe drain area.
- 6 Hook warm return circulation line to tee provided near pump if return line is to be used. A check and gate valve should be installed in return line, with flow through check valve toward generator.
- 7 Hook hot water or steam supply to upper coil supply line. A gate valve should be installed.
- 8 Hook up hot water return to boiler, or for steam, hook up condensate return to boiler condensate return tank. Pipe size to correspond to opening size provided. This pipe must run horizontal, or pitch gradually to condensate tank, with condensate level to be below tube or coil level in generator.
- 9 **CAUTION:** Do not introduce steam or water without having the safety relief valves installed on tank, as excessive pressure may result, with damage to tank or heating coil.
- 10 Water circulating pump should be wired to run continuously.
- 11 Storage water heaters are hydrostatically tested in accordance with code requirements, and are certified as satisfactory by inspection agencies agree upon by manufacturer and purchaser. However, normal yielding of gaskets will occur in the interval between hydrostatic testing in the manufacturer's shop and installation at the job site. Therefore, all external bolted joints should be properly retightened after installation and again after the exchanger has been heated, to prevent leaks and blowing out of gaskets. Follow industry recognized flange bolt tightening practices
- 12 In all installations, care should be taken to eliminate or minimize transmission of fluid pulsations and mechanical vibrations to the tank or tube bundle.
- 13 Install anodes (shipped loose) on all glass lined tanks. **Failure to install anodes will void warranty.**

## Start-up Instruction

- 1 It is assumed that installation is complete and that all connections have been made, including: electrical, water boiler, domestic water, instrument air, vents, drains and safety valve discharge lines. Prior to start-up inspect the strainer for any dirt, scale, welding particles or debris that may have accumulated during construction.
- 2 Make sure the power switch is in the "off" position.
- 3 Set the temperature on the Accritem pr valve to a minimal water temperature output, following instructions in the technical data sheet provided (factory does not preset).
- 4 If option is provided, adjust the high limit control 12° to 15°F higher than the desired hot water outlet temperature.
- 5 Close the shut-off valve on the bonnet side (heating medium side). Slowly introduce domestic water to the unit by opening the shut-off valves at the inlet and outlet of the shell. This will allow water to circulate in the shell. Open the relief valve when filling to purge the trapped air from the unit.
- 6 Plant boiler water is used as the heating medium and is controlled by the control valve, which in turn receives its signal from the temperature controller. If pneumatic, connect the air supply to the filter/regulator (minimum 35psi supply to the air pressure regulator). The instrument air supply gauge on the pressure regulator should be regulated to 30psi to the Accritem. If the control valve is equipped with a valve positioned these pressures will still apply. The outlet pressure gauge on the Accritem should read 30psi when fully opened, and 0psi when fully closed. Under normal operating conditions the outlet gauge reading will fall within this range.
- 7 Set the temperature knob on the Accritem to its lowest temperature setting. If self-contained, adjust the temperature adjustment nut on the valve to its lowest setting.
- 8 Turn on the system by turning the control panel switch to the "ON" position (the manual boiler water supply valve should be closed at this time). The green light should come on. Make sure the circulator pump is running. (Please refer to the pump instruction manual for details.) If pneumatic, the solenoid on the control panel will energize, allowing air to the control valve actuator, which in turn will open the control valve.
- 9 Turn on a number of hot water fixtures to establish a steady 50% load if possible, with at least a flow of 8 to 10GPM for the initial startup. Make sure these stay on and there is not an additional load applied elsewhere during initial startup.
10. Manually open the main boiler water shut-off valve upstream of the control valve and SLOWLY allow boiler water to pass through the control valve. Continue until the shut-off valve is 100% open.
- 11 The storage water heater will now function automatically, reacting according to demand fluctuations and will stabilize once limits are met.
- 12 Slowly increase the system temperature output by adjusting the temperature knob on the Accritem or temperature adjustment nut. Watch the temperature gauge on the front of the unit and wait for the temperature to stabilize prior to turning it up again. Repeat this procedure slowly until the desired outlet temperature set point has been achieved. Please note that the temperature knob on the Accritem may not be accurate to the actual water temperature (see gauge on shell). Once you have achieved your set point, it is recommended to loosen the set screw on the knob and reposition as necessary to indicate the actual (gauge) temperature on the Accritem face plate.
- 13 Once stabilized, turn off the hot water fixtures one at a time and watch the temperature gauge on the unit. There should only be slight temperature fluctuations. With no hot water fixtures on, the temperature gauge should remain stable. Watch the temperature for 5 minutes to verify the valve has closed. If the temperature slowly creeps up, the valve is leaking hot water and may have debris on the seat or the valve requires "zeroing". "Zeroing" the valve requires adjusting the stem length until the valve closes tightly.
- 14 If equipped with dual safety system, check the operation of the high limit safety control. Do this by rotating the temperature dial to its lowest setting and setting the Accritem control 20° above the high limit set point. Check that the temperature of the system matches the temperature set point of the high limit when it engages and shuts the control valve (the red high temp light will engage on the control panel as well). **Caution: Very hot water may splash as it is discharged;**

take the necessary precautions to avoid contact. Return the temperature dial to the desired set point.

- 15 Observe the entire system over a period of variable loads to determine if any calibration is necessary on the Accritem temperature controller. The sensitivity of this controller is adjusted by turning the restriction screw.
- 16 After start-up, inspect the strainer for any dirt, scale, welding particles or debris that may have accumulated and remove as necessary; *any debris can damage the valve seat or obstruct it from full shut-off, resulting in possible over-temp conditions and/or scalding.*
- 17 Check the flange bolt section for leaks. Tighten only enough to stop leakage. *Never tighten more than necessary. Excessive tightening will shorten the life of the gasket and stretch the studs.*

## Safety Features

- 1 The pneumatic hot water control valve is designed to fail safe (closed) in the event of a power failure.
- 2 The single safety solenoid (standard) closes the air line from the Accritem to the actuator upon an over-temp or power failure. The three-way valve also vents any air left in the actuator, thus ensuring full shut-off of the control valve.
- 3 The relief valve is designed to relieve the pressure in the system in the event the pressure gets too high.
- 4 The double safety solenoid is designed to dump the hot domestic water from the shell in the event that the water temperature exceeds the set point on the high limit control. This should be piped to a safe drain per local and state codes.

## Operation of Storage Water Heater

- 1 The entire system should be clean before starting operation to prevent plugging of tubes. Under some conditions, the use of strainers in the pipe may be required.
- 2 When placing unit in operation, open a vent and start to circulate the cold medium only. Be sure that the passages in the tank are entirely filled with cold fluid before closing the vents. The hot medium should be introduced gradually until all passages are filled with liquid or steam. Then close vents and slowly bring the unit up to temperature. (Relief valve or faucet may be used as a vent.)
- 3 Start operation gradually. Do not admit hot fluid to the unit suddenly when empty or cold. Do not stock unit with cold fluid when unit is hot.
- 4 Start the circulating pump (to run constantly). **Note: Do not run the circulating pump without water in the system, as this may damage the pump.**
- 5 Slowly turn on manual hot water or steam supply valve to coil and check for possible leaks in piping, flanges and gaskets.
- 6 Make sure the gate valve on auxiliary air vent and steam trap is open (if provided on the equipment).
- 7 Return line out of coil should start to warm up quickly, indicating boiler water or steam is heating tank.
- 8 The automatic hot water or steam control valve may require adjustment to set to desired tank temperature. If the tank does not get hot enough, the steam valve should be adjusted (screwed in) to a higher number. If the tank temperature is too hot, screwing out to a lower number will be necessary. See valve catalog for further instructions regarding maintenance and adjustments of the control valve. Once the temperature regulator is set, it will maintain a constant tank temperature by modulating the hot water or steam supply to any demand or temperature change of the water stored in the tank, up to the capacity of the coil to produce hot water.
- 9 Ordinarily, once the temperature regulator is set properly, and the strainers and valves are clean and operating properly, no further attention is needed for several months of operation.
- 10 Do not operate equipment under conditions in excess of those specified on nameplate.
- 11 In shutting down, flow of hot medium should be shut off first. If it is necessary to stop circulation of cooling medium, the circulation of hot medium should also be stopped, by bypassing or otherwise.
- 12 When shutting down the system, all fluids should be drained to minimize the possibility of freezing and corrosion. To guard against water hammer, condensate should be drained from steam heaters and similar apparatus when starting up or when shutting down. To minimize water retention after draining the tube side of water cooled exchangers should be blown out with air.

## Trouble-shooting Guide

---

- a **Water temperature too high**
  - 1 Check the setting of the pilot controller and adjust the hand wheel as necessary.
  - 2 Confirm steam supply pressure to the valve does not exceed that specified in the List of Materials.
  - 3 Bad sensing element.
  - 4 Check bleed port for proper orifice fitting (No. 4A) and/or plugging.
  - 5 Check for dirt under valve seats.
  - 6 Valve disc is worn.
- b **Banging or pinging**
  - 1 Check steam traps for proper operation.
  - 2 Check for proper condensate drainage. Clean out all dirt and debris.
  - 3 Check for back pressure in the condensate line.
- c **Erratic temperature control**
  - 1 Make sure the circulator pump is pumping.
  - 2 Check for proper direction of the circulator pump. The pump should be flowing from the tank to the nozzle neck.
  - 3 Check steam traps for debris and proper operation.
  - 4 Confirm steam supply pressure to the valve is steady and agrees with that specified in the List of Materials.
  - 5 The hand wheel on the pilot controller needs adjustment.
  - 6 Check the control temperature bulb for exterior scale or build up and clean if necessary.
  - 7 Check for debris in pilot and valve.
- d **Poor recovery**
  - 1 Check the setting of the pilot controller and adjust the hand wheel as necessary.
  - 2 Confirm steam supply pressure to the control valve meets that specified in the list of materials. Check for a clogged strainer, a partially closed supply valve or other obstructions.
  - 3 Make sure the packaged storage water heater is not trying to supply more hot water than it was designed for. (See performance listed in List of Materials).
  - 4 Check to make sure that the proper bleed port orifice fitting (No. 4A) is on the unit. (See the pilot Technical Data Sheets enclosed).
  - 5 Check for plugging of the control pipe and the orifice in the No. 5A restriction flow elbow.
  - 6 Check the steam trap for any foreign matter and functionality.
  - 7 Main valve diaphragm may be broken. Test with air or water before dismantling.
  - 8 Shut unit down, remove bonnet and coil. Inspect for scale and fouling, which restrict heat transfer. Clean with an approved chemical treatment
- e **Control valve not closing**
  - 1 Check the setting of the pilot controller and adjust the hand wheel as necessary.
  - 2 Confirm steam supply pressure to the valve does not exceed that specified in the List of Materials.
  - 3 Check bleed port No. 4A for proper orifice fitting and/or foreign matter.
  - 4 Check the thermostatic sensing element for kinks & operability.
  - 5 Main valve or pilot may be held open by foreign debris.
  - 6 Valve disc is worn.

## Maintenance Instruction

---

The following service is recommended for proper and safe use of this equipment monthly or more often.

- 1 Open relief valve(s) momentarily by lifting try lever to be sure valve(s) will open and are operational.
- 2 Check tank pressure gauge. Pressure of system should not exceed pressure rating on tank or relief valve name plate.
- 3 Check steam pressure gauge to confirm steam supply is adequate. (Gauge will not show pressure except while system is heating, as pressure connection down stream of automatic steam valve.) Check tank thermometer, preferably when hot water demand is low, to verify that the steam valve is functioning to control temperature of tank within desired limits.

**NOTE:** Tank is supplied with temperature or pressure relief valve(s) which will open automatically should the water temperature exceed 2100°F or rated relief valve pressure.

- 4 Open drain valve at rear of tank for about ½ minute, and flush to drain to remove any mud or sludge from circulation line and bottom of tank.
- 5 Oil pump motor with 6 to 10 drops of S.A.E. 30 non-detergent motor oil, in each of 2 oil cups on motor.
- 6 Oil pump bearing housing with 1 or 2 teaspoons of oil of S.A.E. 30 motor oil as above, in pump bearing oil cup. **CAUTION:** Do not over-oil motor bearings, as this will result in rapid dust collection and overheating of motor.
- 7 Clean pump motor air intake and exhaust slots with a soft brush or vacuum cleaner.
- 8 Inspect anodes on glass lined tanks. Replace anodes if 5/8" or less in diameter. Failure to maintain anodes will void warranty. Keep all records of anode inspection and replacement for warranty guarantee.

### Yearly Maintenance

A thorough cleaning of interior of tank and exterior of tank coil surfaces should be performed as required, or after the first year's service, to establish a basis for future need of services.

TO CLEAN TANK, PROCEED AS FOLLOWS:

- 1 Shut off steam or boiler water supply to tank coil.
- 2 Shut off cold water supply to bottom of tank.
- 3 Shut off hot water supply valve at top of tank if one is used.
- 4 Turn off electric supply to circulating pump.
- 5 Open drain valve at bottom rear of tank and relieve pressure on tank.
- 6 Open relief valve on top of tank, or remove it by unscrewing valve, to allow air to enter tank so water will drain freely, and drain tank fully.
- 7 Remove one manhole bolt and crab assembly, and loosen other bolt about ½"
- 8 With a block of wood about ½" long and a #2 hammer, hold the manhole cover and tap to break the gasket loose, and dislodge cover from manhole ring. This cover may now be pushed into the tank and remove to outside, by rotating the manhole cover after removing the crab from bolt, and using the bolt for a handle to prevent dropping the cover within tank. The interior of tank may be viewed thru the open manhole. If the tank is cement lined, any sludge, mud, or other deposits may be washed out thru the drain, and lining scrubbed off with a coarse brush or wire brush. The copper tank coil should be inspected for buildup of sediment or lime deposits on the tubes.

- 9 A new manhole gasket will probably be required when replacing the manhole cover. To facilitate replacement of the manhole gasket, and cover, it will be helpful to tape the gasket to the cover with 4 pieces of adhesive tape, to avoid slippage of gasket from cover. Gasket and cover should be centered carefully before tightening bolts, to avoid gasket leaking or blowing out.
- 10 Oil and tighten bolts moderately, refill tank and allow pressure to build up on tank before attempting to fully tighten bolts, as the water pressure will help seal the gasket.

## Maintenance of Tube Bundle

### Inspection of Unit

Frequently and at regular intervals, observe interior and exterior conditions of all tubes and keep them clean. Tube cleaning negligence may result in complete stoppage of flow through some tube, with consequent overheating of these tubes and compared to surrounding tubes, resulting in severe expansion strains and leaking tube joints.

### Indication of Fouling

Tube bundles subject to fouling scaling should be cleaned periodically. A light sludge or scale coating on the tube greatly reduces its effectiveness. A marked increase in pressure drop and/or reduction in performance usually indicate cleaning is necessary. (Assuming the unit has been checked for air or vapor binding and this has been found not to be the cause.) Since the difficulty of cleaning increases rapidly as the scale thickens or deposit increases, the intervals between cleaning should not be excessive.

### Access to Tubes

To clean or inspect inside of tubes, remove the cap.  
**CAUTION:** Do not loosen heads until you are sure all pressure is off equipment, and the unit is drained.

### Tube Bundle Removal

When removing the tube bundle from the tank for inspection or cleaning, care should be exercised to see it is not damaged by improper handling. Tube bundles are often of great weight, yet the tubes are small and of relatively thin metal. The bundle, therefore, should rest on parts designed to carry it, i.e., on the tube sheets, baffles, or support plates. For withdrawing tube bundles from the tank, the use of steel eye bolts which are screwed into the tube sheet is recommended for the attachment of the cable or other pulling devices. Steel rods inserted through the tubes, and bolted to a bearing plate at the end of the bundle may also be used. When steel cables are used for lifting vertical tube bundles, the cable should be attached to the lifting eyes where possible. An alternate method is to use

steel rods as described above. If the tube bundle has been in service for a considerable length of time without being removed, it may be necessary to use a hydraulic jack on the tube sheet to get it started. A good-sized steel bearing plate should be inserted between jack and tube sheet and tube ends should be protected by means of a filler board.

### Handling Tube Bundles Outside Shell

Do not handle tube bundles with hooks or other tools, which might damage tubes. Bundles should be moved out on cradles or skids. Horizontal tube bundles should be lifted by means of suitable slings. Baffles can be easily bent and damaged by dragging a bundle over a rough surface. Since the proper functioning of the apparatus depends upon a close fit between the outside of the baffle and the inside of the shell, any damage to the baffles must be carefully avoided.

### Cleaning Procedures

- 1 Do not attempt to clean tubes by blowing steam through individual tubes. This overheats the tube and results in the same expansion strains and leaks as for plugged tubes.
- 2 Do not blow out tube bundle with air when fluids normally handled are inflammable.
- 3 In cleaning a tube bundle, tube should not be hammered on with any metallic tools. In case it is necessary to use a scraper, care should be exercised to see that the scraper is not sharp enough to cut the metal of the tubes.

### Tube Rolling

To tighten a loose tube joint, use a suitable roller type tube expander. Do not roll tubes that are not leaking, as it needlessly thins and work hardens the tube wall.



## Gasket Replacement

Gasket and gasket surfaces should be thoroughly cleaned and should be free of scratches and other defects. Gasket should be properly positioned before attempting to retighten bolts. It is recommended that when a heavy heat exchanger is dismantled for any purpose, it needs to be reassembled with new gaskets. This will tend to prevent future leaks and/or damage to the gasket-seating surface of the heat exchanger. Composition gaskets become dried out and brittle so that they do not always provide an effective seal when re-used, they may provide an imperfect seal or result in deformation and damage to the gasket contact surface of the exchanger. Follow industry recognized flange bolt tightening practices.

## Lifting and Pulling Mechanisms

The following are safe loads for steel rods and eye bolts:

### Rods:

Size Tubes	Size Rods	Safe Load per Rod
5/8"	3/8"	1,000lbs.
3/4"	1/2"	2,000lbs.
1" – larger	5/8"	3,000lbs.

### Eye Bolts:

Size	Safe Load
3/4"	4,000lbs.
1"	6,000lbs.
1 1/4"	10,100lbs.
1 1/2"	15,000lbs.

## Cleaning Methods

Provide convenient means for cleaning tube bundle frequently as suggested below:

- 1 Circulating hot wash oil or light distillate through and over the tube at high velocity will effectively remove sludge or other similar soft deposits.
- 2 Circulating hot fresh water may wash out soft salt deposits.
- 3 Some commercially available cleaning compounds may be used to assist in removing sludge or coke, provided hot wash oil or water, as described above, does not give satisfactory results.
- 4 Removal of various scales and foreign material by chemical cleaning is now being quite extensively practiced. Certain qualified organizations will check the nature of deposits to be removed, furnish proper acid solutions containing inhibitors, and provide equipment and personnel for a complete apparatus and piping cleaning job.
- 5 If none of the above methods are effective for the removal of a hard scale, coke, or other deposits, mechanical means may be used.

## Material Safety Data Sheets

Some of Ace Heaters' products contain materials that have been recognized as posing health risks. Material Safety Data Sheets for these materials are available from your local Manufacturer's rep. When requesting this information, be sure to have the model number and serial number available.

If you do not know who your local Manufacturer's Rep is, you can find out by logging into the <http://www.aceheaters.com> website, and clicking on the Representative tab found in the table of contents.

**Ace Heaters LLC**  
**130 Klug Circle**  
**Corona, CA 92880**  
**Phone: 951.738.2230**  
[www.aceheaters.com](http://www.aceheaters.com)



## FACTORY LIMITED WARRANTY POLICY

The Ace Factory limited warranty provides assurance that all products are free from manufacturer defects at the time of shipment and meet specifications and performance described in the product literature.

It is important to understand the difference between a factory warranty and an installed warranty. There are many factors that can occur to the products after they are shipped that the company has no control over and can not fully verify. These includes:

1. Hidden damage during the shipping.
2. Handling damage.
3. Damage during storage.
4. Installation conditions.
5. Other unknown variables in the system design: maintenance, pulsation and vibrations.

The installed warranty is the responsibility of the architect, specifying engineer, contractor and/or owner who jointly have control over the application, installation, location, operating and maintenance conditions.

The Ace Heaters, LLC warranty excludes extended liabilities. Extended liability typically occurs when products are installed without proper drainage, flooding containment or when safety devices are not tested and repaired or replaced when needed.

Product problems are often caused by the condition of the water, the lack of water treatment and/or the improper treatment of the water, insufficient combustion air, improper draft conditions, bolts not re-tightened, pipes not flushed and cleaned of oil, metal chips, rags, vibration and pulsation etc. These are installation, operating and/or maintenance conditions that are beyond the seller's responsibility and are not covered by the factory warranty, but may be covered by the installer's warranty.

The factory warranty covering company products is based upon extensive product development and testing. Combustion products under go certification testing and approvals to Underwriters Laboratory (UL) standards. Auditing of the production of combustion products is conducted by a nationally recognized testing laboratory.

Pressure vessel products are designed and manufactured to American Society of Mechanical Engineering (ASME) and National Board (NB) Design standards. Design reviews, factory product manufacturing quality inspections and testing are carried out by a third party National Board authorized inspection agency.

Ace Heaters, LLC products have proven themselves in service for over 85 years which indicates that the company products perform exceedingly well when normal installation, operating and maintenance conditions exist.

The following is a review from the terms and conditions of sale. Also included in paragraph two, below, is the Ace Heaters LLC nonconformance policy.

1. Ace Heaters, LLC warrants its products against defective material and/or workmanship only. The warranty does not apply to operational failures, electrical failures, gasket leaks, and/or other malfunctions caused by improper application, installation and/or maintenance.
2. It is the buyer's responsibility to inspect and accept the product, when received, as conforming to their purchase order, specifications and approved drawings. All claims for non-conformance, errors, shortages, etc. must be made within 10 days after receipt of the shipment.
3. Ace Heaters, LLC do not provide a warranty or guarantee, express or implied, in any manner, form, usage of trade, merchantability or fitness which extend beyond the product description and quotation.
4. Ace Heaters, LLC liability is limited to the factory repair or replacement of warranty failures, or non-conformance, upon the return of the product to the factory.
5. Ace Heaters, LLC is not liable for any direct or consequential damages.
6. Ace Heaters, LLC warranty is based upon section 23161(2) of the uniform commercial code and is printed in the terms and conditions of sale which is referenced in every quotation, on the back of sales order acknowledgements and invoices. It is legally correct and is an industry standard policy.

s



# WARRANTY

Limited

Ace Heaters, LLC provides a limited warranty on its products against **defective material and/or workmanship only**. This limited warranty is not applicable to operational failures, electrical failures, gasket leaks, wear or malfunctions caused by improper application, storage, installation, and/or maintenance.

Product Period - The following Limited Warranty period are from date of shipment:

**Tanks**

**Tanks - Carbon Steel:** One Year

**Tanks - Stainless Steel:** Three Years

**Storage Water Heaters Single-wall or Double-wall Tank/Exchanger Coils:** One Year

**Clean Steam Generators:** One Year

**Linings:** (Pro-rated Warranty)

*Magnesium Anodes must be used at all times to maintain the Limit Warranty*

**Section VIII Tanks:**

Epoxy: 30" dia. and above (Three years)

Glass: 24" dia. and under (One year).

Glass: 30" dia. and above (Five years).

Cement: (Five years).

Pre-Krete: (Ten years).

**Section IV Tanks: SW Model Only**

Glass (One year) & Epoxy (Three years).

**Minipacks™ Single-wall or Double-wall:** One Year

**Shell & Tube Heat Exchangers Single-wall or Double-wall:** One Year

**Atlas™ Series Condensing Boiler (Heat Exchanger):** One Year

**Triton™ Series Near Condensing Boiler (Heat Exchanger):** Twelve Years

**Liberty™ Series Condensing Boiler (Heat Exchanger):** Ten Years

**B-Series Copper Fin Boiler:** Three Years

**Controls:** Components manufactured by other than Ace Heaters, LLC such as controls, instruments, forced draft burner, etc., provided with the boilers and packaged products are not covered by the Ace Heaters, LLC Warranty. However, Ace Heaters, LLC extends to the customer the same warranty provided by the manufacturer to Ace Heaters, LLC. The customer shall receive the full benefits of adjustments made to Ace Heaters, LLC by the manufacturer.

Any claim for adjustment under this limited warranty must be made within the warranty period. Ace Heaters, LLC's liability shall be limited to factory repair or, at Ace Heaters, LLC's option, replacement of all parts which, upon test and examination by Ace Heaters, LLC, prove to be defective material and/or workmanship and within the above limited warranty. If required by Ace Heaters, LLC, parts which are claimed to be defective must be promptly delivered to the Ace Heaters, LLC facility, transportation charges prepaid. This warranty does not cover the cost of labor, removal, or installation of the warranted item during the limited period. This warranty is limited to the above and applies only for the period set forth. Ace Heaters, LLC will not be liable for any loss damage, direct, incidental or consequential damages of any kind, whether based upon warranty, contract, negligence or strict liability and arising in connection with the sale, use or repair of the products. Ace heaters's maximum liability shall exceed the contract price for the product's merchantability or fitness for any particular purpose and in no event shall be held responsible for any consequential damages.

For complete Limited Warranty conditions see Section G and H under terms and condition of sale.

Ace Heaters, LLC, also doing business as Ace Heaters, LLC, is referred to herein as Ace Heaters, LLC



**Ace Heater, LLC**

130 Klug Circle, Corona CA 92880

PHONE: (951) 738-2230 • FAX: (951) 281-4959

[www.aceheaters.com](http://www.aceheaters.com)

Ace Heaters, LLC

# WARNING

## PRODUCT SAFETY NOTICE

### ACE BOILER AND WATER HEATER PRODUCTS OPERATE AT HIGH TEMPERATURE AND PRESSURES

- Before using this product, read and understand instructions. Save these instructions for future use.
- Before servicing, to prevent serious burns or injury, the boiler and water heater products must be cooled to less than 80°F (27°C) and the pressure must be 0 psi (0 bar).
- Turn off the electrical power before making electrical connections to prevent electrical shock.
- These products must be placed in a controlled location where untrained or unqualified personnel cannot access the operating or safety controls, must not be able to come in contact with high temperature or high pressure parts and must not perform maintenance or demolition work.
- All work performed must be by qualified properly equipped personnel trained in the proper application, installation, and maintenance or demolition of plumbing, steam, and electrical equipment and/or systems in accordance with all applicable codes and ordinances.
- ACE Boilers and Water Heaters are complete package units with safety and operating controls and are constructed with non ASBESTOS materials. Any replacement gaskets, refractory, insulation, etc used must not contain Asbestos.
- No additional insulation is required on the Boilers and Water Heaters.
- Additions or replacement of insulation on any connecting pipes or accessories to the Boilers and/or Water Heaters must be of "NON-ASBESTOS" and contain only non-hazardous materials.
- Crystalline Silica, a material known to cause cancer, may be encapsulated in some refractory or insulation materials and must be handled only by authorized trained personnel. Crystalline Silica as used is encapsulated and is not harm full in this form. Care must be taken during removal or replacement of refractory or insulation to remove it in bulk form and avoid generation or inhalation of dust. Removal must be properly performed by trained, qualified and equipped personnel. This is also true of Asbestos not contained in ACE products but may be otherwise contained in replacement materials or parts, in connecting piping or other nearby products.
- All safety and operating controls must be set within the specified operating limits and tested periodically to assure proper operation. All limit and operating controls must be installed in series on the boiler.
- Connect drain pipes to a safe drain to prevent serious personal injury from relief valve discharge and or from boiler blow down discharge.
- After installation, check for proper operation of all limit and operating controls before leaving the site.
- Perform scheduled and annual inspections including checking Controls for proper calibration and performance.

**Failure to follow these warnings, to allow access by unauthorized persons and the use of non-properly trained and equipped personnel in the operation, service, modification, removal or demolition of these products or replacement of parts with non-authorized factory non-asbestos materials could cause damage, personal injury or death.**



**Ace Heaters. LLC**  
www.aceheaters.com

### MXG461...U, MXF461...U Series

#### Modulating Control Valves with Magnetic Actuators



1H42100P06



1H42100P06

MXG461...U

MXF461...U

**Description** Mixing or straight-through valves with magnetic actuators for modulating control of hot and chilled water systems in closed circuits.

- Features**
- Fast positioning time (one second), high-resolution stroke (1:1000).
  - Linear or equal-percentage valve characteristic (user-defined).
  - Switch-selectable control signal: 0 to 10 Vdc, 2 to 10 Vdc, or 4 to 20 mA.
  - Wear-free inductive stroke measurement.
  - Heavy-duty, no maintenance required.
  - Fail-safe feature: A → AB closed when de-energized.
  - Positioning control.
  - Position feedback.
  - Manual control.

**Product Numbers** See Table 1.

#### Warning/Caution Notations

<b>WARNING:</b>		Personal injury or loss of life may occur if you do not follow the procedures as specified.
<b>CAUTION:</b>		Equipment damage or loss of data may occur if you do not follow the procedures as specified.

#### Application

The MXG461...U (screwed fitting) and MXF461...U (flange fitting) valves are mixing or straight-through valves with a factory calibrated and mounted magnetic actuator. The magnetic actuator incorporates an electronics module for position control and positioning feedback. Control path A → AB is closed when the valve is de-energized.



#### CAUTION:

The valve is suitable for straight-through normally closed or three-way applications and may be installed only in a mixing arrangement. The direction of flow (A → AB) must be as indicated on the valve.

The fast positioning time, high resolution and high rangeability make these valves ideal for modulating control of chilled and hot water systems in closed circuits. Sturdy construction makes maintenance and regular servicing unnecessary and ensures a long service life.

#### Ordering

When using a 2-1/2 inch flanged valve in a straight-through application, a blanking flange is required for the third port. If required, order Z155/65 separately.

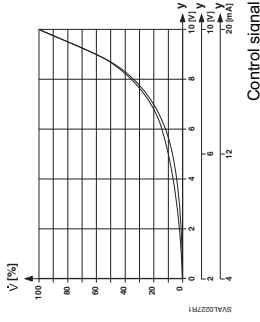
For screwed valves, no additional ordering is required. The components required to create a straight-through valve are included with the valve.

#### Principles/ Construction Automatic Control

The control signal is converted by the microprocessor in the electronics module into an output signal that generates a magnetic field in the core. This causes the only moving part, the armature, to change its position in accordance with the interacting forces (magnetic field, counter-spring, hydraulics, and so on). The armature responds rapidly to any change in signal, transferring the corresponding movement directly to the control disc, enabling fast changes in load to be corrected quickly and accurately. The valve position is measured continuously. The positioning controller ensures an exactly proportional relationship between the control signal and the valve stroke.

#### Valve Characteristic

##### Volumetric flow



##### Volumetric flow

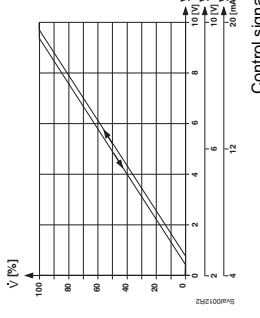


Figure 1. Equal-percentage.

Figure 2. Linear.

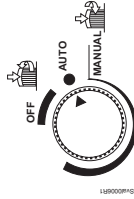
In the event of a power failure, or if the power is switched off, the spring force closes the valve automatically (control path ports A → AB normally closed).

**Manual Control**

The valve control path (ports A → AB) can be opened mechanically up to 95% of the full stroke by pressing the handwheel inward and turning it clockwise (to the MANUAL position). This disables the control signal from the controller.

To disable automatic control of the valve, press the handwheel inward and turn it counterclockwise (to the OFF position). The valve will close.

For automatic control, the handwheel must be set to the AUTO position (the handwheel will spring out).



**Figure 3. Selecting Automatic Control.**

**Sizing** Table 1. MX.461...U - Valves Sizing.

Product Numbers	Line Size (in)	Cv	Δ P <sub>Vmax</sub> (psi)	Maximum Close-off Pressure (psi)	P <sub>NA</sub> <sup>1</sup> (VA)	P <sub>med</sub> <sup>1</sup> (VA)	P <sub>NT</sub> <sup>1</sup> (VA)	Wire Gauge			
								18	16	14	12
MXG461.15-0.6U	1/2	0.7	44	3	22	4	38	108	213	361	525
MXG461.15-1.5U	1/2	1.7	44	3	22	4	38	108	213	361	525
MXG461.15-3.0U	1/2	3.5	44	3	22	4	38	108	213	361	525
MXG461.20-5.0U	3/4	5.8	44	3	43	22	4	38	108	213	361
MXG461.25-8.0U	1	9.3	44	3	43	22	4	38	108	213	361
MXG461.32-12U	1-1/4	14.0	44	3	43	22	4	38	108	213	361
MXG461.40-20U	1-1/2	23.0	44	3	43	36	7	60	66	118	197
MXG461.50-30U	2	35.0	44	3	43	36	9	60	66	118	197
MXF461.65-50U	2-1/2	58.0	44	3	43	45	12	75	49	98	184

**Key:**

- Δ P<sub>Vmax</sub> = Maximum admissible pressure differential with valve closed
- P<sub>VA</sub> = Nominal power at 113°F (45°C)
- P<sub>med</sub> = Mean operating power
- P<sub>NT</sub> = Nominal transformer power
- Cv = Flow rate to IEC534-2-4
- Control path A → AB (normally closed); Tolerance ±5%
- Control path B → AB (normally open); Tolerance ±10%
- L = Maximum cable length. With four-wire connections, the maximum permissible length of the separate 16 AWG Cu (copper) signal cable is 656 feet. With three-wire connections, the maximum permissible cable length is reduced to 1/3 of the values shown in the table.
- 1 = All data relates to a 24 Vac supply.

**Table 2. Water Flow Chart.**

Product Number	Line Size (in)	Δ P <sub>Vmax</sub> C <sub>v</sub>	PSI															
			1	2	3	4	5	6	7	8	9	10	15	20	30	40	50	
MXG461.15-0.6U	1/2	0.7	1.2	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.7	3.1	3.8	4.4	4.9	—		
MXG461.15-1.5U	1/2	1.7	2.4	2.9	3.4	3.8	4.2	4.5	4.8	5.1	5.4	6.6	7.6	9.3	10.8	12		
MXG461.15-3.0U	1/2	3.5	4.9	6.1	7	7.8	8.6	9.3	9.9	10.5	11	14	16	19	22	26		
MXG461.20-5.0U	3/4	5.8	8.2	10	12	13	14	15	16	17	18	22	26	32	37	—		
MXG461.25-8.0U	1	9.3	13	16	19	21	23	25	26	28	29	36	42	51	59	—		
MXG461.32-12U	1-1/4	14	20	24	28	31	34	37	40	42	44	54	63	77	89	—		
MXG461.40-20U	1-1/2	23	33	40	46	51	56	61	65	69	73	89	103	126	145	—		
MXG461.50-30U	2	35	35	49	61	70	78	86	93	99	105	111	136	157	192	221		
MXF461.65-50U	2-1/2	58	58	82	100	116	130	142	153	164	174	183	225	259	318	367		

The two-color LED display indicating operating status can be viewed by opening the cover of the electronics module.

**Table 3. LED Display.**

LED Display	Status	Description
LED green	On continuously	Automatic mode: Auto (normal, no faults)
	Flashing	— Mechanically set to MANUAL — Mechanically set to OFF
LED red	On continuously	— Currently in auto-calibration mode — General fault — General calibration fault — Microcontroller fault
LED	Flashing	— Faulty 24 Vac supply (that is, too low)
	Off	— No 24 Vac supply — Fault with electronics module

As a general rule, the LED can only assume the conditions in Table 3 (continuously red or green, flashing red or green, or off).

**Mounting**

Mounting and operating instructions are printed on the actuator and on the electronics module.

The valve is suitable only for straight-through or three-way applications and may be installed only in a mixing arrangement. In the case of the straight-through valve, strict observance of the direction of flow is essential.

Do not mount with actuator below horizontal position.

**Access for Mounting**

It is essential to maintain the specified minimum clearance above and to the side of the actuator and/or electronics module for servicing, installing and heat dissipation:

- 1/2-inch to 1-1/4 inches = 4 inches
- 1-1/2 inches to 2-1/2 inches = 6 inches

Also see *Dimensions*.

### Mounting, Continued Straight-through Valves

Only three-way MX461...U valves are supplied. They may be used as straight-through normally closed valves by closing off port "B".

Port "B" can be sealed with a Z155/65 blanking flange and gasket.

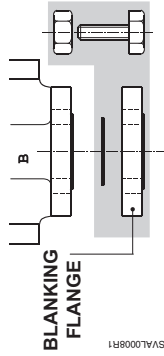


Figure 4. MXF461...U Flanged Valves in Straight-through Applications.

Port "B" can be sealed with the accessories supplied (blanking disk, gasket, and the nut).

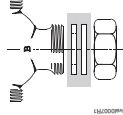


Figure 5. MXG461...U Screwed Valves in Straight-through Applications.

### Installation

MXG461...U screwed valves are flat-faced to facilitate sealing with the gaskets supplied.

Do not use hemp, tape or thread-sealing compound.

Do not insulate the actuator.

For notes on electrical installation, see *Terminal Layout*.

### Maintenance

The valves and actuators require no maintenance or service. The valve stem is sealed with a maintenance-free O-ring gland.

Should the valve electronics prove faulty, the electronics module should be exchanged for a replacement part, part number ASE1 (1/2-inch to 1-1/4 inches) or ASE2 (1-1/2 inches to 2-1/2 inches). Mounting instructions are enclosed (Ref. 35678).



#### WARNING:

Under operating conditions within the limits defined by the application data, the actuator will become hot, but this does not represent a fire risk. Always maintain the minimum clearance specified (see *Dimensions*).

### Specifications Electrical Interface

Power supply	Class 2 24 Vac, 50/60 Hz +20%–15%
Control signal (user-selected)	0 to 10 Vdc, 2 to 10 Vdc, or 4 to 20 mA
Software class	Class A
Position feedback:	See <i>Sizing</i>
Output	0 to 10 Vdc = 0 to 100% stroke
Maximum rating	2 mA
Non-linearity	±2% of full scale

### Product Specific Data

Applications	To EN60730
Nominal pressure	232 psi (16 bar)
Operating pressure $P_{op,max}$	145 psi (1 Mpa) (10 bar)
Pressure differential $\Delta P_{v,max}$	See <i>Sizing</i>
Leakage at $\Delta P_v = 14.5$ psi (0.1 Mpa) (1bar)	A → AB Max. 0.02 % $k_{vs}$ (to IEC534-4) B → AB Depends on application data (<0.2% C.)
Admissible media	Water, or water/glycol mixtures with maximum 50% glycol
Temperature of medium	36°F to 248°F (2°C to 120°C)
Valve characteristic (stroke, $k_{vs}$ )	Linear or equal percentage (user-selected), optimized in low opening range (to IEC534-2-4)
Stroke resolution $\Delta H/H_{100}$	1:1000 (H = stroke)
Hysteresis	Typically 3%
Type of operation	Modulating
Manual adjustment	Yes, with handwheel
Position with actuator de-energized	A → AB closed
Orientation	Upright to horizontal Note that orientation affects protection standard

### Positioning time

≤1 second

### Materials (valve body)

Housing parts	Cast iron
Inner valve	CrNi Steel
Seat	Brass
Valve stem seal	EPDM (O-ring)
Bellows	Tombac, bronze, CrNi steel

### Electrical connection

Connection terminal	Screw terminals
Per terminal, with wire (no lug)	2 x 16 AWG or 1 x 14 AWG
Per terminal with wire	2 x 16 AWG or 1 x 12 AWG

### Miscellaneous

Weight (including packaging)	See <i>Dimensions</i>
Dimensions	See <i>Dimensions</i>

### Ambient conditions

Maximum ambient temperature	113°F (45°C)
-----------------------------	--------------

### Agency Approvals

UL listing	Per UL 873
C-UL	Certified to Canadian Standard C22.2 No. 24
	Suitable for use in air handling spaces
	NEMA Type 1

### Wiring Terminals

#### WARNING:



Earth ground must be connected to the pipe work.

1	GO	1	24 Vac
2	G	2	24 Vac
3	Y	3	Control signal input
4	YM	4	Control signal reference voltage
5	X	5	0 to 10 Vdc stroke signal output (position feedback)
6	YF	6	Override control

Figure 6. Terminal Layout for Four-wire Connections.

### Wiring Diagram

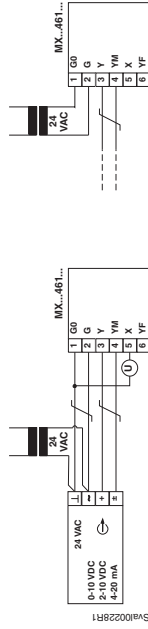
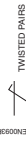


Figure 7. Connection to Controller with Four-wire Output.

= Indication of valve position (only where required). 0 to 10 Vdc → 0 to 100% volumetric flow



If the cables for the 24 Vac supply and the control signal 0 to 10 Vdc (2 to 10 Vdc, 4 to 20 mA) are routed separately, twisted pairs are not required for the 24 Vac cable.

### Forced Control Feature (Input Terminal YF/6)

0 Vac (Bridge G0 – YF) Control path A → AB closed  
24 Vac (Bridge G – YF) Control path A → AB open  
Continuously variable low limit control 10% to 90% volume flow (the higher value YF of Y takes priority).  
This function is available with valves with a manufacturing date of 990701 or later.

### Configuration Switches

**Switch**

**Off**

- 1 Characteristic Linear
- 2 Control signal 0 to 10 Vdc\*
- 3 Volts or mA 0(2) to 10 Vdc\*

**On**

Equal percentage\*  
2 to 10 Vdc or 4 to 20 mA  
4 to 30 mA  
\* Factory setting: equal percentage valve characteristic, 0 to 10 Vdc control signal.

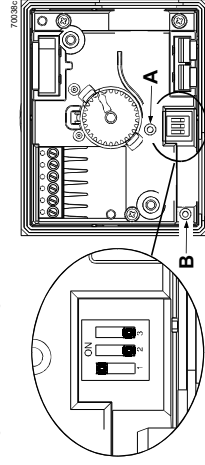


Figure 8. DIP Switches.

### Calibration

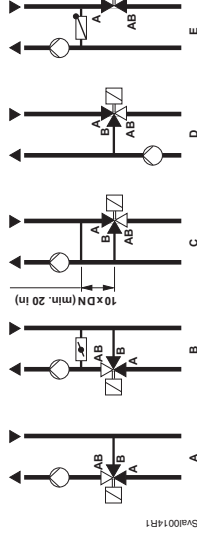
The MX...461...P magnetic valves are factory-calibrated at 0% and 100% stroke. When commissioning the valves (especially under extreme usage conditions) there may still be some leakage via control path A → AB with a 0% stroke control signal (0 Vdc, 4 mA or 2 Vdc). In this case, the valve can be recalibrated as follows (see Figure 8):

- Use a pin or paper clip to push the button in opening (A) in the terminal housing.
- During calibration, the LED light (B) in the electronics module will flash green for approximately 10 seconds. The valve will be briefly closed and fully opened.

### Application Example



**CAUTION:** This valve is suitable for straight-through normally closed or three-way applications only, and should only be installed in a mixing arrangement.



- A Mixing circuit  
B Mixing circuit with bypass (underfloor heating)  
C Injection circuit  
D Diverting circuit  
E Injection circuit with straight-through valve

Figure 9. Hydraulic Circuits.



**Service**

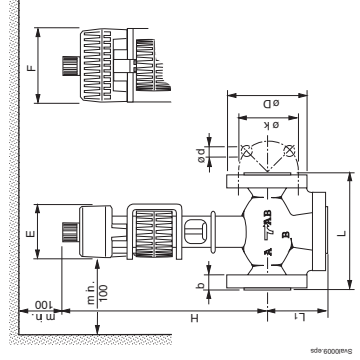


**CAUTION:**

Do not disassemble the valve and actuator combination. This assembly is factory-calibrated, and should only be replaced by qualified personnel.

**Dimensions**

All dimensions in inches (millimeters)



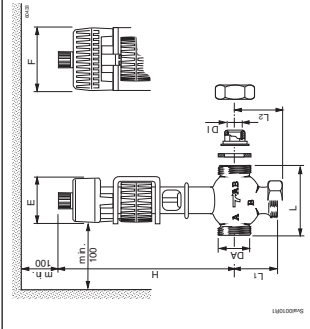
**Table 4. MXF461...U – Flanged Valve with Electronics Module.**

Product Number	L	L1	D	b	k	d	4X	H	E	F	Ibs (kg)
MXF461.65-50U	11.42 (290)	4.92 (125)	7.00 (177.8)	0.88 (22.4)	5.50 (139.7)	0.75 (19.05)		15.43 (392)	3.15 (80)	3.94 (100)	63.1 (28.6)

**NOTE:** Installer must supply counterflanges. Ibs. (kg) = Weight (including packaging)

**Dimensions, Continued**

All dimensions in inches (millimeters)



**Table 5. MXG461...U – Valves with Electronics Module.**

Product Number	DI	DA	L	L1	L2*	H	E	F	Ibs (kg)
MXG461.15-0.6U	1/2	1	3.15 (80)	1.67 (42.5)	2.01 (51)	9.45 (240)	3.15 (80)	3.94 (100)	8.4 (3.8)
MXG461.15-1.5U	1/2	1	3.15 (80)	1.67 (42.5)	2.01 (51)	9.45 (240)	3.15 (80)	3.94 (100)	8.4 (3.8)
MXG461.15-3.0U	1/2	1	3.15 (80)	1.67 (42.5)	2.01 (51)	9.45 (240)	3.15 (80)	3.94 (100)	8.4 (3.8)
MXG461.20-5.0U	3/4	1-1/4	3.74 (95)	2.07 (52.5)	2.40 (61)	10.24 (260)	3.15 (80)	3.94 (100)	9.3 (4.2)
MXG461.25-8.0U	1	1-1/2	4.33 (110)	2.22 (56.5)	2.56 (65)	10.63 (270)	3.15 (80)	3.94 (100)	10.4 (4.7)
MXG461.32-12U	1-1/4	2	4.92 (125)	2.66 (67.5)	2.99 (76)	11.22 (285)	3.15 (80)	3.94 (100)	12.3 (5.6)
MXG461.40-20U	1-1/2	2-1/4	5.51 (140)	3.17 (80.5)	3.70 (94)	12.60 (320)	3.94 (100)	4.72 (120)	20.5 (9.3)
MXG461.50-30U	2	2-3/4	6.69 (170)	3.68 (93.5)	4.29 (109)	13.39 (340)	3.94 (100)	4.72 (120)	26.2 (11.9)

\* When used as a straight-through valve

Ibs. (kg) = Weight (including packaging)

Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Other product or company names mentioned herein may be the trademarks of their respective owners.

© 2006 Siemens Building Technologies, Inc.  
Siemens Building Technologies, Inc.  
1000 Deerfield Parkway  
Buffalo Grove, IL 60089-4513  
U.S.A.

Your feedback is important to us. If you have comments about this document, please send them to [SBT\\_technical\\_edlibr@siemens.com](mailto:SBT_technical_edlibr@siemens.com)

Document No. CA1N4455E-P25  
Country of Origin: US  
**Page 10**

## Table of Contents

Body Style Versus Application .....	3
Body Pressure-Temperature Rating .....	3
Flowing Differential Pressure Limits .....	3
Flow Coefficients (Cv) Versus Travel .....	4
Sizing Reference and Load Sizing Calculations .....	5
Shut-Off $\Delta P$ and Cv Ratings .....	6-10
Dimensions and Weights .....	11-12
Actuators, Positioners, and Accessories .....	13-15
Factory Default Settings .....	16
Configurations .....	17-18

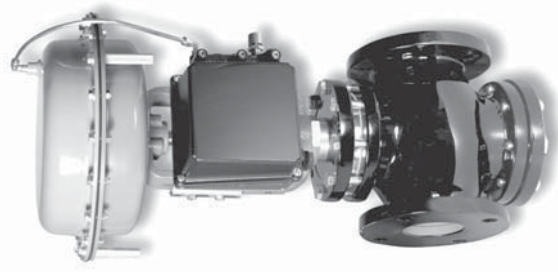
## PRODUCT SPECIFICATION

March 2005

### PNEUMATIC ACTUATED INDUSTRIAL VALVES

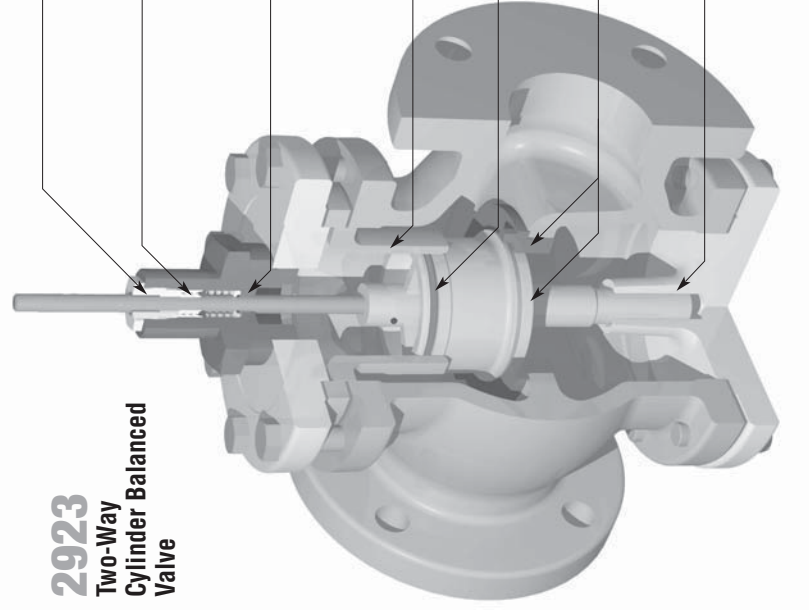
**SERIES: 2900** SIZES 2-1/2 to 10 INCHES

High Capacity, General Purpose, Globe Control Valves



# WARREN CONTROLS

Two-Way and Three-Way, Reciprocating, Iron Body  
Valves for Process and Utility Applications



## 2923 Two-Way Cylinder Balanced Valve

**Peek Bearing**  
for low friction provides stem guiding and protects packing box from external debris.

**Robust Spring-Loaded PTFE V-Ring Packing**  
has low friction and is self adjusting for zero maintenance.

**Peek Bearing in Lower Bonnet Assembly**  
provides stem guiding and protects packing box from entrained solids for longer packing life.

**Thick Balancing Chamber**  
in bronze, 300 SS, or 17-4ph.

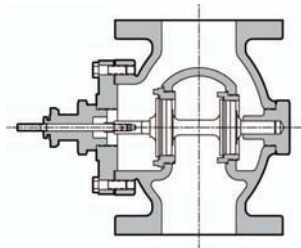
**EPDM O-Ring or Fluoraz O-Ring (for higher temperatures)**  
maintains pressure balance seal.

**Plug and Seat**  
in choice of Bronze, 300 SS, 17-4ph, or Alloy 6 provide Class IV shut off.

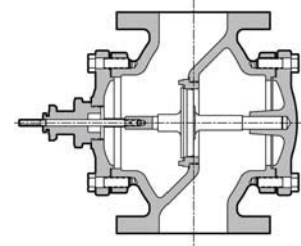
**Bottom Post Guide**  
for additional stability, allowing higher pressure drop.



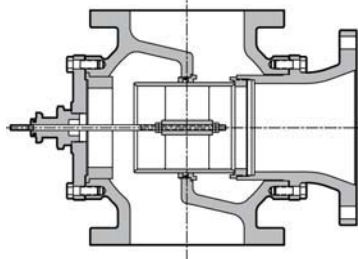
**SERIES: 2900**  
High Capacity  
General Purpose Globe  
Control Valves



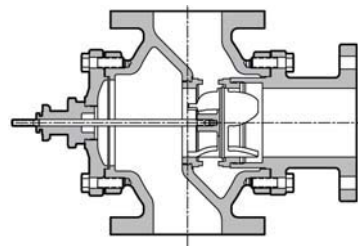
**2922**  
**Two-Way Double Seat  
Balanced Valve**



**2920**  
**Two-Way Single Seat  
Unbalanced Valve**



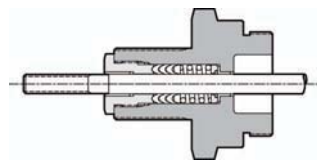
**2932**  
**Three-Way  
Diverting/Mixing  
Valve**



**2930**  
**Three-Way  
Mixing Valve**

**Description**

Warren Controls Series 2900 High Capacity General Purpose Globe Control Valves feature rugged iron bodies with a variety of trim materials. The equal percentage plugs in the 2-way valves and linear plugs in the 3-way valves provide excellent modulating control of a wide variety of fluids. The Series 2900 is ideally suited where valve and long life are important objectives for applications including but not limited to: Food & Beverage, Packaged Water Heaters, Pharmaceutical, General Service, and Waste Water having moderate pressure drops and temperatures from -20° to 400°F.



**Guided Low-Friction  
TFE V-Ring Packing  
Spring-Loaded**

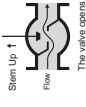
**Body Style Versus Application**

**2-Way Valves (Control of Liquids, Gases, and Steam)**

**2920 Two-Way Single Seat Unbalanced Valve**

The most commonly applied solution for sizes 3" and under with ANSI Class IV shut-off.

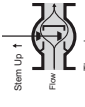
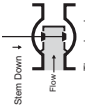
- Sizes:** 2-1/2, 3, 4, 5, 6, 8, 10 inch
- Body:** ANSI B16.1 Iron 125LB Flange or 250LB Flange
- Trim:** E0%, Bronze (2-1/2 thru 6), 300 Series Stainless Steel (2-1/2 thru 10), or 17-4 PH Hardened Stainless Steel (2-1/2 thru 6)
- Packing:** Guided Low-Friction TFE V-Ring, Spring Loaded
- Temperature:** +32 to 350°F (125 FLG) +32 to 400°F (250 FLG)
- Rangeability:** 50:1



**2922 Two-Way Double Seat Balanced Valve**

A balanced valve that is an effective solution for sizes over 3" and for higher pressures. Its double seat design allows for dirtier fluids and requires less force to operate than unbalanced valves so smaller actuators can be used. It is limited to ANSI Class III shut-off.

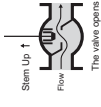
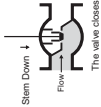
- Sizes:** 2-1/2, 3, 4, 5, 6, 8, 10 inch
- Body:** ANSI B16.1 Iron 125LB Flange or 250LB Flange
- Trim:** E0%, Bronze or 300 Series Stainless Steel
- Packing:** Guided Low-Friction TFE V-Ring, Spring Loaded
- Temperature:** +32 to 350°F (125 FLG) +32 to 400°F (250 FLG)
- Rangeability:** 50:1



**2923 Two-Way Cylinder Balanced Valve**

A balanced valve that is an effective solution for sizes over 3" and for higher pressures. It requires less force to operate than unbalanced valves so smaller actuators can be used. Its single seat o-ring seal design facilitates ANSI Class IV shut-off. It is limited to cleaner fluids.

- Sizes:** 2-1/2, 3, 4, 5, 6 inch
- Body:** ANSI B16.1 Iron 125LB Flange or 250LB Flange
- Trim:** E0%, Bronze, 300 Series Stainless Steel, 17-4 PH Hardened Stainless Steel, or Alloy 6.
- Packing:** Guided Low-Friction TFE V-Ring, Spring Loaded
- O-Ring:** EPDM (BRZ) Fluoroz 797 (300 SS Trim, 17-4 PH or Alloy 6 Trim)
- Temperature:** +32 to 300°F (BRZ) +32 to 350°F (125 FLG w/ 300 SS Trim, 17-4 PH or Alloy 6 Trim) +32 to 400°F (250 FLG w/ 300 SS Trim, 17-4 PH or Alloy 6 Trim)
- Rangeability:** 50:1

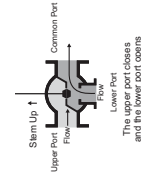
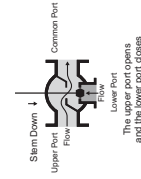


**3-Way Valves (Control of Liquids)**

**2930 Three-Way Mixing Valve**

This valve has two inlets and one outlet, and is the simplest solution for mixing or bypass applications with ANSI Class IV shut-off. In normal applications the inlet pressures are near equal and control is possible from 5% to 95% of travel with inlet pressures up to 100 PSI.

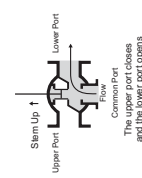
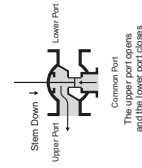
- Sizes:** 2-1/2, 3, 4, 5, 6, 8 inch
- Body:** ANSI B16.1 Iron 125LB Flange or 250LB Flange
- Trim:** Linear, Bronze (2-1/2 thru 6) or 300 Series Stainless Steel (2-1/2 thru 8)
- Packing:** Guided Low-Friction TFE V-Ring, Spring Loaded
- Temperature:** +32 to 350°F (125 FLG) +32 to 400°F (250 FLG)
- Rangeability:** 50:1



**2932 Three-Way Diverting/Mixing Valve**

Designed as a diverting valve with one inlet and two outlets with ANSI Class II shut-off. However, flow can be reversed for mixing if this port configuration is desirable. The difference between the upper port and lower port pressure must not exceed 50PSID.

- Sizes:** 2-1/2, 3, 4, 5, 6, 8 inch
- Body:** ANSI B16.1 Iron 125LB Flange or 250LB Flange
- Trim:** Linear, Bronze or 300 Series Stainless Steel
- Packing:** Guided Low-Friction TFE V-Ring, Spring Loaded
- O-Ring:** EPR
- Temperature:** +32 to 300°F (2-1/2 through 6) +32 to 150°F (6 & 8)
- Rangeability:** 50:1



Body Pressure-Temperature Ratings:	
Temperature (F)	125 FLG / 250 FLG
+32° To 150°	175 / 400
175°	170 / 385
200°	165 / 370
225°	157 / 355
250°	150 / 340
275°	145 / 325
300°	140 / 310
350°	125 / 280
375°	- / 265
400°	- / 250

Pressure ratings are PSIG  
For applications below 32° consult factory

Trim Materials	Flowing Differential Pressure Limit	
	50 PSID	100 PSID
300 Series		
Stainless Steel		
17-4 PH Hardened Steel		
Alloy 6		

## Flow Coefficients (Cv) Versus Travel

Valve Size (IN)	Trim	2920 Flow Coefficients (Cv)									
		Two-Way Single Seat Unbalanced Valve									
		% Travel									
		100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
2-1/2	EO	65.0	55.6	43.8	29.8	15.4	8.07	5.67	4.11	2.81	1.49
3	EO	90.0	83.6	75.1	63.8	49.2	31.6	12.9	4.75	3.37	1.99
4	EO	170	159	143	122	95.1	69.9	31.3	15.6	9.89	4.11
5	EO	280	258	230	194	150	102	54.7	23.1	14.0	6.40
6	EO	360	333	298	255	203	144	83.6	34.1	14.6	7.10
8	EO	450	406	366	318	250	186	130	81.9	44.6	18.3
10	EO	650	556	457	359	267	186	117	64.1	26.5	4.87

Valve Size (IN)	Trim	2922 Flow Coefficients (Cv)									
		Two-Way Double Seat Balanced Valve									
		% Travel									
		100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
2-1/2	EO	70.0	59.5	45.9	30.2	15.7	8.60	6.36	4.12	3.44	2.75
3	EO	100	87.6	71.2	50.8	28.7	12.2	8.94	6.56	4.60	3.27
4	EO	200	180	155	126	91.0	53.3	17.8	8.36	6.07	4.54
5	EO	260	239	212	178	138	100	74.3	53.8	32.2	9.86
6	EO	350	323	286	238	178	113	63.2	44.8	27.5	9.83
8	EO	600	619	557	475	370	246	118	43.9	29.0	14.2
10	EO	960	886	796	689	574	474	383	285	181	72.3

2-Way Valves (Control of Liquids, Gases, and Steam)

Valve Size (IN)	Trim	2923 Flow Coefficients (Cv)									
		Two-Way Cylinder Balanced Valve									
		% Travel									
		100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
2-1/2	EO	65.0	55.6	43.8	29.8	15.4	8.07	5.67	4.11	2.81	1.49
3	EO	90.0	83.6	75.1	63.8	49.2	31.6	12.9	4.75	3.37	1.99
4	EO	170	159	143	122	95.1	69.9	31.3	15.6	9.89	4.11
5	EO	280	258	230	194	150	102	54.7	23.1	14.0	6.40
6	EO	360	333	298	255	203	144	83.6	34.1	14.6	7.10

3-Way Valves (Control of Liquids)

Valve Size (IN)	Trim	2930 Flow Coefficients (Cv)									
		Three-Way Mixing Valve									
		Travel 100%									
		Upper	Lower	Combined	Upper	Lower	Combined	Upper	Lower	Combined	
3	LINEAR	69	69	69	69	69	69	69	69	69	
4	LINEAR	156	156	156	156	156	156	156	156	156	
5	LINEAR	270	270	270	270	270	270	270	270	270	
6	LINEAR	347	347	347	347	347	347	347	347	347	
8	LINEAR	450	450	450	450	450	450	450	450	450	

Valve Size (IN)	Trim	2932 Flow Coefficients (Cv)									
		Three-Way Diverting/Mixing Valve									
		Travel 100%									
		Upper	Lower	Combined	Upper	Lower	Combined	Upper	Lower	Combined	
2-1/2	LINEAR	68	68	68	68	68	68	68	68	68	
3	LINEAR	85	85	85	85	85	85	85	85	85	
4	LINEAR	160	160	160	160	160	160	160	160	160	
5	LINEAR	196	196	196	196	196	196	196	196	196	
6	LINEAR	270	270	270	270	270	270	270	270	270	
8	LINEAR	425	425	425	425	425	425	425	425	425	

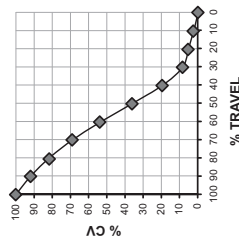
2600 Emrick Blvd., Bethlehem, PA 18020-8010 www.WarrenControls.com  
Tel: 800-922-0085 or 610-317-0800 Fax: 610-317-2989



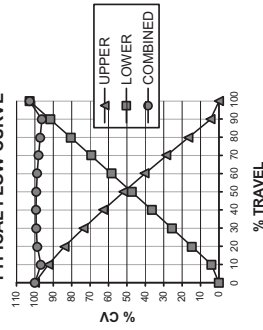
WARREN CONTROLS

## Sizing Reference

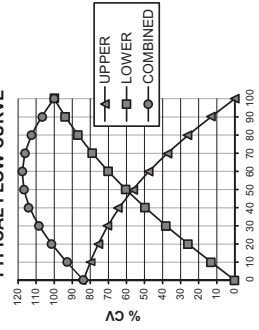
2-WAY VALVE TYPICAL FLOW CURVE



2930 TYPICAL FLOW CURVE



2932 TYPICAL FLOW CURVE



Steam Table					
Steam Pressure PSIG	Temp. °F	Temp. °C	Sensible Heat BTU/Lb.	Latent Heat BTU/Lb.	Total Heat BTU/Lb.
0	212	100	180	971	1151
10	239	115	207	962	1169
25	266	130	236	954	1170
50	297	147	267	912	1179
75	320	160	290	896	1186
100	338	170	309	881	1190
125	353	178	325	868	1193
150	365	185	339	858	1197
200	387	197	362	838	1200
250	406	208	381	821	1204
300	422	217	399	805	1207
400	448	231	438	778	1216
500	470	243	453	762	1205
600	489	254	475	729	1204

### Rectangular Tank Capacity in Gallons

Gallons =  $\frac{\text{Height} \times \text{Width} \times \text{Length (inches)}}{230}$

or

Gallons =  $H \times W \times L \text{ (ft.)} \times 7.5$

### Circular Tank Storage Capacity in Gallons

Storage =  $6D^2 \times L \text{ (Gallons)}$

Where:

$D$  = Tank Diameter in Feet

$L$  = Length in Feet

## Load Sizing Calculations

### Glossary of Terms

$t$  = Time in Hours

$C_p$  = Specific Heat of Liquid

$S$  = Specific Gravity of Fluid

$W$  = Weight in Lbs.

$\Delta T$  = Temperature Rise or Fall in °F

$h_{fg}$  = Latent Heat of Steam

### Heating Water with Steam

Quick Method

$\text{GPM} = \frac{\text{GPM} \times 500 \times \Delta T}{2}$

Accurate Method

$\text{Lbs./Hr.} = \frac{\text{GPM} \times 500 \times \Delta T}{h_{fg}}$

### Heating or Cooling Water with Water

$\text{GPM}_1 = \frac{\text{GPM}_2 \times (\text{°F water}_2 \text{ temp. rise or drop})}{\text{°F water}_1 \text{ temp. rise or drop}}$

### Heating or Cooling Water

$\text{GPM} = \frac{\text{BTU / Hr.}}{(\text{°F water temp. rise or drop}) \times 500}$

### Heating Oil with Steam

$\text{Lbs./Hr.} = \frac{\text{CFM} \times 900}{4} \times (\text{°F oil temp. rise})$

### Heating Air with Water

$\text{GPM} = 2.16 \times \frac{\text{CFM} \times (\text{°F air temp. rise})}{1000 \times (\text{°F water temp. drop})}$

### Heating Liquids with Steam

$\text{Lbs./Hr.} = \frac{\text{GPM} \times 60 \times C_p \times W}{h_{fg}} \times \Delta T$

### Heating Liquids in Steam Jacketed Kettles

$\text{Lbs./Hr.} = \frac{\text{GPM} \times C_p \times S \times 8.33}{h_{fg}} \times \Delta T$

### General Liquid Heating

$\text{Lbs./Hr.} = \frac{W \times C_p}{h_{fg}} \times \Delta T$

### Heating Air with Steam

$\text{Lbs./Hr.} = \frac{\text{CFM}}{900} \times \Delta T$

## Shut-Off ΔP and Cv Ratings

### Valve Actuator Shut-Off ΔP Two-Way Single Seat Unbalanced 2920

Valve Size (IN)	Cv Rating	Plug Travel (IN)	Pneumatic Actuator Range	Maximum Shut-off ΔP in PSI		Fall Open Direct Acting			
				Reverse Acting	Direct Acting	3-15 PSI (1-17 PSI)	0-30 PSI (0-30 PSI)	0-40 PSI (0-40 PSI)	0-40 PSI (0-40 PSI)
2 1/2	65	3/4	DL49	N/A	N/A	20	40	170	N/A
				N/A	N/A	N/A	N/A	130	N/A
				N/A	N/A	10	140	N/A	N/A
				N/A	N/A	63	97	319	N/A
				N/A	N/A	12	N/A	217	N/A
				N/A	N/A	11.4	N/A	217	N/A
				N/A	N/A	114	N/A	N/A	N/A
				N/A	N/A	148	N/A	N/A	N/A
				N/A	N/A	165	N/A	N/A	N/A
				N/A	N/A	5	28	28	400
				N/A	N/A	5	28	28	400
				N/A	N/A	145	169	309	400
				N/A	N/A	609	N/A	309	400
3	90	3/4	DL49	N/A	N/A	10	23	113	N/A
				N/A	N/A	3	89	217	N/A
				N/A	N/A	39	63	217	N/A
				N/A	N/A	4	N/A	146	N/A
				N/A	N/A	4	N/A	146	N/A
				N/A	N/A	39	63	75	N/A
				N/A	N/A	75	N/A	146	N/A
				N/A	N/A	99	110	N/A	N/A
				N/A	N/A	15	15	373	N/A
				N/A	N/A	15	15	373	N/A
				N/A	N/A	113	N/A	210	373
				N/A	N/A	285	N/A	N/A	N/A
4	170	1 1/4	DL84	N/A	N/A	17	30	117	N/A
				N/A	N/A	N/A	N/A	77	N/A
				N/A	N/A	37	N/A	77	N/A
				N/A	N/A	3	31	49	166
				N/A	N/A	3	3	205	N/A
				N/A	N/A	58	58	113	205
				N/A	N/A	140	N/A	N/A	N/A
				N/A	N/A	140	N/A	N/A	N/A
				N/A	N/A	8	16	72	N/A
				N/A	N/A	N/A	N/A	46	N/A
				N/A	N/A	N/A	N/A	46	N/A
				N/A	N/A	17	29	105	163
				N/A	N/A	N/A	N/A	70	128
				N/A	N/A	34	N/A	70	128
				N/A	N/A	28	34	N/A	N/A
				N/A	N/A	81	81	N/A	N/A
				N/A	N/A	N/A	N/A	48	N/A
6	360	1 1/2	DL84	N/A	N/A	N/A	3	9	48
				N/A	N/A	N/A	N/A	30	N/A
				N/A	N/A	N/A	N/A	30	N/A
				N/A	N/A	9	17	70	111
				N/A	N/A	N/A	N/A	46	87
				N/A	N/A	17	21	N/A	87
				N/A	N/A	54	N/A	N/A	N/A
				N/A	N/A	N/A	N/A	44	83
				N/A	N/A	16	20	N/A	83
				N/A	N/A	44	44	N/A	N/A
				N/A	N/A	N/A	N/A	3	7
				N/A	N/A	N/A	N/A	23	46
				N/A	N/A	10	10	N/A	46
				N/A	N/A	7	7	23	46
				N/A	N/A	20	20	N/A	N/A

### NOTES:

- 2920 Seat closure ANSI Class IV.
  - Inlet pressure **cannot** exceed Body Pressure-temperature Rating.
  - The 3-15 and 1-17 columns of the table apply to valves with control signals coming directly from I/P transducers with matching ranges. The 0-30 and 0-40 columns apply to valves with a positioner or an I/P transducer of suitable range.
  - N/A indicates that the air signal is not capable of providing any shut-off or it exceeds the actuator's maximum air pressure.
- Maximum air pressure  
DL49...30PSIG  
DL84 & 84XR...40PSIG  
DL115 & 115XR...40PSIG
- Do Not Use DL115 OR 115XR Actuators on Valves With Bronze Trim.
  - See Actuators, Positioners, and Accessories section for explanation of spring ranges.

## Shut-Off ΔP and Cv Ratings

### Valve Actuator Shut-Off ΔP Two-Way Double Seat Balanced 2922

Valve Size (IN)	Cv Rating	Plug Travel (IN)	Pneumatic Actuator Range	Maximum Shut-off ΔP in PSI		Fall Open Direct Acting			
				Reverse Acting	Direct Acting	3-15 PSI (1-17 PSI)	0-30 PSI (0-30 PSI)	0-30 PSI (0-30 PSI)	0-40 PSI (0-40 PSI)
2 1/2	70	3/4	DL49	N/A	N/A	113	250	388	400
				N/A	N/A	113	250	N/A	113
				N/A	N/A	34	270	400	400
				N/A	N/A	34	270	N/A	34
				N/A	N/A	400	400	N/A	34
3	100	3/4	DL49	N/A	N/A	39	153	267	400
				N/A	N/A	39	153	N/A	39
				N/A	N/A	381	400	400	400
				N/A	N/A	N/A	N/A	400	400
				N/A	N/A	169	169	N/A	400
				N/A	N/A	169	169	N/A	400
				N/A	N/A	400	400	N/A	400
4	200	3/4	DL49	N/A	N/A	N/A	N/A	117	267
				N/A	N/A	N/A	N/A	N/A	400
				N/A	N/A	202	372	400	400
				N/A	N/A	N/A	N/A	44	400
				N/A	N/A	N/A	N/A	44	400
				N/A	N/A	400	400	N/A	400
5	260	1 1/4	DL84	N/A	N/A	N/A	N/A	340	400
				N/A	N/A	N/A	N/A	N/A	400
				N/A	N/A	340	400	N/A	400
6	350	1 1/4	DL84	N/A	N/A	N/A	N/A	242	400
				N/A	N/A	N/A	N/A	N/A	400
				N/A	N/A	242	400	400	400
8	580	1 1/2	DL84	N/A	N/A	N/A	N/A	85	232
				N/A	N/A	N/A	N/A	N/A	400
				N/A	N/A	85	232	305	400
10	960	1 1/2	DL84	N/A	N/A	N/A	N/A	13	134
				N/A	N/A	N/A	N/A	N/A	400
				N/A	N/A	13	134	195	400

### NOTES:

- 2922 Seat closure ANSI Class III.
  - Inlet pressure **cannot** exceed Body Pressure-temperature Rating.
  - The 3-15 and 1-17 columns of the table apply to valves with control signals coming directly from I/P transducers with matching ranges. The 0-30 and 0-40 columns apply to valves with a positioner or an I/P transducer of suitable range.
  - N/A indicates that the air signal is not capable of providing any shut-off or it exceeds the actuator's maximum air pressure.
- Maximum air pressure  
DL49...30PSIG  
DL84 & 84XR...30PSIG
- Do Not Use DL115 Actuators on Valves With Bronze Trim.
  - See Actuators, Positioners, and Accessories section for explanation of spring ranges.

# Shut-Off $\Delta P$ and Cv Ratings

Valve			Shut-Off $\Delta P$ Two-Way Cylinder Balanced				2923									
Valve Size (in)	Cv Rating (lb)	Plug Travel (in)	Maximum Shut-Off $\Delta P$ in PSI				Fall Open									
			Reverse Acting	Direct Acting	Fall Closed	Direct Acting	Reverse Acting	Direct Acting	Fall Closed	Direct Acting						
2-1/2	65	3/4	DL49	DL84	DL115	DL15XR	DL115XR	DL84	DL115	DL15XR	DL115XR	DL84	DL115	DL15XR	DL115XR	
3	90	3/4	N/A	N/A	N/A	N/A	N/A	123	253	333	N/A	N/A	N/A	400	N/A	N/A
			Low	N/A	N/A	N/A	N/A	High	N/A	N/A	N/A	N/A	N/A	400	N/A	N/A
			High	N/A	N/A	N/A	N/A	Low	N/A	N/A	N/A	N/A	N/A	400	N/A	N/A
4	170	1-1/4	DL84	DL84	DL115	DL15XR	DL115XR	N/A	N/A	N/A	N/A	N/A	N/A	400	N/A	N/A
			Low	N/A	N/A	N/A	N/A	High	N/A	N/A	N/A	N/A	N/A	400	N/A	N/A
			High	N/A	N/A	N/A	N/A	Low	N/A	N/A	N/A	N/A	N/A	400	N/A	N/A
5	280	1-1/2	DL84	DL84	DL115	DL15XR	DL115XR	79	230	306	N/A	N/A	N/A	400	N/A	N/A
			Low	N/A	N/A	N/A	N/A	High	N/A	N/A	N/A	N/A	N/A	400	N/A	N/A
			High	N/A	N/A	N/A	N/A	Low	N/A	N/A	N/A	N/A	N/A	400	N/A	N/A
6	360	1-1/2	DL84	DL84	DL115	DL15XR	DL115XR	219	400	400	400	400	400	400	400	400
			Low	N/A	N/A	N/A	N/A	High	N/A	N/A	N/A	N/A	N/A	400	N/A	N/A
			High	N/A	N/A	N/A	N/A	Low	N/A	N/A	N/A	N/A	N/A	400	N/A	N/A
			DL115	DL115	DL15XR	DL115XR	DL115XR	124	290	373	373	N/A	N/A	400	400	400
			Low	N/A	N/A	N/A	N/A	High	N/A	N/A	N/A	N/A	N/A	400	N/A	N/A
			High	N/A	N/A	N/A	N/A	Low	N/A	N/A	N/A	N/A	N/A	400	N/A	N/A

**NOTES:**

- 1) 2923 Seat closure ANSI Class IV.
- 2) Inlet pressure **cannot** exceed Body Pressure-Temperature Rating.
- 3) The 3-15 and 1-17 columns of the table apply to valves with control signals coming directly from I/P transducers with matching ranges. The 0-30 and 0-40 columns apply to valves with a positioner or an I/P transducer or suitable range.
- 4) N/A indicates that the air signal is not capable of providing any shut-off or it exceeds the actuator's maximum air pressure.  
Maximum air pressure  
DL49...30PSIG  
DL84...30PSIG  
DL115 & 115XR...40PSIG
- 5) Do Not Use DL115 OR 115XR Actuators on Valves With Bronze Trim.
- 6) See Actuators, Positioners, and Accessories section for explanation of spring ranges.

# Shut-Off $\Delta P$ and Cv Ratings

Valve			Shut-Off $\Delta P$ Three-Way Mixing				2930								
Valve Size (in)	Cv Rating (lb)	Plug Travel (in)	Maximum Shut-Off $\Delta P$ in PSI				Lower Port Closed								
			Reverse Acting	Direct Acting	Fall Closed	Direct Acting	Reverse Acting	Direct Acting	Fall Closed	Direct Acting					
2-1/2	65	3/4	DL49	DL84	DL115	DL15XR	DL115XR	DL84	DL115	DL15XR	DL115XR	DL84	DL115	DL15XR	DL115XR
3	86	3/4	N/A	N/A	N/A	N/A	N/A	3	16	23	N/A	N/A	N/A	79	N/A
			Low	N/A	N/A	N/A	N/A	High	N/A	N/A	N/A	N/A	N/A	86	N/A
			High	N/A	N/A	N/A	N/A	Low	N/A	N/A	N/A	N/A	N/A	86	N/A
4	156	1-3/8	DL84	DL84	DL115	DL15XR	DL115XR	N/A	N/A	N/A	N/A	N/A	N/A	85	248
			Low	N/A	N/A	N/A	N/A	High	N/A	N/A	N/A	N/A	N/A	114	N/A
			High	N/A	N/A	N/A	N/A	Low	N/A	N/A	N/A	N/A	N/A	74	N/A
			DL115	DL115	DL15XR	DL115XR	DL115XR	17	30	37	N/A	N/A	N/A	74	N/A
			Low	N/A	N/A	N/A	N/A	High	N/A	N/A	N/A	N/A	N/A	140	N/A
			High	N/A	N/A	N/A	N/A	Low	N/A	N/A	N/A	N/A	N/A	140	N/A
5	270	1-3/8	DL84	DL84	DL115	DL15XR	DL115XR	31	49	58	N/A	N/A	N/A	107	198
			Low	N/A	N/A	N/A	N/A	High	N/A	N/A	N/A	N/A	N/A	107	198
			High	N/A	N/A	N/A	N/A	Low	N/A	N/A	N/A	N/A	N/A	43	134
			DL115	DL115	DL15XR	DL115XR	DL115XR	9	17	21	N/A	N/A	N/A	43	84
			Low	N/A	N/A	N/A	N/A	High	N/A	N/A	N/A	N/A	N/A	15	55
			High	N/A	N/A	N/A	N/A	Low	N/A	N/A	N/A	N/A	N/A	64	103
8	450	2-1/2	DL115	DL115	DL15XR	DL115XR	DL115XR	17	28	34	34	N/A	N/A	24	83
			Low	N/A	N/A	N/A	N/A	High	N/A	N/A	N/A	N/A	N/A	24	83
			High	N/A	N/A	N/A	N/A	Low	N/A	N/A	N/A	N/A	N/A	28	N/A
			DL115	DL115	DL15XR	DL115XR	DL115XR	3	9	12	N/A	N/A	N/A	28	N/A
			Low	N/A	N/A	N/A	N/A	High	N/A	N/A	N/A	N/A	N/A	67	108
			High	N/A	N/A	N/A	N/A	Low	N/A	N/A	N/A	N/A	N/A	43	84
			DL115	DL115	DL15XR	DL115XR	DL115XR	9	17	21	N/A	N/A	N/A	43	84
			Low	N/A	N/A	N/A	N/A	High	N/A	N/A	N/A	N/A	N/A	15	55
			High	N/A	N/A	N/A	N/A	Low	N/A	N/A	N/A	N/A	N/A	14	64
			DL115	DL115	DL15XR	DL115XR	DL115XR	9	16	20	20	N/A	N/A	41	80
			Low	N/A	N/A	N/A	N/A	High	N/A	N/A	N/A	N/A	N/A	14	53
			High	N/A	N/A	N/A	N/A	Low	N/A	N/A	N/A	N/A	N/A	14	53

**NOTES:**

- 1) 2930 Mixing Valves have two inlets and one outlet. Published shut-off values are with respect to worst case conditions with zero downstream pressure on the outlet port and zero upstream pressure on the opposing inlet port. Pneumatic Actuators used with the 2930 are direct acting. The upper port fails closed on loss of air pressure to the actuator.
- 2) 2930 Seat closure ANSI Class IV.
- 3) Inlet pressure **cannot** exceed Body Pressure-Temperature Rating.
- 4) The 3-15 and 1-17 columns of the table apply to valves with control signals coming directly from I/P transducers with matching ranges. The 0-30 and 0-40 columns apply to valves with a positioner or an I/P transducer or suitable range.
- 5) N/A indicates that the air signal is not capable of providing any shut-off or it exceeds the actuator's maximum air pressure.  
Maximum air pressure  
DL49...30PSIG  
DL84 & 84XR...30PSIG  
DL115 & 115XR...40PSIG
- 6) Do Not Use DL115 OR 115XR Actuators on Valves With Bronze Trim.
- 7) See Actuators, Positioners, and Accessories section for explanation of spring ranges.

# Shut-Off ΔP and Cv Ratings

Valve Size (IN)	Cv Rating	Plug Travel (IN)	Actuator		Shut-Off ΔP		2932	
			Pneumatic Spring Range	Actuator	Upper Port Closed	Lower Port Closed		
2 1/2	168/75	3/4"	DL49	HIGH	0-30 PSI	1-17 PSI	0-40 PSI	0-40 PSI
3	85/95	3/4"	DL84	HIGH	106	110	104	108
4	160/180	3/4"	DL49	HIGH	104	106	104	108
5	195/220	1-1/4"	DL84	HIGH	102	104	104	108
6	270/300	1-3/8"	DL84	HIGH	97	99	102	106
8	425/510	1-1/2"	DL115	HIGH	101	104	106	108

## NOTES:

- Published shut-off values are for diverting applications. The values are worst case and based on the pressure difference between the inlet and the outlet that is closed. Consult the factory if the required shut-off exceeds the published value and the pressure at the inlet and both outlets is known. For proper operation in diverting applications, the pressure difference between both outlets must not exceed 50 psi. Consult the factory for shut-off values for 2932 mixing applications. Pneumatic Actuators used with 2932 are direct acting. The upper port fails closed on loss of air pressure to the actuator.
- 2932 Seat closure ANSI Class II.
- Inlet pressure **cannot** exceed Body Pressure-temperature Rating.
- The 3-15 and 1-17 columns of the table apply to valves with control signals coming directly from I/P transducers with matching ranges. The 0-30 and 0-40 columns apply to valves with a positioner or an I/P transducer of suitable range.
- N/A indicates that the air signal is not capable of providing any shut-off or it exceeds the actuator's maximum air pressure.

Maximum air pressure  
DL49...30PSIG  
DL84...30PSIG  
DL115...40PSIG

- See Actuators, Positioners, and Accessories section for explanation of spring ranges.

# Dimensions & Weights

Component	2920 Dimension (IN) by Valve Size (IN)					
	2-1/2	3	4	5	6	10
Variable	9	10	13	15-3/4	17-3/4	16-1/4
A	125FLG	9-5/8	10-3/4	13-5/8	16-5/8	18-5/8
250FLG	4-3/4	5-3/8	6-3/8	7-3/8	8	8-7/8
B	DL49 Direct*	17-5/8	18-1/2	N/A	N/A	N/A
DL49 Reverse	17	17-7/8	N/A	N/A	N/A	N/A
DL84 Direct*	21-5/8	22-1/2	23-1/2	24-1/8	24-3/4	N/A
DL84 Reverse	21	21-7/8	22-7/8	23-1/2	24-1/8	N/A
DL115 or 115XR Direct*	34	34-7/8	35-7/8	36-1/2	37-1/8	38-3/8
DL115 or 115XR Reverse	CF	CF	CF	CF	CF	CF
H	DL49	4-1/4	5	N/A	N/A	N/A
W/760	DL84 or 84XR	6	6-7/8	7-7/8	8-1/2	9
DL115 or 115XR Direct	11-1/8	11-7/8	13	13-5/8	14-1/4	15-1/2
DL115 or 115XR Reverse	CF	CF	CF	CF	CF	CF
Item	Weight (LB) by Valve Size (IN)					
Variable	2-1/2	3	4	5	6	10
125FLG	55	72	119	134	175	270
250FLG	64	77	131	166	233	360

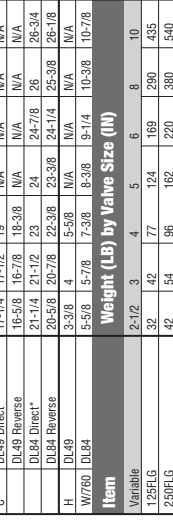
Component	2923 Dimension (IN) by Valve Size (IN)					
	2-1/2	3	4	5	6	10
Variable	9	10	13	15-3/4	17-3/4	16-1/4
A	125FLG	9-5/8	10-3/4	13-5/8	16-5/8	18-5/8
250FLG	4-3/4	5-3/8	6-3/8	7-3/8	8	8-7/8
B	DL49 Direct*	17-5/8	18-1/2	N/A	N/A	N/A
DL49 Reverse	17	17-7/8	N/A	N/A	N/A	N/A
DL84 Direct*	21-5/8	22-1/2	23-1/2	24-1/8	24-3/4	N/A
DL84 Reverse	21	21-7/8	22-7/8	23-1/2	24-1/8	N/A
DL115 or 115XR Direct*	34	34-7/8	35-7/8	36-1/2	37-1/8	38-3/8
DL115 or 115XR Reverse	CF	CF	CF	CF	CF	CF
H	DL49	4-3/4	5-1/2	N/A	N/A	N/A
W/760	DL84	6-1/2	7-3/8	8-1/2	9	9-5/8
DL115 or 115XR Direct	N/A	N/A	13-1/2	14-1/8	14-3/4	N/A
DL115 or 115XR Reverse	N/A	N/A	CF	CF	CF	CF
Item	Weight (LB) by Valve Size (IN)					
Variable	2-1/2	3	4	5	6	10
125FLG	57	75	127	149	197	256
250FLG	66	80	139	181	256	315

Component	2922 Dimension (IN) by Valve Size (IN)					
	2-1/2	3	4	5	6	10
Variable	7-3/4	9	11-3/8	12	14-1/8	16-1/4
A	125FLG	8-3/8	9-3/4	12	12-7/8	14-1/2
250FLG	4-7/8	4-3/8	5	6-7/8	7-3/8	8-7/8
B	DL49 Direct*	17-1/4	17-1/2	19	N/A	N/A
DL49 Reverse	16-5/8	16-7/8	18-3/8	N/A	N/A	N/A
DL84 Direct*	21-1/4	21-1/2	23	24	24-7/8	26
DL84 Reverse	20-5/8	20-7/8	22-3/8	23-3/8	24-1/4	25-3/8
H	DL49	3-3/8	4	5-5/8	N/A	N/A
W/760	DL84	5-5/8	5-7/8	7-3/8	8-3/8	9-1/4
Item	Weight (LB) by Valve Size (IN)					
Variable	2-1/2	3	4	5	6	10
125FLG	32	42	77	124	169	290
250FLG	42	54	96	162	220	380

Face to face dimensions conform to historical Warren Controls standard and are NOT ANSI/ISA compatible.

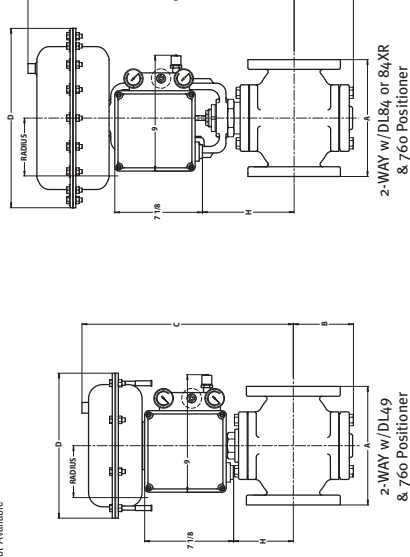
RADIUS is from centerline of actuator to outside edge of positioner.

Positioner Removal Clearance  
Allow 3-1/4 Inch beyond 760 for cover removal/service.



\* includes 1-3/8 inch for air fitting  
H = Centerline of pipe to bottom of positioner  
CF = Consult factory  
N/A = Not Available

Consult factory for drawings, weights, and dimensions of configurations not shown.



2-WAY w/ DL84 or 84XR & 760 Positioner

2-WAY w/ DL115 or 115XR & 760 Positioner

# Actuators, Positioners, & Accessories

# Dimensions & Weights

Component	Dimension (IN) by Valve Size (IN)				
Variable	2-1/2	3	4	5	6
A	125FLG	9	10	13	15-3/4
B	250FLG	9-5/8	10-3/4	13-5/8	16-1/4
C	DL49 Direct*	7-3/8	8-3/8	10-1/4	11
D	DL84 or 84XR Direct*	17-5/8	18-1/2	19-1/4	19-1/4
E	DL115 or 115XR Direct*	21-5/8	22-1/2	23-1/2	23-1/8
F	DL115 or 115XR Direct*	34	34-7/8	35-7/8	34-3/4
G	DL49	4-1/4	5	5-7/8	6-1/4
H	DL84 or 84XR	6	6-7/8	7-7/8	8-1/4
I	DL115 or 115XR Direct	11-1/8	11-7/8	13	11-7/8

\* Includes 1-3/8 inch for air filling  
 H = Centerline of pipe to bottom of positioner  
 CF = Consult factory  
 N/A = Not Available

Actuator	Dimension (IN)
DL49	11
DL84 or 84XR	15-7/8
DL115 or 115XR	16-3/4
DL49	7-7/8
DL84 or 84XR	8-1/8
DL115 or 115XR Direct	10-5/8
DL115 or 115XR Reverse	CF

Actuator	Weight (LB)
DL49	24-1/2
DL84 or 84XR	48-1/2
DL115 Direct	84
DL115XR Direct	92
DL115 Reverse	CF
DL115XR Reverse	CF

Positioner	Weight (LB)
760	10

Component	Dimension (IN) by Valve Size (IN)				
Variable	2-1/2	3	4	5	6
A	125FLG	9	10	13	14-1/8
B	250FLG	9-5/8	10-3/4	13-5/8	14-1/2
C	DL49 Direct*	7-3/8	8-3/8	10-1/4	11
D	DL84 or 84XR Direct*	17-5/8	18-1/2	19-1/4	19-1/4
E	DL115 or 115XR Direct*	21-5/8	22-1/2	23-1/4	23-7/8
F	DL115 or 115XR Direct*	N/A	N/A	35-3/8	36-7/8
G	DL49	4-1/4	5	5-7/8	6-1/4
H	DL84 or 84XR	6	6-7/8	7-7/8	8-1/4
I	DL115 or 115XR Direct	N/A	N/A	12-3/4	13-5/8

\* Includes 1-3/8 inch for air filling  
 H = Centerline of pipe to bottom of positioner  
 CF = Consult factory  
 N/A = Not Available

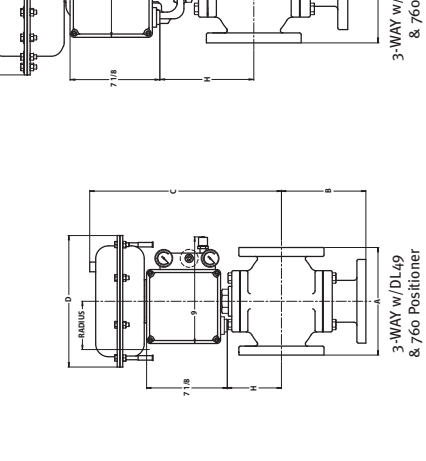
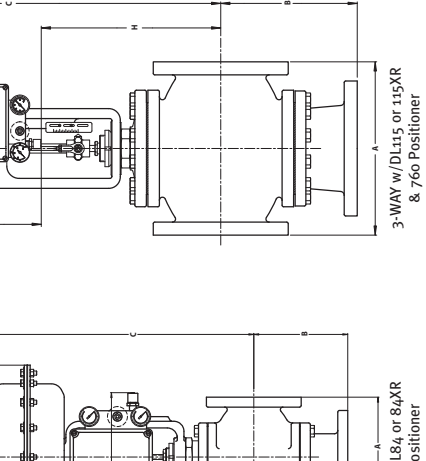
Actuator	Dimension (IN)
DL49	11
DL84 or 84XR	15-7/8
DL115 or 115XR	16-3/4
DL49	7-7/8
DL84 or 84XR	8-1/8
DL115 or 115XR Direct	10-5/8
DL115 or 115XR Reverse	CF

Actuator	Weight (LB)
DL49	24-1/2
DL84 or 84XR	48-1/2
DL115 Direct	84
DL115XR Direct	92
DL115 Reverse	CF
DL115XR Reverse	CF

Positioner	Weight (LB)
760	10



## Actuators

Actuator	Action	Spring Range (PSI)		
		Low	Full	High
DL49	Direct	3-9	4-13	8-12
DL84 & DL115	Reverse	4-10	5-14	10-14
DL84 & DL115	Direct	3-9	3-15	9-15
DL84XR & DL115XR	Direct	N/A	N/A	N/A
DL84XR & DL115XR	Reverse	N/A	N/A	N/A

Note: The spring range of XR (Extended Range) actuators varies with travel. These actuators require positioners or I/Ps for modulating control.

Effective Area: DL49 49 Sq In, DL84 & 84XR (84 Sq In)  
 DL115 & 115XR (115 Sq In)

Springs: DL49, 84 & 84XR Multiple  
 DL115 & 115XR Single

Max Air Supply: DL49, 84 & 84XR 30PSIG  
 DL115 & 115XR 40PSIG

Air Connections: 1/4 NPT  
 Buna-N Fabric Reinforced

Diaphragm: Diaphragm Chambers: Steel  
 DL49, 84 & 84XR Ductile Iron  
 DL115 & 115XR Aluminum  
 300 Series Stainless Steel

Yoke: DL49 Epoxy-Coated  
 DL84, 84XR, 115, & 115XR Acrylic Enamel

Stem: DL49-20 to 160°F

Finish: DL84, 84XR, 115 & 115XR -40 to 180°F

Ambient Temperature: DL49-20 to 160°F

Mounting: Vertical Above or Below Valve  
 Available on DL84, 84XR, 115 & 115XR

Handwheel: Not Available on DL49

## Positioners

**Split Ranging with Positioners**  
 Positioners are sometimes used to "Split-Range" two control valves in a parallel configuration within a piping scheme. This technique is used to obtain higher rangeability than could otherwise be achieved with a single control valve. Typically one smaller valve supplying 15% to 35% of total flow is mated with a larger valve supplying 65% to 85% of total flow.

The best-matched pair will each be providing similar rangeability for each respective flow contribution to the manifold. Calculated as maximum flow / minimum controllable flow, the smaller valve should not be attempting to control flow below 5% of stroke. Estimate Cv from Cv tables vs. stroke to calculate this.

The chosen positioners would then have a Low Range signal for the smaller valve and a High Range Signal for the larger valve. With this, a single control signal can be used and serially applied to each valve. At mid-signal range, the little valve is completely open while the larger valve is just starting to open. Controllability for wide process set point ranges is dramatically improved.

## BLX Models:



Models:

BFP : Full Range Signal (3-15 PSIG)  
 BLP : Low Range Signal (3-9 PSIG)  
 BHP : High Range Signal (9-15 PSIG)  
 Options 2SPDT Limit Switches, 4-20 mA Feedback  
 Ingress & Corrosion Protection: NEMA 4X, IP66  
 Supply Pressure: Pneumatic: 145 PSIG Max **Not to exceed actuator rating**  
 Air Consumption: 0.19 SCFM at 30 PSIG, 0.25 SCFM at 40 PSIG

## BLX Electro-Pneumatic

Models:

BFE : Full Range Signal (4-20 mA)  
 BLE : Low Range Signal (4-12 mA)  
 BHE : High Range Signal (12-20 mA)  
 Options 2SPDT Limit Switches, 4-20 mA Feedback  
 Ingress & Corrosion Protection: NEMA 4X, IP66  
 Supply Pressure: 21.8 to 145 PSIG **Not to exceed actuator rating**  
 Air Consumption: 0.21 SCFM at 30 PSIG, 0.28 SCFM at 40 PSIG

## BLX Electro-Pneumatic Intrinsically Safe

Models:

BFL : Full Range Signal (4-20 mA)  
 BLL : Low Range Signal (4-12 mA)  
 BHL : High Range Signal (12-20 mA)  
 Options 2SPDT Limit Switches, 4-20 mA Feedback  
 Ingress & Corrosion Protection: NEMA 4X, IP66  
 Approvals & Ratings: Class I II III, Div 1, Groups A,B,C,D,E,F,G.  
 EM Intrinsically Safe: Class I, Div 1, Groups A, B, C, D.  
 CSA Intrinsically Safe: Class I, Div 1, Groups E, F, G, Class III.  
 Class I, Div 2, Groups A, B, C, D.  
 Class II, Div 2, Groups E, F, G.  
 Supply Pressure: 30 to 145 PSIG **Not to exceed actuator rating**  
 Air Consumption: 0.21 SCFM at 30 PSIG, 0.28 SCFM at 40 PSIG



## Actuators, Positioners, & Accessories

### Positioners (Continued)

#### BLX Electro-Pneumatic Explosion Proof

Models:  
 BFX: Full Range Signal (4-20 mA)  
 BLX: Low Range Signal (4-12 mA)  
 BHX: High Range Signal (12-20 mA)

Options 2SPDT Limit Switches, 4-20 mA Feedback  
 Ingress & Corrosion Protection: NEMA 4X, IP66  
 Approvals & Ratings:  
 EM: Intrinsically Safe, Class I, Div 1, Groups A,B,C,D,E,F,G

Non-Incandive, Class I, Div 1, Groups A,B,C,D,E,F,G  
 Explosion Proof: Class I, Div 1, Groups A,B,C  
 Class I, Div 1, Groups B,C,D  
 Class I, Div 1, Groups E,F,G

CSA Intrinsically Safe, Class I, Div 1, Groups A,B,C,D  
 Class II, Div 1, Groups E,F,G

Class III  
 Class I, Div 2, Groups A,B,C,D  
 Class II, Div 2, Groups E,F,G

Class I, Div 1, Groups E,F,G  
 Class II, Div 1, Groups E,F,G

Explosion Proof: Class I, Div 1, Groups A,B,C,D,E,F,G  
 Supply Pressure:  
 30 to 145 PSIG **Not to exceed actuator rating**  
 Air Consumption:  
 0.21 SCFM at 30 PSIG, 0.28 SCFM at 40 PSIG

#### BLX Electro-Pneumatic Fail Freeze

Models:  
 BFF: Full Range Signal (4-20 mA)  
 BLF: Low Range Signal (4-12 mA)  
 BHF: High Range Signal (12-20 mA)

Options 2SPDT Limit Switches, 4-20 mA Feedback  
 Ingress & Corrosion Protection: NEMA 4X, IP66

Supply Pressure:  
 20 to 100 PSIG Max **Not to exceed actuator rating**  
 Air Consumption:  
 0.21 SCFM at 30 PSIG, 0.28 SCFM at 40 PSIG

#### All Models:

Construction:  
 Aluminum Housing with Polyester Powder Coat  
 Action:  
 Direct or Reverse  
 Media:  
 Clean Dry Oil Free Air Filtered to 5 micron  
 1/4 NPT

Air Connections:  
 9.8 SCFM at 30 PSIG, 13.1 SCFM at 40 PSIG  
 Flow Capacity:  
 1/4 NPT  
 Electrical Connection:  
 1/2 NPT

Gauges:  
 Input 0-30 PSIG, Output 0-60 PSIG, Supply 0-60 PSIG,  
 Housing Black Steel Case with Chrome Ring

Ambient Temperature:  
 -40 to 185°F (Except Fail Freeze -4 to 68°F)  
 Mounting:  
 Yoke Mounted  
 Limit Switches and Feedback Options are NEMA 4X, IP66 only, and are not suitable for hazardous locations.

#### Moore 760 Models:



#### 760P Pneumatic

Models:  
 76P: Full Range Signal (3-15 PSIG)  
 Options Limit Switches, 4-20 mA Feedback *(Reduced feedback span for valves with less than 1 inch travel - Call factory for details)*

#### 760E Electro-Pneumatic

Models:  
 76E: Full Range Signal (4-20 mA)  
 Options Limit Switches, 4-20 mA Feedback *(Reduced feedback span for valves with less than 1 inch travel - Call factory for details)*

#### Approvals & Ratings:

EM: Intrinsically Safe, Class I, Div 1, Groups A,B,C,D  
 Class II, Div 1, Groups E,F,G

Class III, Div 1  
 Non-Incandive, Class I, Div 2, Groups A,B,C,D  
 Suitable for: Class II, Div 2, Groups E,F,G

Class III, Div 2

#### 760E Electro-Pneumatic (Continued)

CSA Intrinsically Safe: Class I, Div 1, Groups A,B,C,D  
 Class II, Div 1, Groups E,F,G

Suitable for: Class I, Div 2, Groups A,B,C,D  
 Class II, Div 2, Groups E,F,G  
 Class III, Div 2

Aluminum Housing with Epoxy/Polyester Powder Coat  
 Ingress & Corrosion  
 Protection:  
 NEMA 4, 4X, IP65

Action:  
 Direct or Reverse  
 Supply Pressure:  
 150 PSIG Max **Not to exceed actuator rating**

Media:  
 Clean Dry Oil Free Air Filtered to 3 micron

Flow Capacity:  
 9.0 SCFM  
 Air Connections:  
 0.5 SCFM Typical  
 1/4 NPT

Electrical Connection:  
 3/4 NPT

Gauges:  
 Input 0-30 PSIG, Output 0-60 PSIG,  
 Housing Black Steel Case with Chrome Ring

Ambient Temperature:  
 70°F -40 to 180°F, 70E -40 to 167°F

Mounting:  
 Yoke Mounted

#### Westlock ICoT Models:



#### Electro-Pneumatic

Models:  
 510: Full Range Signal (4-20 mA)

Options 2SPDT Limit Switches  
**Intelligent with Keypad**

Models:  
 520: Full Range Signal (4-20 mA)

Options 2SPDT Limit Switches, 4-20 mA Feedback  
**Intelligent with HART**

Models:  
 530: Full Range Signal (4-20 mA)

Options 2SPDT Limit Switches, 4-20 mA Feedback  
**Intelligent with Foundation Fieldbus**

Models:  
 540: Full Range Signal (4-20 mA)

Options 2SPDT Limit Switches, 4-20 mA Feedback

#### All Models:

Construction:  
 Engineered Resin Housing

Ingress & Corrosion  
 Protection:  
 NEMA 4, 4X

Approvals & Ratings:  
 Non-Incandive Groups A-G, Div 2

Action:  
 Direct or Reverse

Supply Pressure:  
 15 to 45 PSIG **Not to exceed actuator rating**

Media:  
 Clean Dry Oil Free Air Filtered to 40 micron  
 8.0 SCFM at 25 PSIG

Flow Capacity:  
 0.003 SCFM at 20 PSIG  
 Air Connections:  
 1/4 NPT

Electrical Connection:  
 1/2 NPT

Gauges:  
 Supply 0-60 PSIG, Output 1 0-60 PSIG,  
 Housing Black Steel Case with Chrome Ring

Ambient Temperature:  
 -40 to 180°F

Mounting:  
 Yoke Mounted

### Position Indication Switches

#### Proximity Mark 1



#### Models:

2 SPDT Switches  
 4 SPDT Switches  
 6 SPDT Switches

2 SPDT Switches w/ 2K Potentiometer  
 2 SPDT Switches w/ 4-20 mA Feedback

Locations:  
 Aluminum Housing, Hard Anodized

Ambient Temperature:  
 -40 to 180°F

Electrical Connection:  
 3/4 NPT, Terminal Strip  
 Mounting:  
 Yoke Mounted

#### I/P's

##### Type 500X



#### Locations:

NEMA 3  
 Zinc Alloy Base with Aluminum Bonnet,  
 Epoxy Painted

Ranges:  
 3-9, 9-15, 3-15, 1-17, or 6-30 PSI

Supply Pressure:  
 Minimum 3 PSIG Above Maximum Output  
 Maximum 100 PSIG **Not to Exceed Actuator Rating**

Flow Capacity:  
 4.5 SCFM at 25 PSIG, 12 SCFM at 100 PSIG

Air Consumption:  
 0.05 SCFM Midrange Typical  
 Ambient Temperature:  
 -20 to 140°F

##### Type 550X



#### Locations:

NEMA 4X (IP65)  
 Chromate-treated Aluminum with Epoxy Paint

Ranges:  
 0-30, or 0-60 PSI

Supply Pressure:  
 Minimum 5 PSIG Above Maximum Output  
 Maximum 100 PSIG **Not to Exceed Actuator Rating**

Flow Capacity:  
 12 SCFM at 100 PSIG

Air Consumption:  
 6.0 SCFM Midrange Typical  
 Ambient Temperature:  
 -20 to 150°F

##### Type 650X



#### Locations:

NEMA 4X (IP65), Explosion proof  
 Chromate-treated Aluminum with Epoxy Paint

Ranges:  
 3-15 PSI

Supply Pressure:  
 Minimum 5 PSIG Above Maximum Output  
 Maximum 100 PSIG **Not to Exceed Actuator Rating**

Flow Capacity:  
 4.5 SCFM at 25 PSIG  
 Air Consumption:  
 3.0 SCFM Midrange Typical  
 Ambient Temperature:  
 -40 to 160°F

## Actuators, Positioners, & Accessories

#### I/P's (Continued)

##### All Models:

Input:  
 4-20 mA  
 Field Reversible  
 1/4 NPT

Air Connections:  
 Electrical Connection:  
 1/2 NPT, Pigtail Leads  
 Media:  
 Clean Dry Oil Free Air Filtered to 40 micron

Mounting:  
 Yoke Mounted

### Air Filter Regulators



#### Models:

Type 300, Type 350SS  
 Type 300, 0-30 or 0-60 PSIG  
 Type 350SS, 0-100 PSIG

Supply Pressure:  
 Type 300, 250 PSIG Maximum  
 Type 350SS, 290 PSIG Maximum

Construction:  
 Type 300, Die-Cast Aluminum with Iridium  
 and Baked Epoxy Paint  
 Type 350SS, 316 Stainless Steel

Gauge:  
 Type 300, Output, Housing Stainless Steel  
 Type 350SS, Output, Housing Stainless Steel

Air Connections:  
 Filter:  
 1/4 NPT  
 Mounting:  
 Chamber Mounted

### Solenoids



#### Models:

8320G184, EF8320G184,  
 8320G202, EF8320G202

Construction:  
 (EF)8320G184, 3-Way Brass  
 (EF)8320G202, 3-Way Stainless Steel

Locations:  
 8320G184 & 8320G202, Watertight,  
 Types 1, 2, 3, 3S, 4 & 4X  
 EF8320G184 & EF8320G202, Explosion proof  
 and Watertight, Types 3, 3S, 4, 4X, 6, 6P, 7 & 9

Supply:  
 120VAC

Ambient Temperature:  
 -32 to 125°F

Air Connections:  
 1/4 NPT

Electrical Connection:  
 1/2 NPT, Pigtail Leads  
 Approvals:  
 CSA, UL, CE

Mounting:  
 Chamber Mounted

### Air Tubing

Standard:  
 Copper

Optional:  
 Stainless Steel

## Factory Default Settings

Positioners			
Valve Type	Actuator Action	Input Signal	Failure Modes
2920, 22 & 23	Direct	Pneumatic	Loss of Signal* Valve Fails...
2930 & 32	Reverse	Pneumatic	Loss of Signal* Valve Fails...
	Direct	4-20 mA	Increases Signal
	Reverse	4-20 mA	Decreases Signal
	Direct	3-15 PSI	Opens Valve
	Reverse	3-15 PSI	Closes Valve
	Direct	4-20 mA	Upper Port Closed/ Lower Port Open
	Reverse	4-20 mA	Upper Port Open/ Lower Port Closed

\* Valves with Fail Freeze Positioners Fall in Last Position on Loss of Signal.

Positioner Feedback			
Valve Type	Actuator Action	Feedback Signal	Settings
2920, 22 & 23	Direct	4-20 mA	Increases as Signal
2930 & 32	Reverse	4-20 mA	Decreases as Signal
	Direct	4-20 mA	Upper Port Closed/ Lower Port Open
	Reverse	4-20 mA	Upper Port Open/ Lower Port Closed

\* Reduced feedback span for valves with 760 and less than 1 inch travel.

I/P's			
Valve Type	Actuator Action	Input Signal	Failure Modes
2920, 22 & 23	Direct	As Required For Shut-off	Loss of Signal Valve Fails...
2930 & 32	Direct	As Required For Shut-off	Loss of Signal Valve Fails...
	Reverse	As Required For Shut-off	Loss of Air Supply Valve Fails...
	Direct	As Required For Shut-off	Loss of Air Supply Valve Fails...

SOLENOIDS (without Positioners or I/P's)			
Valve Type	Actuator Action	Input Signal	Failure Modes
2920, 22 & 23	Direct	As Required For Shut-off	Loss of Signal Valve Fails...
2930 & 32	Direct	As Required For Shut-off	Loss of Signal Valve Fails...
	Reverse	As Required For Shut-off	Loss of Air Supply Valve Fails...
	Direct	As Required For Shut-off	Loss of Air Supply Valve Fails...

If the Solenoid is used with a Positioner or an I/P, refer to the Positioner or I/P listings for factory default settings and failure modes with the solenoid not failed.

Proximity MARK 1 Position Indication Switches Feedback			
Valve Type	Actuator Action	Feedback Signal	Settings
2920, 22 & 23	Direct	0-350 ohm	Increases as Signal
2930 & 32	Reverse	0-350 ohm	Decreases as Signal
	Direct	0-350 ohm	Upper Port Closed/ Lower Port Open
	Reverse	0-350 ohm	Upper Port Open/ Lower Port Closed

\* Span varies from approx 155 to 350 ohm depending on actuator and travel.

Air Filter Regulators			
Actuator	Output Pressure	Settings	Position
DL49, 84 & 84XR	30PSIG	Switch 1, 3, 5	Switch 2, 4, 6
DL115 & 115XR	40PSIG	Closed	Open
		Open	Closed
		Upper Port Closed	Upper Port Open
		Lower Port Closed	Lower Port Open

2600 Emrick Blvd., Bethlehem, PA 18020-8010 www.WarrenControls.com  
Tel: 800-922-0085 or 610-317-0800 Fax: 610-317-2989



## Configurations

1. SELECTIONS Please make a selection from each table of OPTIONS below to make a complete model number string.

29		R		VALVE BODY		Trim Cv		Packing Type	
Model	Valve Type	Body Material	End Connection	Trim Style	Trim Material	Trim Cv	Packing Type		
291N 49" or 84" Pneumatic	20 2-Way Single Seat	R Cast Iron	F 125 lb. Flanged G 250 lb. Flanged	E Equal % Types 20/22/23 L Linear Types 30/32	B Bronze S 300 SS H 17-4 PH G Alloy 6 Wrought	F Full Port	T Teflon G Graphite Packing Used for Temp up to 500F where Body Pressure Temp is not Violated		
291 115 Pneumatic	22 2-Way Double Seated								
	23 2-Way Cylinder Bbl.								
	30 3-Way Mixing								
	32 3-Way Diverting								

NOTE: Valve Type 22 is Only Used with 29W Body & DL49/DL44 Actuators.

VALVE TYPE / TRIM MATERIAL COMBINATIONS:

SIZE	B		S		H		6	
	Bronze		300SS		17-4 PH		Alloy 6 Wrought	
250 2-1/2 in.	20, 22, 23, 30, 32	20, 22, 23, 30, 32	20, 22, 23, 30, 32	20, 23	23	23	23	
300 3 in.	20, 22, 23, 30, 32	20, 22, 23, 30, 32	20, 22, 23, 30, 32	20, 23	23	23	23	
400 4 in.	20, 22, 23, 30, 32	20, 22, 23, 30, 32	20, 22, 23, 30, 32	20, 23	23	23	23	
500 5 in.	20, 22, 23, 30, 32	20, 22, 23, 30, 32	20, 22, 23, 30, 32	20, 23	23	23	23	
600 6 in.	20, 22, 23, 30, 32	20, 22, 23, 30, 32	20, 22, 23, 30, 32	20, 23	23	23	23	
800 8 in.	22, 32	20, 22, 30, 32	20, 22, 30, 32	N/A	N/A	N/A	N/A	
010 10 in.	22	20, 22	20, 22	N/A	N/A	N/A	N/A	

VALVE TYPE / ACTUATOR COMPATIBILITY:

VALVE STYLE	VALVE SIZES	ACTUATORS
Type 20	2-1/2" - 6"	DL49 & DL54XR
Type 20	2-1/2" - 6"	DL84
Type 20	2-1/2" - 10"	DL115 & DL115XR
Type 22	2-1/2" - 4"	DL49 & DL84
Type 23	5" - 10"	DL49
Type 23	2-1/2" & 3"	DL49
Type 23	2-1/2" - 6"	DL84
Type 23	4" - 6"	DL115
Type 23	6"	DL115XR
Type 30	2-1/2" & 3"	DL49 & DL54XR
Type 30	2-1/2" - 6"	DL84
Type 32	2-1/2" - 6"	DL115 DL115XR
Type 32	2-1/2" - 4"	DL49
Type 32	2-1/2" - 6"	DL84
Type 32	4" - 6"	DL115

# WARREN CONTROLS

## ACTUATED INDUSTRIAL VALVES

**1800 SERIES**

**2800 SERIES**

**2900 SERIES**

**3800 SERIES**

**5800 SERIES**

Heavy Globe Control Valves

Precision Globe Control Valves

High Capacity General Purpose Globe Control Valves

E-Ball Rotary Control Valves

Compact Globe Control Valves

styles:

- 2-way balanced
- 2-way unbalanced
- 3-way mixing
- 3-way diverting

styles:

- 2-way balanced
- 2-way unbalanced
- 3-way mixing
- 3-way diverting

styles:

- 2-way rotary
- flow to open
- flow to close

styles:

- 2-way cage-retained seat

sizes 2-1/2 to 12 in.

sizes 1/2 to 2 in.

sizes 2-1/2 to 10 in.

sizes 1 to 8 in.

sizes 1 to 4 in.

class 300

class 250 & 300

class 125 & 250

class 300

class 300

ends 150,300 RF fig.

ends Butt-weld, NPT

ends Flange

ends 150,300 RF fig.

ends 150,300 RF fig.

body WCB, CF8M

body Cast Iron

body Cast Iron

body WCB, CF8M

body WCB, CF8M

trim 316 SST, Alloy 6

trim Bronze, 316SST 17-4PH, Alloy 6

trim Bronze, 300SS, 17-4PH, Alloy 6

trim 316 SST, Alloy 6

trim 316 SST, Alloy 6, TFE, PEEK

Cv up to 1649

Cv up to 40

Cv up to 960

Cv up to 1420

Cv up to 170

temp. -20° to 800°F

temp. -20° to 500°F

temp. -20° to 800°F

temp. -20° to 800°F

temp. -20° to 800°F

body limit to 740 psi

body limit to 720 psi

body limit to 400 psi

body limit to 740 psi

body limit to 740 psi

shutoff class III, IV

shutoff class III, IV, VI

shutoff class III, IV, VI

shutoff class IV, VI

shutoff class IV, VI

rangeability 50:1

rangeability 50:1

rangeability 100:1

rangeability 100:1

rangeability 50:1

Highly Efficient, Compact Design

General Purpose Moderate Pressure Drops

High Capacity General Purpose Moderate Pressure Drops

Severe Service High Pressure Differentials

Highly Efficient, Compact Design

High Pressure Drops

Well Suited for Erosive Service

Typically Suited for High Force Piston Actuators

Compatible Options Include Liquids and Gas, Steam & Water

Well Suited for Erosive Service

Various Trim Options Include Ceramic for Slurries or Gritty Materials & Chemicals & Teflon® for Class VI Shutoff

Highly Efficient, Compact Design

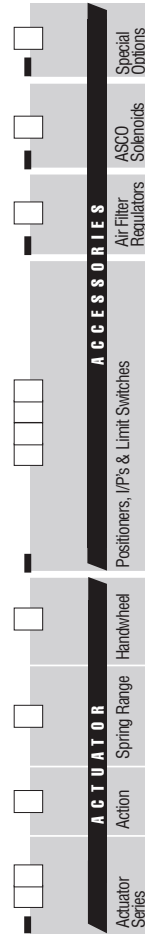
High Pressure Drops

Well Suited for Erosive Service

Typically Suited for High Force Piston Actuators

Compatible Options Include Liquids and Gas, Steam & Water

Modulating or On/Off Control



**ACTUATOR**  
Action Spring Range Handwheel

**ACCESSORIES**  
Positioners, I/P's & Limit Switches Air Filter Regulators ASCO Solenoids Special Options

**0000** None  
**B-P** BLX Pneumatic  
**B-E** BLX Electro-Pneumatic  
**B-I** BLX Electro-Pneum. Intrn. Safe  
**B-X** BLX Electro-Pneum. Exp. Pico  
**B-Y** BLX Electro-Pneum. Fail Freeze  
**76P** Moore/60 Pneumatic  
**510** Westlock (CoT) Electro-Pneumatic  
**520** Westlock (CoT) Intelligent-Keycard  
**530** Westlock (CoT) Intelligent-Hart  
**540** Westlock (CoT) Found Fieldbus  
**PX11** Mark 1 Series - 2 ea. SPDT  
**PX12** Mark 1 Series - 2 ea. SPDT w/2k Pkt  
**PX13** Mark 1 Series - 2 ea. SPDT w/4-20 Feedback  
**PX14** Mark 1 Series - 4 ea. SPDT  
**PX15** Mark 1 Series - 6 ea. SPDT  
**MAP1** Type 500X (IP, 3-15 PSI)  
**MAP2** Type 500X (IP, 3-15 PSI)  
**MAP3** Type 500X (IP, 3-15 PSI)  
**MAP4** Type 500X (IP, 1-17 PSI)  
**MAP5** Type 500X (IP, 6-30 PSI)  
**MAP6** Type 500X (IP, 0-30 PSI)  
**MAP7** Type 500X (IP, 0-60 PSI)-For 15 or 5X only  
**MAP9** Type 500X (IP, 3-15 EXP)

**POSITIONERS:**  
**A** Type 300, 0-30 PSI  
**B** Type 300, 0-60 PSI  
**D** Type 350S, 0-100 PSI  
**MF** FR20G202, 3-Way EXP, SS  
**ZZ** VAC, Coils

**4th digit spec.**  
**F** Full Stroke  
**L** Low of Split Range  
**H** High of Split Range  
**9-15 PSI or 4-20mA**  
**3-9 PSI or 4-17mA**  
**9-15 PSI or 12-20mA**

**4th digit spec.**  
**O** No Address  
**L** when Lin Swtch  
**F** w/4-20 feedback  
**B** w/20k & feedback

**FAILURE MODES:**  
**MODE** VALVE TYPE ACTUATOR ACTION  
 Closed 20/22 Reverse  
 Open 20/22 Direct  
 Upper Closed 30/22 Direct  
 Upper Open 30/22 Reverse  
 \*Standard

**ACTUATOR / BODY COMPATIBILITY:**

DUPHARM	BODY
49 49 Sq.In. (D149)	For 23N Bodies
84 84 Sq.In. (D184)	For 23N Bodies
8X DL84XR	For 23N Bodies
15 15 Sq.In. (D115)	For 231 Bodies
5X DL15XR	For 231 Bodies

**NOTE:**  
 5X & 8X Only  
 10-14 psi 49R  
 8-12 psi 48D  
 10-14 psi 48R  
 8-12 psi 48D  
 10-14 psi 48R  
 8-12 psi 48D  
 10-14 psi 48R  
 8-12 psi 48D

**NOTE:**  
 Standard pneumatic tubing is copper. SS tubing is optional.  
 SS tagging "g" (Two lines, 24 characters/line) is optional.  
 SS tagging and tagging together "B" is optional.

Warren Controls does not assume responsibility for the selection, use, or maintenance of any product. Responsibility for proper selection, use, and maintenance of any Warren Controls product remains solely with the purchaser and end-user.

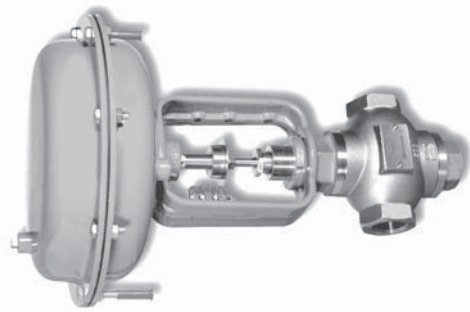
PRODUCT SPECIFICATION

March 2005

## PNEUMATIC ACTUATED INDUSTRIAL VALVES

SERIES: **2800** SIZES 1/2 to 2 INCHES

Precision Globe Control Valves



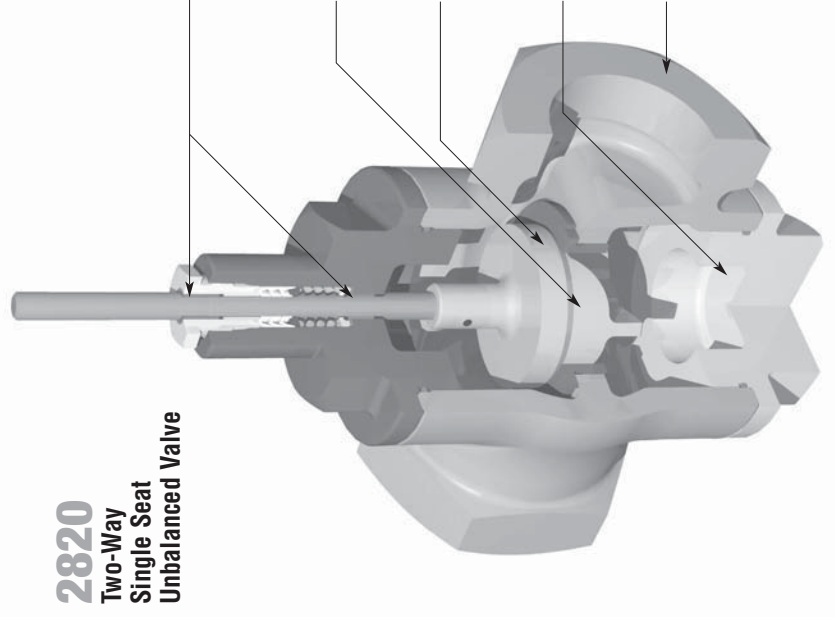
## WARREN CONTROLS

Two-Way and Three-Way, Reciprocating,  
Bronze or Stainless Steel Body Valves  
for Process and Utility Applications

## Table of Contents

Body Style Versus Application .....	3
Body Pressure-Temperature Rating .....	3
Flowing Differential Pressure Limits .....	3
Flow Coefficients (Cv) Versus Travel .....	4
Sizing Reference and Load Sizing Calculations .....	5
Shut-Off $\Delta P$ Ratings .....	6-7
Dimensions and Weights .....	8
Actuators, Positioners, and Accessories .....	9-11
Factory Default Settings .....	12
Configurations .....	13-14

### 2820 Two-Way Single Seat Unbalanced Valve



**Flexible Design Options**  
provide optimum performance and extended reliability in a cost effective, application specific package.

**Dual Point PEEK Bearing Stem Guiding**  
provides both stability and low friction, yielding reduced hysteresis and optimum control.

**Trim**  
available in 316SS, 17-4 pH, Alloy 6, PEEK, and PTFE.

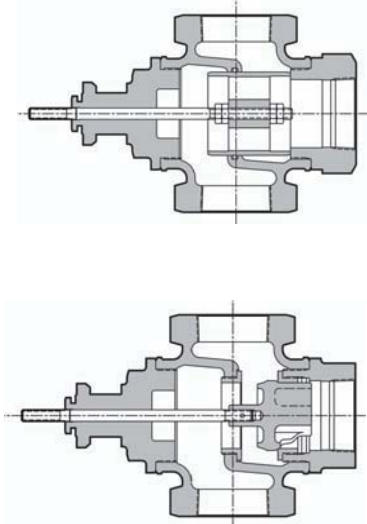
**Port Guided Plug Assembly**  
provides stability and desired equal percentage flow characteristic.

**Lower Plug**  
offers easy access for inspection and clean out.

**Rugged Body**  
with a selection of port reductions.

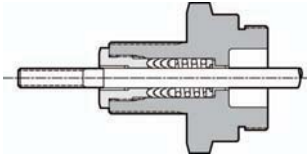


**SERIES: 2800**  
Precision Globe  
Control Valves

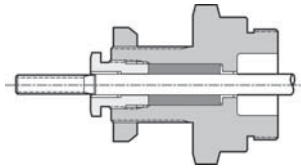


**2830**  
**Three-Way Mixing Valve**  
**Bronze Body**

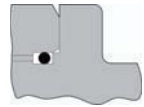
**2832**  
**Three-Way Diverting/Mixing Valve**  
**Bronze Body**



**Guided Low-Friction TFE V-Ring Packing Spring Loaded**



**Adjustable Graphite Packing**



**Fluoraz O-Ring Upper and Lower Body Seals in Stainless Steel Body Valves**

**Description**

Warren Controls Series 2800 Precision Globe Control Valves feature rugged bronze or stainless steel bodies with a variety of trim materials and port sizes. The equal percentage and linear plugs in the 2-way valves and linear plugs in the 3-way valves provide excellent modulating control of a wide variety of fluids for pressure, temperature, level, and flow applications from -20 to 500°F. The Series 2800 is ideally suited where value and long life are important objectives for applications including but not limited to the Chemical, Food & Beverage, General Service, Refining, and Pharmaceutical Industries.

2600 Emrick Blvd., Bethlehem, PA 18020-8010 www.WarrenControls.com  
Tel: 800-922-0085 or 610-317-0800 Fax: 610-317-2989



3 For additional applications, and/or products call: 800-922-0085 or visit: www.WarrenControls.com

PS 2800 C 0916

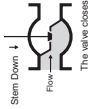
**Body Style Versus Application**

**2-Way Valves (Control of Liquids, Gases, and Steam)**

**2820 Two-Way Single Seat Unbalanced Valve**

The most commonly applied solution with ANSI Class IV and VI shut-off.

- Sizes:** 1/2, 3/4, 1, 1-1/4, 1-1/2, 2, 3 inch
- Body:** ANSI B16.15 Bronze 250LB Threaded (NPT) or 316 Stainless Steel 300LB Threaded (NPT)
- Trim:** F0% or Linear, 316 Stainless Steel, Alloy 6, TFE, PEEK, or 17-4 PH Hardened Stainless Steel
- Shut-off:** ANSI Class IV (Stainless Steel and Alloy 6 Trim), ANSI Class VI (TFE and PEEK Trim)
- Packing:** Guided Low-Friction TFE V-Ring, Spring Loaded (-32 to 450°F), Adjustable Graphite Packing (-32 to 500°F)
- Temperature:** -32 to 400°F (Bronze 250LB Threaded Body w/ TFE or PEEK Trim) -32 to 500°F (316 Stainless Steel 300LB Threaded Body w/ Stainless Steel or Alloy 6 Trim)
- Rangeability:** 50:1



Body Pressure-Temperature Ratings:	
Temperature (F)	250 THD Bronze SS 300 THD SS
+32° to 150°F	400 720
150°	400 670
175°	392 645
200°	385 620
225°	375 605
250°	365 590
275°	350 575
300°	335 560
325°	317 548
350°	300 537
375°	275 526
400°	250 515
450°	- 497
500°	- 480

Pressure ratings are PSIG  
For applications below 32° consult factory.  
For applications above 375° 300 THD Stainless Steel Body is recommended.

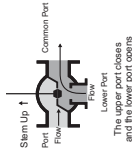
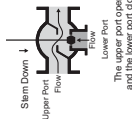
Trim Materials	Flowing Differential Pressure Limit
Bronze	50 PSID
316 Stainless Steel	100 PSID
TFE	100 PSID
PEEK	100 PSID
17-4 PH Hardened Steel	200 PSID
Alloy 6	300 PSID

**3-Way Valves (Control of Liquids)**

**2830 Three-Way Mixing Valve**

This valve has two inlets and one outlet, and is the simplest solution for mixing or bypass applications with ANSI Class IV shut-off. In normal applications the inlet pressures are near equal and control is possible from 5% to 95% of travel with inlet pressures up to 100 PSI.

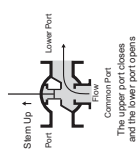
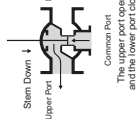
- Sizes:** 1/2, 3/4, 1, 1-1/4, 1-1/2, 2, 3 inch
- Body:** ANSI B16.15 Bronze 250LB Threaded (NPT) or 316 Stainless Steel 300LB Threaded (NPT)
- Trim:** Linear, 316 Stainless Steel
- Packing:** Guided Low-Friction TFE V-Ring, Spring Loaded (-32 to 450°F), Adjustable Graphite Packing (-32 to 500°F)
- Temperature:** -32 to 400°F (Bronze 250LB Threaded) -32 to 500°F (316 Stainless Steel 300LB Threaded)
- Rangeability:** 50:1



**2832 Three-Way Diverting/Mixing Valve**

Designed as a diverting valve with one inlet and two outlets with ANSI Class III shut-off. However, flow can be reversed for mixing if this port configuration is desirable. The difference between the upper port and lower port pressure must not exceed 50 PSID.

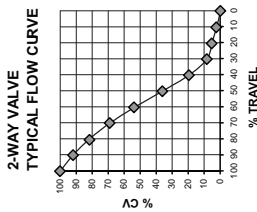
- Sizes:** 1, 1-1/2, 2, 3 inch
- Body:** ANSI B16.15 Bronze 250LB Threaded (NPT) or 316 Stainless Steel 300LB Threaded (NPT)
- Trim:** Linear, Bronze (Bronze 250LB Threaded), or 316 Stainless Steel (316 Stainless Steel 300LB Threaded)
- Packing:** Guided Low-Friction TFE V-Ring, Spring Loaded (-32 to 450°F), Adjustable Graphite Packing (-32 to 500°F)
- O-Ring:** EPR (Bronze 250LB Threaded), Fluoraz 797 (316 Stainless Steel 300LB Threaded)
- Temperature:** -32 to 300°F (Bronze 250LB Threaded) -32 to 500°F (316 Stainless Steel 300LB Threaded)
- Rangeability:** 50:1



## Flow Coefficients (Cv) Versus Travel

Valve		2820 Flow Coefficients (Cv)									
Two-Way Single Seat Unbalanced Valve		% Travel									
Valve Size (In)	Trim Style	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
1/2	EQ	0.876	FULL 4.90	4.78	3.53	2.57	1.92	1.51	0.95	0.69	0.43
	LINEAR	0.626	1.5R 3.20	3.16	2.29	1.61	1.19	0.75	0.51	0.39	0.26
3/4	EQ	0.626	2.5R 6.00	5.44	4.96	0.42	0.31	0.21	0.10	0.06	
	LINEAR	0.876	FULL 6.00	5.40	4.80	4.20	3.60	3.00	2.40	1.80	1.20
1	EQ	0.876	1.5R 7.20	7.09	5.53	3.51	2.53	1.73	1.24	0.88	0.52
	LINEAR	0.626	3.5R 3.30	3.30	2.94	1.63	1.20	0.75	0.51	0.39	0.26
1-1/4	EQ	0.876	FULL 10.0	9.70	6.52	4.40	3.32	2.04	1.36	0.81	0.55
	LINEAR	0.626	5.5R 8.60	8.38	6.09	3.64	2.58	1.74	1.25	0.89	0.52
1-1/2	EQ	0.876	2.5R 6.00	5.79	3.88	2.70	1.97	1.22	0.96	0.70	0.43
	LINEAR	0.626	3.5R 3.40	3.41	2.38	1.64	1.20	0.75	0.51	0.39	0.26
2	EQ	0.876	FULL 24.0	22.9	19.7	15.1	10.3	7.30	4.90	3.20	1.90
	LINEAR	1.126	FULL 16.0	15.5	10.4	7.04	4.81	3.28	2.18	1.30	0.88
3	EQ	0.876	2.5R 6.00	5.79	3.88	2.70	1.97	1.22	0.96	0.70	0.43
	LINEAR	0.626	4.5R 3.40	3.41	2.38	1.64	1.20	0.75	0.51	0.39	0.26
4	EQ	0.876	FULL 30.0	28.9	25.9	22.2	18.5	14.8	11.1	7.40	3.70
	LINEAR	1.126	FULL 20.0	19.0	13.0	9.00	6.00	4.00	3.00	2.00	1.00
5	EQ	0.876	3.5R 3.40	3.41	2.38	1.64	1.20	0.75	0.51	0.39	0.26
	LINEAR	0.626	5.5R 8.60	8.38	6.09	3.64	2.58	1.74	1.25	0.89	0.52
6	EQ	0.876	FULL 30.0	28.9	25.9	22.2	18.5	14.8	11.1	7.40	3.70
	LINEAR	1.126	FULL 20.0	19.0	13.0	9.00	6.00	4.00	3.00	2.00	1.00

### 2-Way Valves (Control of Liquids, Gases, and Steam)



## Sizing Reference

Steam Table					
Steam Pressure PSIG	Temp. °F	Temp. °C	Sensible Heat BTU/Lb.	Latent Heat BTU/Lb.	Total Heat BTU/Lb.
0	212	100	180	971	1151
10	239	115	207	962	1169
25	266	130	236	954	1170
50	297	147	267	912	1179
75	320	160	290	896	1186
100	338	170	309	881	1190
125	353	178	325	868	1193
150	365	185	339	858	1197
200	387	197	362	838	1202
250	406	208	381	821	1204
300	422	217	399	805	1204
400	448	231	438	778	1216
500	470	243	453	762	1205
600	489	254	475	729	1204

**Rectangular Tank Capacity in Gallons**  
 Height x Width x Length (inches)  
 Gallons =  $\frac{\hspace{2cm}}{230}$

or  
 Gallons =  $H \times W \times L \text{ (Ft.)} \times 7.5$

**Circular Tank Storage Capacity in Gallons**  
 Storage =  $6D^2 \times L \text{ (Gallons)}$

Where:  
 D = Tank Diameter in Feet  
 L = Length in Feet

## Load Sizing Calculations

**Glossary of Terms**  
 t = Time in Hours  
 Cp = Specific Heat of Liquid  
 S = Specific Gravity of Fluid  
 W = Weight in Lbs.  
 ΔT = Temperature Rise or Fall in °F  
 h<sub>fg</sub> = Latent Heat of Steam

**Conversion Factors**  
 1 Lb. Steam / Hr. = 1000 BTU / Hr.  
 1 Cubic Meter = 264 U.S. Gallons  
 1 Cubic Foot Water = 62.4 Lbs.  
 1 PSI = 2.04 inches of Mercury  
 1 PSI = 2.77 inches of Water  
 1 U.S. Gallon Water = 231 Cubic inches  
 1 U.S. Gallon Water = 8.33 Lbs.

### Heating Water with Steam

Quick Method

$$\text{GPM} = \frac{\text{CFM} \times (\text{°F air temp. rise})}{1000 \times (\text{°F water temp. drop})}$$

$$\text{Lbs./Hr.} = \frac{\text{GPM} \times 8.33}{2} \times \Delta T$$

Accurate Method

$$\text{Lbs./Hr.} = \frac{\text{GPM} \times 500 \times \Delta T}{h_{fg}}$$

Heating or Cooling Water with Water

$$\text{GPM}_1 = \frac{\text{GPM}_2 \times (\text{°F water}_2 \text{ temp. rise or drop})}{\text{°F water}_1 \text{ temp. rise or drop}}$$

Heating or Cooling Water

$$\text{GPM} = \frac{\text{BTU} / \text{Hr.}}{(\text{°F water temp. rise or drop}) \times 500}$$

Heating Oil with Steam

$$\text{Lbs./Hr.} = \frac{\text{CFM} \times (\text{°F oil temp. rise})}{900}$$

### Heating Air with Water

$$\text{GPM} = 2.16 \times \frac{\text{CFM} \times (\text{°F air temp. rise})}{1000 \times (\text{°F water temp. drop})}$$

### Heating Liquids with Steam

$$\text{Lbs./Hr.} = \frac{\text{GPM} \times 60 \times \text{Cp} \times W}{h_{fg}} \times \Delta T$$

### Heating Liquids in Steam Jacketed Kettles

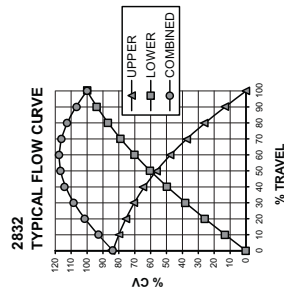
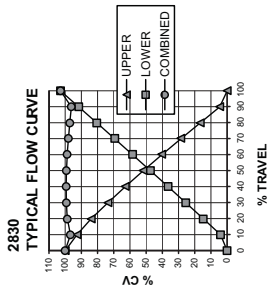
$$\text{Lbs./Hr.} = \frac{\text{GPM} \times \text{Cp} \times S \times 8.33}{h_{fg}} \times \Delta T$$

### General Liquid Heating

$$\text{Lbs./Hr.} = \frac{W \times \text{Cp}}{h_{fg}} \times \Delta T$$

### Heating Air with Steam

$$\text{Lbs./Hr.} = \frac{\text{CFM}}{900} \times \Delta T$$



Valve		2830 Flow Coefficients (Cv)									
Three-Way Mixing Valve		% Travel									
Valve Size (In)	Trim Style	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
1/2	LINEAR	1.126	FULL 6.30	6.30	4.62	3.24	2.16	1.51	1.00	0.69	0.43
	EQ	0.876	1.5R 4.00	4.00	2.94	2.07	1.45	1.00	0.69	0.43	0.26
3/4	LINEAR	0.626	2.5R 2.00	2.00	1.45	1.00	0.69	0.43	0.26	0.15	
	EQ	0.876	FULL 2.00	2.00	1.45	1.00	0.69	0.43	0.26	0.15	
1	LINEAR	1.126	FULL 8.20	8.20	5.94	4.17	2.97	2.07	1.45	1.00	0.69
	EQ	0.876	1.5R 4.00	4.00	2.94	2.07	1.45	1.00	0.69	0.43	0.26
2	LINEAR	1.126	FULL 12.0	12.0	8.64	6.00	4.17	2.97	2.07	1.45	1.00
	EQ	0.876	2.5R 4.00	4.00	2.94	2.07	1.45	1.00	0.69	0.43	0.26

### 3-Way Valves (Control of Liquids)

Valve		2832 Flow Coefficients (Cv)			
Three-Way Diverting/Mixing Valve		% Travel			
Valve Size (In)	Trim Style	100%	Upper	Lower	100%
1	LINEAR	12	15	15	12
1-1/2	LINEAR	22	26	26	22
2	LINEAR	40	47	47	40

## Shut-Off ΔP Ratings

### NOTES:

- 2820 Seat closure ANSI Class IV (Stainless Steel and Alloy 6 Trim), ANSI Class VI (PE and PEEK Trim).
- Inlet pressure **cannot** exceed Body Pressure-Temperature Rating.
- The 3-15 and 1-17 columns of the table apply to valves with control signals coming directly from I/P transducers with matching ranges. The 0-30 and 0-40 columns apply to valves with a positioner or an I/P transducer of suitable range.
- N/A indicates that the air signal is not capable of providing any shut-off or it exceeds the actuator's maximum air pressure.
- See Actuators, Positioners, and Accessories section for explanation of spring ranges.

Valve		Actuator				Shut-Off ΔP			
Trim Size (IN)	Valve Size (IN)	Plug Travel (IN)	Pneumatic Actuator Range	Two-Way, Single Seat Unbalanced					
				Maximum Shut-Off ΔP in PSI	Fall Closed	Reverse Acting	Fall Open		
		Air Signal to Actuator		Direct Acting		Air Signal to Actuator			
		3-15 PSI	1-17 PSI	0-30 PSI	0-40 PSI	0-30 PSI	0-40 PSI		
0.626	1/2	3/4	DL49	N/A	226	386	704	720	720
	thru		DL49	N/A	67	386	67	386	720
	1-1/4		DL49	N/A	226	545	226	545	720
	thru		DL49	N/A	90	496	333	496	720
0.876	1/2	3/4	DL49	N/A	8	171	8	171	720
	thru		DL49	N/A	90	252	90	252	720
1.126	1	3/4	DL49	N/A	38	88	186	284	720
	thru		DL49	N/A	88	137	N/A	88	720
2			DL84	N/A	235	334	38	137	720
			DL84	N/A	60	144	N/A	60	720
			DL84	N/A	397	566	N/A	60	720
1.438	1-1/4	3/4	DL49	N/A	11	42	102	162	555
	thru		DL49	N/A	42	72	N/A	42	434
2			DL84	N/A	231	335	11	72	464
			DL84	N/A	24	76	N/A	24	697
			DL84XR	N/A	231	335	N/A	24	697
			DL84XR	N/A	396	490	N/A	24	697
1.676	1-1/4	3/4	DL49	N/A	24	46	68	113	401
	thru		DL49	N/A	24	46	N/A	24	313
2			DL84	N/A	91	135	N/A	46	335
			DL84	N/A	11	49	163	240	720
			DL84XR	N/A	11	49	N/A	11	506
			DL84XR	N/A	163	240	N/A	11	506
2.126	2	3/4	DL49	N/A	278	354	34	62	242
			DL49	N/A	212	236	N/A	7	186
			DL84	N/A	48	76	N/A	21	200
			DL84	N/A	N/A	23	94	141	449
			DL84XR	N/A	N/A	23	N/A	N/A	307
			DL84XR	N/A	94	141	N/A	N/A	307
			DL84XR	N/A	165	212	N/A	N/A	N/A

N/A Exceeds DL49 and DL84 Actuator's Maximum Air Pressure

N/A Exceeds DL49 and DL84 Actuator's Maximum Air Pressure

## Shut-Off ΔP Ratings

### NOTES:

- 2830 Mixing Valves have two inlets and one outlet. Published shut-off values are with respect to worst case conditions with zero downstream pressure on the outlet port and zero upstream pressure on the opposing inlet port. Pneumatic Actuators used with the 2830 are direct acting. The upper port fails closed on loss of air pressure to the actuator.
- 2830 Seat closure ANSI Class IV.
- Inlet pressure **cannot** exceed Body Pressure-Temperature Rating.
- The 3-15 and 1-17 columns of the table apply to valves with control signals coming directly from I/P transducers with matching ranges. The 0-30 and 0-40 columns apply to valves with a positioner or an I/P transducer of suitable range.
- N/A indicates that the air signal is not capable of providing any shut-off or it exceeds the actuator's maximum air pressure.

Valve		Actuator				Shut-Off ΔP			
Trim Size (IN)	Valve Size (IN)	Plug Travel (IN)	Pneumatic Actuator Range	Three-Way Mixing					
				Maximum Shut-Off ΔP in PSI	Upper Port Closed	Direct Acting	Lower Port Closed		
		Air Signal to Actuator		Direct Acting		Air Signal to Actuator			
		3-15 PSI	1-17 PSI	0-30 PSI	0-40 PSI	3-15 PSI	1-17 PSI		
0.626	1/2	9/16	DL49	N/A	67	226	360	720	
	thru		DL49	N/A	226	386	N/A	720	
	1	9/16	DL49	N/A	8	90	83	401	
	thru		DL49	N/A	90	171	260	423	
1.126	1/2	9/16	DL49	N/A	252	415	16	179	
	thru		DL49	N/A	N/A	38	N/A	720	
1.676	1-1/4	3/4	DL49	N/A	137	235	N/A	92	
	thru		DL49	N/A	2	24	N/A	381	
2			DL84	N/A	48	91	N/A	4	
			DL84	N/A	11	49	N/A	26	
			DL84XR	N/A	163	240	N/A	22	
2.126	2	3/4	DL49	N/A	21	48	N/A	50	
			DL49	N/A	21	48	N/A	50	
			DL84	N/A	81	129	N/A	8	
			DL84XR	N/A	81	129	N/A	8	
			DL84XR	N/A	94	141	N/A	58	
			DL84XR	N/A	165	212	N/A	284	

N/A Exceeds DL49 and DL84 Actuator's Maximum Air Pressure

6) See Actuators, Positioners, and Accessories section for explanation of spring ranges.

Maximum air pressure DL49...30PSIG DL84 & 84XR...30PSIG

## Valve

Valve		Actuator				Shut-Off ΔP			
Valve Size (IN)	Plug Travel (IN)	Pneumatic Actuator Range	Three-Way Diverting/Mixing						
			Maximum Shut-Off ΔP in PSI	Upper Port Closed	Direct Acting	Lower Port Closed			
		Air Signal to Actuator		Direct Acting		Air Signal to Actuator			
		3-15 PSI	1-17 PSI	0-30 PSI	0-40 PSI	3-15 PSI	1-17 PSI		
1	3/4	DL49	High	110	113	N/A	N/A		
	thru	DL49	High	113	115	N/A	N/A		
1-1/2	3/4	DL49	High	N/A	110	N/A	N/A		
	thru	DL49	High	N/A	113	N/A	N/A		
2	3/4	DL49	High	N/A	110	N/A	N/A		
	thru	DL49	High	N/A	110	N/A	N/A		

N/A Exceeds Actuator Rating

- Published shut-off values are for diverting applications. The values are worst case and based on the pressure difference between the inlet and the outlet that is closed. Consult the factory if the required shut-off exceeds the published value and the pressure at the inlet and both outlets is known. For proper operation in diverting applications, the pressure difference between both outlets must not exceed 50 PSI. Consult the factory for shut-off values for 2832 mixing applications. Pneumatic Actuators used with the 2832 are direct acting. The upper port fails closed on loss of air pressure to the actuator.
- 2832 Seat closure ANSI Class III.
- Inlet pressure **cannot** exceed Body Pressure-Temperature Rating.

4) The 3-15 and 1-17 columns of the table apply to valves with control signals coming directly from I/P transducers with matching ranges. The 0-30 and 0-40 columns apply to valves with a positioner or an I/P transducer of suitable range.

5) N/A indicates that the air signal is not capable of providing any shut-off or it exceeds the actuator's maximum air pressure.

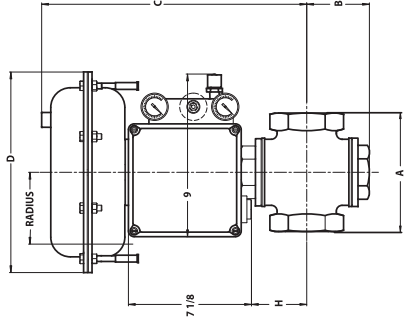
Maximum air pressure DL49...30 PSIG DL84...30 PSIG

6) See Actuators, Positioners, and Accessories section for explanation of spring ranges.

## Dimensions & Weights

Component	2820 Dimension (IN) by Valve Size (IN)	
Variable	1/2, 3/4, 1	1-1/4 & 1-1/2
A	250THD 300THD	5-3/4 6-1/8
B	250THD 300THD	3-1/4 3-7/8
C	DL49 Direct* DL49 Reverse DL84 Direct* DL84 or 84XR Reverse	15-1/4 14-5/8 19-1/4 18-5/8
H	DL49 DL84 or 84XR	15-7/8 19-7/8 19-1/4 18-1/2
Item	1-3/4 3-5/8	2-3/8 4-1/4
Variable	1/2, 3/4, 1	1-1/4 & 1-1/2
A	250THD 300THD	8-1/2 9
B	250THD 300THD	14-1/2 15-1/2
C	DL49 Direct* DL49 Reverse DL84 Direct* DL84 or 84XR Reverse	15-1/4 14-5/8 19-1/4 18-5/8
H	DL49 DL84 or 84XR	15-7/8 19-7/8 19-1/4 18-1/2
Item	1-3/4 3-5/8	2-3/8 4-1/4

Component	2830 Dimension (IN) by Valve Size (IN)	
Variable	1/2, 3/4, 1	1-1/4 & 1-1/2
A	250THD 300THD	5-3/4 6-1/8
B	250THD 300THD	3-3/4 3-3/8
C	DL49 Direct* DL84 or 84XR Direct*	15-1/4 15-7/8
H	DL49 DL84 or 84XR	15-7/8 19-7/8
Item	1-3/4 N/A	2-3/8 4-1/4
Variable	1/2, 3/4, 1	1-1/4 & 1-1/2
A	250THD 300THD	9 8
B	250THD 300THD	15-1/2 15
C	DL49 Direct* DL84 or 84XR Direct*	15-1/4 15-7/8
H	DL49 DL84 or 84XR	15-7/8 19-7/8
Item	1-3/4 N/A	2-3/8 4-1/4

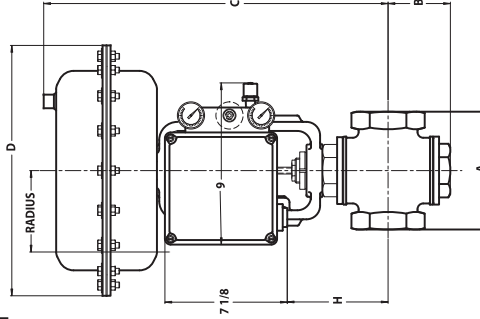


2-WAY or 3-WAY  
w/DL49 & 760 Positioner

Actuator	Weight (LB)
DL49	24-1/2
DL84 or 84XR Direct*	N/A
DL84 or 84XR	48-1/2

Positioner	Weight (LB)
760	10

Dimension (IN)	DL49	DL84 or 84XR	DL84 or 84XR (W/760)
D	DL49	11	
Radius	DL49	13-7/8	7-7/8
	DL84 or 84XR	13-7/8	8-1/8



2-WAY or 3-WAY  
w/DL84 or 84XR & 760 Positioner

Component	2832 Dimension (IN) by Valve Size (IN)	
Variable	1	1-1/2
A	250THD 300THD	5-3/4 6-1/8
B	250THD 300THD	3-1/2 3-3/8
C	DL49 Direct* DL84 Direct*	15-1/4 15-7/8
H	DL49 DL84	15-7/8 19-7/8
Item	1-3/4 3-5/8	4-1/4 4-1/2
Variable	1	1-1/2
A	250THD 300THD	9 8
B	250THD 300THD	16-1/2 15
C	DL49 Direct* DL84 Direct*	15-1/4 15-7/8
H	DL49 DL84	15-7/8 19-7/8
Item	1-3/4 3-5/8	4-1/4 4-1/2

\* Includes 1-3/8 inch for air fitting  
H = Centerline of pipe to bottom of positioner and dimensions of configurations not shown.  
CF = Consult factory  
N/A = Not Available

Actual shipping weights may vary.

Face to face dimensions conform to historical Warren Controls standard and are NOT ANSIS/ISA compatible.

RADIUS is from centerline of actuator to outside edge of positioner.

Positioner Removal Clearance  
Allow 3-1/4 inch beyond 760 for cover removal/service.

## Actuators, Positioners, & Accessories

### Actuators

Actuator	Spring Range (PSI)			
Size	Action	Low	Full	High
DL49	Direct	3-9	4-13	8-12
DL49	Reverse	4-10	5-14	10-14
DL84	Direct	3-9	3-15	9-15
DL84R	Reverse	3-9	3-15	9-15
DL84XR	Reverse	N/A	N/A	N/A

Note: The spring range of XR (extended range) actuators varies with travel. These actuators require positioners or I/Ps for modulating control.

Effective Area: DL49 (49 Sq In), DL84 & 84XR (84 Sq In)

Springs: Multiple

Max Air Supply: 30PSIG

Air Connections: 1/4 NPT

Diaphragm: Buna-N Fabric Reinforced

Diaphragm Chambers: Steel

Yoke: Ductile Iron

Stem: 300 Series Stainless Steel

Finish: DL49 Epoxy-Coated

Ambient Temperature: DL84, 84XR -40 to 160°F

Mounting: Vertical Above or Below Valve

Handwheel: Available on DL84 & 84XR

Not available on DL49

### Positioners

#### Split Ranging with Positioners

Positioners are sometimes used to "Split-Range" two control valves in a parallel configuration within a piping scheme. This technique is used to obtain higher rangeability than could otherwise be achieved with a single control valve. Typically one smaller valve supplying 15% to 35% of total flow is mated with a larger valve supplying 65% to 85% of total flow.

The best-matched pair will each be providing similar rangeability for each respective flow contribution to the manifold. Calculated as maximum flow / minimum controllable flow, the smaller valve should not be attempting to control flow below 5% of stroke. Estimate Cv from Cv tables vs. stroke to calculate this.

The chosen positioners would then have a Low Range signal for the smaller valve and a High Range Signal for the larger valve. With this, a single control signal can be sequentially applied to each valve. At mid-signal range, the little valve is completely open while the larger valve is just starting to open. Controlability for wide process set point ranges is dramatically improved.

#### BLX Models:



#### BLX Electro-Pneumatic Models:

BFP : Full Range Signal (3-15 PSIG)

BLP : Low Range Signal (3-9 PSIG)

BHP : High Range Signal (9-15 PSIG)

Options 2SPDT Limit Switches, 4-20 mA Feedback

Ingress & Corrosion Protection: NEMA 4X, IP66

Supply Pressure: Pneumatic 145 PSIG Max **Not to exceed actuator rating**

Air Consumption: 0.19 SCFM at 30 PSIG

#### BLX Electro-Pneumatic Models:

BFE : Full Range Signal (4-20 mA)

BLE : Low Range Signal (4-12 mA)

BHE : High Range Signal (12-20 mA)

Options 2SPDT Limit Switches, 4-20 mA Feedback

Ingress & Corrosion Protection: NEMA 4X, IP66

Supply Pressure: 21.8 to 145 PSIG **Not to exceed actuator rating**

Air Consumption: 0.21 SCFM at 30 PSIG

#### BLX Electro-Pneumatic Intrinsically Safe Models:

BLI : Full Range Signal (4-20 mA)

BLL : Low Range Signal (4-12 mA)

BLH : High Range Signal (12-20 mA)

Options 2SPDT Limit Switches, 4-20 mA Feedback

Ingress & Corrosion Protection: NEMA 4X, IP66

Approvals & Ratings: Class I, Div 1, Groups A, B, C, D

EM Intrinsically Safe: Class I, Div 1, Groups A, B, C, D

CSA Intrinsically Safe: Class II, Div 1, Groups E, F, G

Class III

Class I, Div 2, Groups A, B, C, D

Class II, Div 2, Groups E, F, G

Supply Pressure: 30 to 145 PSIG **Not to exceed actuator rating**

Air Consumption: 0.21 SCFM at 30 PSIG



## Actuators, Positioners, & Accessories

### Positioners (Continued)

#### BLX Electro-Pneumatic Explosion Proof

Models:  
 BFX: Full Range Signal (4-20 mA)  
 BLX: Low Range Signal (4-12 mA)  
 BHX: High Range Signal (12-20 mA)

Options 2SPDT Limit Switches, 4-20 mA Feedback  
 Ingress & Corrosion Protection: NEMA 4X, IP66  
 Approvals & Ratings:

EM: Intrinsically Safe, Class I, Div 1, Groups A,B,C,D,E,F,G  
 Non-Incendive, Class I, Div 2, Groups A,B,C  
 Explosion Proof: Class I, Div 1, Groups B,C,D  
 Class III, Div 1, Groups E,F,G

CSA Intrinsically Safe, Class I, Div 1, Groups A,B,C,D  
 Class II, Div 1, Groups E,F,G

Class III  
 Class I, Div 2, Groups A,B,C,D  
 Class II, Div 2, Groups E,F,G

Class I, Div 1, Groups A,B,C,D  
 Class II, Div 1, Groups E,F,G

Class III, Div 1, Groups A,B,C,D  
 Class II, Div 1, Groups E,F,G

Explosion Proof: Class I, Div 1, Groups A,B,C,D,E,F,G  
 Class II, Div 1, Groups E,F,G

Supply Pressure: 30 to 145 PSIG **Not to exceed actuator rating**  
 Air Consumption: 0.21 SCFM at 30 PSIG

#### BLX Electro-Pneumatic Fail Freeze

Models:  
 BFF: Full Range Signal (4-20 mA)  
 BLF: Low Range Signal (4-12 mA)  
 BHF: High Range Signal (12-20 mA)

Options 2SPDT Limit Switches, 4-20 mA Feedback  
 Ingress & Corrosion Protection: NEMA 4X, IP66

Supply Pressure: 20 to 100 PSIG Max **Not to exceed actuator rating**  
 Air Consumption: 0.21 SCFM at 30 PSIG

#### All Models:

Construction: Aluminum Housing with Polyester Powder Coat  
 Action: Direct or Reverse

Media: Clean Dry Oil Free Air Filtered to 5 micron  
 1/4 NPT

Air Connections: 9.8 SCFM at 30 PSIG  
 Electrical Connection: 1/2 NPT

Gauges: Input 0-30 PSIG, Output 0-60 PSIG, Supply 0-60 PSIG,  
 Housing Black Steel Case with Chrome Ring

Ambient Temperature: -40 to 185°F (Except Fail Freeze -4 to 68°F)  
 Mounting: Yoke Mounted

Limit Switches and Feedback Options are NEMA 4X, IP66 only, and are not suitable for hazardous locations.

#### Moore 760 Models:



#### 760P Pneumatic

Models:  
 Options Limit Switches, 4-20 mA Feedback (Reduced feedback span for valves with less than 1 inch travel - Call factory for details)

#### 760E Electro-Pneumatic

Models:  
 Options Limit Switches, 4-20 mA Feedback (Reduced feedback span for valves with less than 1 inch travel - Call factory for details)

Approvals & Ratings:  
 EM: Intrinsically Safe, Class I, Div 1, Groups A,B,C,D  
 Class II, Div 1, Groups E,F,G

Class III, Div 1  
 Non-Incendive, Class I, Div 2, Groups A,B,C,D  
 Suitable for: Class II, Div 2, Groups F,G

Class III, Div 2

#### 760E Electro-Pneumatic (Continued)

CSA Intrinsically Safe: Class I, Div 1, Groups A,B,C,D  
 Class II, Div 1, Groups E,F,G

Suitable for: Class I, Div 2, Groups A,B,C,D  
 Class II, Div 2, Groups E,F,G

Class III, Div 2

#### All Models:

Construction: Aluminum Housing with Epoxy/Polyester Powder Coat  
 Ingress & Corrosion Protection: NEMA 4X, IP66

Action: Direct or Reverse  
 Supply Pressure: 150 PSIG Max **Not to exceed actuator rating**

Media: Clean Dry Oil Free Air Filtered to 3 micron  
 Flow Capacity: 9.0 SCFM

Air Connections: 0.5 SCFM Typical  
 1/4 NPT

Electrical Connection: 3/4 NPT  
 Gauges: Input 0-30 PSIG, Output 0-60 PSIG,  
 Housing Black Steel Case with Chrome Ring

Ambient Temperature: 70°F -40 to 180°F, 70E -40 to 167°F  
 Mounting: Yoke Mounted

#### Westlock ICoT Models:



#### Electro-Pneumatic

Models:  
 510: Full Range Signal (4-20 mA)

Options 2SPDT Limit Switches  
 Intelligent with Keypad

Models:  
 520: Full Range Signal (4-20 mA)

Calibration 3 Button Keypad  
 Options 2SPDT Limit Switches, 4-20 mA Feedback

Intelligent with HART  
 Models:  
 530: Full Range Signal (4-20 mA)

Calibration 3 Button Keypad & HART  
 Options 2SPDT Limit Switches, 4-20 mA Feedback

Intelligent with Foundation Fieldbus  
 Models:  
 540: Full Range Signal (4-20 mA)

Calibration 3 Button Keypad & Foundation Fieldbus  
 Options 2SPDT Limit Switches, 4-20 mA Feedback

All Models:  
 Construction: Engineered Resin Housing

Ingress & Corrosion Protection: NEMA 4, 4X

Approvals & Ratings: Non-Incendive Groups A-G, Div 2  
 Action: Direct or Reverse

Supply Pressure: 15 to 45 PSIG **Not to exceed actuator rating**  
 Media: Clean Dry Oil Free Air Filtered to 40 micron

Flow Capacity: 8.0 SCFM at 25 PSIG  
 Air Consumption: 0.003 SCFM at 20 PSIG

Electrical Connection: 1/2 NPT  
 Gauges: Supply 0-60 PSIG, Output 0-60 PSIG,  
 Housing Black Steel Case with Chrome Ring

Ambient Temperature: -40 to 180°F  
 Mounting: Yoke Mounted

### Position Indication Switches

#### Proximity Mark 1



Models:  
 2 SPDT Switches  
 4 SPDT Switches  
 6 SPDT Switches

Construction: 2 SPDT Switches w/ 2K Potentiometer  
 2 SPDT Switches w/ 4-20 mA Feedback

Locations: Aluminum Housing, Hard Anodized  
 NEMA 1, 2, 3, 3R, 3S

Ambient Temperature: -40 to 180°F  
 Electrical Connection: 3/4 NPT, Terminal Strip

Mounting: Yoke Mounted

#### I/P's

##### Type 500X



#### Locations:

NEMA 3  
 Zinc Alloy Base with Aluminum Bonnet,  
 Epoxy Painted

Ranges: Minimum 3 PSIG Above Maximum Output  
 3-9, 9-15, 3-15, 1-17, or 6-30 PSI

Supply Pressure: Maximum 100 PSIG **Not to exceed Actuator Rating**  
 4.5 SCFM at 25 PSIG

Flow Capacity: 0.05 SCFM Midrange Typical  
 Air Consumption: -20 to 140°F

##### Type 550X



#### Locations:

NEMA 4X (IP66)  
 Chromate-treated Aluminum with Epoxy Paint

Ranges: Minimum 5 PSIG Above Maximum Output  
 0-30 PSI

Supply Pressure: Maximum 100 PSIG **Not to exceed Actuator Rating**  
 12 SCFM at 100 PSIG

Flow Capacity: 6.0 SCFM Midrange Typical  
 Air Consumption: -20 to 150°F

Ambient Temperature: -20 to 150°F

##### Type 650X



#### Locations:

NEMA 4X (IP66), Explosion proof  
 Chromate-treated Aluminum with Epoxy Paint

Ranges: Construction: 3-15 PSI  
 Minimum 5 PSIG Above Maximum Output

Supply Pressure: Maximum 100 PSIG **Not to exceed Actuator Rating**  
 4.5 SCFM at 25 PSIG

Flow Capacity: 3.0 SCFM Midrange Typical  
 Air Consumption: -40 to 160°F

#### I/P's (Continued)

#### All Models:

Input: 4-20 mA  
 Field Reversible  
 1/4 NPT

Air Connections: Clean Dry Oil Free Air Filtered to 40 micron  
 Electrical Connection: Yoke Mounted

Media: Yoke Mounted

#### Air Filter Regulators



Models:  
 Type 300, Type 350SS  
 Type 300, 0-30, 0-60 PSIG

Output Ranges: Type 350SS, 0-100 PSIG  
 Type 300, 250 PSIG Maximum

Supply Pressure: Type 350SS, 290 PSIG Maximum  
 Type 300, Die-Cast Aluminum with Iridium and Baked Epoxy Paint

Construction: Type 300, Output, Housing Stainless Steel  
 Type 350SS, 316 Stainless Steel

Gauge: Type 300, Output, Housing Stainless Steel  
 Type 350SS, Output, Housing Stainless Steel

Air Connections: 1/4 NPT  
 Filter: Type 300, 40 micron, Type 350SS, 25 micron

Mounting: Chamber Mounted

#### Solenoids



#### Models:

8320G184, EF8320G184,  
 8320G202, EF8320G202

Construction: (EF)8320G184, 3-Way Brass  
 (EF)8320G202, 3-Way Stainless Steel

Locations: 83206G184 & 8320G202, Watertight,  
 Types 1, 2, 3, 3S, 4 & 4X

Supply: EF8320G184 & EF8320G202, Explosion proof  
 and Watertight, Types 3, 3S, 4, 4X, 6, 6P, 7 & 9

Ambient Temperature: 120VAC  
 +32 to 125°F

Air Connections: 1/4 NPT  
 Electrical Connection: 1/2 NPT, Pigtail Leads

Approvals: CSA, UL, CE  
 Mounting: Chamber Mounted

#### Air Tubing

Standard: Copper  
 Optional: Stainless Steel

## Actuators, Positioners, & Accessories

## Factory Default Settings

Positioners			
Valve Type	Actuator Action	Input Signal	Failure Modes
2820	Direct	Pneumatic	Loss of Signal <sup>1</sup> Valve Fails...
	Reverse	Pneumatic	Loss of Signal <sup>1</sup> Valve Fails...
2830 & 32	Direct	Increasing Signal	Loss of Supply Valve Fails...
	Reverse	Decreasing Signal	Loss of Supply Valve Fails...

\* Valves with Fail Freeze Positioners Fail in Last Position on Loss of Signal.

Positioner Feedback			
Valve Type	Actuator Action	Feedback Signal	Settings
2820	Direct	Increases as Valve Closes	Switch 1 Closed
	Reverse	Increases as Valve Opens	Switch 2 Open
2830 & 32	Direct	Upper Port Closes/ Lower Port Opens	Open
	Reverse	Upper Port Closes/ Lower Port Opens	Closed

\* Reduced feedback span for valves with 760 and less than 1 inch travel.

I/P's			
Valve Type	Actuator Action	Input Signal	Failure Modes
2820	Direct	Increasing Signal	Loss of Signal Valve Fails...
	Reverse	Decreasing Signal	Loss of Signal Valve Fails...
2830 & 32	Direct	Upper Port Closes/ Lower Port Opens	Open
	Reverse	Upper Port Closes/ Lower Port Opens	Closed

SOLENOIDS (without Positioners or I/P's)			
Valve Type	Actuator Action	Input Signal	Failure Modes
2820	Direct	Increasing Signal	Loss of Signal Valve Fails...
	Reverse	Decreasing Signal	Loss of Signal Valve Fails...
2830 & 32	Direct	Upper Port Closes/ Lower Port Opens	Open
	Reverse	Upper Port Closes/ Lower Port Opens	Closed

If the Solenoid is used with a Positioner or an I/P, refer to the Positioner or I/P listings for factory default settings and failure modes with the solenoid not failed.

Proximity MARK 1 Position Indication Switches Feedback			
Valve Type	Actuator Action	Feedback Signal	Settings
2820	Direct	Increases as Valve Closes	Switch 1, 3, 5 Closed
	Reverse	Increases as Valve Opens	Switch 2, 4, 6 Open
2830 & 32	Direct	Upper Port Closes/ Lower Port Opens	Open
	Reverse	Upper Port Closes/ Lower Port Opens	Closed

\* Span varies from approx 155 to 350 ohm depending on actuator and travel.

Air Filter Regulators	
Actuator	Output Pressure
DL49, 84 & 84XR	30 PSIG

2600 Emrick Blvd., Bethlehem, PA 18020-8010 www.WarrenControls.com  
Tel: 800-922-0085 or 610-317-0800 Fax: 610-317-2989

## Configurations

1. SELECTIONS Please make a selection from each table of OPTIONS below to make a complete model number string.

### 28N

### 2. OPTIONS

VALVE BODY						
Model	Valve Type	Size	Body Material	End Connection	Trim Style	Trim Cv
28N	20 2-Way Single Seat	050 1/2 inch 075 3/4 inch	B Bronze F CF8M	S Screwed NOTE: Additional end connections are available-check with the factory.	E Equal % L Linear Types 30/32 Linear Only	F Full Port 1 1st Port Reduction 2 1st Port Reduction 3 3rd Port Reduction 4 4th Port Reduction NOTE: Port reductions only available on Type 20/30. Check factory for availability.
	30 3-Way Mixing	100 1 inch 125 1-1/4 inch				
	32 3-Way Diverting	150 1-1/2 inch 200 2 inch				

VALVE STYLE		VALVE SIZES		ACTUATORS	
Type 20	1/2" - 2"	DL49			
Type 20	1" - 2"	DL84			
Type 20	1-1/4" - 2"	DL8XR			
Type 30	1/2" - 2"	DL49			
Type 30	1-1/4" - 2"	DL84			
Type 30	2"	DL8XR			
Type 32	1/2" - 2"	DL49 & DL84			

VALVE TYPE/TRIM MATERIAL COMBINATIONS:

SIZE	TRIM MATERIAL			T	P
	S	B	H		
050 1/2 inch	316SS	Alloy 6	17-4PH	20	20
075 3/4 inch	316SS	Alloy 6	17-4PH	20	20
100 1 inch	316SS	Alloy 6	17-4PH	20	20
125 1-1/4 inch	316SS	Alloy 6	17-4PH	20	20
150 1-1/2 inch	316SS	Alloy 6	17-4PH	20	20
200 2 inch	316SS	Alloy 6	17-4PH	20	20

VALVE TYPE/ACTUATOR COMPATIBILITY:

VALVE STYLE	VALVE SIZES	ACTUATORS
Type 20	1/2" - 2"	DL49
Type 20	1" - 2"	DL84
Type 20	1-1/4" - 2"	DL8XR
Type 30	1/2" - 2"	DL49
Type 30	1-1/4" - 2"	DL84
Type 30	2"	DL8XR
Type 32	1/2" - 2"	DL49 & DL84

See Shut-off/OP Ratings for details.

# WARREN CONTROLS

## ACTUATED INDUSTRIAL VALVES

**1800**  
SERIES

**Heavy Globe Control Valves**

**styles:**  
 • 2-way balanced  
 • 2-way unbalanced  
 • 3-way mixing  
 • 3-way diverting

**sizes** 2-1/2 to 12 in.  
**class** 300  
**ends** 150,300 RF fig.  
**body** Cast Iron, WCB, CF8M

**trim** 316 SST, Alloy 6

**Cv** up to 1649  
**temp.** -20° to 800°F  
**body limit** to 740 psi  
**shutoff** class III, IV  
**rangeability** 50:1

- Heavy Duty
- Severe Service
- High Pressure Differentials
- Corrosive Materials, Liquids, Gases & Steam
- Modulating or On/Off Control

**2800**  
SERIES

**Precision Globe Control Valves**

**styles:**  
 • 2-way unbalanced  
 • 3-way mixing  
 • 3-way diverting

**sizes** 1/2 to 2 in.  
**class** 250 & 300  
**ends** Butt-weld, NPT  
**body** Bronze, CF8M

**trim** Bronze, 316SST 17-4PH, Alloy 6, TFE, PEEK

**Cv** up to 40  
**temp.** -20° to 500°F  
**body limit** to 720 psi  
**shutoff** class III, IV, VI  
**rangeability** 50:1

- Economical
- Precision Control
- Suited for Gases, Steam, or Liquids that are Not Viscous or Solids Bearing

**2900**  
SERIES

**High Capacity General Purpose Globe Control Valves**

**styles:**  
 • 2-way balanced  
 • 2-way unbalanced  
 • 3-way mixing  
 • 3-way diverting

**sizes** 2-1/2 to 10 in.  
**class** 125 & 250  
**ends** Flange  
**body** Cast Iron

**trim** Bronze, 300SS, 17-4PH, Alloy 6

**Cv** up to 960  
**temp.** -20° to 400°F  
**body limit** to 400 psi  
**shutoff** class II, III, IV  
**rangeability** 100:1

- High Capacity
- General Purpose
- Moderate Pressure Drops
- Compatible Liquids and Gas, Steam & Water
- Modulating or On/Off Control

**3800**  
SERIES

**E-Ball Rotary Control Valves**

**styles:**  
 • 2-way rotary - flow to open  
 • flow to close

**sizes** 1 to 8 in.  
**class** 300  
**ends** 150,300 RF fig.  
**body** WCB, CF8M

**trim** 316 SST, Alloy 6, Ceramic, TFE, PEEK

**Cv** up to 1420  
**temp.** -20° to 800°F  
**body limit** to 740 psi  
**shutoff** class IV, VI  
**rangeability** 100:1

- Eccentric
- Segmented Ball
- Well Suited for Erosive Service
- Various Trim Options include Ceramic for Slurries or Gritty Materials & Teflon® for Class VI Shutoff

**5800**  
SERIES

**Compact Globe Control Valves**

**styles:**  
 • 2-way cage-retained seat

**sizes** 1 to 4 in.  
**class** 300  
**ends** 150,300 RF fig.  
**body** WCB, CF8M

**trim** 316 SST, Alloy 6, TFE, PEEK

**Cv** up to 170  
**temp.** -20° to 800°F  
**body limit** to 740 psi  
**shutoff** class IV, VI  
**rangeability** 50:1

- Highly Efficient, Compact Design
- High Pressure Drops
- Typically Suited for High Force Piston Actuators for Steam, Chemicals & Dirty Fluids
- Minimizes Cavitation or Flashing Effects

### ACCESSORIES

#### Positioners, I/P's & Limit Switches

<b>0000</b> None	<b>A</b> type 300, 0-30 PSI	<b>O</b> None	<b>S</b> Special Ops or Set-Up
<b>B-P</b> BLX Pneumatic	<b>B</b> type 300, 0-60 PSI	<b>T</b> SS Tubing	<b>G</b> SS Tubing
<b>B-E</b> BLX Electro-Pneumatic	<b>D</b> type 350SS, 0-100 PSI	<b>M</b> FR20G202 3-Way EXP. Br.	<b>M</b> FR20G202 3-Way EXP. SS
<b>B-I</b> BLX Electro-Pneum. Intrn. Safe	<b>L</b> 3-15 PSI or 4-20mA	<b>W</b> 120 IAC, Coils	
<b>B-X</b> BLX Electro-Pneum. Exp. Pico	<b>H</b> High or Split Range 3-9 PSI or 4-20mA		
<b>B-Y</b> BLX Electro-Pneum. Fail Fringe	<b>4th digit spec.</b>		

<b>00</b> None	<b>O</b> None	<b>R</b> Reverse
<b>49</b> 49 Sq. In.	<b>L</b> Low 4-10 PSI 4BR ; 3-9 PSI 4BD, 84RD	<b>D</b> Direct
<b>84</b> 84 Sq. In.	<b>F</b> Full 5-14 PSI 4BR ; 3-15 PSI 4BD, 84RX	<b>D</b> Direct
<b>8X</b> 84 Sq. In. (84 Ex. Inq.)	<b>H</b> High 9-15 PSI 84 ; 10-14 PSI 4BR ; 8-12 PSI 4BD	<b>X</b> Xtra-High DL8XR

**NOTE:**  
 8X Only  
 In Xtra-High Spring Range

**POSITIONERS:**  
**B-P** BLX Pneumatic  
**B-E** BLX Electro-Pneumatic  
**B-I** BLX Electro-Pneum. Intrn. Safe  
**B-X** BLX Electro-Pneum. Exp. Pico  
**B-Y** BLX Electro-Pneum. Fail Fringe

**4th digit spec.**  
**L** Low or Split Range 3-9 PSI or 4-20mA  
**H** High or Split Range 9-15 PSI or 2-20mA  
**4th digit spec.**  
**O** No Address  
**L** when Lin Swt's w/4-20 feedback  
**F** w/4-20 feedback  
**B** w/switch & feedback

**PROXIMITY SWITCHES:**  
**PX11** Mark I Series - 2 ea. SPDT  
**PX12** Mark I Series - 2 ea. SPDT w/2k Pk  
**PX13** Mark I Series - 2 ea. SPDT w/4-20 feedback  
**PX14** Mark I Series - 4 ea. SPDT  
**PX15** Mark I Series - 6 ea. SPDT

**I/P's - Use with Diaphragm Only**  
**MAP1** Type 500X (IP 3-9 PSI)  
**MAP2** Type 500X (IP 3-15 PSI)  
**MAP3** Type 500X (IP 3-15 PSI)  
**MAP4** Type 500X (IP 1-17 PSI)  
**MAP5** Type 500X (IP 6-30 PSI)  
**MAP6** Type 500X (IP 0-30 PSI)  
**MAP9** Type 950X (IP 3-15 EXP)

**NOTE:** Standard pneumatic tubing is copper. SS tubing 'T' is optional.  
 SS tagging 'to' (two lines, 24 characters/line) is optional.  
 SS tubing and tagging together 'B' is optional.

#### FAILURE MODES:

MODE	VALVE TYPE	ACTUATOR ACTION
Closed	20	Release
Open	20	Direct
Upper Closed*	30/32	Direct
Upper Open	30/32	Reverse

\*Standard

#### ACTUATOR/BODY COMPATIBILITY:

DIAPHRAGM	BODY
<b>49</b> 49 Sq. In. (DL49)	For 28N Bodies
<b>84</b> 84 Sq. In. (DL84)	For 28N Bodies
<b>8X</b> (DL8XR)	For 28N Bodies

Warren Controls does not assume responsibility for the selection, use, or maintenance of any product. Responsibility for proper selection, use, and maintenance of any Warren Controls product remains solely with the purchaser and end-user.

# POWERS

A WATTS INDUSTRIES CO.

## TECHNICAL INSTRUCTIONS

### Accritem Controller Model 3

#### SPECIFICATIONS

Operation	Direct or Reverse Acting
Adjustment Dial Range	Standard 50 to 350°F (10 to 177°C)
Maximum Supply Pressure at Room Temperature	35 psi (241.3 kPa)
Air Consumption (max.)	218 cm <sup>3</sup> /s (800 SCIM)
Maximum Operating Pressure	1724 kPa (250 psi)
Maximum Operating Temperature	400°F(204°C)
Temperature Response	0.5°F(0.3°C)
Mounting	1/2" NPT
Air or Water Connections	1/8" NPT
Drain Connection (water only)	1/4" NPT
Shipping Weight	4 lbs. (1.8 kg)
Sensitivity (adjustable)	3.1 to 27.9 kPa/C (1/4 to 2-1/4 psi/F)
Maximum Pressure on Wells	1125 psi (7756 kPa)
Stainless Steel no. 744-082	525 psi (3619 kPa)
Copper no. 744-111	See page 5
Well Dimensions	

#### OPERATION (Direct Acting Controller)

A temperature change in the medium being controlled creates a change in length of the sensitive tube (1). An increase in temperature lengthens the sensitive tube (1) and moves the Invar rod (2) away from the lever (3). The lever (3), which pivots at Point A, is moved to close the exhaust valve (4) by spring (5). This permits the supply (air or water) (S) to increase the pressure in the control line (R) and close the normally-open valve. A decrease in temperature shortens the sensitive tube (1) and moves the Invar rod against the lever (3). The lever (3) moves against the pressure spring (5), to open the exhaust valve (4). This exhausts the pressure in the control line and opens the valve.

The sensitivity adjustment screw (6) regulates the rate of flow of the supply (air or water) to the controller to a change in temperature. Turning the screw clockwise increases the sensitivity by reducing the flow and increasing the response time. Turning the screw counterclockwise decreases the sensitivity by increasing the flow and reducing the response time. Also see Figure 8 on page 6.

#### SENSITIVITY

The sensitivity of the Accritem controller is adjusted by turning the restriction screw (Figure 2). (The restriction screw is factory-set for air operation.) For water operation, the restriction screw should be opened a minimum of 1/2 turn and con-



<b>AIR OPERATED:</b>	
<b>Rigid Stainless Bulb</b>	
Direct Action	744-1270
Reverse Action	744-1271
<b>Rigid Copper Bulb</b>	
Direct Action	744-1213
Reverse Action	744-1214
<b>WATER OPERATED:</b>	
<b>Rigid Stainless Bulb</b>	
Direct Action	744-1217
Reverse Action	744-1218

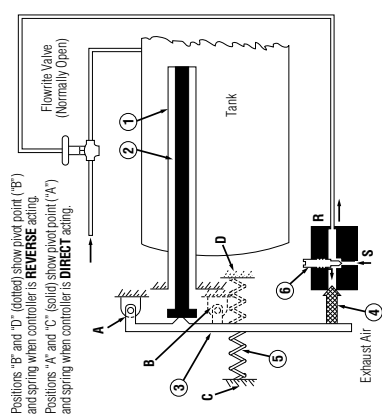


Figure 1.

troller recalibrated. Restriction screw must never be fully closed. Make adjustments slowly, allowing about two (2) minutes after each adjustment for the controller to balance. NOTE: If sensitivity is changed, controller must be recalibrated.

#### CALIBRATION

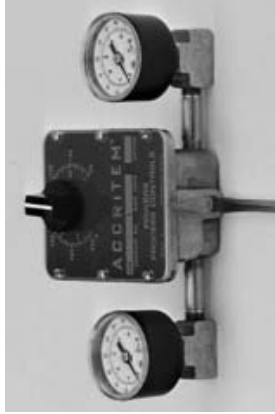


Figure 2. Set restriction screw for desired sensitivity. Air: 1/8 turn from closed (minimum). Water: 1/2 turn from closed (minimum).

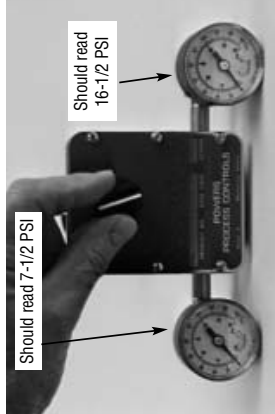


Figure 3. Turn adjusting knob until 52 kPa (7-1/2 psi) control pressure shows on gauge. Read temperature at bulb with an accurate thermometer.

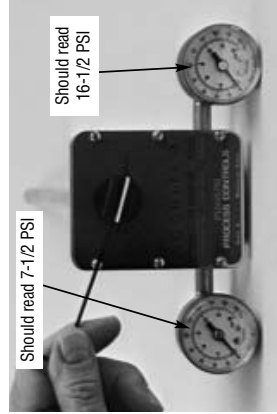


Figure 4. Loosen set screw and turn adjusting knob to indicate temperature at bulb. Tighten set screw. Set controller for desired control temperature.

#### INSTALLATION (GENERAL INSTRUCTIONS)

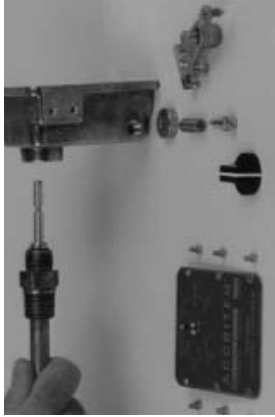


Figure 5.

#### To disassemble and replace sensitive tube assembly:

The Accritem Controller requires a clean, reliable supply of compressed air or cold water at room temperature and 15 to 20 pounds of pressure. Other fluids may be used, such as gas, oil, etc., providing provision is made for safe disposal. Select sensitive element location with care to insure satisfactory results. Bulb must project entirely into the liquid or air being controlled.

Flush or blow out all lines before making final connections. Put supply pressure through all control lines and check for leaks.

#### INSTALLATION FOR AIR OPERATION

Controller should normally be installed in horizontal position; however, other positions may be used if the supply and control connections are parallel with the ground and calibration is checked after installation.

#### INSTALLATION FOR WATER OPERATION

Controller should normally be installed in horizontal position with drain connection at bottom. For positive drainage at all times, drain piping should be 3/8" minimum.

#### TO CHANGE CONTROLLER ACTION

(See Figures 6 and 7)

1. Turn adjusting knob clockwise to remove tension.
2. Remove adjusting knob and cover.
3. Remove lever spring retainer (D) and spring (E).
4. Relocate lever pivots (F).
5. Turn lever pivots to be snug without binding.
6. Replace lever spring retainer (D) and spring (E).
7. Replace cover and adjusting knob.
8. Recalibrate.

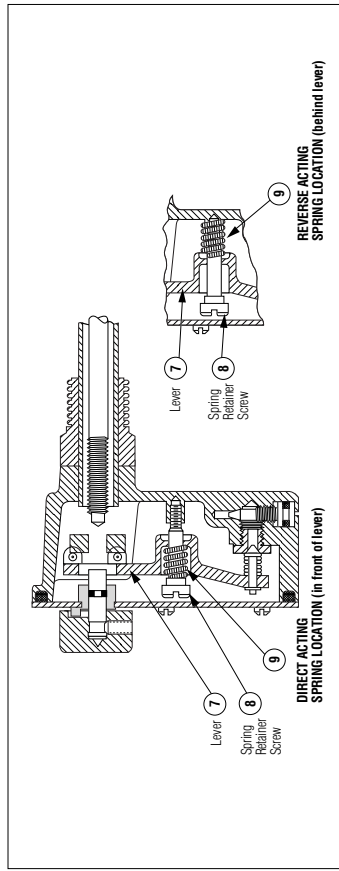


Figure 6.

The parts in Figure 7 are identified by letter in order of disassembly. For item number reference, see Parts Drawing: A (item 3) adjusting knob with set screw, B (item 10) cover screws, C (item 2) cover plate, D (item 8) spring retainer screw, E (item 9) lever spring, F (item 21) lever pivot, G (item 7) lever.

Always locate the controller as close as possible to the controlled device. The piping between the controller and controlled device (valve or damper motor) should be 1/8" NPT brass pipe or 6.4 mm (1/4") OD copper tubing.

Difference in height between Accritem controller and controlled device should be kept to a minimum. When controller is **below** controlled device, elevation cannot exceed 3 m (10') with 104 kPa (15 psi) supply pressure. If controller is **above** controlled device, adjust springs on valve or damper motor to compensate for static head pressure.

**PRESSURE CONTROLLER FOR USE WITH WATER**

Set pressure at 104-138 kPa (15-20 psi) when water is flowing. Clean strainer at regular intervals.

**BOTH AIR AND WATER CONTROLLERS**

To disassemble (Refer to Parts Drawing and Figure 5):

1. Remove knob (3) after loosening its set screw.
2. Remove cover plate (2).
3. Remove spring retainer screw (8) and lever spring (9).
4. Back out one lever pivot (21) and remove lever (7).
5. Unscrew sensitive tube assembly (20) from body (1).

**To reassemble:**

1. Install new sensitive tube assembly (20) to body (1).
2. Install lever (7). Tighten the lever pivot screws (21) as required. The lever must be in the exact center of the body and must move freely but without side play.

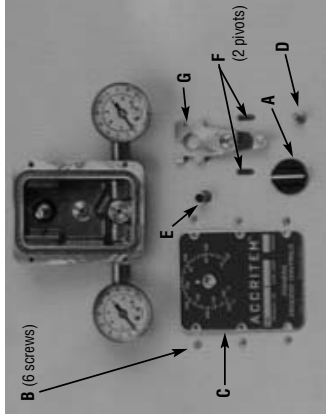


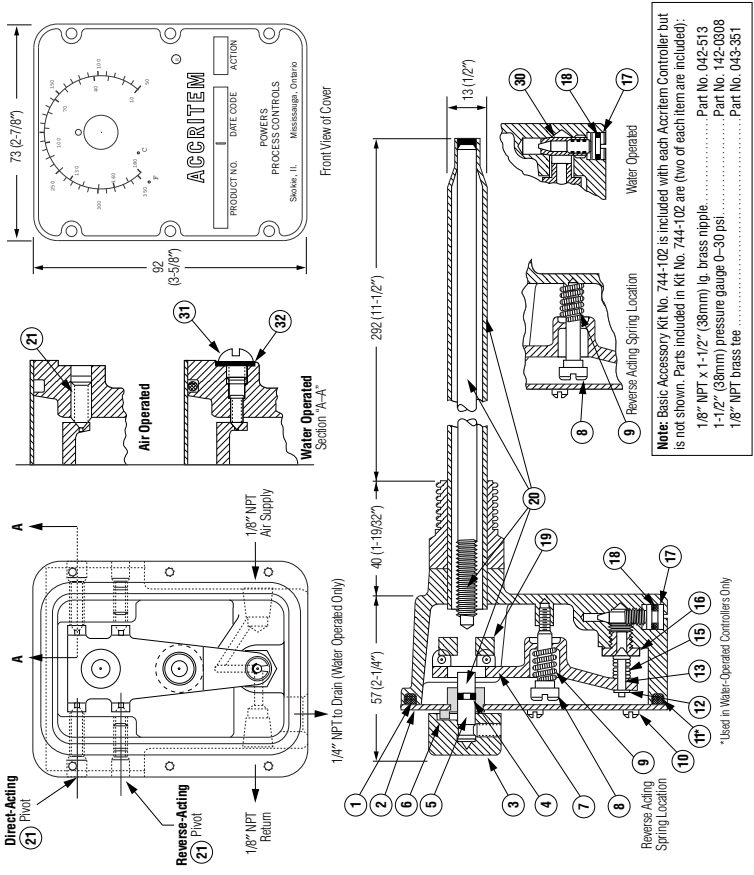
Figure 7.

3. Install screws (3) and gaskets (2) on water-operated controller.
4. Install parts (8) and (9). (Note relationship for direct and reverse acting. See Figure 6.)
5. Back out adjustment screw (5) until collar (19) touches the pivots on the lever (7).
6. Install cover plate (2).
7. Install adjustment knob with set screw (3). The knob indicator (white line on side of knob) should be opposite the dial marking corresponding to the room temperature. Tighten the knob set screw very firmly.
8. Turn the adjusting knob to the desired control temperature for approximate calibration.
9. Recalibrate as required after the controller is installed and connected to the supply and control lines.

NOTE: On units with a date code of 3L48 and later: When replacing a knob (744-036) or cover plate (744-170), a new knob (744-234) and cover plate (744-170D) must be ordered.

**PARTS**

Dimensions: Millimeters (Inches)



Note: Basic Accessory Kit No. 744-102 is included with each Accritem Controller but is not shown. Parts included in Kit No. 744-102 are (two of each item are included):  
 1/8" NPT x 1-1/2" (38mm) lg. brass nipple ..... Part No. 042-513  
 1-1/2" (38mm) pressure gauge 0-30 psi ..... Part No. 142-0308  
 1/8" NPT brass tee ..... Part No. 043-351

**PARTS LIST**

Item	Part Name	Part Numbers		No. Req'd	Material	Part Numbers		No. Req'd	Material
		Air or Gas	Water			Air or Gas	Water		
1	Body	744-170D	744-170D	1	Brass	100-124*	100-124**	1	Phos. Bronze
2	Cover Plate	744-234	744-234	1	—	744-155*	744-163**	1	Phos. Bronze
3	Adjusting Knob w/ Set Screw	744-234	744-234	1	—	744-075*	744-075**	1	Phos. Bronze
4	Quad Ring	047-043	047-043	1	Brass	744-063*	744-131***	1	Phos. Bronze
5	Adjustment Screw	744-175	744-175	1	Brass	744-072	744-134*	1	Brass
6	Cover Screw	030-041	030-041	6	Brass	047-049*	047-045	1	Brass
7	Lever	Not used	047-050	1	Brass	—	—	1	—
8	Spring Retainer	744-124	744-124	1	Brass	744-172	744-172	1	—
9	Lever Spring	225-073	430-021*	1	Stainless Steel	744-154	744-154	2	Stainless Steel
10	Cover Screw	030-041	030-041	6	Brass	—	—	4	Stainless Steel
11	O-Ring	Not used	047-050	1	Silicone Rubber	—	—	4	Rubber

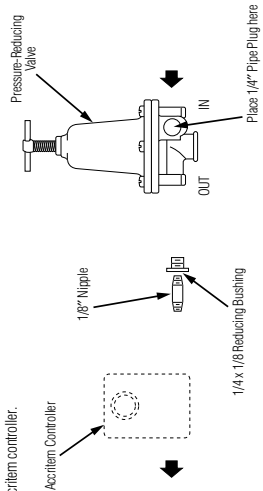
\* (Pkg. of 10)  
 \*\* Also order O-ring (see item 18).  
 † Material is Stainless Steel  
 • Material is Silicone Rubber  
 \* Included in Valve and Seat Kit for Model 3 (Air-Operated Accritem)  
 No. 744-168—parts are not available separately.  
 \*\* Included in Valve and Seat Kit for Model 3 (Water-Operated Accritem)  
 No. 744-169—parts are not available separately.  
 † † Included in Valve and Seat Kit for Model 3 (Water-Operated Accritem)  
 No. 744-168  
 Valve and Seat Kit for Model 3 (Air-Operated Accritem) ..... 744-168  
 Valve and Seat Kit for Model 3 (Water-Operated Accritem) ..... 744-169

**ACCESSORIES**

Dimensions: Millimeters (Inches)

**AIR**  
**Accessory Kit No. 744-107**  
 (Dotted line item not included)

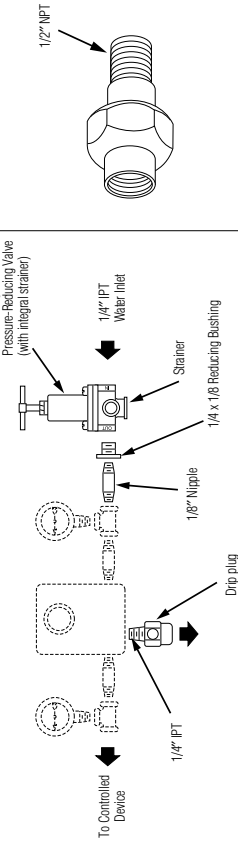
Provides materials necessary to reduce the incoming air supply pressure to within the supply pressure range of the Accritem controller.



**WATER**

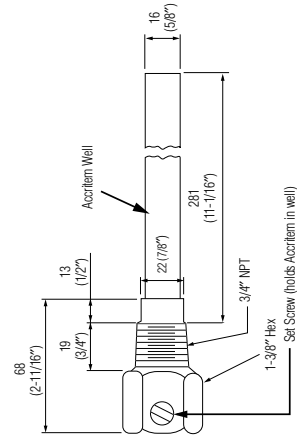
**Accessory Kit No. 744-180**  
 (Dotted line items not included)

Kit provides materials necessary to convert the Accritem from air operation to water operation.



Supply gauge may also be installed in extra outlet of PRV.

**Well Dimensions**  
 mm (inches)



**OPERATION (continued)**

Figure 8. Additional information on controller action and applications.

	APPLICATION		
	HEATING	COOLING	MIXING
<b>ACTION:</b> <b>DIRECT Acting</b>	Normally OPEN valve Valve OPENS on air failure	Normally CLOSED valve Valve CLOSES on air failure	Hot piped to Normally OPEN port of valve Valve opens to HOT flow on air failure
<b>REVERSE Acting</b>	Normally CLOSED valve Valve CLOSES on air failure	Normally OPEN valve Valve OPENS on air failure	Hot piped to Normally CLOSED port of valve Valve opens to COLD flow on air failure

**CALIFORNIA PROPOSITION 65 WARNING**  
**WARNING:** This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. (Installer: California law requires that this warning be given to the consumer.)  
 For more information: [www.wattsinf.com/jp3965](http://www.wattsinf.com/jp3965)

**WARRANTY INFORMATION**

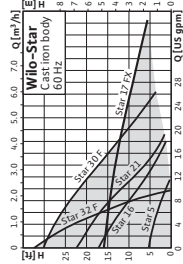
Powers warrants that the equipment manufactured by it is free from defects in material and workmanship and, without charge, equipment found to be defective in material and workmanship will be repaired, or at Seller's option, replaced F.O.B. original point of shipment, if written notice of failure is received by Seller within one (1) year after date of shipment, provided said equipment has been properly installed, operated in accordance with Seller's instructions, and provided such defects are not due to abuse or chemical decomposition by chemical vapors or other environmental conditions. Defects are not due to abuse or chemical decomposition by chemical vapors or other environmental conditions. There are no implied warranties of merchantability or of fitness for a particular purpose. The Seller assumes no responsibility for repairs made on Seller's equipment unless done by Seller's authorized personnel, or by written authority from the Seller. The Seller makes no guarantee with respect to material not manufactured by it.

**POWERS**  
 A WATTS INDUSTRIES CO.

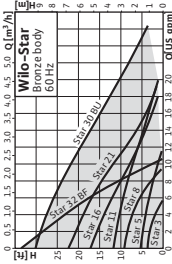
© January 2002 Powers, a Watts Industries Co.  
 USA Phone: 800.669.5430  
[www.powerscontrols.com](http://www.powerscontrols.com)  
 Canada Phone: 888.208.8827



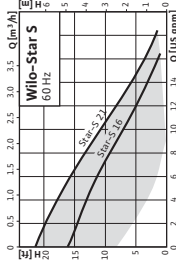
Range: Wilo-Star



- >Maintenance free single-head circulators
- >Pipe connection:
  - flange
  - flange rotated 90°
  - unions
  - internal sweat
- >Cast iron body for all hot water, heating and air conditioning applications
- >Bronze body for domestic hot water applications
- >Special features:
  - quick connection with spring clips
  - non overload motor



Range: Wilo-Star S



- >Maintenance free single-head circulators with 3 speed motors
- >Flange connection 90° rotated
- >Cast iron housing and bronze body housing for all hot water and heating applications
- >Special features:
  - quick connection with spring clips
  - 3 speed motor
  - non overload motor

Function, Equipment & Technical data Wilo-Star (Cast iron body)

	Wilo-Star... (Cast iron body)									
	5 FX	16 F	16 FX	17 FX	21 F	21 FX	30 F	30 FX	32 F	32 FX
<b>Approved fluids</b> (other fluids on request)										
Heating water	•	•	•	•	•	•	•	•	•	•
Water/glycol mixtures (max. 32; mixtures with more than 20% glycol require reassessment of the hydraulic criteria)	•	•	•	•	•	•	•	•	•	•
Domestic hot water	-	-	-	-	-	-	-	-	-	-
<b>Performance</b>										
Max. delivery head [ft]	5.5	16	16	17	21	21	30	30	33	33
Max. delivery head [m]	1.7	4.9	4.9	5.2	6.4	6.4	9.1	9.1	10.1	10.1
Max. volume rate of flow [USGPM]	12	16.5	16.5	50	19	19	26	26	10.5	10.5
Max. volume rate of flow [m³/h]	2.7	3.7	3.7	11.4	4.3	4.3	5.9	5.9	2.4	2.4
<b>Acceptable field of application</b>										
Temperature range for application in heating and cooling installations	14 °F (-10 °C) up to 230 °F (+110 °C)									
Temperature range in domestic hot water system	-									
Ambient temperature range	104 °F (+40 °C)									
Max. working pressure P <sub>max</sub> [psi]	140	140	140	140	140	140	140	140	140	140
<b>Pipe connections</b>										
Flange	-	•	-	-	•	•	-	•	•	•
Flange rotated 90°	•	-	•	•	-	-	-	-	-	-
Union connection	-	-	-	-	-	-	-	-	-	-
Internal sweat	-	-	-	-	-	-	-	-	-	-
<b>Electrical connections</b>										
Power supply 1~ [V]	115	115	115	115	115	115	115	115	115	115
Power frequency [Hz]	60	60	60	60	60	60	60	60	60	60
Wilo's quick connection with spring clips	•	•	•	•	•	•	•	•	•	•
<b>Motor/Electronics</b>										
Number of speed steps	1	1	1	1	1	1	1	1	1	1
Non overload motor	•	•	•	•	•	•	•	•	•	•
Insulation class	F	F	F	F	F	F	F	F	F	F

• = available, - = not available



# Circulating Pumps

Product review: Wilo-Star/Star S

# Circulating Pumps

Product review: Wilo-Star/Star S



## Function, Equipment & Technical data Wilo-Star (Cast iron body)

	Wilo-Star... (Cast iron body)						
	5 FX	16 F	16 FX	17 FX	21 F	21 FX	32 F
<b>Materials</b>							
Pump housing - cast iron	•	•	•	•	•	•	•
Pump housing - bronze	-	-	-	-	-	-	-
Impeller	Plastics (PP - 40 % GF)						
Shaft	Stainless steel (X40 Cr13)						
Bearing	Metal impregnated carbon						
<b>Minimal static inlet pressure at pump suction port [psi] to avoid cavitation at fluid temperatures</b>							
122 F (50 °C)	0.7	0.7	0.7	0.7	0.7	0.7	0.7
203 F (95 °C)	4,4	4,4	4,4	4,4	4,4	4,4	4,4
230 F (110 °C)	14,5	14,5	14,5	14,5	14,5	14,5	14,5

• = available, - = not available

## Function, Equipment & Technical data Wilo-Star S (Cast iron body)

	Wilo-Star S... (Cast iron body)			
	S 16 F	S 16 FX	S 21 F	S 21 FX
<b>Approved fluids</b> (other fluids on request)				
Heating water	•	•	•	•
Water/glycol mixtures (max. 33: mixtures with more than 20% glycol require reassessment of the hydraulic criteria)	•	•	•	•
Domestic hot water	-	-	-	-
<b>Performance</b>				
Max. delivery head [ft]	16	16	21	21
Max. delivery head [m]	4.9	4.9	6.4	6.4
Max. volume rate of flow [USGPM]	16.5	16.5	19	19
Max. volume rate of flow [m³/h]	3.7	3.7	4.3	4.3
<b>Acceptable field of application</b>				
Temperature range for application in heating and cooling installations	14 °F (-10 °C) up to 230 °F (+110 °C)			
Temperature range in domestic hot water system	-	-	-	-
Ambient temperature range	104 °F (+40 °C)	104 °F (+40 °C)	104 °F (+40 °C)	104 °F (+40 °C)
Max. working pressure P <sub>max</sub> [psi]	140	140	140	140
<b>Pipe connections</b>				
Flange	•	-	•	-
Flange rotated 90°	-	•	-	•
Union connection	-	-	-	-
Internal sweat	-	-	-	-
<b>Electrical connections</b>				
Power supply 1- [V]	115	115	115	115
Power frequency [Hz]	60	60	60	60
Wilo's quick connection with spring clips	•	•	•	•
<b>Motor/Electronics</b>				
Number of speed steps	3	3	3	3
Non overload motor	•	•	•	•
Insulation class	F	F	F	F

• = available, - = not available

# Circulating Pumps

Product review: Wilo-Star/Star S

# Circulating Pumps

Product review: Wilo-Star/Star S



## Function, Equipment & Technical data Wilo-Star S (Cast iron body)

	Wilo-Star S... (Cast iron body)			
	S 16 F	S 16 FX	S 21 F	S 21 FX
<b>Materials</b>				
Pump housing - cast iron	•	•	•	•
Pump housing - bronze	-	-	-	-
Impeller		Plastics (PP - 40 % GF)		
Shaft		Stainless steel (X40 Cr13)		
Bearing		Metal impregnated carbon		
<b>Minimal static inlet pressure at pump suction port [psi] to avoid cavitation at fluid temperatures</b>				
122 °F (50 °C)	0.7	0.7	0.7	0.7
203 °F (95 °C)	4.4	4.4	4.4	4.4
230 °F (110 °C)	14.5	14.5	14.5	14.5

• = available, - = not available

## Function, Equipment & Technical data Wilo-Star (Bronze body)

	Wilo-Star... (Bronze body)								
	3 BS	5 BU	5 BFX	8 BS	11 BU	16 BFX	21 BFX	30 BU	32 BF
<b>Approved fluids</b> (other fluids on request)									
Heating water	•	•	•	•	•	•	•	•	•
Water/glycol mixtures (max. 3:1; mixtures with more than 20% glycol require reassessment of the hydraulic criteria)	•	•	•	•	•	•	•	•	•
Domestic hot water	•	•	•	•	•	•	•	•	•
<b>Performance</b>									
Max. delivery head [ft]	3.5	6.5	6.5	9	11.5	16	21	30	33
Max. delivery head [m]	1.1	2.0	2.0	2.7	3.5	4.9	6.4	9.1	10.1
Max. volume rate of flow [USGPM]	5.5	12	12	9	19.5	16.5	19	26	10.5
Max. volume rate of flow [m³/h]	1.2	2.7	2.7	2.0	4.4	3.7	4.3	5.9	2.4

### Acceptable field of application

Temperature range for application in heating and cooling installations  
14 °F (-10 °C) up to 230 °F (+110 °C)

Temperature range in domestic hot water system  
< 140 °F (+60 °C)

Ambient temperature range  
104 °F (+40 °C)

Max. working pressure P<sub>max</sub> [psi]  
140 140 140 140 140 140 140 140 140 140

### Pipe connections

Flange	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Flange rotated 90°	-	-	•	-	-	•	-	-	-	•	-	-	-	-	-	-	-	-	-
Union connection	-	•	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Internal sweat	•	-	-	•	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

### Electrical connections

Power supply 1~ [V]	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
Power frequency [Hz]	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Wilo's quick connection with spring clips	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

### Motor/Electronics

Number of speed steps	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Non overload motor	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Insulation class	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F

• = available, - = not available

# Circulating Pumps

Product review: Wilo-Star/Star S

# Circulating Pumps

Product review: Wilo-Star/Star S



## Function, Equipment & Technical data Wilo-Star (Bronze body)

	Wilo-Star... (Bronze body)								
	3 BS	5 BU	5 BFX	8 BS	11 BU	16 BFX	21 BFX	30 BU	32 BF
<b>Materials</b>									
Pump housing - cast iron	-	-	-	-	-	-	-	-	-
Pump housing - bronze	•	•	•	•	•	•	•	•	•
Impeller	Plastics (PP - 40 % GF)								
Shaft	Stainless steel (X40 Cr13)								
Bearing	Metal impregnated carbon								
<b>Minimal static inlet pressure at pump suction port [psij] to avoid cavitation at fluid temperatures</b>									
122 °F (50 °C)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
203 °F (95 °C)	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
230 °F (110 °C)	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5

• = available, - = not available

## Function, Equipment & Technical data Wilo-Star S (Bronze body)

	Wilo-Star S... (Bronze body)	
	5 16 BFX	5 21 BFX
<b>Approved fluids</b> (other fluids on request)		
Heating water	•	•
Water/glycol mixtures (max. 3:1; mixtures with more than 20% glycol require reassessment of the hydraulic criteria)	•	•
Domestic hot water	•	•
<b>Performance</b>		
Max. delivery head [ft]	16	21
Max. delivery head [m]	4.9	6.4
Max. volume rate of flow [USGPM]	16.5	19
Max. volume rate of flow [m³/h]	3.7	4.3
<b>Acceptable field of application</b>		
Temperature range for application in heating and cooling installations	14 °F (-10 °C) up to 230 °F (+110 °C)	
Temperature range in domestic hot water system	-	-
Ambient temperature range	104 °F (+40 °C)	104 °F (+40 °C)
Max. working pressure P <sub>max</sub> [psi]	140	140
<b>Pipe connections</b>		
Flange	-	-
Flange rotated 90°	•	•
Union connection	-	-
Internal sweat	-	-
<b>Electrical connections</b>		
Power supply 1- [V]	115	115
Power frequency [Hz]	60	60
Wilo's quick connection with spring clips	•	•
<b>Motor/Electronics</b>		
Number of speed steps	3	3
Non overload motor	•	•
Insulation class	F	F

• = available, - = not available



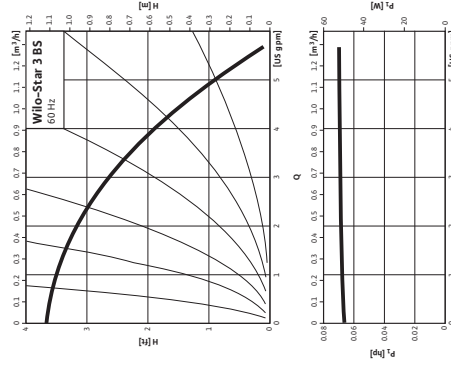
Function, Equipment & Technical data Wilo-Star S (Bronze body)

	S 16 BFX	S 21 BFX
<b>Materials</b>		
Pump housing – cast iron	–	–
Pump housing – bronze	•	•
Impeller	Plastics (PP – 40 % GF)	•
Shaft	Stainless steel (X40 Cr13)	
Bearing	Metal impregnated carbon	
<b>Minimal static inlet pressure at pump suction port [psi] to avoid cavitation at fluid temperatures</b>		
122 °F (50 °C)	0.7	0.7
203 °F (95 °C)	4.4	4.4
230 °F (110 °C)	14.5	14.5

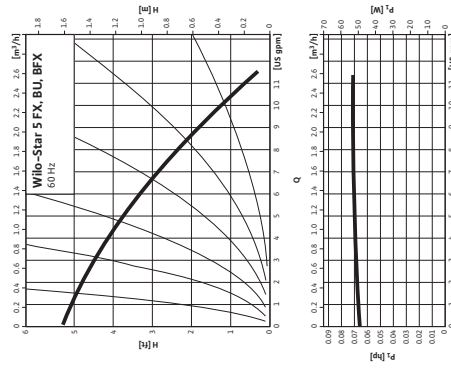
• = available, – = not available

Pump curves Wilo-Star

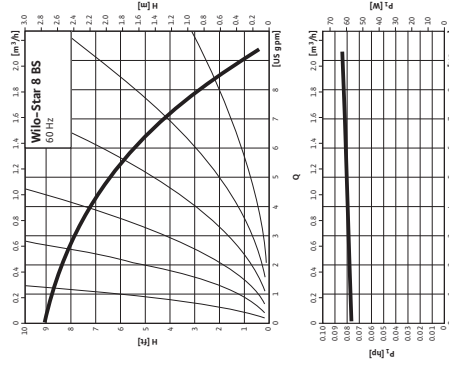
Wilo-Star 3 BS



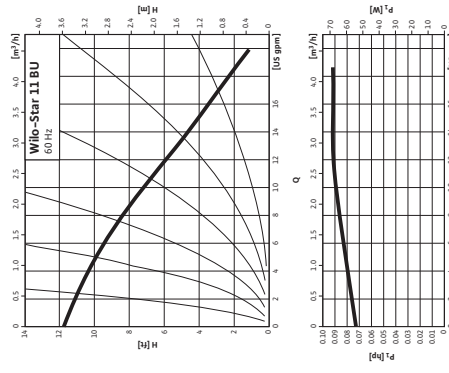
Wilo-Star 5 FX, BU, BFX



Wilo-Star 8 BS



Wilo-Star 11 BU

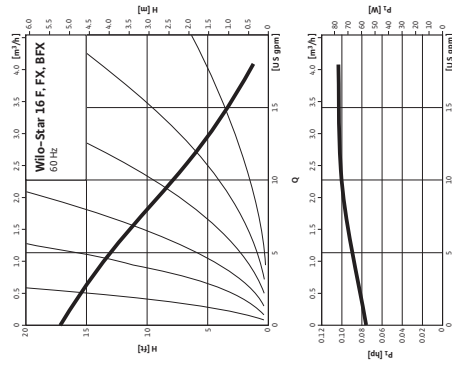




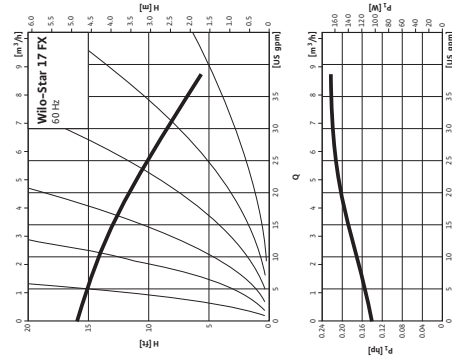
Pump curves Wilo-Star

Pump curves Wilo-Star

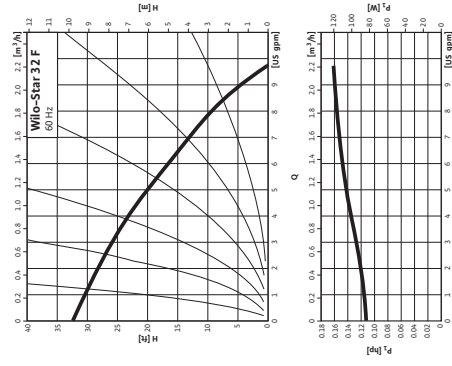
Wilo-Star 16 F, FX, BFX



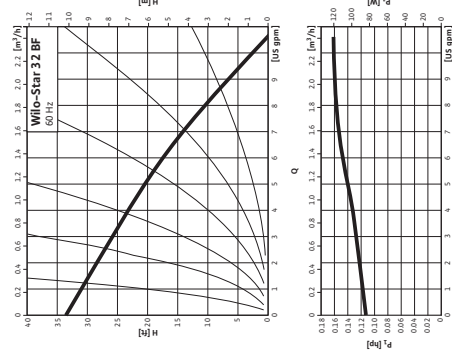
Wilo-Star 17 FX



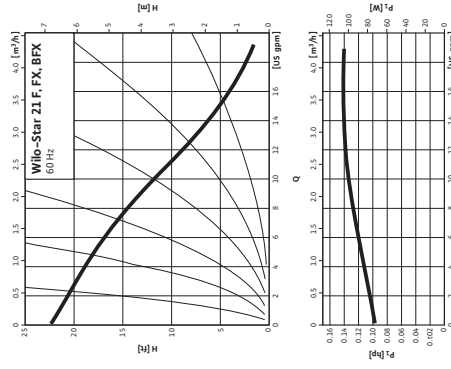
Wilo-Star 32 F



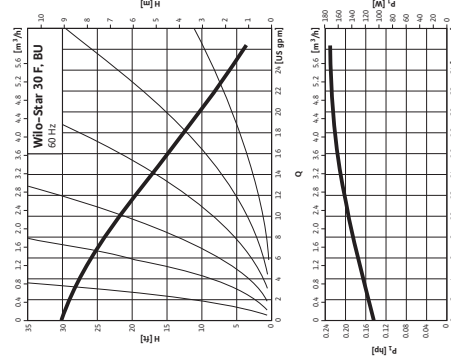
Wilo-Star 32 BF



Wilo-Star 21 F, FX, BFX



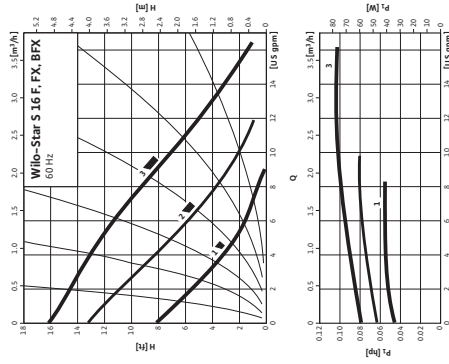
Wilo-Star 30 F, BU



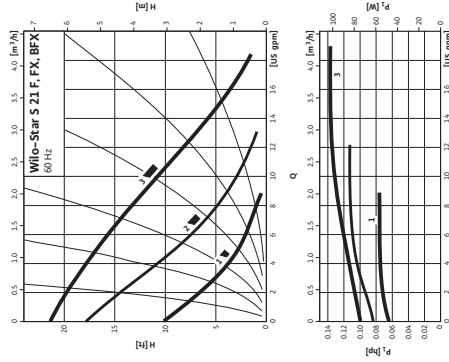
Pump curves Wilo-Star S

Wiring diagrams, motor data

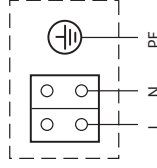
Wilo-Star S 16 F, FX, BFX



Wilo-Star S 21 F, FX, BFX



Wiring diagram



Single phase motor 2-pole, 1-115 V/60 Hz with integrated capacitor

Motor data Wilo-Star

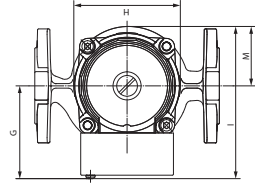
Wilo-Star...	Rated Power		Speed	Power consumption		Current 1-115 V, 60 Hz	Motor protection	Capacitor
	[hp]	[W]		[hp]	[W]			
Star 3...	0.03	20	3400	0.07	50	0.49	-	[μF]
Star 5...	0.03	20	2700	0.07	50	0.49	-	7
Star 8...	0.03	20	3000	0.09	64	0.58	-	7
Star 11...	0.03	20	3000	0.09	64	0.58	-	7
Star 16...	0.05	35	2700	0.11	80	0.66	not necessary (blocking-current-proof)	7
Star 17...	0.10	70	3000	0.24	166	1.45	-	12
Star 21...	0.05	40	2700	0.15	110	0.92	-	9
Star 30...	0.10	70	2700	0.24	173	1.50	-	12

Motor data Wilo-Star S...

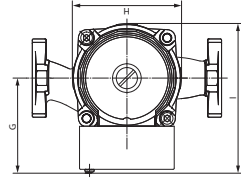
Wilo-Star S...	Rated Power		Speed	Power consumption		Current 1-115 V, 60 Hz	Motor protection	Capacitor
	[hp]	[W]		[hp]	[W]			
Star S 16...	0.05	35	max. 2700	0.10	80	0.66	-	[μF]
Star S 21...	0.05	40	min. 1600	0.05	41	0.38	not necessary (blocking-current-proof)	7
			max. 2700	0.13	110	0.92	-	9
			min. 1300	0.07	56	0.52	-	-

Dimension, weights

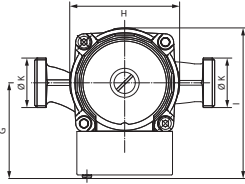
Wilo-Star, Drawing no.: 1



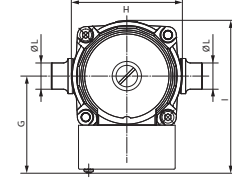
Wilo-Star, Drawing no.: 2



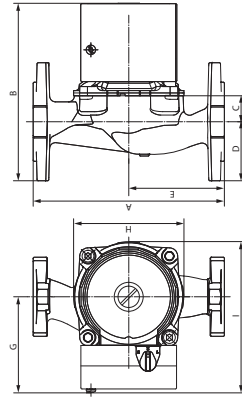
Wilo-Star, Drawing no.: 3



Wilo-Star, Drawing no.: 4



Wilo-Star S, Drawing no.: 5



Dimension, weights

Wilo-Star...	A	B	C	D	E	F	G	H	I	Ø K	Ø L	M	Weight approx. [lbs]	Draw- ing No.
Star 3 BS 5	5	4 15/16	15/16	7/8	2 7/8	9/16	3 3/16	3 11/16	5 1/16	5/8	7/8	-	6.5	4
Star 3 BS 7	5	4 15/16	15/16	7/8	2 7/8	9/16	3 3/16	3 11/16	5 1/16	5/8	1 1/8	-	5.3	4
Star 5 BU	6	5 1/8	1 5/16	1 5/16	3	-	3 3/16	3 11/16	5 1/16	1 3/4 NPSM	-	-	6.5	3
Star 5 BFX	6 3/8	5 15/16	7/8	2	3 3/16	-	3 3/16	3 11/16	5 1/16	-	-	-	7.2	2
Star 5 FX	6 3/8	5 15/16	7/8	2	3 3/16	-	3 3/16	3 11/16	5 1/16	-	-	-	6.5	2
Star 8 BS 5	5	4 15/16	15/16	7/8	2 7/8	9/16	3 3/16	3 11/16	5 1/16	5/8	7/8	-	6.5	4
Star 8 BS 7	5	4 15/16	15/16	7/8	2 7/8	9/16	3 3/16	3 11/16	5 1/16	5/8	1 1/8	-	5.3	4
Star 11 BU	6	5 1/8	1 5/16	1 5/16	3	-	3 3/16	3 11/16	5 1/16	1 3/4 NPSM	-	-	6.5	3
Star 16 F	6 3/8	5 1/4	7/8	1 5/16	3 3/16	-	3 3/16	3 11/16	5 3/16	5 3/16	-	-	6.5	1
Star 16 FX	6 3/8	5 15/16	7/8	2	3 3/16	-	3 3/16	3 11/16	5 1/16	-	-	-	6.5	2
Star 16 BFX	6 3/8	5 15/16	7/8	2	3 3/16	-	3 3/16	3 11/16	5 1/16	-	-	-	7.2	2
Star 17 FX	8 1/2	7	1 7/8	2 3/16	4 1/4	-	3 3/8	3 7/8	5 3/8	-	-	-	10.8	2
Star 21 F	6 3/8	5 1/4	7/8	1 5/16	3 3/16	-	3 3/16	3 11/16	5 3/16	-	-	-	6.5	1
Star 21 FX	6 3/8	5 15/16	7/8	2	3 3/16	-	3 3/16	3 11/16	5 3/16	-	-	-	6.5	2
Star 21 BFX	6 3/8	5 15/16	7/8	2	3 3/16	-	3 3/16	3 11/16	5 3/16	-	-	-	7.1	2
Star 30 BU	6	6 1/8	1 1/4	1 3/8	3	-	3 1/4	3 3/4	5 1/8	-	-	-	7.7	3
Star 30 F	6 1/2	6	1 1/4	1 5/16	3 1/4	-	3 1/4	3 3/4	5 3/16	-	-	-	1 15/16	1
Star 32 BF	6 3/8	5 3/8	7/8	1 5/16	3 3/16	-	3 3/16	3 11/16	5 3/16	-	-	-	2 1/16	1
Star 32 F	6 3/8	5 3/8	15/16	1 5/16	3 3/16	-	3 3/16	3 11/16	5 3/16	-	-	-	2 1/16	1
Star S16 F	6 3/8	6 3/8	7/8	2	3 3/16	-	3 3/16	3 11/16	5 1/16	-	-	-	6.5	5
Star S16 FX	6 3/8	6 3/8	7/8	2	3 3/16	-	3 3/16	3 11/16	5 1/16	-	-	-	6.5	5
Star S16 BFX	6 3/8	6 3/8	7/8	2	3 3/16	-	3 3/16	3 11/16	5 1/16	-	-	-	7.0	5
Star S21 F	6 3/8	6 3/8	7/8	2	3 3/16	-	3 3/16	3 11/16	5 1/16	-	-	-	6.5	5
Star S21 FX	6 3/8	6 3/8	7/8	2	3 3/16	-	3 3/16	3 11/16	5 1/16	-	-	-	6.5	5
Star S21 BFX	6 3/8	6 3/8	7/8	2	3 3/16	-	3 3/16	3 11/16	5 1/16	-	-	-	7.1	5

# Circulating Pumps

Wilo-Star/Star S

## Dimension, weights

Wilo-Star...	metric													Weight approx. [kg]	Drawing No.
	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	I [mm]	Ø K [mm]	Ø L [mm]	M [mm]			
Star 2 BS 5	127	125	24	23	64	15	81	93.5	128	16	22	-	-	3.0	4
Star 2 BS 7	127	125	24	23	64	15	81	93.5	128	22	28	-	-	2.4	4
Star 5 BU	152	130	18	33	76	-	81	93.5	128	-	-	-	-	3.0	3
Star 5 BFX	162	150	22	50	81	-	81	93.5	128	-	-	-	-	3.3	2
Star 5 FX	162	150	22	50	81	-	81	93.5	128	-	-	-	-	3.0	2
Star 8 BS 5	127	125	24	23	64	15	81	93.5	128	16	22	-	-	3.0	4
Star 8 BS 7	127	125	24	23	64	15	81	93.5	128	22	28	-	-	2.4	4
Star 11 BU	152	130	18	33	76	-	81	93.5	128	-	-	-	-	3.0	3
Star 16 F	162	134	22	34	81	-	82	93.5	132	-	-	-	-	3.0	1
Star 16 FX	162	150	22	50	81	-	81	93.5	128	-	-	-	-	3.0	2
Star 16 BFX	162	150	22	50	81	-	81	93.5	128	-	-	-	-	3.3	2
Star 17 FX	216	176	33	55	108	-	82	96.0	130	-	-	-	-	4.9	2
Star 21 F	162	134	22	34	81	-	82	93.5	132	-	-	-	-	3.0	1
Star 21 FX	162	150	22	50	81	-	81	93.5	128	-	-	-	-	3.0	2
Star 21 BFX	162	150	22	50	81	-	81	93.5	128	-	-	-	-	3.2	2
Star 30 BU	152	155	32	35	76	-	82	96	130	-	-	-	-	3.5	3
Star 30 F	165	153	31	34	83	-	82	96.0	132	-	-	-	50	3.7	1
Star 32 BF	162	136	24	34	81	-	81	93.5	128	-	-	-	52	3.5	1
Star 32 F	162	136	24	34	81	-	81	93.5	128	-	-	-	52	3.1	1
Star S 16 F	162	154	22	50	81	-	81	93.5	128	-	-	-	-	3.0	5
Star S 16 FX	162	154	22	50	81	-	81	93.5	128	-	-	-	-	3.0	5
Star S 16 BFX	162	154	22	50	81	-	81	93.5	128	-	-	-	-	3.2	5
Star S 21 F	162	154	22	50	81	-	81	93.5	128	-	-	-	-	3.0	5
Star S 21 FX	162	154	22	50	81	-	81	93.5	128	-	-	-	-	3.0	5
Star S 21 BFX	162	154	22	50	81	-	81	93.5	128	-	-	-	-	3.3	5



**For Hot Water Boiler Applications**

Job Name \_\_\_\_\_ Contractor \_\_\_\_\_  
 Job Location \_\_\_\_\_ Approval \_\_\_\_\_  
 Engineer \_\_\_\_\_ Contractor's P.O. No. \_\_\_\_\_  
 Approval \_\_\_\_\_ Representative \_\_\_\_\_

**Series 174A-740  
 ASME Water Pressure  
 Relief Valves**  
 for Pressure Protection of  
 Hot Water Heating Boilers

Sizes: 3/4" through 2" (20 - 50mm)

**Series 174A**

Bronze body safety relief valves for pressure protection only of all types of hot water heating boiler equipment. Pressure range 30 to 150 psi (2 - 10 bars) with corresponding high ratings from 650,000 to 14,370,000 BTU/hr. Female inlet and outlet connections. Sizes 3/4" to 2" (20 to 50mm).

**Series 374A**

Iron body with forged bronze inlet, 550,000 BTU/hr rating. Size 3/4" (20mm) only.

**Series 740**

Iron body with expanded outlets for hot water space heating boilers. Pressure range 30 to 75 psi (2 to 5 bars) with corresponding high ratings from 925,000 to 10,700,000 BTU/hr.

**FEATURES**

- Seat located above drain; water can't be trapped and sediment can't foul seat.
- Non-mechanical seat-to-disc alignment will not stick or freeze.
- Water seal of high temperature resisting material isolates spring working parts from water during relief.

**SPECIFICATIONS**

**Boiler Relief Valves**

An ASME Section IV certified pressure relief valve shall be installed on each boiler as noted. The valve shall have a BTU rating in excess of the BTU rating of the boiler's heating output. Each hot water space heating boiler shall be equipped with a pressure relief valve set to relieve below the maximum boiler working pressure. The valve shall feature a raised seat and non-mechanical disc alignment. Working parts and spring shall be isolated from any discharge by a high temperature resistant material. Valve shall be a Watts 174A or 740 Series.



Series 740

Series 174A

**OPERATION**

As thermal expansion conditions develop, pressure builds up to the setting of the relief valve. This will cause discharging of small quantity of water.

Should operating controls fail, permitting runaway firing, the boiler water may reach steam temperatures. The valve will then open to discharge steam at the rate or faster than the boiler can generate it, thus restoring system pressure to a safer level.

**Important:** The discharge line must be the same size as the valve outlet, and must pitch downward from the valve to a safe place for disposal.

Valve lever must be tripped at least once a year to insure that waterways are clear. This device is designed for emergency safety relief and shall not be used as an operating control.

Watts product specifications in U.S. customary units and metric are approximate and are provided for reference only. Watts reserves the right to change or modify product design, construction, specifications, or materials without prior notice and without incurring any obligations to make such changes or modifications on Watts products previously or subsequently sold.



Water Products Division • Safety & Control Valves

**MATERIALS**

**Series 174A**

- Bronze body construction
- Nonmetallic disc-to-metal seating

**Series 740**

- Iron body construction
- Nonmetallic disc-to-metal seating

**PRESSURE - TEMPERATURE**

**Series 174A**  
 Pressure range: 30 psi to 150 psi (2 to 10 bars) with corresponding high BTU/hr ratings from 650,000 to 14,370,000 BTU/hr.  
 Maximum Temperature: 250°F (121°C).

**No. 374A**  
 Pressure range: rated up to 550,000 BTU/hr at a 30 psi (2 bars) setting only.

**Series 740**

Pressure range: 30 PSI to 75 psi (2 to 5 bars) with corresponding high ratings from 925,000 to 10,700,000 BTU/hr.  
 Maximum Temperature: 250°F (121°C).

**STANDARDS**



Tested and rated by A.S.M.E. National Board of Boiler and Pressure Vessel Inspectors.  
 Meets Military Spec. MIL-V-18634B, Type I, Class 3A, Style A (Bronze Body), Style B (Iron Body).

**CAPACITY**

BTU/hr Steam Pressure Discharge Capacities  
 As tested and rated by the National Board of Boiler and Pressure Vessel Inspectors

**Series 174A**

Set Pressure psi	3/4" x 3/4" Model M3	1" x 1" Model M1	1 1/2" x 1 1/2" Model M1	1 1/2" x 1 1/4" Model M1	1 1/2" x 1" Model M1	2" x 2" Model M
30	2,07	650,000	1,005,000	1,682,000	1,788,000	2,020,000
33	2,27	695,000	1,075,000	1,788,000	1,894,000	2,150,000
35	2,41	725,000	1,125,000	1,877,000	1,983,000	2,250,000
36	2,48	740,000	1,145,000	1,916,000	2,010,000	2,310,000
40	2,76	800,000	1,240,000	2,071,000	2,180,000	2,490,000
45	3,10	875,000	1,365,000	2,265,000	2,390,000	2,720,000
50	3,45	950,000	1,470,000	2,459,000	2,590,000	2,950,000
55	3,79	1,025,000	1,560,000	2,653,000	2,780,000	3,190,000
60	4,13	1,100,000	1,620,000	2,847,000	2,970,000	3,430,000
65	4,58	1,175,000	1,690,000	3,041,000	3,160,000	3,670,000
70	4,82	1,245,000	1,765,000	3,235,000	3,350,000	3,910,000
75	5,17	1,320,000	1,865,000	3,429,000	3,540,000	4,150,000
80	5,51	1,400,000	1,965,000	3,623,000	3,730,000	4,390,000
85	5,86	1,470,000	2,065,000	3,817,000	3,920,000	4,630,000
90	6,60	1,620,000	2,260,000	4,011,000	4,110,000	4,870,000
95	6,55	1,620,000	2,260,000	4,011,000	4,110,000	4,870,000
100	6,89	1,695,000	2,350,000	4,205,000	4,300,000	5,110,000
105	7,23	1,770,000	2,450,000	4,399,000	4,490,000	5,350,000
110	7,58	1,845,000	2,550,000	4,593,000	4,680,000	5,590,000
115	7,92	1,920,000	2,650,000	4,787,000	4,870,000	5,830,000
120	8,27	1,995,000	2,750,000	4,981,000	5,060,000	6,070,000
125	8,61	2,070,000	2,850,000	5,175,000	5,250,000	6,310,000
130	8,96	2,145,000	2,950,000	5,370,000	5,440,000	6,550,000
135	9,30	2,220,000	3,050,000	5,564,000	5,630,000	6,790,000
140	9,65	2,295,000	3,150,000	5,758,000	5,820,000	7,030,000
145	9,99	2,370,000	3,250,000	5,952,000	6,010,000	7,270,000
150	10,34	2,445,000	3,350,000	6,146,000	6,200,000	7,510,000

**Series 740**

Set Pressure psi	3/4" x 1" Model M3	1 1/2" x 1 1/2" Model M1	1 1/2" x 1 1/4" Model M1	1 1/2" x 1" Model M1	2" x 2 1/2" Model M
30	2,07	925,000	1,300,000	2,105,000	2,900,000
33	2,27	989,000	1,390,000	2,250,000	3,100,000
35	2,41	1,027,000	1,450,000	2,345,000	3,235,000
36	2,48	1,053,000	1,480,000	2,395,000	3,300,000
40	2,76	1,135,000	1,600,000	2,590,000	3,569,000
45	3,10	1,245,000	1,750,000	2,830,000	3,903,000
50	3,45	1,352,000	1,899,000	3,075,000	4,237,000
55	3,79	1,459,000	2,048,000	3,315,000	4,572,000
60	4,13	1,566,000	2,200,000	3,560,000	4,907,000
65	4,58	1,672,000	2,349,000	3,800,000	5,241,000
70	4,82	1,775,000	2,499,000	4,045,000	5,575,000
75	5,17	1,885,000	2,649,000	4,285,000	5,909,000

**DIMENSIONS - WEIGHTS**

**Series 174A**

No.	Size (mm)	Model	Height in.	Height mm	Length in.	Length mm	Weight lbs.	Weight kg.
374A	3/4" x 3/4"	20 x 20	92	2 1/4	64	1 1/3	5	1.13
174A	3/4" x 3/4"	20 x 20	130	5 1/8	64	1 5/8	7	1.50
174A	1" x 1"	25 x 25	146	5 3/4	76	3 1/3	1.4	3.13
174A	1 1/2" x 1 1/2"	32 x 32	213	8 3/8	121	4 7/8	2.8	6.25
174A	1 1/2" x 1 1/4"	40 x 40	229	9 1/8	124	4 7/8	3.3	7.25
174A	2" x 2"	50 x 50	285	11 1/4	159	6 1/4	6.6	14.75

**Series 740**

740	3/4" x 1"	20 x 25	143	5 5/8	76	3	1.88	4.19
740	1" x 1 1/4"	25 x 32	184	7 1/4	89	3 3/4	3.13	6.94
740	1 1/2" x 1 1/2"	32 x 40	222	8 7/8	117	4 5/8	4.63	10.30
740	1 1/2" x 1"	40 x 50	235	9 1/4	133	5 1/8	5.50	12.25
740	2" x 2 1/2"	50 x 65	295	11 5/8	171	6 5/8	7.5	16.50

## **N O T I C E**

This owners & operation manual provides warnings of risk of harm from improper installation, operation and/or maintenance of Ace Products. Ace Heaters, LLC used ordinary care and complied with UL and ASME Standards in the design and manufacture of Ace Products. Proper installation, operation and maintenance are covered in the manual supplied with the product. All equipment must comply with local codes.

## **W A R N I N G**

**THIS PRODUCT CONTAINS CRYSTALLINE SILICA, A CHEMICAL KNOWN TO CAUSE CANCER. CONTAINS NO ASBESTOS.**

---

**Ace Heaters, LLC**

[www.aceheaters.com](http://www.aceheaters.com)

SO # \_\_\_\_\_

Serial No. \_\_\_\_\_

Model No. \_\_\_\_\_