

Ace Heaters

Packaged Storage Water Heater

Steam-to-Water System

Operating and Maintenance Manual



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



Photo shown may vary from actual model.

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Operating and Installation Instructions (Pneumatic / Pilot-Operated)

Congratulations on your purchase of a new Ace Boiler, 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.

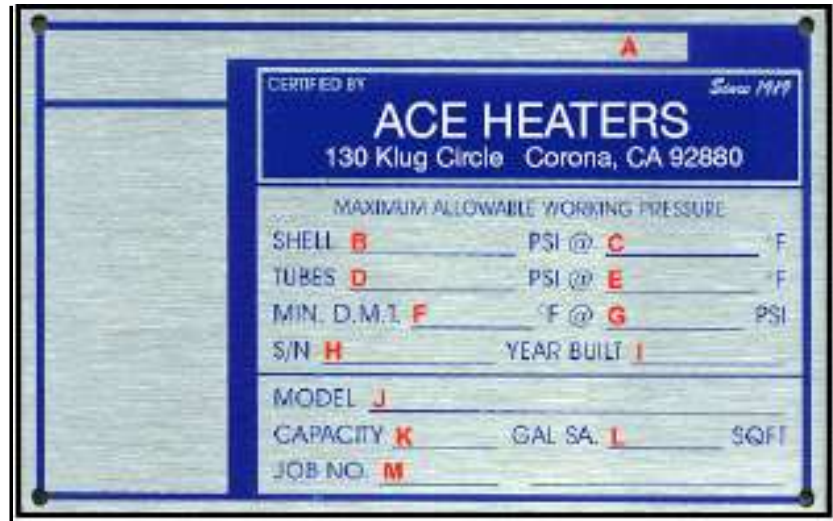
Experience in the field has proven that the Ace Packaged Storage Water Heater, if properly applied and maintained, will give many years of efficient, dependable and economical service.

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



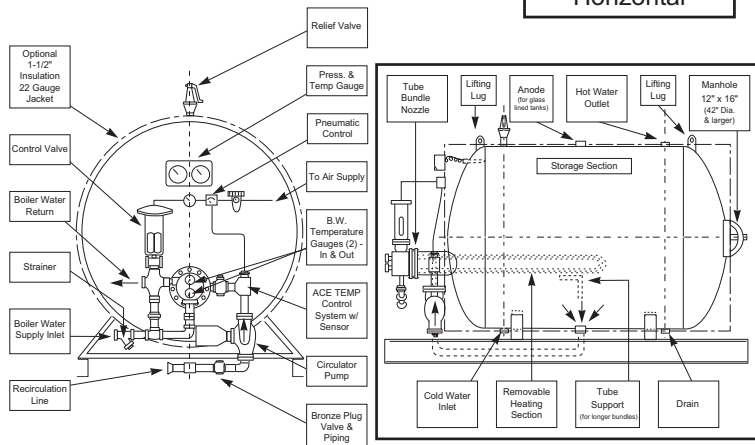
The Packaged Storage Water Heater Model Number

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

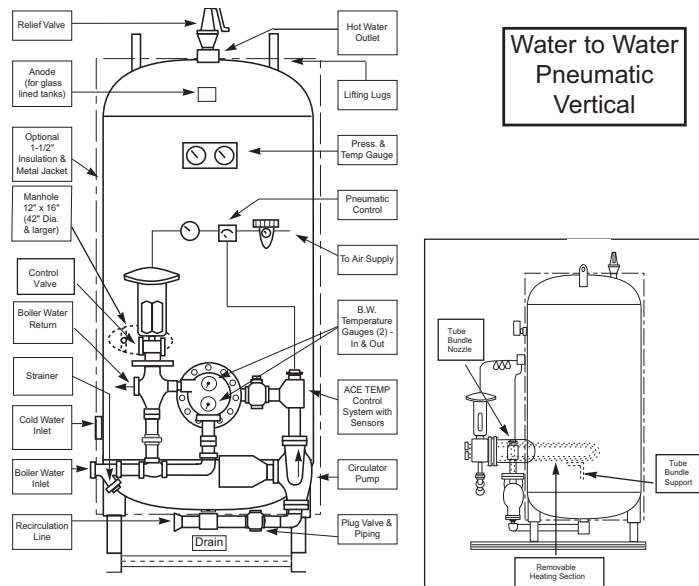
- P = Packaged
- H = Type (H = Horizontal, V = Vertical)
- G = Tank Design Pressure (G = 125, J = 150)
- 72 = Tank Diameter
- 10 = Shell Length in feet
- G = Lining Code (G = glass, K = prekrete, U = unlined, C = cement, X = special, S = stainless)
- 2. = # of Passes
- 1066 = Coil model number (10 = 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)

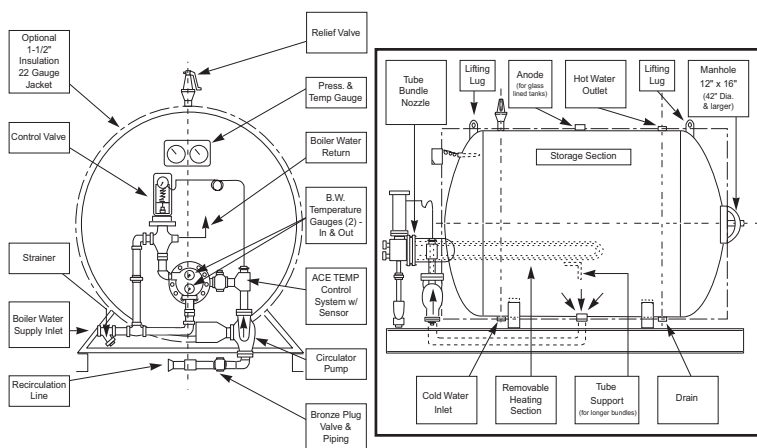
Water to Water
Pneumatic
Horizontal



Water to Water
Pneumatic
Vertical



Water to Water
Self-Operating
Horizontal



Water to Water
Self-Operating
Vertical

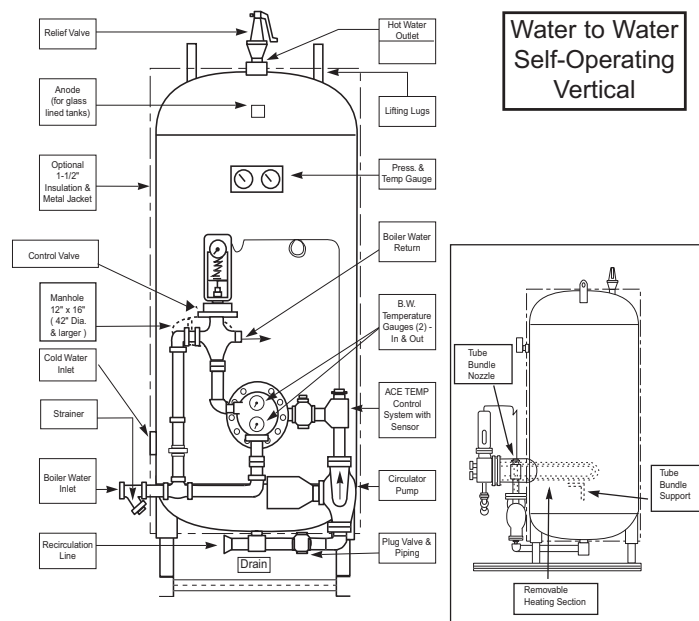


Diagram may vary from actual model

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 Boiler 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-lbf.	60 ft-lbf.
5/8"	90 ft-lbf.	120 ft-lbf.
3/4"	150 ft-lbf.	200 ft-lbf.
7/8"	240 ft-lbf.	320 ft-lbf.
1"	368 ft-lbf.	490 ft-lbf.
1 1/8"	533 ft-lbf.	710 ft-lbf.
1 1/4"	750 ft-lbf.	1000 ft-lbf.
1 1/2"	1200 ft-lbf.	1600 ft-lbf.

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.

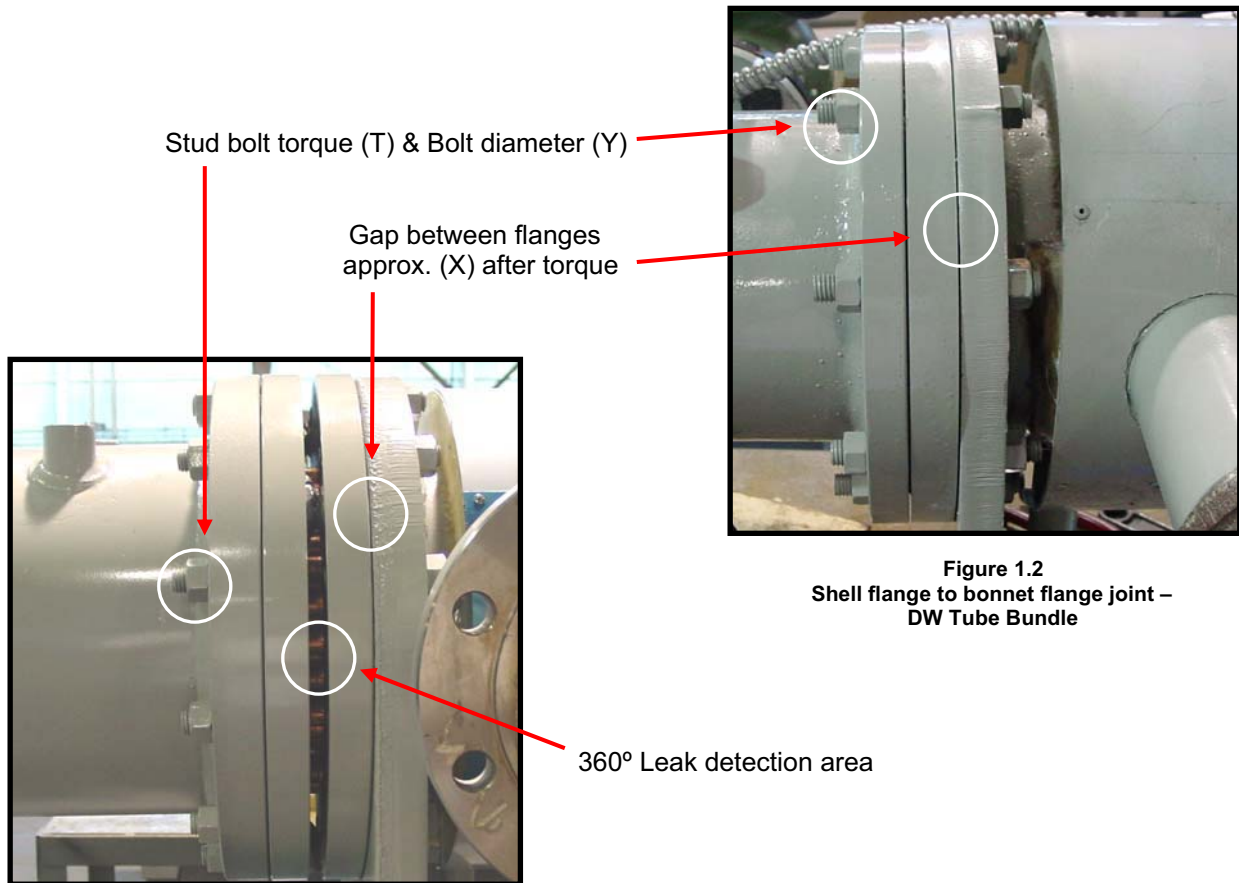


Figure 1.1
Shell flange to bonnet flange joint –
SW Tube Bundle

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, steam, domestic water, instrument air, vents, drains and safety valve discharge lines.
- 2 If an optional control box is included, make sure the power switch is in the "off" position.
- 3 Set the temperature controller on the pilot to a minimal water temperature output, following instruction in the technical data sheet provided (factory does not present).
- 4 If option is provided, adjust the high limit control 12° to 15°F higher than the desired hot water outlet temperature.
- 5 Ensure the shut-off valve on the bonnet side (heating medium side) is closed.
- 6 Slowly fill the packaged storage water heater with domestic water, making sure all air is evacuated prior to start-up.
- 7 Plant steam, used as the heating medium, is controlled by a pilot operated control valve. The pilot utilizes upstream steam pressure to modulate the control valve based on the temperature of the thermostatic element. Steady upstream supply steam pressure is imperative to the temperature control.
- 8 If an optional control panel is included, turn the control panel switch to "On" position (the manual steam supply valve should be closed). The green light should come on. At the same time, it will energize the solenoid to open the pilot control line to the valve. Make sure the circulator pump is running. (Please refer to the pump instruction manual for details.)
- 9 Manually open the main steam shut-off valve upstream of the control valve and SLOWLY allow steam to pass through the control valve. Continue until the shut-off valve is 100% open.
- 10 The packaged storage water heater will now function automatically, reacting according to demand fluctuations and will stabilize once limits are met.
- 11 Observe the entire system over a period of large demand fluctuations and readjust as necessary by adjusting the pilot control wheel. (See enclosed technical instruction on the temperature pilot).
- 12 After initial start-up, it is recommended to inspect the upstream strainer for any dirt or debris that may have accumulated. This should be done in accordance with company recommended safety procedures.

Shut Down Instructions

- 1 Close the main upstream shut-off valve to the packaged storage water heater.
- 2 De-energize all electrical power to the packaged storage water heater.
- 3 Allow the unit to cool down (Approximately 24 hours).
- 4 Close domestic water inlet and outlet shut-off valves.

Safety Features

- 1 The pilot-operated steam control valve is designed to fail closed in the event of an over-temp condition or power failure.
- 2 The relief valve is designed to relieve the pressure in the packaged storage water heater in the event the system pressure exceeds its set point.
- 3 The double safety solenoid (Optional) is designed to dump the domestic water in the shell in the event that the water temperature exceeds the set point on the high limit control (Optional).

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 ¼"	10,100lbs.
1 ½"	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 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



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 include:

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.

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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' 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

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

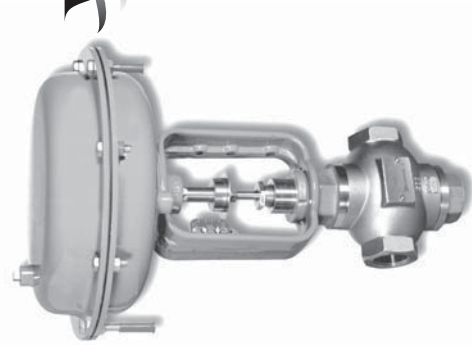
PRODUCT SPECIFICATION

March 2005

PNEUMATIC ACTUATED INDUSTRIAL VALVES

SERIES: 2800 SIZES 1/2 to 2 INCHES

Precision Globe Control Valves



WARREN CONTROLS

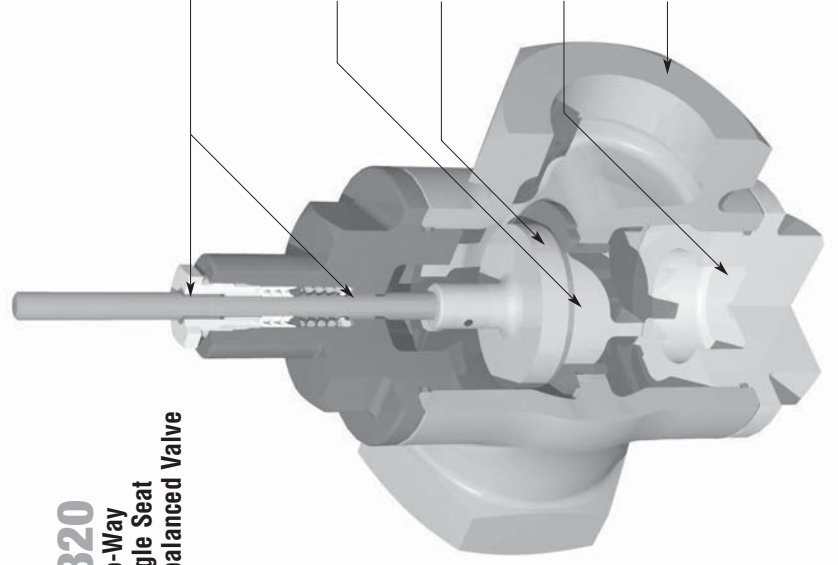
Two-Way and Three-Way, Reciprocating,
Bronze or Stainless Steel Body Valves
for Process and Utility Applications

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2820

**Two-Way
Single Seat
Unbalanced Valve**



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

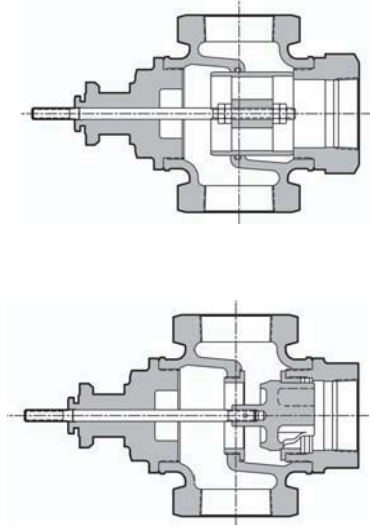
Dual Point PEEK Bearing Stem Guiding
provides both stability and low friction, yielding reduced hysteresis and optimum control.

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

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

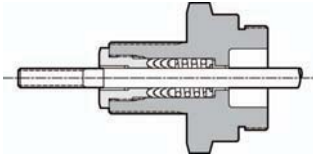
Lower Plug
offers easy access for inspection and clean out.

Rugged Body
with a selection of port reductions.

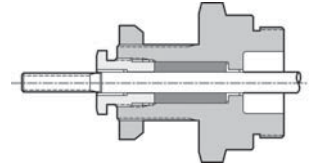


2830
Three-Way Mixing Valve
Bronze Body

2832
Three-Way
Diverting/Mixing Valve
Bronze Body



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



Adjustable Graphite
Packing

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.

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 inch

Body: ANSI B16.15 Bronze 250LB Threaded (NPT) or 316 Stainless Steel 300LB Threaded (NPT)

Trim: EQ 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)

Temperature: -32 to 400°F (Bronze 250LB Threaded Body) w/ TFE or PEEK Trim

Rangeability: 50:1

Stem Down ↓

Flow →

The valve closes

The valve opens

The upper port closes and the lower port opens

The lower port closes and the upper port opens

The upper port closes and the lower port opens

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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 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)

Temperature: -32 to 400°F (Bronze 250LB Threaded)

Rangeability: 50:1

Stem Up ↑

Flow →

The upper port closes and the lower port opens

The lower port closes and the upper port opens

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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 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)

O-Ring: EPR (Bronze 250LB Threaded), Fluoraz 797 (316 Stainless Steel 300LB Threaded)

Temperature: -32 to 300°F (Bronze 250LB Threaded)

Rangeability: 50:1

Stem Up ↑

Flow →

The upper port closes and the lower port opens

The lower port closes and the upper port opens

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Flow Coefficients (Cv) Versus Travel

Sizing Reference

2820 Flow Coefficients (Cv)											
Two-Way Single Seat Unbalanced Valve											
Valve	Trim	Port	% Travel								
Size(In)	Style	Size(In)	100%	90%	80%	70%	60%	50%	40%	30%	
1/2	EQ	FULL	4.90	4.78	3.53	2.57	1.92	1.92	0.95	0.69	0.43
		1SR	3.20	3.16	2.29	1.61	1.19	0.75	0.51	0.39	0.26
		2SR	1.50	1.44	0.96	0.72	0.52	0.42	0.31	0.21	0.10
		FULL	6.00	5.40	4.20	3.60	3.00	2.40	1.80	1.20	0.60
3/4	EQ	FULL	7.20	7.09	5.53	2.53	1.73	1.24	0.88	0.52	0.27
		1SR	5.50	5.31	3.73	2.64	1.95	1.21	0.86	0.52	0.27
		2SR	3.30	3.20	2.34	1.63	1.20	0.75	0.51	0.39	0.26
		FULL	10.0	9.70	7.50	5.04	3.60	2.88	2.16	1.44	0.72
1	EQ	FULL	12.0	11.70	9.00	6.52	4.40	2.82	2.04	1.36	0.88
		1SR	8.60	8.38	6.09	3.64	2.58	1.74	1.25	0.89	0.52
		2SR	6.00	5.79	3.88	2.70	1.97	1.22	0.96	0.70	0.43
		FULL	3.40	3.41	2.38	1.64	1.20	0.75	0.51	0.39	0.26
1-1/4	EQ	FULL	16.0	15.5	10.4	7.04	4.81	3.28	2.18	1.30	0.88
		1SR	10.0	9.70	6.52	4.40	2.82	2.04	1.36	0.81	0.55
		2SR	6.00	5.79	3.88	2.70	1.97	1.22	0.96	0.70	0.43
		FULL	3.40	3.41	2.38	1.64	1.20	0.75	0.51	0.39	0.26
1-1/2	EQ	FULL	17.2	15.5	13.38	1.64	1.20	0.860	0.688	0.56	0.344
		1SR	14.0	12.5	10.4	7.04	4.81	3.28	2.18	1.30	0.88
		2SR	8.60	8.38	6.09	3.64	2.58	1.74	1.25	0.89	0.52
		FULL	10.0	9.70	6.52	4.40	2.82	2.04	1.36	0.81	0.55
2	EQ	FULL	24.0	22.5	19.7	15.1	10.3	7.30	4.90	3.20	1.90
		1SR	16.0	15.5	10.4	7.04	4.81	3.28	2.18	1.30	0.88
		2SR	10.0	9.70	6.52	4.40	2.82	2.04	1.36	0.81	0.55
		FULL	3.40	3.41	2.38	1.64	1.20	0.75	0.51	0.39	0.26
2	EQ	FULL	30.0	28.5	24.0	18.0	12.0	8.0	5.0	3.0	1.80
		1SR	20.0	19.0	13.0	9.0	6.0	4.0	2.5	1.5	0.90
		2SR	12.0	11.0	7.5	5.0	3.5	2.5	1.5	0.9	0.50
		FULL	6.0	5.5	4.0	3.0	2.0	1.5	1.0	0.6	0.30

Shut-Off ΔP Ratings

NOTES:

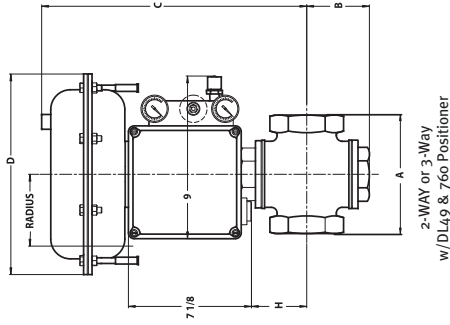
- 1) 2820 Seat closure ANSI Class IV (Stainless Steel and Alloy 6 Trim), ANSI Class VI (PE and PEEK Trim).
- 2) Inlet pressure **cannot** exceed Body Pressure-Temperature Rating.
- 3) The 3-15 and 1-17 columns of the table apply to valves with control signals coming directly from I/P transducers with matching ranges. The 0-30 and 0-40 columns apply to valves with columns apply to valves with a positioner or an I/P transducer of 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...30 PSIG
DL84 & 84XR...30 PSIG
- 5) See Actuators, Positioners, and Accessories section for explanation of spring ranges.

Valve		Actuator		Shut-Off ΔP Two-Way, Single Seat Unbalanced				
Trim Size (IN)	Valve Size (IN)	Plug Travel (IN)	Pneumatic Actuator	Spring Range	Maximum Shut-off ΔP in PSI			
					Fail Closed		Fail Open	
					Reverse Acting		Direct Acting	
					Air Signal to Actuator		Air Signal to Actuator	
					3-16 PSI	1-17 PSI	0-30 PSI	0-40 PSI
					3-15 PSI	1-17 PSI	0-30 PSI	0-40 PSI
N/A Exceeds DL49 and DL84 Actuator's Maximum Air Pressure								
					N/A		N/A	
					N/A		N/A	
					N/A		N/A	
					N/A		N/A	
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					N/A		N/A	
					N/A		N/A	
					N/A		N/A	
					N/A		N/A	
					N/A		N/A	
					N/A		N/A	
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					N/A		N/A	

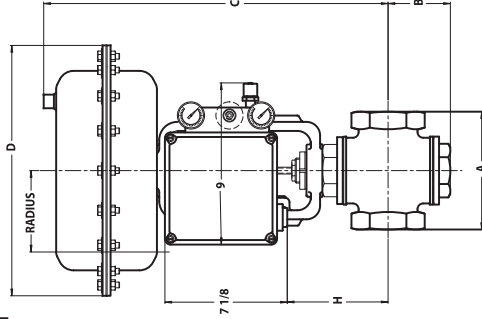
Dimensions & Weights

Component	2820	Dimension (IN) by Valve Size (IN)			
Variable		1/2, 3/4, 1	1-1/4 & 1-1/2	2	
A	250THD	4-7/8	5-3/4	6-1/2	
	300THD	5	6-1/8	6-1/2	
B	250THD	2-3/4	3-1/4	3-5/8	
	300THD	3	3-1/2	3-7/8	
C	DL49 Direct*	15-1/4	15-7/8	16-1/8	
	DL49 Reverse	14-5/8	15-1/4	15-1/2	
	DL84 Direct*	19-1/4	19-7/8	20-1/8	
	DL84 or 84XR Reverse	18-5/8	19-1/4	19-1/2	
H	DL49	1-3/4	2-3/8	2-3/4	
	DL84 or 84XR	3-5/8	4-1/4	4-1/2	
Item		Weight (LB) by Valve Size (IN)			
Variable		1/2, 3/4, 1	1-1/4 & 1-1/2	2	
	250THD	8-1/2	14-1/2	18-1/2	
	300THD	8	15-1/2	19	

Component	2830	Dimension (IN) by Valve Size (IN)			
Variable		1/2, 3/4, 1	1-1/4 & 1-1/2	2	
A	250THD	4-7/8	5-3/4	6-1/2	
	300THD	5	6-1/8	6-1/2	
B	250THD	2-3/4	3-3/4	3-3/4	
	300THD	2-3/4	3-3/8	3-3/4	
C	DL49 Direct*	15-1/4	15-7/8	16-1/8	
	DL84 or 84XR Direct*	N/A	19-7/8	20-1/8	
H	DL49	1-3/4	2-3/8	2-3/4	
	DL84 or 84XR	N/A	4-1/4	4-1/2	
Item		Weight (LB) by Valve Size (IN)			
Variable		1/2, 3/4, 1	1-1/4 & 1-1/2	2	
	250THD	9	15-1/2	20	
	300THD	8	15	18-1/2	



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



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

Component	2832	Dimension (IN) by Valve Size (IN)			
Variable		1	1-1/2	2	
A	250THD	4-7/8	5-3/4	6-1/2	
	300THD	5	6-1/8	6-1/2	
B	250THD	3-1/2	3-3/4	4	
	300THD	2-3/4	3-3/8	3-3/4	
C	DL49 Direct*	15-1/4	15-7/8	16-1/8	
	DL84 Direct*	19-1/4	19-7/8	20-1/8	
H	DL49	1-3/4	2-3/8	2-3/4	
	DL84	3-5/8	4-1/4	4-1/2	
Item		Weight (LB) by Valve Size (IN)			
Variable		1	1-1/2	2	
	250THD	9	16-1/2	21	
	300THD	8	15	18-1/2	

* 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.

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

Allow 4-7/8 inch clearance above actuator for removal.

Actual shipping weights may vary.

Actuator	Weight (LB)	Dimension (IN)
DL49	24-1/2	11
DL84	48-1/2	13-7/8
DL84 84XR	48-1/2	7-7/8
760	10	DL84 or 84XR 8-1/8

Actuators, Positioners, & Accessories

Actuators

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

DL84, 84XR Acrylic Enamel

Ambient Temperature: DL49 -20 to 160°F

DL84, 84XR -40 to 180°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. Controllability 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:

BFI : Full Range Signal (4-20 mA)
BLI : Low Range Signal (4-12 mA)
BHI : 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.

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

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

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

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

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

Class I, Div 2, Groups E,F,G.

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

760E Electro-Pneumatic (Continued)
CSA Intrinsically Safe: Class I, Div 1, Groups A,B,C,D.
Class II, Div 1, Groups E,F,G.
Class III, Div 1.
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 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 Consumption: 0.5 SCFM Typical
Air Connections: 1/4 NPT
Electrical Connection: 3/4 NPT, Terminal Strip
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

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

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

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

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

Class I, Div 2, Groups E,F,G.

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

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
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

Construction: 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 Consumption: 0.5 SCFM Typical
Air Connections: 1/4 NPT
Electrical Connection: 3/4 NPT, Terminal Strip
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

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

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

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

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

Class I, Div 2, Groups E,F,G.

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

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
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

Construction: 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 Consumption: 0.5 SCFM Typical
Air Connections: 1/4 NPT
Electrical Connection: 3/4 NPT, Terminal Strip
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

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

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

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

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

Class I, Div 2, Groups E,F,G.

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

Class II, Div 1, Groups B,C,D.

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

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

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, 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 Iridite and Baked Epoxy Paint
Type 350SS, 316 Stainless Steel
Gauge:
Type 300, Output, Housing Steel Painted
Type 350SS, Output, Housing Stainless Steel
Air Connections:
1/4 NPT
Filler:
Type 300, 40 micron, Type 350SS, 25 micron
Mounting:
Chamber Mounted

Solenoids



Models:
8320G184, EF8320G184,
8320G202, EF8320G202
(EF8320G184, 3-Way Brass
(EF8320G202, 3-Way Stainless Steel
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
120VAC
Supply:
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	
2820	Direct	Pneumatic 3-15 PSI	Increasing Signal Closes Valve	Loss of Signal ^a Valve Fails...
	Reverse	Pneumatic 3-15 PSI	Decreasing Signal Opens Valve	Valve Fails... Open
2830 & 32	Direct	Electro-Pneumatic 4-20 mA	Closes Valve Opens Upper Port/ Lower Port Closed	Upper Port Closed/ Lower Port Open
	Reverse	Electro-Pneumatic 4-20 mA	Opens Valve Closes Upper Port/ Lower Port Open	Upper Port Open/ Lower Port Closed

^a Valves with Fail Freeze Positioners Fail in Last Position on Loss of Signal.

Positioner Feedback				
Valve Type	Actuator Action	Feedback Signal ^a	Settings	
2820	Direct	Signal ^a Increases as Valve Closes	Switch 1 Closed	Switch 2 Open
	Reverse	Signal ^a Valve Opens	Valve Open	Open
2830 & 32	Direct	4-20 mA Lower Port Closed/ Upper Port Opens	Upper Port Closed/ Lower Port Closed	Open
	Reverse	4-20 mA Upper Port Opens	Lower Port Closed	Closed

^a 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 As Required For Shut-off	Loss of Signal Valve Fails...	Loss of Air Supply Valve Fails...
	Reverse	Decreasing Signal As Required For Shut-off	Valve Fails... Open	Valve Fails... Open
2830 & 32	Direct	4-20 mA Closes Lower Port/ Opens Upper Port	Closes Upper Port Closed/ Lower Port Open	Closes Upper Port Closed/ Lower Port Open
	Reverse	4-20 mA Opens Lower Port/ Closes Upper Port	Opens Lower Port Open/ Upper Port Closed	Opens Lower Port Open/ Upper Port Closed

SOLENOIDS (without Positioners or I/P's)				
Valve Type	Actuator Action	Input Signal	Failure Modes	
2820	Direct	Increasing Signal As Required For Shut-off	Loss of Signal Valve Fails...	Loss of Air Supply Valve Fails...
	Reverse	Decreasing Signal As Required For Shut-off	Valve Fails... Open	Valve Fails... Open
2830 & 32	Direct	4-20 mA Closes Lower Port/ Opens Upper Port	Closes Upper Port Closed/ Lower Port Open	Closes Upper Port Closed/ Lower Port Open
	Reverse	4-20 mA Opens Lower Port/ Closes Upper Port	Opens Lower Port Open/ Upper Port Closed	Opens Lower Port Open/ Upper Port 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	Feedback Signal	
2820	Direct	0-350 ohm Valve Closes	Increases as Valve Closes	
	Reverse	0-350 ohm Valve Opens	Valve Opens	
2830 & 32	Direct	0-350 ohm Lower Port Closed/ Upper Port Opens	Lower Port Closed/ Upper Port Opens	
	Reverse	0-350 ohm Upper Port Closed/ Lower Port Opens	Upper Port Closed/ Lower Port Opens	

^a Span varies from approx 155 to 350 ohm depending on actuator and travel.

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

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 Material	Trim Cv	Packing Type	
28N	20 2-Way Single Seat	050 1/2 inch	B Bronze	S Screwed	E Equal %	S 316SS	F Full Port	T Teflon	
	30 3-Way Mixing	075 3/4 inch	F CF8M	NOTE: Additional and connections are available-check with the factory.	L Linear	B Bronze	1 1st Port Reduction	G Graphite	
	32 3-Way Diverting	100 1 inch			Types 30/32 Linear Only	6 Alloy 6	2 2nd Port Reduction	Stainless Steel	
		125 1-1/4 inch				H 17-4 PH	3 3rd Port Reduction	Type 20 Bodies come standard w/PEEK bearings. Used for Temp. up to 500 F.	
28N		150 1-1/2 inch				T Teflon	4 4th Port Reduction		
		200 2 inch				P PEEK	NOTE: Port reductions only available on Type 20/30. Check factory for availability.		

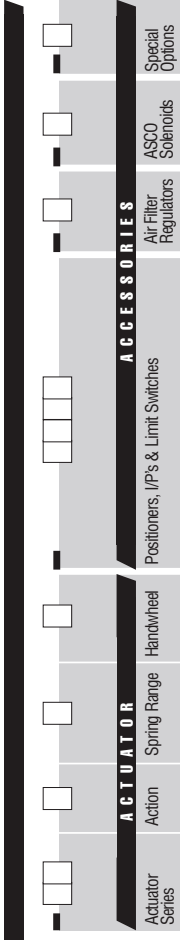
VALVE TYPE/TRIM MATERIAL COMBINATIONS:

SIZE	TRIM MATERIAL			
	S	B	H	T
050 1/2 inch	316SS	Alloy 6	17-4 PH	Teflon
075 3/4 inch	20, 30, 32SS	20, 30, 32BRZ	20, 30, 32SS	20, 30, 32BRZ
100 1 inch	20, 30, 32SS	20, 30, 32BRZ	20, 30, 32SS	20, 30, 32BRZ
125 1-1/4 inch	20, 30, 32SS	20, 30, 32BRZ	20, 30, 32SS	20, 30, 32BRZ
150 1-1/2 inch	20, 30, 32SS	20, 30, 32BRZ	20, 30, 32SS	20, 30, 32BRZ
200 2 inch	20, 30, 32SS	20, 30, 32BRZ	20, 30, 32SS	20, 30, 32BRZ

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"	DL84XR
Type 30	1/2" - 2"	DL49
Type 30	1-1/4" - 2"	DL84
Type 30	2"	DL84XR
Type 32	1/2" - 2"	DL49 & DL84

See Shut-Off AP Ratings for details.



ACTUATOR		ACCESSORIES	
Actuator Series	Action	Spring Range	Handwheel
00 None	0 None	L Low	R Reverse
49 4-49 (49 Sq.In.)	R Reverse	4-10 PSI 48R ;	D Direct
84 4-84 (84 Sq.In.)	F Full	3-9 PSI 48D, 84D or	
8X (DL8XR)	D Direct	5-14 PSI 48R ;	
	S Stem	5-14 PSI 48D ;	
	F Fall Up	3-15 PSI 84D.	
NOTE: 8X Only in Xtra-High Spring Range			
		H High	
		9-15 PSI 84	
		10-14 PSI 48R	
		8-12 PSI 49D	
		X Xtra-High	
		DL8XR	

POSITIONERS:	
0000 None	A Type 300L
B-P BLX Pneumatic	B Type 300L
B-E BLX Electro-Pneumatic	D Type 350SS
B-J BLX Electro-Pneum. Intri. Safe	L High of Split Range
B-X BLX Electro-Pne. Exp. Proof	M FR820G202
B-Y BLX Electro-Pne. Fail Free	3-Way EXP. SS
76P More 760 Pneumatic	3-Way EXP. SS
510 Westlock (CoT) Electro-Pneumatic	120 IAC Code
520 Westlock (CoT) Electro-Pneumatic	
530 Westlock (CoT) Intelligent-Keypad	
540 Westlock (CoT) Found Fieldbus	
PROXIMITY SWITCHES:	
PX11 Mark 1 Series - 2 as SPDT	
PX12 Mark 1 Series - 2 as SPDT w/2k Pst	
PX13 Mark 1 Series - 2 as SPDT w/4-20 Feedback	
PX14 Mark 1 Series - 4 as SPDT	
PX15 Mark 1 Series - 6 as SPDT	

4th digit spec.	
F Full Range	
L Low of Split Range	
H High of Split Range	
M Match	
A Action	

4th digit spec.	
O No Additions	
L when Unit Switch	
F w/4-20 Feedback	
B w/switch & feedback	

MODE	VALUE TYPE	ACTUATOR ACTION
Closed	20	Reverse
Open	20	Direct
Upper Closed*	30/32	Direct
Upper Open	30/32	Reverse
*Standard		

ACTUATOR/BODY COMPATIBILITY:

DIAPHRAGMS	BODY
49 49 Sq.In. (DL49)	For 28N Bodies
84 84 Sq.In. (DL84)	For 28N Bodies
8X (DL8XR)	For 28N Bodies

ACTUATOR/BODY COMPATIBILITY:

DIAPHRAGMS	BODY
49 49 Sq.In. (DL49)	For 28N Bodies
84 84 Sq.In. (DL84)	For 28N Bodies
8X (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.

WARREN CONTROLS

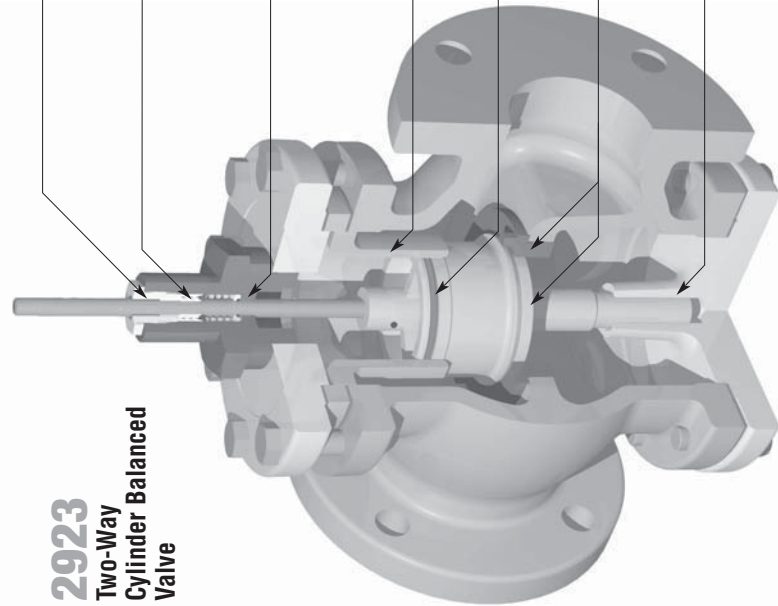
ACTUATED INDUSTRIAL VALVES

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 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 flg	ends Buttweld, NPT	ends Flange	ends 150,300 RF flg	ends 150,300 RF flg
body WCB, CF8M	body Bronze, CF8M	body Cast Iron	body WCB, CF8M	body WCB, CF8M
trim 316 SST, Alloy 6	trim Bronze, 316SST, 17-4pH, Alloy 6, TFE, PEEK	trim Bronze, 300SS, 17-4pH, Alloy 6	trim 316 SST, Alloy 6, Ceramic, TFE, PEEK	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 400°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 II, III, IV	shutoff class IV, VI	shutoff class IV, VI
rangeability 50:1	rangeability 50:1	rangeability 50:1	rangeability 100:1	rangeability 50:1
• Heavy Duty	• Economical	• High Capacity	• Eccentric	• Highly Efficient,
• Severe Service	• Precision Control	• General Purpose	• Segmented Ball	• Compact Design
• High Pressure Differentials	• Suited for Gases, Steam, or Liquids that are Not Viscous or Solids Bearing	• Moderate Pressure Drops	• Well Suited for Erosive Service	• High Pressure Drops
• Corrosive Materials, Liquids, Gases & Steam		• Compatible Liquids and Gas, Steam & Water	• Various Trim Options Include Ceramic for Slurries or Gritty Materials & Teflon® for Class VI Shutoff	• Typically Suited for High Force Piston Actuators for Steam, Chemicals & Dirty Fluids
• Modulating or On/Off Control		• Modulating or On/Off Control		• Minimizes Cavitation or Flashing Effects

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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.

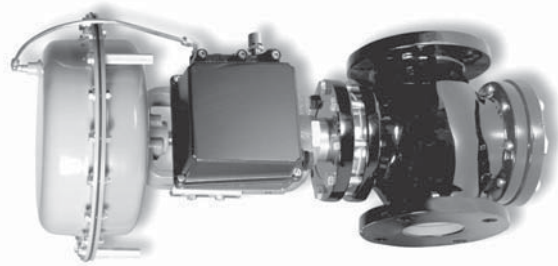
PRODUCT SPECIFICATION

March 2005

PNEUMATIC ACTUATED INDUSTRIAL VALVES

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

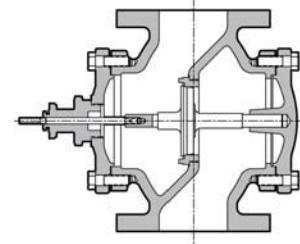
High Capacity, General Purpose, Globe Control Valves



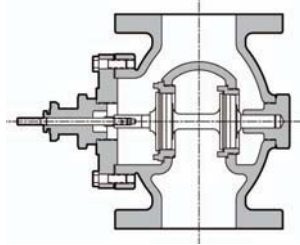
Two-Way and Three-Way, Reciprocating, Iron Body
Valves for Process and Utility Applications

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

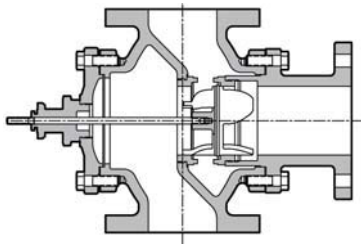




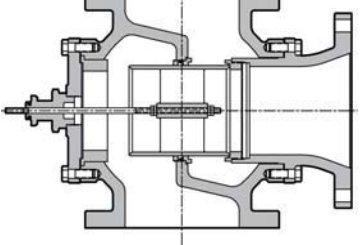
2920
Two-Way Single Seat
Unbalanced Valve



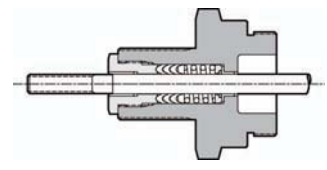
2922
Two-Way Double Seat
Balanced Valve



2930
Three-Way
Mixing Valve



2932
Three-Way Diverting/Mixing
Valve



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

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 value 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.

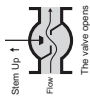
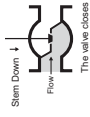
Body Style Versus Application

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.

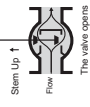
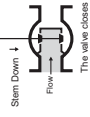
Sizes:	2-1/2, 3, 4, 5, 6, 8, 10 inch
Body:	ANSI B16.1 Iron 125LB Flange or 250LB Flange
Trim:	EQ%, Bronze (2-1/2 thru 6), 300 Series Stainless Steel (2-1/2 thru 10), or 17-4 PH Hardened Stainless Steel (2-1/2 thru 6)
Packing:	Guided Low-Friction TFE V-Ring, Spring Loaded
Temperature:	+32° to 350°F (125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

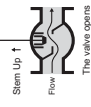
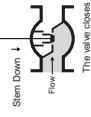
Sizes:	2-1/2, 3, 4, 5, 6, 8, 10 inch
Body:	ANSI B16.1 Iron 125LB Flange or 250LB Flange
Trim:	EQ%, Bronze or 300 Series Stainless Steel
Packing:	Guided Low-Friction TFE V-Ring, Spring Loaded
Temperature:	+32° to 350°F (125 FLG) +32° to 400°F (250 FLG)
Rangeability:	50:1



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:	EQ%, 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) Fluoraz 797 (300 SSTrim, 17-4 PH or Alloy 6 Trim)
Temperature:	+32° to 300°F (BRZ) +32° to 350°F (125 FLG w/ 300 SSTrim, 17-4 PH or Alloy 6 Trim) +32° to 400°F (250 FLG w/ 300 SSTrim, 17-4 PH or Alloy 6 Trim)
Rangeability:	50:1

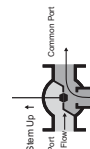
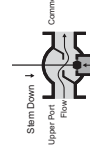


3-Way Valves (Control of Liquids)

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.

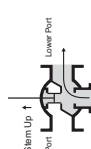
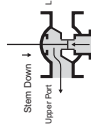
Sizes:	2-1/2, 3, 4, 5, 6, 8 inch
Body:	ANSI B16.1 Iron 125LB Flange or 250LB Flange
Trim:	Linear, Bronze (2-1/2 thru 6) or 300 Series Stainless Steel (2-1/2 thru 8)
Packing:	Guided Low-Friction TFE V-Ring, Spring Loaded
Temperature:	+32° to 350°F (125 FLG) +32° to 400°F (250 FLG)
Rangeability:	50:1



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

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

Flow Coefficients (Cv) Versus Travel

Valve		2920 Flow Coefficients (Cv) Two-Way Single Seat Unbalanced Valve											
Valve Size (IN)	Trim	% Travel											
		100%	90%	80%	70%	60%	50%	40%	30%	20%	10%		
2-1/2	EO	50	55.6	43.8	29.8	15.4	8.07	5.67	4.11	2.81	1.49		
3	EO	90	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	396	318	250	186	130	81.9	44.6	18.3	2.92		
10	EO	650	556	457	359	267	186	117	64.1	26.5	4.87		

Valve		2922 Flow Coefficients (Cv) Two-Way Double Seat Balanced Valve											
Valve Size (IN)	Trim	% Travel											
		100%	90%	80%	70%	60%	50%	40%	30%	20%	10%		
2-1/2	EO	70	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)

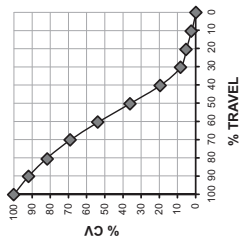
Valve		2923 Flow Coefficients (Cv) Two-Way Cylinder Balanced Valve											
Valve Size (IN)	Trim	% Travel											
		100%	90%	80%	70%	60%	50%	40%	30%	20%	10%		
2-1/2	EO	65	55.6	43.8	29.8	15.4	8.07	5.67	4.11	2.81	1.49		
3	EO	90	83.6	75.1	63.8	49.2	31.6	12.9	4.75	3.37	1.99		
4	EO	170	159	143	122	95.1	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		

Valve		2930 Flow Coefficients (Cv) Three-Way Mixing Valve											
Valve Size (IN)	Trim	Travel 100%											
		Upper	Lower	Combined	Upper	Lower	Combined	Upper	Lower	Combined	Upper	Lower	Combined
2-1/2	EO	69	69	69	69	69	69	69	69	69	69	69	69
3	EO	86	86	86	86	86	86	86	86	86	86	86	86
4	EO	156	156	156	156	156	156	156	156	156	156	156	156
5	EO	270	270	270	270	270	270	270	270	270	270	270	270
6	EO	347	347	347	347	347	347	347	347	347	347	347	347
8	EO	450	450	450	450	450	450	450	450	450	450	450	450

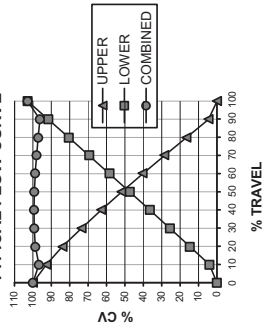
3-Way Valves (Control of Liquids)

Valve		2932 Flow Coefficients (Cv) Three-Way Diverting/Mixing Valve											
Valve Size (IN)	Trim	Travel 100%											
		Upper	Lower	Combined	Upper	Lower	Combined	Upper	Lower	Combined	Upper	Lower	Combined
2-1/2	EO	68	75	75	68	75	75	68	75	75	68	75	75
3	EO	85	95	95	85	95	95	85	95	95	85	95	95
4	EO	160	180	180	160	180	180	160	180	180	160	180	180
5	EO	195	220	220	195	220	220	195	220	220	195	220	220
6	EO	270	300	300	270	300	300	270	300	300	270	300	300
8	EO	425	510	510	425	510	510	425	510	510	425	510	510

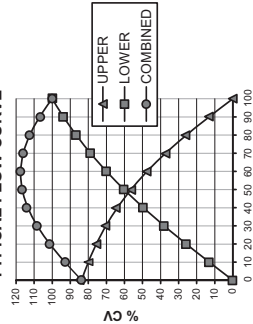
2-WAY VALVE
TYPICAL FLOW CURVE



2930
TYPICAL FLOW CURVE



2932
TYPICAL FLOW CURVE



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	952	1159	
25	266	130	236	934	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	1202	
300	422	217	399	805	1204	
400	448	231	438	778	1216	
500	470	243	453	752	1205	
600	489	254	475	729	1204	

Rectangular Tank Capacity in Gallons
Height x Width x Length (inches)
Gallons = _____
or
230

Gallons = H x W x L (Ft.) x 7.5

Circular Tank Storage Capacity in Gallons
Storage = 6D³ x L (Gallons)

Where:

D = Tank Diameter in Feet
L = Length in Feet

Heating Air with Water

CFM x (°F air temp. rise)
GPM = 2.16 x _____
1000 x (°F water temp. drop)

Heating Liquids with Steam

GPM x 60 x Cp x W
Lbs./Hr. = _____
h_g

Heating Liquids in Steam Jacketed Kettles

GPM x Cp x S x 8.33
Lbs./Hr. = _____
h_g x t

General Liquid Heating

W x Cp
Lbs./Hr. = _____
h_g x t

Heating Air with Steam

CFM
Lbs./Hr. = _____
900

Heating Water with Steam

Quick Method

GPM
Lbs./Hr. = _____
2

Accurate Method

GPM x 500 x ΔT
Lbs./Hr. = _____
h_g

Heating or Cooling Water with Water

°F water₂ temp. rise or drop
GPM₁ = GPM₂ x _____
°F water₁ temp. rise or drop

Heating or Cooling Water

BTU / Hr.
GPM = _____
(°F water temp. rise or drop) x 500

Heating Oil with Steam

GPM
Lbs./Hr. = _____
4

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_g = 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 = 2.3 Feet of Water

1 U.S. Gallon Water = 231 Cubic Inches

1 U.S. Gallon Water = 8.33 Lbs.

Shut-Off ΔP and Cv Ratings

Valve		Actuator		Shut-Off ΔP Two-Way Single Seat Unbalanced	
Valve Size (IN)	Cv Rating	Plug Travel (IN)	Pneumatic Actuator	Maximum Shut-off ΔP In PSI	
				Fail Closed Reverse Acting	Fail Open Direct Acting
2 1/2	65	3/4"	DL49	Air Signal to Actuator 3-15 PSI 1-17 PSI 0-30 PSI 0-40 PSI	Air Signal to Actuator 3-15 PSI 1-17 PSI 0-30 PSI 0-40 PSI
				Low N/A N/A N/A	Low N/A N/A N/A
			DL84	High 30 50 60 N/A	High 30 50 60 N/A
				Low N/A 10 140 N/A	Low N/A 10 140 N/A
			DL84XR	High 63 97 114 N/A	High 63 97 114 N/A
				Low N/A 114 148 165 N/A	Low N/A 114 148 165 N/A
			DL115	High 63 97 114 N/A	High 63 97 114 N/A
				Low N/A 5 28 28 N/A	Low N/A 5 28 28 N/A
			DL115XR	High 98 145 169 N/A	High 98 145 169 N/A
				Low N/A N/A 400 N/A	Low N/A N/A 400 N/A
3	90	3/4"	DL49	High 16 30 37 N/A	High 16 30 37 N/A
				Low N/A 3 N/A N/A	Low N/A 3 N/A N/A
			DL84	High 39 63 75 N/A	High 39 63 75 N/A
				Low N/A 4 N/A N/A	Low N/A 4 N/A N/A
			DL84XR	High 75 99 110 N/A	High 75 99 110 N/A
				Low N/A 15 15 N/A	Low N/A 15 15 N/A
			DL115	High 64 96 113 N/A	High 64 96 113 N/A
				Low N/A 15 15 N/A	Low N/A 15 15 N/A
			DL115XR	High 64 96 113 N/A	High 64 96 113 N/A
				Low N/A 15 15 N/A	Low N/A 15 15 N/A
4	170	1 1/4"	DL84	High 17 30 37 N/A	High 17 30 37 N/A
				Low N/A 3 3 N/A	Low N/A 3 3 N/A
			DL115	High 31 49 58 N/A	High 31 49 58 N/A
				Low N/A 3 3 N/A	Low N/A 3 3 N/A
5	280	1 1/2"	DL115XR	High 17 28 34 N/A	High 17 28 34 N/A
				Low N/A 8 16 N/A	Low N/A 8 16 N/A
			DL84	High 8 16 21 N/A	High 8 16 21 N/A
				Low N/A 17 29 105 163	Low N/A 17 29 105 163
			DL115	High 17 28 34 N/A	High 17 28 34 N/A
				Low N/A 8 16 N/A	Low N/A 8 16 N/A
			DL115XR	High 17 28 34 N/A	High 17 28 34 N/A
				Low N/A 8 16 N/A	Low N/A 8 16 N/A
6	360	1 1/2"	DL84	High 3 9 12 N/A	High 3 9 12 N/A
				Low N/A 9 17 70 111	Low N/A 9 17 70 111
			DL115	High 9 17 21 N/A	High 9 17 21 N/A
				Low N/A 9 16 67 106	Low N/A 9 16 67 106
8	450	2	DL115XR	High 9 16 20 N/A	High 9 16 20 N/A
				Low N/A 3 7 37 60	Low N/A 3 7 37 60
			DL115	High 3 7 10 10	High 3 7 10 10
				Low N/A 3 7 10 10	Low N/A 3 7 10 10
			DL115XR	High 3 7 10 10	High 3 7 10 10
				Low N/A 3 7 10 10	Low N/A 3 7 10 10

NOTES:

- 1) 2920 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 of 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 & 84XR...40PSIG
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 ΔP and Cv Ratings

NOTES:

- 1) 2922 Seat closure ANSI Class III.
- 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 of 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 & 84XR...30PSIG
- 5) Do Not Use DL115 Actuators on Valves With Bronze Trim.
- 6) See Actuators, Positioners, and Accessories section for explanation of spring ranges.

Valve		Actuator		Shut-Off ΔP Two-Way Double Seat Balanced	
Valve Size (IN)	Cv Rating	Plug Travel (IN)	Pneumatic Actuator	Maximum Shut-off ΔP In PSI	
				Fail Closed Reverse Acting	Fail Open Direct Acting
2 1/2	70	3/4"	DL49	Air Signal to Actuator 3-15 PSI 1-17 PSI 0-30 PSI 0-40 PSI	Air Signal to Actuator 3-15 PSI 1-17 PSI 0-30 PSI 0-40 PSI
				Low N/A N/A 113	Low N/A N/A 113
			DL84	High 400 400 400	High 400 400 400
				Low N/A 34 270	Low N/A 34 270
			DL84XR	High 400 400 400	High 400 400 400
				Low N/A 39 153	Low N/A 39 153
3	100	3/4"	DL49	High 381 400 400	High 381 400 400
				Low N/A 169	Low N/A 169
			DL84	High 400 400 400	High 400 400 400
				Low N/A 189	Low N/A 189
			DL84XR	High 400 400 400	High 400 400 400
				Low N/A 32	Low N/A 32
4	200	3/4"	DL49	High 202 372 400	High 202 372 400
				Low N/A 44	Low N/A 44
			DL84	High 400 400 400	High 400 400 400
				Low N/A 44	Low N/A 44
			DL84XR	High 400 400 400	High 400 400 400
				Low N/A 44	Low N/A 44
5	260	1 1/4"	DL84	High 340 400 400	High 340 400 400
				Low N/A 400	Low N/A 400
			DL84XR	High 340 400 400	High 340 400 400
				Low N/A 400	Low N/A 400
6	350	1 1/4"	DL84	High 242 400 400	High 242 400 400
				Low N/A 400	Low N/A 400
			DL84XR	High 242 400 400	High 242 400 400
				Low N/A 400	Low N/A 400
8	580	1 1/2"	DL84	High 85 232 305	High 85 232 305
				Low N/A 13 134	Low N/A 13 134
10	960	1 1/2"	DL84	High 13 134 195	High 13 134 195
				Low N/A 400	Low N/A 400

Shut-Off ΔP and Cv Ratings

Valve		Actuator		Shut-Off ΔP Two-Way Cylinder Balanced				2923											
Valve Size (IN)	Cv Rating	Plug Travel (IN)	Pneumatic Actuator	Spring Range	Maximum Shut-Off ΔP in PSI				Fail Open										
					Reverse Acting	Air Signal to Actuator	3-15 PSI	1-17 PSI	0-30 PSI	0-40 PSI	Direct Acting	Fail Open							
3	90	3/4	DL49	Low	N/A	N/A	N/A	N/A	124	288	400	N/A	N/A						
				High	N/A	N/A	42	N/A	N/A	N/A	42	400	N/A	N/A					
			DL84	Low	N/A	N/A	206	370	400	N/A	N/A	N/A	400	400	N/A	N/A			
				High	N/A	N/A	53	N/A	N/A	N/A	N/A	N/A	400	400	N/A	N/A			
				High	N/A	N/A	400	400	400	N/A	N/A	N/A	N/A	400	400	N/A	N/A		
				High	N/A	N/A	53	N/A	N/A	N/A	N/A	N/A	N/A	400	400	N/A	N/A		
4	170	1 1/4	DL84	Low	N/A	N/A	N/A	N/A	N/A	53	193	400	N/A	N/A	N/A	N/A			
				High	N/A	N/A	123	263	333	N/A	N/A	N/A	N/A	400	N/A	N/A	N/A		
			DL84	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	353	400	400	N/A	N/A		
				High	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	400	400	N/A	N/A		
			DL84	Low	N/A	N/A	353	400	400	N/A	N/A	N/A	N/A	400	400	N/A	N/A		
				High	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	182	369	400	N/A	N/A	N/A	
5	280	1 1/2		Low	N/A	N/A	N/A	N/A	N/A	N/A	343	400	400	400	N/A	N/A	N/A		
				High	N/A	N/A	182	369	400	N/A	N/A	N/A	N/A	400	400	400	N/A	N/A	
			DL115	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	400	400	400	N/A	N/A	
				High	N/A	N/A	343	400	400	400	N/A	N/A	N/A	400	400	400	N/A	N/A	
			DL84	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	79	230	400	400	N/A	N/A	
				High	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	400	400	N/A	N/A	
				Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	219	400	400	400	N/A	N/A	
				High	N/A	N/A	219	400	400	400	N/A	N/A	N/A	400	400	400	N/A	N/A	
			DL115	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	400	400	400	N/A	N/A
				High	N/A	N/A	219	400	400	400	N/A	N/A	N/A	N/A	400	400	400	N/A	N/A
			DL84	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	127	400	400	N/A	N/A	N/A
				High	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	400	400	N/A	N/A	N/A
				Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	124	290	400	400	N/A	N/A	N/A
				High	N/A	N/A	127	192	N/A	N/A	N/A	N/A	N/A	N/A	400	400	N/A	N/A	N/A
			DL115	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	400	400	N/A	N/A	N/A
				High	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	400	400	N/A	N/A	N/A
			DL115XR	Xtra-High	N/A	N/A	124	290	373	373	N/A	N/A	N/A	N/A	400	400	N/A	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 of 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 ΔP and Cv Ratings

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 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...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.

Valve		Actuator		Shut-Off ΔP Three-Way Mixing				2930					
Valve Size (IN)	Cv Rating	Plug Travel (IN)	Pneumatic Actuator Range	Maximum Shut-Off ΔP in PSI				Lower Port Closed					
				Upper Port Closed		Direct Acting		Air Signal to Actuator		Air Signal to Actuator			
2 1/2	69	3/4"	DL49	Low	N/A	N/A	N/A	0-40 PSI	0-40 PSI	3-15 PSI	1-17 PSI	0-30 PSI	0-40 PSI
				High <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A</td></td></td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A</td></td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A</td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A</td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A</td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A</td></td></td>	N/A <td>N/A<td>N/A</td></td>	N/A <td>N/A</td>	N/A
			DL84 <td>Low<td>N/A<td>N/A<td>12<td>N/A<td>N/A<td>54<td>88<td>310<td>N/A</td></td></td></td></td></td></td></td></td></td>	Low <td>N/A<td>N/A<td>12<td>N/A<td>N/A<td>54<td>88<td>310<td>N/A</td></td></td></td></td></td></td></td></td>	N/A <td>N/A<td>12<td>N/A<td>N/A<td>54<td>88<td>310<td>N/A</td></td></td></td></td></td></td></td>	N/A <td>12<td>N/A<td>N/A<td>54<td>88<td>310<td>N/A</td></td></td></td></td></td></td>	12 <td>N/A<td>N/A<td>54<td>88<td>310<td>N/A</td></td></td></td></td></td>	N/A <td>N/A<td>54<td>88<td>310<td>N/A</td></td></td></td></td>	N/A <td>54<td>88<td>310<td>N/A</td></td></td></td>	54 <td>88<td>310<td>N/A</td></td></td>	88 <td>310<td>N/A</td></td>	310 <td>N/A</td>	N/A
				High <td>N/A<td>N/A<td>12<td>N/A<td>N/A<td>N/A<td>N/A<td>208<td>N/A</td></td></td></td></td></td></td></td></td>	N/A <td>N/A<td>12<td>N/A<td>N/A<td>N/A<td>N/A<td>208<td>N/A</td></td></td></td></td></td></td></td>	N/A <td>12<td>N/A<td>N/A<td>N/A<td>N/A<td>208<td>N/A</td></td></td></td></td></td></td>	12 <td>N/A<td>N/A<td>N/A<td>N/A<td>208<td>N/A</td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>208<td>N/A</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>208<td>N/A</td></td></td></td>	N/A <td>N/A<td>208<td>N/A</td></td></td>	N/A <td>208<td>N/A</td></td>	208 <td>N/A</td>	N/A
			DL84XR <td>Xtra-High<td>N/A<td>114<td>148<td>165<td>N/A<td>N/A<td>N/A<td>208<td>N/A</td></td></td></td></td></td></td></td></td></td>	Xtra-High <td>N/A<td>114<td>148<td>165<td>N/A<td>N/A<td>N/A<td>208<td>N/A</td></td></td></td></td></td></td></td></td>	N/A <td>114<td>148<td>165<td>N/A<td>N/A<td>N/A<td>208<td>N/A</td></td></td></td></td></td></td></td>	114 <td>148<td>165<td>N/A<td>N/A<td>N/A<td>208<td>N/A</td></td></td></td></td></td></td>	148 <td>165<td>N/A<td>N/A<td>N/A<td>208<td>N/A</td></td></td></td></td></td>	165 <td>N/A<td>N/A<td>N/A<td>208<td>N/A</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>208<td>N/A</td></td></td></td>	N/A <td>N/A<td>208<td>N/A</td></td></td>	N/A <td>208<td>N/A</td></td>	208 <td>N/A</td>	N/A
			DL115 <td>Low<td>N/A<td>5<td>28<td>28<td>N/A<td>82<td>129<td>400</td><td>400</td></td></td></td></td></td></td></td></td>	Low <td>N/A<td>5<td>28<td>28<td>N/A<td>82<td>129<td>400</td><td>400</td></td></td></td></td></td></td></td>	N/A <td>5<td>28<td>28<td>N/A<td>82<td>129<td>400</td><td>400</td></td></td></td></td></td></td>	5 <td>28<td>28<td>N/A<td>82<td>129<td>400</td><td>400</td></td></td></td></td></td>	28 <td>28<td>N/A<td>82<td>129<td>400</td><td>400</td></td></td></td></td>	28 <td>N/A<td>82<td>129<td>400</td><td>400</td></td></td></td>	N/A <td>82<td>129<td>400</td><td>400</td></td></td>	82 <td>129<td>400</td><td>400</td></td>	129 <td>400</td> <td>400</td>	400	400
				High <td>N/A<td>5<td>28<td>28<td>N/A<td>N/A<td>N/A<td>293</td><td>400</td></td></td></td></td></td></td></td>	N/A <td>5<td>28<td>28<td>N/A<td>N/A<td>N/A<td>293</td><td>400</td></td></td></td></td></td></td>	5 <td>28<td>28<td>N/A<td>N/A<td>N/A<td>293</td><td>400</td></td></td></td></td></td>	28 <td>28<td>N/A<td>N/A<td>N/A<td>293</td><td>400</td></td></td></td></td>	28 <td>N/A<td>N/A<td>N/A<td>293</td><td>400</td></td></td></td>	N/A <td>N/A<td>N/A<td>293</td><td>400</td></td></td>	N/A <td>N/A<td>293</td><td>400</td></td>	N/A <td>293</td> <td>400</td>	293	400
				High <td>98<td>145<td>169<td>169<td>N/A<td>N/A<td>N/A<td>293</td><td>400</td></td></td></td></td></td></td></td>	98 <td>145<td>169<td>169<td>N/A<td>N/A<td>N/A<td>293</td><td>400</td></td></td></td></td></td></td>	145 <td>169<td>169<td>N/A<td>N/A<td>N/A<td>293</td><td>400</td></td></td></td></td></td>	169 <td>169<td>N/A<td>N/A<td>N/A<td>293</td><td>400</td></td></td></td></td>	169 <td>N/A<td>N/A<td>N/A<td>293</td><td>400</td></td></td></td>	N/A <td>N/A<td>N/A<td>293</td><td>400</td></td></td>	N/A <td>N/A<td>293</td><td>400</td></td>	N/A <td>293</td> <td>400</td>	293	400
			DL115XR <td>Xtra-High<td>N/A<td>N/A<td>400<td>400<td>N/A<td>N/A<td>N/A<td>129<td>363</td></td></td></td></td></td></td></td></td></td>	Xtra-High <td>N/A<td>N/A<td>400<td>400<td>N/A<td>N/A<td>N/A<td>129<td>363</td></td></td></td></td></td></td></td></td>	N/A <td>N/A<td>400<td>400<td>N/A<td>N/A<td>N/A<td>129<td>363</td></td></td></td></td></td></td></td>	N/A <td>400<td>400<td>N/A<td>N/A<td>N/A<td>129<td>363</td></td></td></td></td></td></td>	400 <td>400<td>N/A<td>N/A<td>N/A<td>129<td>363</td></td></td></td></td></td>	400 <td>N/A<td>N/A<td>N/A<td>129<td>363</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>129<td>363</td></td></td></td>	N/A <td>N/A<td>129<td>363</td></td></td>	N/A <td>129<td>363</td></td>	129 <td>363</td>	363
3	86	3/4"	DL49 <td>Low<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>3</td><td>17</td><td>107</td><td>N/A</td></td></td></td></td></td></td>	Low <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>3</td><td>17</td><td>107</td><td>N/A</td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>3</td><td>17</td><td>107</td><td>N/A</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>3</td><td>17</td><td>107</td><td>N/A</td></td></td></td>	N/A <td>N/A<td>N/A<td>3</td><td>17</td><td>107</td><td>N/A</td></td></td>	N/A <td>N/A<td>3</td><td>17</td><td>107</td><td>N/A</td></td>	N/A <td>3</td> <td>17</td> <td>107</td> <td>N/A</td>	3	17	107	N/A
				High <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>79</td><td>N/A</td></td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>79</td><td>N/A</td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>79</td><td>N/A</td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>79</td><td>N/A</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>79</td><td>N/A</td></td></td></td>	N/A <td>N/A<td>N/A<td>79</td><td>N/A</td></td></td>	N/A <td>N/A<td>79</td><td>N/A</td></td>	N/A <td>79</td> <td>N/A</td>	79	N/A
			DL84 <td>Low<td>N/A<td>N/A<td>4</td><td>N/A<td>N/A<td>33</td><td>57</td><td>211</td><td>N/A</td></td></td></td></td></td>	Low <td>N/A<td>N/A<td>4</td><td>N/A<td>N/A<td>33</td><td>57</td><td>211</td><td>N/A</td></td></td></td></td>	N/A <td>N/A<td>4</td><td>N/A<td>N/A<td>33</td><td>57</td><td>211</td><td>N/A</td></td></td></td>	N/A <td>4</td> <td>N/A<td>N/A<td>33</td><td>57</td><td>211</td><td>N/A</td></td></td>	4	N/A <td>N/A<td>33</td><td>57</td><td>211</td><td>N/A</td></td>	N/A <td>33</td> <td>57</td> <td>211</td> <td>N/A</td>	33	57	211	N/A
				High <td>N/A<td>39</td><td>63</td><td>75<td>N/A<td>N/A<td>N/A<td>140</td><td>N/A</td></td></td></td></td></td>	N/A <td>39</td> <td>63</td> <td>75<td>N/A<td>N/A<td>N/A<td>140</td><td>N/A</td></td></td></td></td>	39	63	75 <td>N/A<td>N/A<td>N/A<td>140</td><td>N/A</td></td></td></td>	N/A <td>N/A<td>N/A<td>140</td><td>N/A</td></td></td>	N/A <td>N/A<td>140</td><td>N/A</td></td>	N/A <td>140</td> <td>N/A</td>	140	N/A
			DL84XR <td>Xtra-High<td>75</td><td>99<td>110<td>N/A<td>N/A<td>N/A<td>N/A<td>140</td><td>N/A</td></td></td></td></td></td></td></td>	Xtra-High <td>75</td> <td>99<td>110<td>N/A<td>N/A<td>N/A<td>N/A<td>140</td><td>N/A</td></td></td></td></td></td></td>	75	99 <td>110<td>N/A<td>N/A<td>N/A<td>N/A<td>140</td><td>N/A</td></td></td></td></td></td>	110 <td>N/A<td>N/A<td>N/A<td>N/A<td>140</td><td>N/A</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>140</td><td>N/A</td></td></td></td>	N/A <td>N/A<td>N/A<td>140</td><td>N/A</td></td></td>	N/A <td>N/A<td>140</td><td>N/A</td></td>	N/A <td>140</td> <td>N/A</td>	140	N/A
			DL115 <td>Low<td>N/A<td>N/A<td>15</td><td>15</td><td>53</td><td>85</td><td>296</td><td>400</td><td>400</td></td></td></td>	Low <td>N/A<td>N/A<td>15</td><td>15</td><td>53</td><td>85</td><td>296</td><td>400</td><td>400</td></td></td>	N/A <td>N/A<td>15</td><td>15</td><td>53</td><td>85</td><td>296</td><td>400</td><td>400</td></td>	N/A <td>15</td> <td>15</td> <td>53</td> <td>85</td> <td>296</td> <td>400</td> <td>400</td>	15	15	53	85	296	400	400
				High <td>N/A<td>N/A<td>15</td><td>15<td>N/A<td>N/A<td>199</td><td>362</td><td>N/A</td></td></td></td></td></td>	N/A <td>N/A<td>15</td><td>15<td>N/A<td>N/A<td>199</td><td>362</td><td>N/A</td></td></td></td></td>	N/A <td>15</td> <td>15<td>N/A<td>N/A<td>199</td><td>362</td><td>N/A</td></td></td></td>	15	15 <td>N/A<td>N/A<td>199</td><td>362</td><td>N/A</td></td></td>	N/A <td>N/A<td>199</td><td>362</td><td>N/A</td></td>	N/A <td>199</td> <td>362</td> <td>N/A</td>	199	362	N/A
			DL115XR <td>Xtra-High<td>64</td><td>96<td>113</td><td>113<td>N/A<td>N/A<td>N/A<td>199</td><td>362</td></td></td></td></td></td></td>	Xtra-High <td>64</td> <td>96<td>113</td><td>113<td>N/A<td>N/A<td>N/A<td>199</td><td>362</td></td></td></td></td></td>	64	96 <td>113</td> <td>113<td>N/A<td>N/A<td>N/A<td>199</td><td>362</td></td></td></td></td>	113	113 <td>N/A<td>N/A<td>N/A<td>199</td><td>362</td></td></td></td>	N/A <td>N/A<td>N/A<td>199</td><td>362</td></td></td>	N/A <td>N/A<td>199</td><td>362</td></td>	N/A <td>199</td> <td>362</td>	199	362
				High <td>N/A<td>N/A<td>285</td><td>285<td>N/A<td>N/A<td>85</td><td>248</td><td>N/A</td></td></td></td></td></td>	N/A <td>N/A<td>285</td><td>285<td>N/A<td>N/A<td>85</td><td>248</td><td>N/A</td></td></td></td></td>	N/A <td>285</td> <td>285<td>N/A<td>N/A<td>85</td><td>248</td><td>N/A</td></td></td></td>	285	285 <td>N/A<td>N/A<td>85</td><td>248</td><td>N/A</td></td></td>	N/A <td>N/A<td>85</td><td>248</td><td>N/A</td></td>	N/A <td>85</td> <td>248</td> <td>N/A</td>	85	248	N/A
4	156	1 3/8"	DL84 <td>Low<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>14</td><td>27</td><td>114</td><td>N/A</td></td></td></td></td></td></td>	Low <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>14</td><td>27</td><td>114</td><td>N/A</td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>14</td><td>27</td><td>114</td><td>N/A</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>14</td><td>27</td><td>114</td><td>N/A</td></td></td></td>	N/A <td>N/A<td>N/A<td>14</td><td>27</td><td>114</td><td>N/A</td></td></td>	N/A <td>N/A<td>14</td><td>27</td><td>114</td><td>N/A</td></td>	N/A <td>14</td> <td>27</td> <td>114</td> <td>N/A</td>	14	27	114	N/A
				High <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>74</td><td>N/A</td></td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>74</td><td>N/A</td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>74</td><td>N/A</td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>74</td><td>N/A</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>74</td><td>N/A</td></td></td></td>	N/A <td>N/A<td>N/A<td>74</td><td>N/A</td></td></td>	N/A <td>N/A<td>74</td><td>N/A</td></td>	N/A <td>74</td> <td>N/A</td>	74	N/A
			DL115 <td>Low<td>N/A<td>N/A<td>17</td><td>30</td><td>37<td>N/A<td>N/A<td>N/A<td>74</td></td></td></td></td></td></td></td>	Low <td>N/A<td>N/A<td>17</td><td>30</td><td>37<td>N/A<td>N/A<td>N/A<td>74</td></td></td></td></td></td></td>	N/A <td>N/A<td>17</td><td>30</td><td>37<td>N/A<td>N/A<td>N/A<td>74</td></td></td></td></td></td>	N/A <td>17</td> <td>30</td> <td>37<td>N/A<td>N/A<td>N/A<td>74</td></td></td></td></td>	17	30	37 <td>N/A<td>N/A<td>N/A<td>74</td></td></td></td>	N/A <td>N/A<td>N/A<td>74</td></td></td>	N/A <td>N/A<td>74</td></td>	N/A <td>74</td>	74
				High <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>3</td><td>25</td><td>43</td><td>162</td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>3</td><td>25</td><td>43</td><td>162</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>3</td><td>25</td><td>43</td><td>162</td></td></td></td>	N/A <td>N/A<td>N/A<td>3</td><td>25</td><td>43</td><td>162</td></td></td>	N/A <td>N/A<td>3</td><td>25</td><td>43</td><td>162</td></td>	N/A <td>3</td> <td>25</td> <td>43</td> <td>162</td>	3	25	43	162
			DL115XR <td>Low<td>N/A<td>N/A<td>3</td><td>3</td><td>N/A<td>N/A<td>N/A<td>107</td><td>198</td></td></td></td></td></td></td>	Low <td>N/A<td>N/A<td>3</td><td>3</td><td>N/A<td>N/A<td>N/A<td>107</td><td>198</td></td></td></td></td></td>	N/A <td>N/A<td>3</td><td>3</td><td>N/A<td>N/A<td>N/A<td>107</td><td>198</td></td></td></td></td>	N/A <td>3</td> <td>3</td> <td>N/A<td>N/A<td>N/A<td>107</td><td>198</td></td></td></td>	3	3	N/A <td>N/A<td>N/A<td>107</td><td>198</td></td></td>	N/A <td>N/A<td>107</td><td>198</td></td>	N/A <td>107</td> <td>198</td>	107	198
				High <td>31</td> <td>49</td> <td>58</td> <td>58<td>N/A<td>N/A<td>N/A<td>107</td><td>198</td></td></td></td></td>	31	49	58	58 <td>N/A<td>N/A<td>N/A<td>107</td><td>198</td></td></td></td>	N/A <td>N/A<td>N/A<td>107</td><td>198</td></td></td>	N/A <td>N/A<td>107</td><td>198</td></td>	N/A <td>107</td> <td>198</td>	107	198
5	270	1 3/8"	DL115XR <td>Xtra-High<td>N/A<td>N/A<td>N/A<td>136</td><td>136<td>N/A<td>N/A<td>43</td><td>134</td></td></td></td></td></td></td></td>	Xtra-High <td>N/A<td>N/A<td>N/A<td>136</td><td>136<td>N/A<td>N/A<td>43</td><td>134</td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>136</td><td>136<td>N/A<td>N/A<td>43</td><td>134</td></td></td></td></td></td>	N/A <td>N/A<td>136</td><td>136<td>N/A<td>N/A<td>43</td><td>134</td></td></td></td></td>	N/A <td>136</td> <td>136<td>N/A<td>N/A<td>43</td><td>134</td></td></td></td>	136	136 <td>N/A<td>N/A<td>43</td><td>134</td></td></td>	N/A <td>N/A<td>43</td><td>134</td></td>	N/A <td>43</td> <td>134</td>	43	134
			DL84 <td>Low<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>5</td><td>14</td><td>70</td><td>N/A</td></td></td></td></td></td></td>	Low <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>5</td><td>14</td><td>70</td><td>N/A</td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>5</td><td>14</td><td>70</td><td>N/A</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>5</td><td>14</td><td>70</td><td>N/A</td></td></td></td>	N/A <td>N/A<td>N/A<td>5</td><td>14</td><td>70</td><td>N/A</td></td></td>	N/A <td>N/A<td>5</td><td>14</td><td>70</td><td>N/A</td></td>	N/A <td>5</td> <td>14</td> <td>70</td> <td>N/A</td>	5	14	70	N/A
				High <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>44</td><td>N/A</td></td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>44</td><td>N/A</td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>44</td><td>N/A</td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>44</td><td>N/A</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>44</td><td>N/A</td></td></td></td>	N/A <td>N/A<td>N/A<td>44</td><td>N/A</td></td></td>	N/A <td>N/A<td>44</td><td>N/A</td></td>	N/A <td>44</td> <td>N/A</td>	44	N/A
			DL115 <td>Low<td>N/A<td>8</td><td>16</td><td>21<td>N/A<td>N/A<td>N/A<td>44</td><td>N/A</td></td></td></td></td></td></td>	Low <td>N/A<td>8</td><td>16</td><td>21<td>N/A<td>N/A<td>N/A<td>44</td><td>N/A</td></td></td></td></td></td>	N/A <td>8</td> <td>16</td> <td>21<td>N/A<td>N/A<td>N/A<td>44</td><td>N/A</td></td></td></td></td>	8	16	21 <td>N/A<td>N/A<td>N/A<td>44</td><td>N/A</td></td></td></td>	N/A <td>N/A<td>N/A<td>44</td><td>N/A</td></td></td>	N/A <td>N/A<td>44</td><td>N/A</td></td>	N/A <td>44</td> <td>N/A</td>	44	N/A
				High <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>13</td><td>24</td><td>100</td><td>159</td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>13</td><td>24</td><td>100</td><td>159</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>13</td><td>24</td><td>100</td><td>159</td></td></td></td>	N/A <td>N/A<td>N/A<td>13</td><td>24</td><td>100</td><td>159</td></td></td>	N/A <td>N/A<td>13</td><td>24</td><td>100</td><td>159</td></td>	N/A <td>13</td> <td>24</td> <td>100</td> <td>159</td>	13	24	100	159
			DL115XR <td>Low<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>65</td><td>124</td></td></td></td></td></td></td></td></td>	Low <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>65</td><td>124</td></td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>65</td><td>124</td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>65</td><td>124</td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>65</td><td>124</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>65</td><td>124</td></td></td></td>	N/A <td>N/A<td>N/A<td>65</td><td>124</td></td></td>	N/A <td>N/A<td>65</td><td>124</td></td>	N/A <td>65</td> <td>124</td>	65	124
				High <td>17</td> <td>28</td> <td>34</td> <td>34</td> <td>N/A<td>N/A<td>N/A<td>65</td><td>124</td></td></td></td>	17	28	34	34	N/A <td>N/A<td>N/A<td>65</td><td>124</td></td></td>	N/A <td>N/A<td>65</td><td>124</td></td>	N/A <td>65</td> <td>124</td>	65	124
			DL115XR <td>Xtra-High<td>N/A<td>N/A<td>84</td><td>84</td><td>N/A<td>N/A<td>N/A<td>24</td><td>83</td></td></td></td></td></td></td>	Xtra-High <td>N/A<td>N/A<td>84</td><td>84</td><td>N/A<td>N/A<td>N/A<td>24</td><td>83</td></td></td></td></td></td>	N/A <td>N/A<td>84</td><td>84</td><td>N/A<td>N/A<td>N/A<td>24</td><td>83</td></td></td></td></td>	N/A <td>84</td> <td>84</td> <td>N/A<td>N/A<td>N/A<td>24</td><td>83</td></td></td></td>	84	84	N/A <td>N/A<td>N/A<td>24</td><td>83</td></td></td>	N/A <td>N/A<td>24</td><td>83</td></td>	N/A <td>24</td> <td>83</td>	24	83
6	347	1 3/8"	DL84 <td>Low<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>2</td><td>8</td><td>46</td><td>N/A</td></td></td></td></td></td></td>	Low <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>2</td><td>8</td><td>46</td><td>N/A</td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>2</td><td>8</td><td>46</td><td>N/A</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>2</td><td>8</td><td>46</td><td>N/A</td></td></td></td>	N/A <td>N/A<td>N/A<td>2</td><td>8</td><td>46</td><td>N/A</td></td></td>	N/A <td>N/A<td>2</td><td>8</td><td>46</td><td>N/A</td></td>	N/A <td>2</td> <td>8</td> <td>46</td> <td>N/A</td>	2	8	46	N/A
				High <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>28</td><td>N/A</td></td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>28</td><td>N/A</td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>28</td><td>N/A</td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>28</td><td>N/A</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>28</td><td>N/A</td></td></td></td>	N/A <td>N/A<td>N/A<td>28</td><td>N/A</td></td></td>	N/A <td>N/A<td>28</td><td>N/A</td></td>	N/A <td>28</td> <td>N/A</td>	28	N/A
			DL115 <td>Low<td>N/A<td>N/A<td>3</td><td>9</td><td>12</td><td>N/A<td>N/A<td>28</td><td>N/A</td></td></td></td></td></td>	Low <td>N/A<td>N/A<td>3</td><td>9</td><td>12</td><td>N/A<td>N/A<td>28</td><td>N/A</td></td></td></td></td>	N/A <td>N/A<td>3</td><td>9</td><td>12</td><td>N/A<td>N/A<td>28</td><td>N/A</td></td></td></td>	N/A <td>3</td> <td>9</td> <td>12</td> <td>N/A<td>N/A<td>28</td><td>N/A</td></td></td>	3	9	12	N/A <td>N/A<td>28</td><td>N/A</td></td>	N/A <td>28</td> <td>N/A</td>	28	N/A
				High <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>7</td><td>15</td><td>67</td><td>108</td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>7</td><td>15</td><td>67</td><td>108</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>7</td><td>15</td><td>67</td><td>108</td></td></td></td>	N/A <td>N/A<td>N/A<td>7</td><td>15</td><td>67</td><td>108</td></td></td>	N/A <td>N/A<td>7</td><td>15</td><td>67</td><td>108</td></td>	N/A <td>7</td> <td>15</td> <td>67</td> <td>108</td>	7	15	67	108
			DL115XR <td>Xtra-High<td>9</td><td>17</td><td>21</td><td>21</td><td>N/A<td>N/A<td>N/A<td>43</td><td>84</td></td></td></td></td>	Xtra-High <td>9</td> <td>17</td> <td>21</td> <td>21</td> <td>N/A<td>N/A<td>N/A<td>43</td><td>84</td></td></td></td>	9	17	21	21	N/A <td>N/A<td>N/A<td>43</td><td>84</td></td></td>	N/A <td>N/A<td>43</td><td>84</td></td>	N/A <td>43</td> <td>84</td>	43	84
				High <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>43</td><td>84</td></td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>43</td><td>84</td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>43</td><td>84</td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>43</td><td>84</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>43</td><td>84</td></td></td></td>	N/A <td>N/A<td>N/A<td>43</td><td>84</td></td></td>	N/A <td>N/A<td>43</td><td>84</td></td>	N/A <td>43</td> <td>84</td>	43	84
8	450	2 1/2"	DL115XR <td>Low<td>N/A<td>N/A<td>N/A<td>56</td><td>56</td><td>N/A<td>N/A<td>15</td><td>55</td></td></td></td></td></td></td>	Low <td>N/A<td>N/A<td>N/A<td>56</td><td>56</td><td>N/A<td>N/A<td>15</td><td>55</td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>56</td><td>56</td><td>N/A<td>N/A<td>15</td><td>55</td></td></td></td></td>	N/A <td>N/A<td>56</td><td>56</td><td>N/A<td>N/A<td>15</td><td>55</td></td></td></td>	N/A <td>56</td> <td>56</td> <td>N/A<td>N/A<td>15</td><td>55</td></td></td>	56	56	N/A <td>N/A<td>15</td><td>55</td></td>	N/A <td>15</td> <td>55</td>	15	55
			DL115 <td>Low<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>6</td><td>14</td><td>64</td><td>103</td></td></td></td></td></td></td>	Low <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>6</td><td>14</td><td>64</td><td>103</td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>6</td><td>14</td><td>64</td><td>103</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>6</td><td>14</td><td>64</td><td>103</td></td></td></td>	N/A <td>N/A<td>N/A<td>6</td><td>14</td><td>64</td><td>103</td></td></td>	N/A <td>N/A<td>6</td><td>14</td><td>64</td><td>103</td></td>	N/A <td>6</td> <td>14</td> <td>64</td> <td>103</td>	6	14	64	103
				High <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>41</td><td>80</td></td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>41</td><td>80</td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>41</td><td>80</td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>41</td><td>80</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>41</td><td>80</td></td></td></td>	N/A <td>N/A<td>N/A<td>41</td><td>80</td></td></td>	N/A <td>N/A<td>41</td><td>80</td></td>	N/A <td>41</td> <td>80</td>	41	80
			DL115XR <td>Xtra-High<td>9</td><td>16</td><td>20</td><td>20</td><td>N/A<td>N/A<td>N/A<td>41</td><td>80</td></td></td></td></td>	Xtra-High <td>9</td> <td>16</td> <td>20</td> <td>20</td> <td>N/A<td>N/A<td>N/A<td>41</td><td>80</td></td></td></td>	9	16	20	20	N/A <td>N/A<td>N/A<td>41</td><td>80</td></td></td>	N/A <td>N/A<td>41</td><td>80</td></td>	N/A <td>41</td> <td>80</td>	41	80
				High <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>14</td><td>53</td></td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>14</td><td>53</td></td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>N/A<td>14</td><td>53</td></td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>N/A<td>14</td><td>53</td></td></td></td></td>	N/A <td>N/A<td>N/A<td>N/A<td>14</td><td>53</td></td></td></td>	N/A <td>N/A<td>N/A<td>14</td><td>53</td></td></td>	N/A <td>N/A<td>14</td><td>53</td></td>	N/A <td>14</td> <td>53</td>	14	53

Shut-Off ΔP and Cv Ratings

Dimensions & Weights

Valve		Actuator		Shut-Off Δ P Three-Way Diverting/Mixing				2932	
Valve	Plug	Pneumatic Spring Actuator	Range	Upper Port Closed		Lower Port Closed			
				Direct Acting	Air Signal to Actuator	Direct Acting	Air Signal to Actuator		
Size (in.)	Cv (in.)	Rating (in.)	Travel (in.)	3-15 PSI	1-17 PSI	3-30 PSI	0-40 PSI	3-15 PSI	1-17 PSI
2 1/2	68/75	3/4"	0.84	HIGH	106	106	106	N/A	N/A
3	85/95	3/4"	0.84	HIGH	104	106	106	N/A	115
4	160/180	3/4"	0.84	HIGH	104	106	108	N/A	113
			0.84	HIGH	102	104	106	N/A	106
5	195/220	1-1/4"	0.84	HIGH	106	108	111	N/A	111
			1-1/4"	HIGH	99	102	104	N/A	108
6	270/300	1-3/8"	0.84	HIGH	104	106	108	N/A	111
			1-3/8"	HIGH	97	99	102	N/A	106
8	425/510	1-1/2"	0.84	HIGH	101	104	106	N/A	108
			1-1/2"	HIGH	99	101	104	N/A	106

NOTES:

- 1) 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. Shut-off the factory if the required Δp 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 falls closed on loss of air pressure to the actuator.

2) 2932 Seat closure ANSI Class II.

- 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 transducers that require 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 actuators' maximum air pressure.

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

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

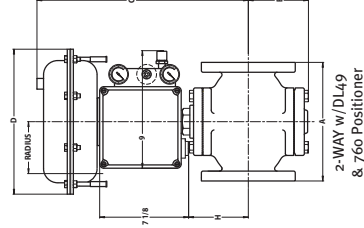
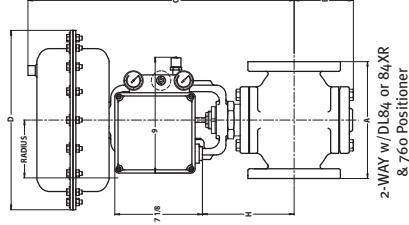
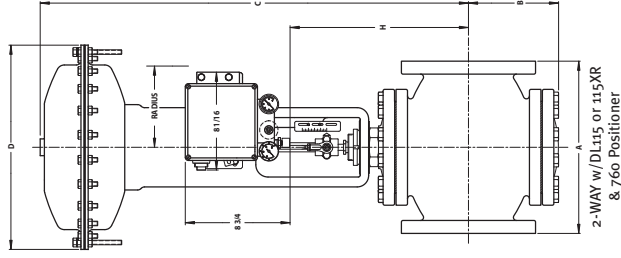
Component	2023	Dimension (IN) by Valve Size (IN)					
		Variable	2-1/2	3	4	5	6
A	125FI G	9	10	13	15-3/4	17-3/4	
	250FI G	9-5/8	10-3/4	13-5/8	16-5/8	18-5/8	
B		4-3/4	5-3/8	6-7/8	7-7/8	8-1/2	
C	DL48 Direct*	18-1/8	19		N/A	N/A	
	DL48 Reverse	17-1/2	18-3/8	N/A	N/A	N/A	
	DL84 Direct*	22-1/8	23	24-1/8	24-5/8	25-1/4	
	DL84 Reverse	21-1/2	22-3/8	23-1/2	24	24-5/8	
	DL115 or 115XR Direct*	N/A	N/A	36-1/2	37	37-5/8	
	DL115 or 115XR Reverse	N/A	N/A	CF	CF	CF	
H	DL49	4-3/4	5-1/2	N/A	N/A	N/A	
	W/760	6-1/2	7-3/8	8-1/2	9	9-5/8	
	DL115 or 115XR Direct	N/A	13-1/2	14-1/8	14-3/4	14-3/4	
	DL115 or 115XR Reverse	N/A	N/A	CF	CF	CF	
Item		Weight (LB) by Valve Size (IN)					
Variable		2-1/2	3	4	5	6	
125FI G		57	75	127	149	197	
250FI G		66	80	139	181	256	

Face to face dimensions conform to historical Warren Controls

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

Component	2022	Dimension (IN) by Valve Size (IN)							
		Variable	2-1/2	3	4	5	6	8	10
A	125R.G		7-3/4	9	11-3/8	12	14-1/8	16-1/4	20
A	250R.G		8-3/8	9-3/4	12	12-7/8	14-1/2	16-1/4	21-3/8
B			4-1/8	4-3/8	5	6-7/8	7-5/8	8-7/8	9-7/8
C	DL49 Direct*		17-1/4	17-1/2	19	N/A	N/A	N/A	N/A
DL49 Reverse			16-5/8	16-7/8	18-3/8	N/A	N/A	N/A	N/A
DL84 Direct*			21-1/4	21-1/2	23	24	24-7/8	26	26-3/4
DL84 Reverse			20-5/8	20-7/8	22-3/8	23-3/8	24-1/4	25-3/8	26-1/8
H	DL49		3-3/8	4	4-5/8	N/A	N/A	N/A	N/A
W/160 DL84			5-5/8	5-7/8	7-3/8	8-3/8	9-1/4	10-3/8	10-7/8
Item		Weight (LB) by Valve Size (IN)							
Variable		2-1/2	3	4	5	6	8	10	
125R.G		32	42	77	124	169	200	435	
250R.G		42	54	96	162	220	300	540	

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

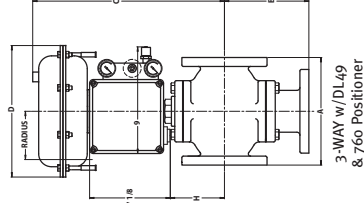


Dimensions & Weights

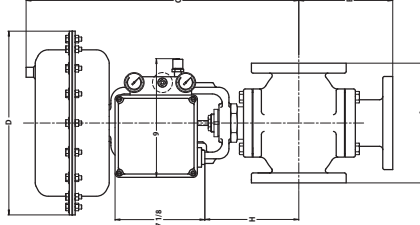
Component		Dimension (IN) by Valve Size (IN)							
Variable	2-1/2	3	4	5	6	8			
A	125FLG	9	10	13	15-3/4	17-3/4	16-1/4		
	250FLG	9-5/8	10-3/4	13-5/8	16-5/8	18-5/8	16-1/4		
B	125FLG	7-1/8	8	9-7/8	9-1/4	9-7/8	11-7/8		
	250FLG	7-3/8	8-3/8	10-1/4	11	11-1/2	12-3/8		
C	DL49 Direct*	17-5/8	18-1/2	N/A	N/A	N/A	N/A		
	DL84 or 84XR Direct*	21-5/8	22-1/2	23-1/4	23-7/8	N/A	N/A		
	DL115 or 115XR Direct*	34	34-7/8	35-7/8	34-3/4	35-1/2	38-2/8		
H	DL49	4-1/4	5	5-7/8	N/A	N/A	N/A		
	DL84 or 84XR	6	6-7/8	7-7/8	6-3/4	7-1/2	N/A		
	DL115 or 115XR Direct	11-1/8	11-7/8	13	11-7/8	12-5/8	15-1/2		
Item		Weight (LB) by Valve Size (IN)							
Variable	2-1/2	3	4	5	6	8			
125FLG	64	83	139	157	202	306			
250FLG	73	94	157	211	283	398			

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

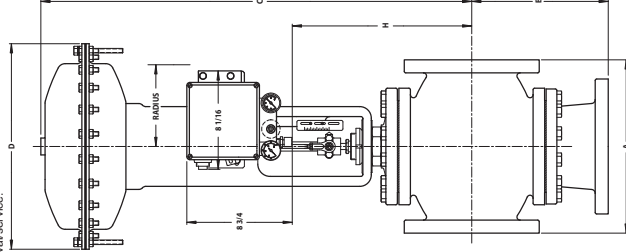
Component		Dimension (IN)							
Variable	2-1/2	3	4	5	6	8			
D	DL49	11							
	DL84 or 84XR	13-7/8							
	DL115 or 115XR	16-3/4							
RADIUS	DL49	7-7/8							
	DL84 or 84XR	8-1/8							
	DL115 or 115XR Direct	10-5/8							
	DL115 or 115XR Reverse	CF							
Actuator		Weight (LB)							
Variable	2-1/2	3	4	5	6	8			
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)							
Variable	2-1/2	3	4	5	6	8			
760									



3-WAY w/ DL49
& 760 Positioner



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



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

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.

Actuator Removal Clearance
Above DL49, 84, or 84XR allow 5-5/8 IN
Above DL115 or 115XR allow 6-1/8 IN

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

Actual shipping weights may vary.

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

Actuators, Positioners, & Accessories

Actuators

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

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)

DL49, 84 & 84XR Multiple

DL115 & 115XR Single

DL49, 84 & 84XR 30PSIG

DL115 & 115XR 40PSIG

1/4 NPT

Buna-N Fabric Reinforced

Diaphragm: Clambers Steel

DL49, 84 & 84XR Ductile Iron

DL115 & 115XR Aluminum

300 Series Stainless Steel

DL49 Epoxy-Coated

DL84, 84XR, 115, & 115XR Acrylic Enamel

Ambient Temperature: DL49 -20 to 160°F

DL84, 84XR, 115 & 115XR -40 to 180°F

Vertical Above or Below Valve

Mounting: Available on DL84, 84XR, 115 & 115XR

Handwheel: Not Available on DL49

BLX Models:



BLX 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, 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:

EM Intrinsically Safe:

CSA Intrinsically Safe:

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

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, 0.28 SCFM at 40 PSIG

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.

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 1, Groups A,B,C.
Explosion Proof: Class I, Div 1, Groups B,C,D.

CSA Intrinsically Safe: Class I, Div 1, Groups A,B,C,D.
Class I, Div 1, Groups E,F,G.
Class I, Div 1, Groups A,B,C,D.
Class I, Div 1, Groups E,F,G.
Class I, Div 2, Groups A,B,C,D.
Class I, Div 2, Groups E,F,G.
Class I, Div 1, Groups B,C,D.
Class I, Div 1, Groups E,F,G.

Explosion Proof: Class I, Div 1, Groups B,C,D.
Class I, Div 1, Groups E,F,G.
Class I, Div 2, Groups A,B,C,D.
Class I, Div 2, Groups E,F,G.
Class I, Div 1, Groups B,C,D.
Class I, Div 1, Groups E,F,G.

Supply Pressure:
Air Consumption:
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)
BFF_: 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:
Air Consumption:
Air Consumption: 0.21 SCFM at 30 PSIG, 0.28 SCFM at 40 PSIG

All Models:
Construction:
Action:
Media:
Air Connections:
Flow Capacity:
Electrical Connection:
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 158°F)
Mounting:
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 I, Div 1, Groups E,F,G.
Non-Incendive: Class I, Div 2, Groups A,B,C,D.
Suitable for: Class II, Div 2, Groups F,G.
Class III, Div 2.

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Actuators, Positioners, & Accessories

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

Construction:
Locations:
Ambient Temperature: -40 to 180°F
Electrical Connection: 3/4 NPT, Terminal Strip
Mounting:
Yoke Mounted

I/P's
Type 500X



Locations:
Construction:
Ranges:
Supply Pressure:
Flow Capacity:
Air Consumption:
Ambient Temperature: -20 to 140°F

Maximum 100 PSIG Above Maximum Output
Air Consumption: 0.05 SCFM Midrange Typical
Ambient Temperature: -20 to 140°F

Type 550X



Locations:
Construction:
Ranges:
Supply Pressure:
Flow Capacity:
Air Consumption:
Ambient Temperature: -20 to 150°F

Minimum 5 PSIG Above Maximum Output
Air Consumption: 6.0 SCFH Midrange Typical
Ambient Temperature: -20 to 150°F

Type 550X



Locations:
Construction:
Ranges:
Supply Pressure:
Flow Capacity:
Air Consumption:
Ambient Temperature: -40 to 160°F

Minimum 5 PSIG Above Maximum Output
Air Consumption: 3.0 SCFH Midrange Typical
Ambient Temperature: -40 to 160°F

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:
Output Ranges:
Supply Pressure:
Construction:
Gauge:
Air Connections:
Filler:
Mounting:

Type 300, Type 350SS
Type 300, 0-30 or 0-60 PSIG
Type 350SS, 0-100 PSIG
Type 300, 250 PSIG Maximum
Type 350SS, 290 PSIG Maximum
Type 300, Die-Cast Aluminum with Iridite and Baked Epoxy Paint
Type 350SS, 316 Stainless Steel
Type 300, Output, Housing Steel Painted
Type 350SS, Output, Housing Stainless Steel
1/4 NPT
Type 300, 40 micron, Type 350SS, 25 micron
Chamber Mounted

Solenoids

Models:
Construction:
Locations:
Supply:
Ambient Temperature: -32 to 125°F
Air Connections:
Air Connections: 1/4 NPT
Approvals:
Mounting:



8320G184, EF8320G184,
8320G202, EF8320G202
(EF8320G184, 3-Way Brass
(EF8320G202, 3-Way Stainless Steel
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
120VAC
Ambient Temperature: -32 to 125°F
Air Connections:
Air Connections: 1/4 NPT
Approvals:
Mounting:

Chromate-treated Aluminum with Epoxy Paint
0-30, or 0-60 PSI
Minimum 5 PSIG Above Maximum Output
Air Consumption: 12 SCFM at 100 PSIG
Ambient Temperature: -20 to 150°F

Air Tubing
Standard:
Optional:

Copper
Stainless Steel

Factory Default Settings

Configurations

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

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

Positioner Feedback				
Valve Type	Actuator Action	Feedback Signal	Signal	Settings
2920, 22 & 23	Direct	Signal*	Increases as Signal	Switch 1
	Reverse	4-20 mA	Valve Closes	Open
2930 & 32	Direct	4-20 mA	Valve Opens	Closed
	Reverse	4-20 mA	Valve Closes	Open

* Reduced feedback span for valves with 750 and less than 1 inch travel.

I/P's				
Valve Type	Actuator Action	Input Signal	Increasing Signal	Failure Modes
2920, 22 & 23	Direct	As Required For Shut-off	Closes Valve	Loss of Signal Valve Fails...
	Reverse	As Required For Shut-off	Opens Valve	Open
2930 & 32	Direct	As Required For Shut-off	Closes Lower Port/ Opens Upper Port	Closed
	Reverse	As Required For Shut-off	Opens Lower Port/ Closes Upper Port	Upper Port Closed/ Lower Port Open

SOLENOIDS (without Positioners or I/P's)				
Valve Type	Actuator Action	Failure Modes	Loss of Signal	Loss of Air Supply
2920, 22 & 23	Direct	Solenoid Energized	Valve Fails...	Valve Fails...
	Reverse	Closes Valve	Open	Open
2930 & 32	Direct	Closes Lower Port/ Opens Upper Port	Upper Port Closed/ Lower Port Open	Upper Port Closed/ Lower Port Open

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	Feedback Signal	Settings
2920, 22 & 23	Direct	Potentiometer*	Increases as	Switch 1, 3, 5
	Reverse	0-350 ohm	Valve Closes	Closed
2930 & 32	Direct	0-350 ohm	Valve Opens	Open
	Reverse	0-350 ohm	Valve Closes	Closed

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

Air Filter Regulators		
Actuator	Output Pressure	
DL49, 84 & 84XR	30PSIG	
DL115 & 115XR	40PSIG	

Limit Switches		
Valve Type	Position	Settings
2920, 22 & 23	Valve Closed	Switch 2, 4, 6
	Valve Open	Open
2930 & 32	Upper Port Open	Closed
	Lower Port Closed	Open

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

29									
2. OPTIONS									
VALVE BODY									
Model	Valve Type	Size	Body Material	End Connection	Trim Style	Trim Material	Trim Cv	Packing Type	
29N 49" or 84" Pneumatic	20 2-Way Single Seat	250 2-1/2 inch	R Cast Iron	F 125 lb. Flanged	E Equal %	B Bronze	F Full Port	T Teflon	
29B 115 Pneumatic	22 2-Way Double Seat	300 3 inch	G 250 lb. Flanged	G 250 lb. Flanged	L Linear	S 300 SS		G Graphite Packing	
	23 2-Way Cylinder Bal.	400 4 inch				H 17-4 PH		Used for Temp up to 500F where Body Pressure Temp is not Violated	
	30 3-Way Mixing	500 5 inch							
	32 3-Way Diverting	600 6 inch							
		800 8 inch							
		010 10 inch							

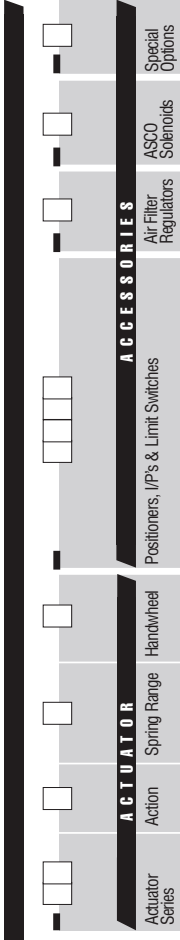
NOTE: Valve Type 22 is Only Used with 29N Body & DL49/DL115 Actuators.

VALVE TYPE / TRIM MATERIAL COMBINATIONS:

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

VALVE TYPE / ACTUATOR COMPATIBILITY:

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



ACTUATOR		ACCESSORIES	
Actuator Series	Action	Spring Range	Handwheel
00 None	0 None	0 None	0 None
49 49 (49 Sq.In.)	R Reverse	L Low	R Reverse
84 84 (84 Sq.In.)	F Full	3-9psi 490, 840, 1150	D Direct
8X 84 (84 Sq.In.)	D Direct	NOTE: DL14, DL15, DL14R & DL15R only - <i>Min match action.</i>	NOTE: DL14, DL15, DL14R & DL15R only - <i>Min match action.</i>
15 15 (15 Sq.In.)	F Full	5-14psi 490, 840, 1150	NOTE: DL14, DL15, DL14R & DL15R only - <i>Min match action.</i>
5X 5X (5X Sq.In.)	H High	9-15psi 84, 115, 10-14 psi 490	NOTE: DL14, DL15, DL14R & DL15R only - <i>Min match action.</i>
NOTE: 5X & 8X Only in 200-400 psi Range Reverse Action	X High	8-12 psi 490, 1150	NOTE: DL14, DL15, DL14R & DL15R only - <i>Min match action.</i>
DIAPHRAGM:	0 None	POSITIONERS:	0 None
49 49 (49 Sq.In.)	R Reverse	B-P B-X Pneumatic	A Type 300, 0-30 PSI
84 84 (84 Sq.In.)	F Full	B-E B-X Electro-Pneumatic	B Type 300, 0-60 PSI
8X 84 (84 Sq.In.)	D Direct	B-J B-X Electro-Pneumatic Intra. Safe	D Type 300, 0-60 PSI
15 15 (15 Sq.In.)	F Full	B-X B-X Electro-Pneumatic Expt. Proof	D Type 300, 0-60 PSI
5X 5X (5X Sq.In.)	H High	B-XF B-X Electro-Pneumatic Fail Freeze	D Type 300, 0-60 PSI
NOTE: 5X & 8X Only in 200-400 psi Range Reverse Action	X High	76P Moore/60 Pneumatic	MF FR2020202
DIAPHRAGM:	0 None	76E Moore/60 Electro-Pneumatic	3-Way EXP. SS
49 49 (49 Sq.In.)	R Reverse	510 Westlock (CoT) Electro-Pneumatic	3-Way EXP. SS
84 84 (84 Sq.In.)	F Full	520 Westlock (CoT) Intelligent-Keypad	3-Way EXP. SS
8X 84 (84 Sq.In.)	D Direct	530 Westlock (CoT) Intelligent-Hart	3-Way EXP. SS
15 15 (15 Sq.In.)	F Full	540 Westlock (CoT) Found Fieldbus	3-Way EXP. SS
5X 5X (5X Sq.In.)	H High	PROXIMITY SWITCHES:	3-Way EXP. SS
NOTE: 5X & 8X Only in 200-400 psi Range Reverse Action	X High	PX11 Mark 1 Series - 2 in. SPDT	3-Way EXP. SS
DIAPHRAGM:	0 None	PX12 Mark 1 Series - 2 in. SPDT w/2% Pst	3-Way EXP. SS
49 49 (49 Sq.In.)	R Reverse	PX13 Mark 1 Series - 2 in. SPDT w/2% Feedback	3-Way EXP. SS
84 84 (84 Sq.In.)	F Full	PX14 Mark 1 Series - 4 in. SPDT	3-Way EXP. SS
8X 84 (84 Sq.In.)	D Direct	PX15 Mark 1 Series - 6 in. SPDT	3-Way EXP. SS
15 15 (15 Sq.In.)	F Full	MAP1 Type 500X (IP, 3-15 PSI)	3-Way EXP. SS
5X 5X (5X Sq.In.)	H High	MAP2 Type 500X (IP, 3-15 PSI)	3-Way EXP. SS
NOTE: 5X & 8X Only in 200-400 psi Range Reverse Action	X High	MAP3 Type 500X (IP, 3-15 PSI)	3-Way EXP. SS
DIAPHRAGM:	0 None	MAP4 Type 500X (IP, 1-17 PSI)	3-Way EXP. SS
49 49 (49 Sq.In.)	R Reverse	MAP5 Type 500X (IP, 6-30 PSI)	3-Way EXP. SS
84 84 (84 Sq.In.)	F Full	MAP6 Type 500X (IP, 0-30 PSI)	3-Way EXP. SS
8X 84 (84 Sq.In.)	D Direct	MAP7 Type 500X (IP, 0-60 PSI) For 15 or 5X only	3-Way EXP. SS
15 15 (15 Sq.In.)	F Full	MAP9 Type 500X (IP, 3-15 EXP)	3-Way EXP. SS
5X 5X (5X Sq.In.)	H High		3-Way EXP. SS
NOTE: 5X & 8X Only in 200-400 psi Range Reverse Action	X High		3-Way EXP. SS

ACTUATOR / BODY COMPATIBILITY:

DIAPHRAGM	BODY
49 49 (49 Sq.In.)	For 23N Bodies
84 84 (84 Sq.In.)	For 23N Bodies
8X 84 (84 Sq.In.)	For 23N Bodies
15 15 (15 Sq.In.)	For 23N Bodies
5X 5X (5X Sq.In.)	For 23N Bodies

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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 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 flg	ends Buttweld, NPT	ends Flange	ends 150,300 RF flg	ends 150,300 RF flg
body WCB, CF8M	body Bronze, CF8M	body Cast Iron	body WCB, CF8M	body WCB, CF8M
trim 316 SST, Alloy 6	trim Bronze, 316SST, 17-4PH, Alloy 6, TFE, PEEK	trim Bronze, 300SS, 17-4PH, Alloy 6	trim 316 SST, Alloy 6, Ceramic, TFE, PEEK	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 400°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	shutoff class IV, VI	shutoff class IV, VI
rangeability 50:1	rangeability 50:1	rangeability 50:1	rangeability 100:1	rangeability 50:1
• Heavy Duty	• Economical	• High Capacity	• Eccentric, Segmented Ball	• Highly Efficient, Compact Design
• Severe Service	• Precision Control	• General Purpose	• Well Suited for Erosive Service	• High Pressure Drops
• High Pressure Differentials	• Suited for Gases, Steam, or Liquids that are Not Viscous or Solids Bearing	• Moderate Pressure Drops	• Various Trim Options Include Liquids and Gases, Steam & Water	• Typically Suited for High Force Piston Actuators
• Corrosive Materials, Liquids, Gases & Steam		• Compatible Liquids and Gases, Steam & Water	• Ceramic for Slurries or Gritty Materials & Teflon® for Class VI Shutoff	• Ceramic for Steam, Chemicals & Dirty Fluids
• Modulating or On/Off Control		• Modulating or On/Off Control		• Minimizes Cavitation or Flashing Effects

WARREN CONTROLS
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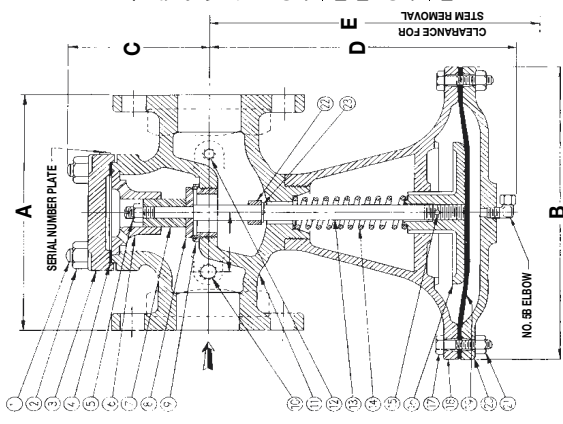
TYPE E2 Main Valve

Sizes 3/4" through 12"

The Spence Type E2 Main Valve is of normally closed, single seat design featuring packless construction, Hycar diaphragm and protected main spring.

When controlled by one or more of the various types of Spence Pilots, this valve will accomplish most functions required of a regulator.

CAST IRON RATINGS (Maximum Inlet Conditions)			
Valve Ends	Pressure	Temperature	
☐ ANSI NPT Screwed.....	15 PSIG	(250°F)	
☐ ANSI 125 Flanged.....	15 PSIG	(250°F)	
CAST BRONZE RATINGS (Maximum Inlet Conditions)			
Valve Ends	Pressure	Temperature	
☐ ANSI NPT Screwed.....	15 PSIG	(250°F)	



TYPE E2 MAIN VALVE

SIZE	A			OTHER DIMENSIONS					APPROX. WT.		
	CI BRZ	CI ANSI	CI NPT	B	C	D	E	CI BRZ	CI ANSI	CI NPT	
	125	125	125					125	125	125	
¾	4¾	—	—	8	2½	7¼	11½	18	—	7.6	
1	5½	5½	8	8	3½	8½	12½	19	21	11.7	
1¼	6½	6½	9	9	4½	8½	12½	30	33	18.9	
1½	7½	6½	9¼	9¼	4½	8½	13¼	36	40	27.4	
2	7½	8½	10½	10½	5¼	10	15¼	50	57	44	
2½	—	9½	10½	10½	5½	11½	17¼	—	70	68	
3	—	10½	11¼	11¼	6½	12¼	19¼	—	98	96	
4	—	11½	13½	13½	6½	13½	21¼	—	135	143	
5	—	13½	14¼	14¼	7½	15	23	—	185	202	
6	—	15½	16½	16½	7½	16½	26	—	250	255	
8	—	19	20	20	9½	19½	30½	—	415	465	
10	—	23½	24	24	10½	23½	38½	—	690	748	
12	—	26½	28	28	12¼	27¼	44¼	—	1060	1118	

OPERATING PRINCIPLE

The regulator is operated by initial steam or fluid pressure. It is normally closed, being held so by initial pressure on the disc and by an internal main spring. When the pilot is opened (see pilot instructions), initial pressure flows through the pilot to the 8B tee. Bleedport 4A restricts the flow and pressure builds under the diaphragm and opens the main valve.

Delivery pressure feeds back through the control pipe to the pilot diaphragm. As this pressure approaches a balance with the thrust of the adjusting spring, the pilot throttles the loading pressure. In turn, the main valve takes a position established by the loading pressure where just enough steam flows to maintain the set delivery pressure.

RECOMMENDED INSTALLATION

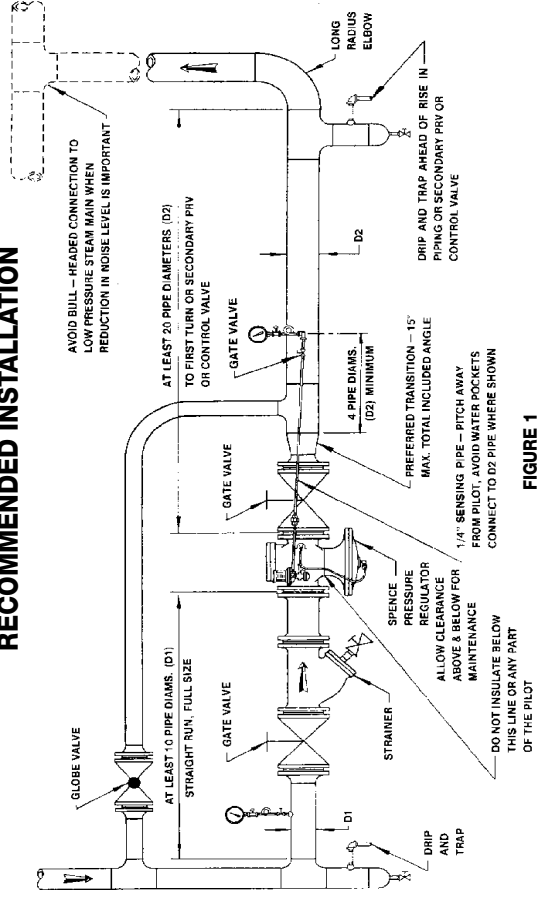


FIGURE 1

INSTALLATION

PLANNING

Locate the valve in a straight run of horizontal pipe. Allow headroom above the valve for access through the blind flange. Provide clearance for stem withdrawal underneath. Prevent water hammer and erratic operation by installing traps to provide proper drainage before and after the valve and before secondary PRV or control valve. Avoid damaging effects of scale and dirt in pipe lines by using a strainer as shown in Figure 1. Provide a 3-valve by-pass to facilitate inspection without interrupting service.

INSTALLATION

Screw No. 8B tee into 1/8" pipe tap in pilot. Select tap facing downstream.

Screw No. 5B elbow into 1/8" pipe tap on underside of main valve diaphragm chamber.

Connect tubing bends as illustrated in Fig. 2.

CONTROL PIPE (if required)

Use 1/4" pipe for this line which connects the pilot diaphragm chamber to the desired point of pressure control. Take the control at a point of minimum turbulence. Avoid control immediately at the valve outlet or after a turn. When the delivery pipe expands in size, select a spot at least 4 pipe diameters beyond the point of enlargement. Pitch away from pilot to avoid erratic operation and excessive fouling. Eliminate water pockets. Locate delivery pressure gage in control pipe to show pressure actually reaching pilot diaphragm.

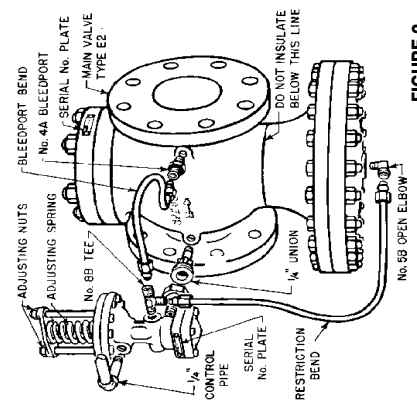


FIGURE 2

MAIN VALVE

Flush the piping system thoroughly to clear it of welding beads, scale, sand, etc. Mount the main valve with diaphragm chamber down and arrow on body pointing in the direction of flow. Scribed end valves should be mounted in unions.

PILOT

Mount the pilot on either side of the main valve by means of 1/4" nipple and union provided. Make this connection the 1/4" pipe tap at the inlet of the main valve as shown in Figure 2.

Screw No. 4A bleedport fitting into the 1/8" pipe tap at the outlet of the main valve body. Note bleed orifice in this fitting - vital to operation of regulator.

MAINTENANCE

After grinding, disassemble and clean all parts.

VALVE SIZE	TYPE E2	
	HOOD	TOTAL
(K)		
3/4	1/8	1/4
1	3/16	5/16
1-1/4	7/32	3/8
1-1/2	1/4	7/16
2	9/32	9/16
2-1/2	11/32	11/16
3	13/32	13/16
4	15/32	15/16
5	17/32	1-1/16
6	19/32	1-3/16
8	25/32	1-9/16
10	31/32	1-15/16
12	1-5/32	2-5/16

Under normal conditions, complete dismantling at regular intervals is not recommended. A valve kept relatively free of dirt will function for years with minimum attention. After the first few days of operation and twice a year, the following should be checked.

1. Inspect for dirt collected at bleedport No. 4A.
2. Inspect all joints for leakage. Keep bolts tight. Never allow a leak to persist.

DISMANTLING MAIN VALVE

Connect a source of air or water pressure which can be adjusted by hand to the No. 5B elbow. Apply pressure to jack valve open and prevent stem from turning while removing stem nuts. Usually 30 psi will suffice. Use penetrating oil on the threads.

REPLACING SEAT RINGS

These joints should be made up with Copalittle, Permatex or equal high temperature gasket compound. Remove old compound from body and seat ring with a wire brush. Apply new compound sparingly to both parts, threads and shoulders. Let stand until tacky before assembling.

GRINDING IN

Seats and discs should never require more than the lightest touch up with very fine (400 grit) grinding compound. Heavy grinding will produce galling, wider seating surface and a groove in the disc, all of which tend to cause leakage. Replace a damaged surface before attempting to grind it in. Grind sparingly.

Main stem (13) is slotted for rotation with a screwdriver. Valve spring (14) is omitted from the assembly during grinding. Slip the stem into its normal position. Apply compound to the disc, place it on the stem and guide plug, tighten with stem nut.

START-UP AND SETTING

Open inlet stop valve and gradually compress adjusting spring until the valve opens and takes control at desired pressure. Alternately choke down on the by-pass and open outlet stop valve until the regulator is on the line. See individual instructions for other pilots.

TROUBLE SHOOTING

3. By-pass valve may be leaking.
 4. On pressure regulators like the E2D, the main valve or pilot may be held open by foreign matter in seat. To determine which valve leaks, first close inlet stop valve and 1/4" control valve. Then remove bleedport bend so pilot will exhaust to atmosphere. Crack inlet stop valve. Steam will issue from No. 8B tee. Release compression on adjusting spring to see if pilot closes tight. Open and close several times to wash seat. Steam blowing back from bleedport means main valve disc is held open by foreign matter. Steam may wash the obstruction from the seat if the valve is made to open wide. This can be accomplished, even at light loads, if the control point is beyond the outlet stop valve. Reassemble bleedport bend and place regulator in operation. Then, slowly open and close outlet stop valve.
- 3
- Under normal conditions, complete dismantling at regular intervals is not recommended. A valve kept relatively free of dirt will function for years with minimum attention. After the first few days of operation and twice a year, the following should be checked.
1. Inspect for dirt collected at bleedport No. 4A.
 2. Inspect all joints for leakage. Keep bolts tight. Never allow a leak to persist.
- DISMANTLING MAIN VALVE**
- Connect a source of air or water pressure which can be adjusted by hand to the No. 5B elbow. Apply pressure to jack valve open and prevent stem from turning while removing stem nuts. Usually 30 psi will suffice. Use penetrating oil on the threads.
- REPLACING SEAT RINGS**
- These joints should be made up with Copalittle, Permatex or equal high temperature gasket compound. Remove old compound from body and seat ring with a wire brush. Apply new compound sparingly to both parts, threads and shoulders. Let stand until tacky before assembling.
- GRINDING IN**
- Seats and discs should never require more than the lightest touch up with very fine (400 grit) grinding compound. Heavy grinding will produce galling, wider seating surface and a groove in the disc, all of which tend to cause leakage. Replace a damaged surface before attempting to grind it in. Grind sparingly.
- Main stem (13) is slotted for rotation with a screwdriver. Valve spring (14) is omitted from the assembly during grinding. Slip the stem into its normal position. Apply compound to the disc, place it on the stem and guide plug, tighten with stem nut.
- START-UP AND SETTING**
- Open inlet stop valve and gradually compress adjusting spring until the valve opens and takes control at desired pressure. Alternately choke down on the by-pass and open outlet stop valve until the regulator is on the line. See individual instructions for other pilots.
- TROUBLE SHOOTING**
3. By-pass valve may be leaking.
 4. On pressure regulators like the E2D, the main valve or pilot may be held open by foreign matter in seat. To determine which valve leaks, first close inlet stop valve and 1/4" control valve. Then remove bleedport bend so pilot will exhaust to atmosphere. Crack inlet stop valve. Steam will issue from No. 8B tee. Release compression on adjusting spring to see if pilot closes tight. Open and close several times to wash seat. Steam blowing back from bleedport means main valve disc is held open by foreign matter. Steam may wash the obstruction from the seat if the valve is made to open wide. This can be accomplished, even at light loads, if the control point is beyond the outlet stop valve. Reassemble bleedport bend and place regulator in operation. Then, slowly open and close outlet stop valve.

CAST IRON & BRONZE PARTS LIST - 3/4" to 3"

ITEM NO.	PART NAME	MATERIAL	VALVE SIZE				
			3/4	1	1 1/4	1 1/2	2
1	Blind Flange Stud	Steel	04-05516-00	04-101118-00	04-055442-00	04-055443-00	04-10119-00
2	Blind Flange Nut	Steel	05-02847-00	05-02851-00	05-02854-00	05-02856-00	05-02860-00
3	Blind Flange	Cast Iron	04-02171-00	04-02173-00	04-02176-00	04-02178-00	04-02180-00
4	Blind Flange	Bronze	04-02172-00	04-02174-00	04-02177-00	04-02179-00	04-02181-00
5	*Gasket	Non-Asbestos	05-02381-00	05-02382-00	05-02382-00	05-02385-00	05-02386-00
6	*Stem Nut	Steel	05-02869-00	05-02970-00	05-02970-00	05-02971-00	05-02972-00
7	Disc Guide Plate	Cast Iron	04-03376-00	04-03479-00	04-03480-00	04-03500-00	04-03509-00
8	Guide Plug	Stainless Steel	—	—	—	04-03751-01	04-03754-00
9	*Integral Disc	Stainless Steel	04-01813-02	04-01832-02	04-01850-02	04-01870-02	04-01888-02
10	Pipe Plug 1/4"	Steel	04-03772-00	04-03772-00	04-03772-00	04-03772-00	04-03772-00
11	Pipe Plug 1/4"	Brass	04-03771-00	04-03771-00	04-03771-00	04-03771-00	04-03771-00
12	NPT Body	Cast Iron	04-00868-00	04-00869-01	04-00871-01	04-00873-01	04-00875-01
13	125 Body	Cast Iron	—	04-08176-00	04-08964-00	04-08965-00	04-08977-00
14	Pipe Plug 1/8"	Steel	04-03769-00	04-03769-00	04-03769-00	04-03769-00	04-03769-00
15	Pipe Plug 1/8"	Brass	04-03770-00	04-03770-00	04-03770-00	04-03770-00	04-03770-00
16	*Stem	Stainless Steel	08-08765-00	08-08766-00	08-08766-00	08-08767-00	08-08769-00
17	*Main Spring	Steel	05-05093-01	05-05093-01	05-05094-01	05-05095-01	05-05096-01
18	*Groove Pin	Steel	05-03247-00	05-03247-00	05-03247-00	05-03251-00	05-03253-00
19	*Pressure Plate	Cast Iron	04-03621-00	04-03700-00	04-03622-00	04-03623-01	04-03625-00
20	Diaphragm Bolt	Steel	05-04770-00	05-04770-00	05-04773-00	05-04773-00	05-04773-00
21	Base	Cast Iron	04-00501-00	04-00501-00	04-00509-00	04-00505-00	04-00506-00
22	*Diaphragm	Hycar	05-01668-00	05-01668-00	05-01670-00	05-01672-00	05-01673-00
23	Hood	Cast Iron	04-02571-00	04-02571-00	04-02605-00	04-02606-00	04-02608-00
24	Diaphragm Nut	Steel	05-02872-00	05-02872-00	05-02874-00	05-02874-00	05-02874-00
25	Stem Washer	Stainless Steel	04-06130-00	04-06131-00	04-06132-00	04-06132-00	04-06247-00
26	Retaining Ring	Stainless Steel	05-09382-00	05-09383-00	05-09383-00	05-09384-00	05-09385-00
27	Top Flange	Cast Iron	04-02246-00	04-02248-00	04-02253-00	04-02253-00	04-02259-00
28	Repair Kit		08-07940-00	08-07941-00	08-07942-00	08-07943-00	08-07945-01

CAST IRON & BRONZE PARTS LIST - 4" to 12"

ITEM NO.	PART NAME	MATERIAL	VALVE SIZE							
			4	5	6	8	10	12		
1	Blind Flange Stud	Steel	04-05443-00	04-10119-00	04-10120-00	04-10120-00	04-10120-00	04-10120-00	04-05445-00	
2	Blind Flange Nut	Steel	05-02856-00	05-02860-00	05-02860-00	05-02860-00	05-02860-00	05-02860-00	05-02864-00	
3	Blind Flange	Cast Iron	04-02157-00	04-02158-00	04-02162-00	04-02165-00	04-02167-00	04-02167-00	04-02169-00	
4	*Gasket	Non-Asbestos	05-02369-00	05-02371-00	05-02397-00	05-02374-00	05-02375-00	05-02375-00	04-02398-00	
5	*Stem Nut	Steel	05-02973-00	05-02947-00	05-02975-00	05-03044-00	05-03045-00	05-02977-00	05-02977-00	
6	Disc Guide Plate	Cast Iron	04-03496-00	04-03504-00	04-03473-00	05-03474-00	05-03497-00	05-03475-00	05-03475-00	
7	Guide Plug	Stainless Steel	04-03756-00	04-03757-00	04-03742-00	04-03743-00	04-03744-00	04-03745-00	04-03745-00	
8	*Integral Disc	Stainless Steel	04-01922-00	04-01931-00	04-01940-00	04-01995-00	04-01995-01	04-01995-01	04-01700-00	
9	*Sat. Ring	Stainless Steel	04-11759-00	04-11666-00	04-15802-00	07-43794-00	07-43795-00	07-43795-00	07-40509-00	
10	Pipe Plug 1/4"	Steel	04-03772-00	04-03772-00	04-03772-00	04-03772-00	04-03772-00	04-03772-00	04-03772-00	
11	1 1/2 Body	Cast Iron	04-00863-00	04-00884-01	04-00885-01	04-00887-01	04-00888-01	04-00888-01	04-00726-00	
12	Pipe Plug 1/8"	Steel	04-03769-00	04-03769-00	04-03769-00	04-03769-00	04-03769-00	04-03769-00	04-03769-00	
13	*Stem	Stainless Steel	08-08771-00	08-08772-00	08-08773-00	08-08774-00	08-08775-00	08-08775-00	08-08776-00	
14	*Main Spring	Steel	05-05099-01	05-05100-01	05-05101-01	05-05102-01	05-05103-01	05-05104-01	05-05104-01	
15	*Groove Pin	Steel	05-03256-00	05-03257-00	05-03259-00	05-03260-00	05-03262-00	05-03262-00	05-03262-00	
16	*Pressure Plate	Cast Iron	04-03627-00	04-03628-01	04-03626-00	04-03630-00	04-03631-00	04-03632-00	04-03632-00	
17	Diaphragm Bolt	Steel	05-04774-00	05-04775-00	05-04780-00	05-04780-00	05-04782-00	05-04782-00	05-04787-00	
18	Base	Cast Iron	04-00507-00	04-00510-01	04-00511-01	04-00511-01	04-00512-01	04-00513-01	04-00513-01	
19	*Diaphragm	Hycar	05-01674-00	05-01675-00	05-01676-00	05-01677-00	04-01678-00	04-01678-00	04-01679-00	
20	Hood	Cast Iron	04-02609-00	04-02618-00	04-02618-00	04-02611-00	04-02612-00	04-02614-00	04-02614-00	
21	Diaphragm Nut	Steel	05-02874-00	05-02874-00	05-02877-00	05-02877-00	05-02877-00	05-02877-00	05-02881-00	
22	Stem Washer	Stainless Steel	04-06249-00	04-06270-00	04-06250-00	04-06251-00	04-06271-00	04-06272-00	05-02881-00	
23	Retaining Ring	Stainless Steel	05-09386-00	05-09387-00	05-09387-00	05-09388-00	05-09389-00	05-09390-00	05-09391-00	
24	Top Flange	Cast Iron	04-02261-00	04-02263-00	04-02268-00	04-02268-00	04-02268-00	04-02268-00	04-02268-00	
25	Repair Kit		08-09567-01	08-10980-00	08-10985-00				—	

*These parts furnished in Repair Kit

When ordering parts, it is essential that the valve type, size, service and serial number be stated. Select part by item number, but order by part number. Specify complete part number when ordering.

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 (air or water) at Room Temperature.....	35 psi (241.3 kPa)
Air Consumption (max.).....	218 cm ³ /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	
Stainless Steel no. 744-082.....	1125 psi (7756 kPa)
Copper no. 744-111.....	525 psi (3619 kPa)
Well Dimensions.....	See page 5

AIR OPERATED:

Rigid Stainless Bulb

Direct Action 744-1270

Reverse Action 744-1271

WATER OPERATED:

Rigid Stainless Bulb

Direct Action 744-1217

Reverse Action 744-1218

Rigid Copper Bulb

Direct Action 744-1213

Reverse Action 744-1214



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-

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.

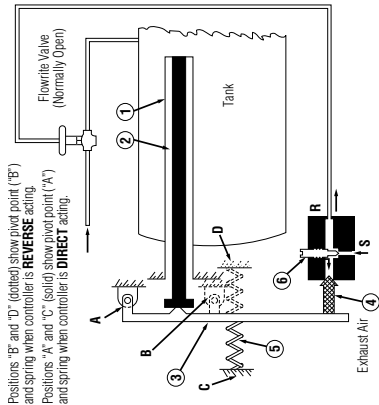


Figure 1.

CALIBRATION



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

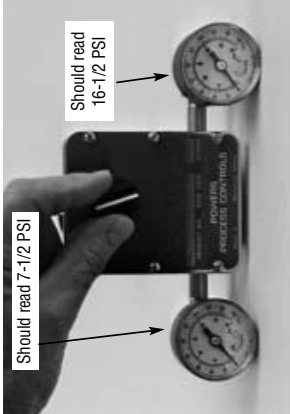


Figure 3. Turn adjusting knob until 52 kPa (7-1/2 psi) control pressure shows on gauge. Read temperature at bulb with an accurate thermometer.

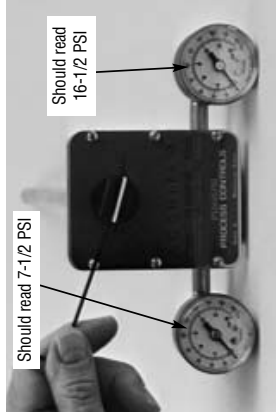


Figure 4. Loosen set screw and turn adjusting knob to indicate temperature at bulb. Tighten set screw. Set controller for desired control temperature.

INSTALLATION (GENERAL INSTRUCTIONS)

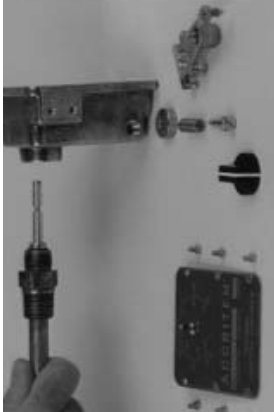


Figure 5.

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.

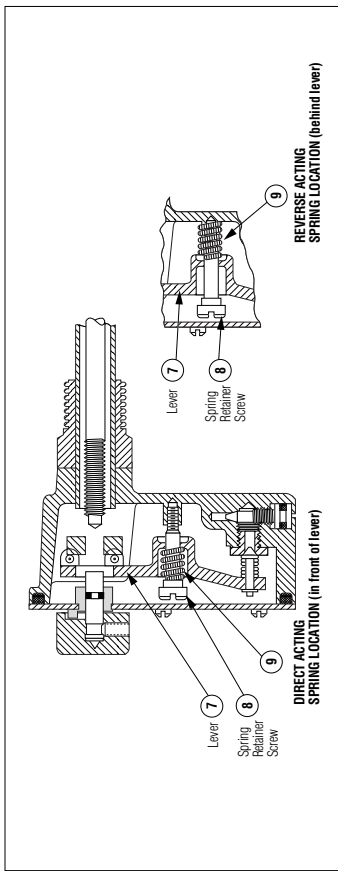


Figure 6.

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.

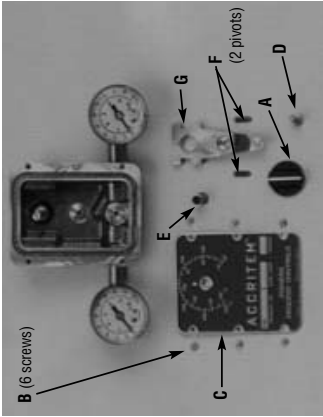


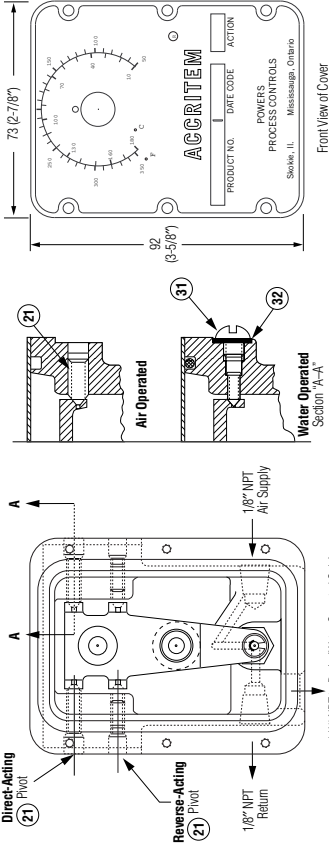
Figure 7.

3. Install screws (31) and gaskets (32) 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 (16) 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.

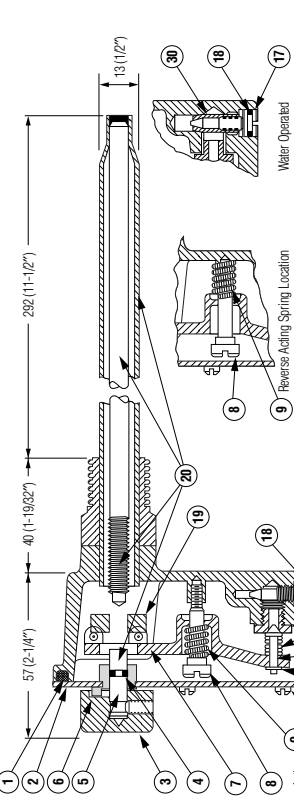
NOTE: On units with a date code of 3L48 and later: When replacing a knob (744-036) or cover plate (744-170), a new knob (744-234) and cover plate (744-170D) must be ordered.

PARTS

Dimensions: Millimeters (Inches)



1/4" NPT to Drain (Water Operated Only)



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

*Used in Water-Operated Controllers Only

PARTS LIST

Item	Part Name	Part Numbers		No. Req'd	Material	Item	Part Name	Part Numbers		No. Req'd	Material
		Air or Gas	Water					Air or Gas	Water		
1	Body	—	—	1	Brass	12	Retaining Ring	100-124*	100-124**	1	Phos. Bronze
2	Cover Plate	744-170D	744-170D	1	—	13	Valve	744-155*	744-163**	1	Phos. Bronze
3	Adjusting Knob w/ Set Screw	744-234	744-234	1	—	15	Valve Spring	744-075*	744-075**	1	Phos. Bronze
4	Quad Ring	—	047-043	1	—	16	Valve Seat	744-063*	744-131**	1	Phos. Bronze
5	Adjustment Screw	744-175	744-175	1	Brass	17	Restriction Screw	744-072	744-134*	1	Brass
6	Stop Pin	744-061	744-061	1	Brass	18	O-Ring	047-049●	047-045	1	Butyl-N
7	Lever	—	—	1	Brass	19	Thrust Collar	—	—	1	Brass
8	Spring Retainer Screw	744-124	744-124	1	Brass	20	Sensitive Tube Assembly	744-172	744-172	1	—
9	Lever Spring	225-073	430-021●	1	Stainless Steel	21	Lever Pivot	744-154	744-154	2	Stainless Steel
10	Cover Screw	030-041	030-041	6	Brass	30	Insert	—	—	1	Stainless Steel
11	O-Ring	Not used	047-050	1	Silicone Rubber	31	Sealing Screw	—	030-985	4	Stainless Steel
12	—	—	—	—	—	32	Gasket	—	744-083	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.

Valve and Seat Kit for Model 3 (Air-Operated Accritem) 744-168

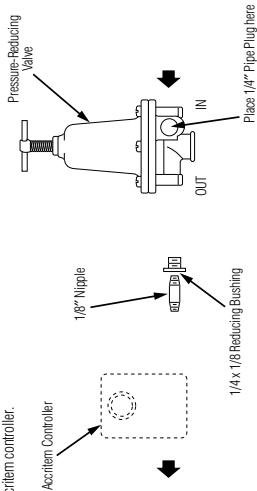
Valve and Seat Kit for Model 3 (Water-Operated Accritem) 744-169

ACCESSORIES

Dimensions: Millimeters (Inches)

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

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

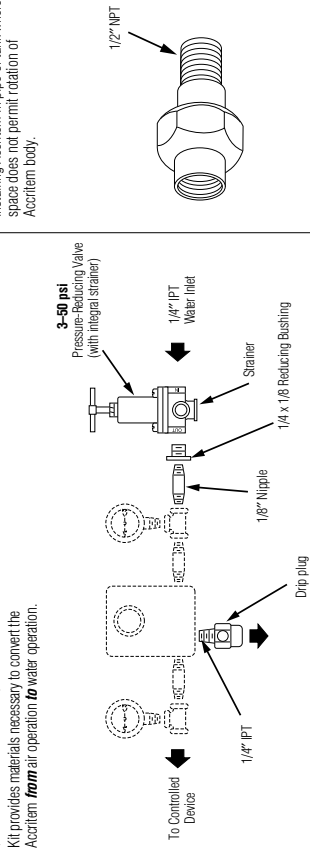


WATER

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

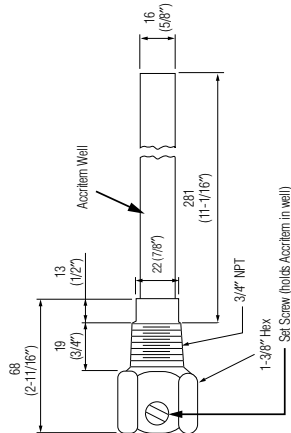
Kit provides materials necessary to convert the Acrictem from air operation to water operation.

Brass Union Assembly No. 744-106
Provides pressure-tight connection for installing Acrictem in pipe or tank where space does not permit rotation of Acrictem body.



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
ACTION: DIRECT Acting	Normally OPEN valve	Normally CLOSED valve	Hot piped to Normally OPEN port of valve
	Valve OPENS on air failure	Valve CLOSES on air failure	Valve opens to HOT flow on air failure
REVERSE Acting	Normally CLOSED valve	Normally OPEN valve	Hot piped to Normally CLOSED port of valve
	Valve CLOSES on air failure	Valve OPENS on air failure	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.wattsind.com/jp965

POWERS
A WATTS INDUSTRIES CO.

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USA Phone: 800.669.5430
www.powerscontrols.com
Canada Phone: 888.208.8827

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 cleaning or other corrosive agents. Defects are not due to abuse or chemical decomposition by chemical cleaning or other corrosive agents. 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.

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.



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 obligation to make such changes and modifications on Watts products previously or subsequently sold.



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" 20 x 20mm Model M3	1" x 1" 25 x 32mm Model M1	1 1/2" x 1 1/2" 32 x 40mm Model M1	1 1/2" x 1 1/2" 40 x 40mm Model M1	2" x 2" 50 x 50mm Model M
30	2,07	650,000	1,005,000	1,682,000	2,020,000
33	2,27	695,000	1,075,000	1,788,000	2,150,000
35	2,41	725,000	1,125,000	1,877,000	2,250,000
36	2,48	740,000	1,145,000	1,916,000	2,310,000
40	2,76	800,000	1,240,000	2,071,000	2,490,000
45	3,10	875,000	1,355,000	2,265,000	2,720,000
50	3,45	950,000	1,470,000	2,459,000	2,950,000
55	3,79	1,025,000	1,590,000	2,653,000	3,190,000
60	4,13	1,100,000	1,720,000	2,847,000	3,430,000
65	4,58	1,170,000	1,850,000	3,041,000	3,660,000
70	4,82	1,245,000	1,985,000	3,235,000	3,890,000
75	5,17	1,320,000	2,165,000	3,429,000	4,125,000
80	5,51	1,400,000	2,165,000	3,605,000	4,360,000
85	5,86	1,470,000	2,285,000	3,817,000	4,590,000
90	6,60	1,545,000	2,400,000	4,011,000	4,825,000
95	6,55	1,620,000	2,520,000	4,205,000	5,060,000
100	6,89	1,695,000	2,635,000	4,399,000	5,290,000
105	7,23	1,770,000	2,750,000	4,593,000	5,525,000
110	7,58	1,845,000	2,865,000	4,787,000	5,760,000
115	7,92	1,920,000	2,980,000	4,981,000	5,990,000
120	8,27	1,995,000	3,100,000	5,175,000	6,225,000
125	8,61	2,070,000	3,215,000	5,370,000	6,460,000
130	8,96	2,145,000	3,330,000	5,564,000	6,690,000
135	9,30	2,220,000	3,445,000	5,758,000	6,925,000
140	9,65	2,295,000	3,565,000	5,952,000	7,160,000
145	9,99	2,370,000	3,680,000	6,146,000	7,390,000
150	10,34	2,445,000	3,795,000	6,340,000	7,630,000

Series 740

Set Pressure psi	3/4" x 1" 20 x 25mm Model M3	1" x 1 1/2" 25 x 32mm Model M1	1 1/2" x 1 1/2" 32 x 40mm Model M1	1 1/2" x 2" 40 x 50mm Model M	2" x 2 1/2" 50 x 65mm 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	1,037,000	1,450,000	2,345,000	3,235,000
36	2,48	1,055,000	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	1,455,000	2,049,000	3,315,000	4,572,000
60	4,13	1,565,000	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

Series 174A

No.	Size (In)	mm	Model	Height in.	mm	Length in.	mm	Weight lbs.	kg.
374A	3/4" x 3/4"	20 x 20	M3	3 1/2	92	2 1/2	64	1 1/3	.5
174A	3/4" x 3/4"	20 x 20	M3	5 1/4	130	2 1/2	64	1 50	.7
174A	1" x 1"	25 x 25	M1	5 1/4	146	3	76	3 13	1.4
174A	1 1/2" x 1 1/2"	32 x 32	M1	8 1/4	213	4 1/4	121	6 25	2.8
174A	1 1/2" x 1 1/2"	32 x 32	M1	9	229	4 1/4	124	7 25	3.3
174A	2" x 2"	50 x 50	M	11 1/4	285	6 1/4	159	13 75	6.2

Series 740

740	3/4" x 1"	20 x 25	M1	5 1/4	143	3	76	1 38	.9
740	1" x 1 1/4"	25 x 32	M	7 1/4	184	3 1/4	89	3 13	1.4
740	1 1/2" x 1 1/2"	32 x 40	M	8 1/4	222	4 1/4	117	6 13	2.8
740	1 1/2" x 2"	32 x 50	M	9 1/4	235	5 1/4	133	7 50	3.4
740	2" x 2 1/2"	50 x 65	M	11 1/4	285	6 1/4	171	16 50	7.5



USA: 815 Chestnut St., No. Andover, MA 01845-0098; www.wattsreg.com
Canada: 545 North Service Rd., Burlington, ONT. L7L 5H7; www.watts.ca

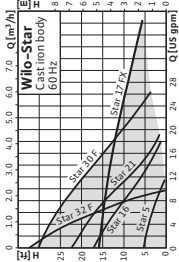


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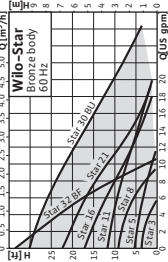
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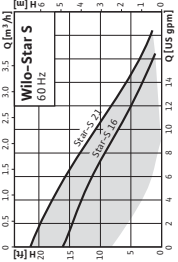
Range: Wilo-Star



- >Maintenance free single-head circulators
- >Pipe connection:
 - flange
 - 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
- >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	32 F
Approved fluids (other fluids on request)								
Heating water	•	•	•	•	•	•	•	•
Water/glycol mixtures (max. 1:1; mixtures with more than 20 % glycol require reassessment of the hydraulic criteria)	•	•	•	•	•	•	•	•
Domestic hot water	–	–	–	–	–	–	–	–
Performance								
Max. delivery head [ft]	5.5	16	16	17	21	21	30	33
Max. delivery head [m]	1.7	4.9	4.9	5.2	6.4	6.4	9.1	10.1
Max. volume rate of flow [USGPM]	12	16.5	16.5	50	19	19	26	10.5
Max. volume rate of flow [m³/h]	2.7	3.7	3.7	11.4	4.3	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	–	–	–	–	–	–	–	–
Ambient temperature range	104° F (+40 °C)							
Max. working pressure P _{max} [psi]	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
Power frequency [Hz]	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
Non overload motor	•	•	•	•	•	•	•	•
Insulation class	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	30 F	32 F	
Materials									
Pump housing – cast iron	•	•	•	•	•	•	•	•	•
Pump housing – bronze	–	–	–	–	–	–	–	–	–
Impeller	Plastics (PP – 40 % GF)								
Shaft	Stainless steel (X40 Cr13)								
Bearing	Metal impregnated carbon								
Minimal static inlet pressure at pump suction port [psi] to avoid cavitation at fluid temperatures									
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 (Cast iron body)

Wilo-Star S... (Cast iron body)				
	S 16 F	S 16 FX	S 21 F	S 21 FX
Approved fluids (other fluids on request)				
Heating water	•	•	•	•
Water/glycol mixtures (max. 1:1; mixtures with more than 20 % glycol require reassessment of the hydraulic criteria)	•	•	•	•
Domestic hot water	–	–	–	–
Performance				
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
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	–	–	–	–
Ambient temperature range	104° °F (+40 °C)	104° °F (+40 °C)	104° °F (+40 °C)	104° °F (+40 °C)
Max. working pressure P _{max} [psi]	140	140	140	140
Pipe connections				
Flange	•	–	•	–
Flange rotated 90°	–	•	–	•
Union connection	–	–	–	–
Internal sweat	–	–	–	–
Electrical connections				
Power supply 1~ [V]	115	115	115	115
Power frequency [Hz]	60	60	60	60
Wilo's quick connection with spring clips	•	•	•	•
Motor/Electronics				
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

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
Materials				
Pump housing – cast iron	•	•	•	•
Pump housing – bronze	–	–	–	–
Impeller	Plastics (PP – 40 % GF)			
Shaft	Stainless steel (X40 Cr13)			
Bearing	Metal impregnated carbon			
Minimal static inlet pressure at pump suction port [psi] to avoid cavitation at fluid temperatures				
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

Circulating Pumps

Product review: Wilo-Star/Star S



Function, Equipment & Technical data Wilo-Star (Bronze body)									
Wilo-Star... (Bronze body)									
Approved fluids (other fluids on request)	3 BS	5 BU	5 BFX	8 BS	11 BU	16 BFX	21 BFX	30 BU	32 BF
	•	•	•	•	•	•	•	•	•
	Water/glycol mixtures (max. 1:1; mixtures with more than 20 % glycol require reassessment of the hydraulic criteria)	•	•	•	•	•	•	•	•
	Domestic hot water	•	•	•	•	•	•	•	•
Performance									
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 _{max} [psi]	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
Power frequency [Hz]	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
Non overload motor	•	•	•	•	•	•	•	•	•
Insulation class	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		
Materials											
Pump housing – cast iron	–	–	–	–	–	–	–	–	–	–	–
Pump housing – bronze	•	•	•	•	•	•	•	•	•	•	•
Impeller	Plastics (PP – 40 % GF)										
Shaft	Stainless steel (X40 Cr13)										
Bearing	Metal impregnated carbon										
Minimal static inlet pressure at pump suction port [psi] to avoid cavitation at fluid temperatures											
122 °F (50 °C)	0.7	0.7	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	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	14.5	14.5
• = available, – = not available											

• = available, – = not available

Function, Equipment & Technical data Wilo-Star S (Bronze body)		
	S 16 BFX	S 21 BFX
Wilo-Star S... (Bronze body)		
Approved fluids (other fluids on request)		
Heating water	•	•
Water/glycol mixtures (max. 1:1; mixtures with more than 20 % glycol require reassessment of the hydraulic criteria)	•	•
Domestic hot water	•	•
Performance		
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
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	–	–
Ambient temperature range	104 °F (+40 °C)	104 °F (+40 °C)
Max. working pressure P _{max} [psi]	140	140
Pipe connections		
Flange	–	–
Flange rotated 90°	•	•
Union connection	–	–
Internal sweat	–	–
Electrical connections		
Power supply 1~ [V]	115	115
Power frequency [Hz]	60	60
Wilo's quick connection with spring clips	•	•
Motor/Electronics		
Number of speed steps	3	3
Non overload motor	•	•
Insulation class	F	F

• = available, – = not available

Circulating Pumps

Product review: Wilo-Star/Star S

Circulating Pumps

Wilo-Star/Star S

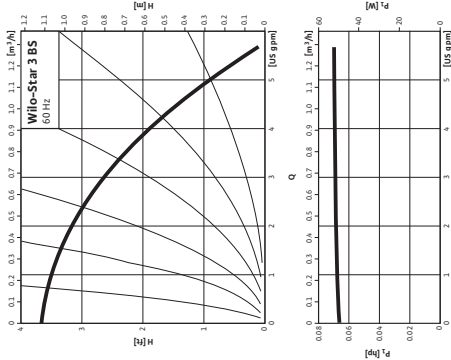


Function, Equipment & Technical data Wilo-Star S (Bronze body)

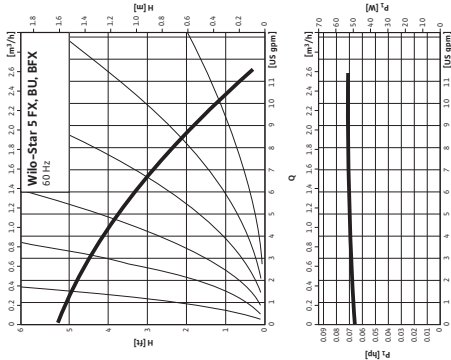
Wilo-Star S... (Bronze body)		S 16 BFX	S 21 BFX
Materials			
Pump housing – cast iron		–	–
Pump housing – bronze		•	•
Impeller	Plastics (PP – 40 % GF)		
Shaft	Stainless steel (X40 Cr13)		
Bearing	Metal impregnated carbon		
Minimal static inlet pressure at pump suction port [psi] to avoid cavitation at fluid temperatures			
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

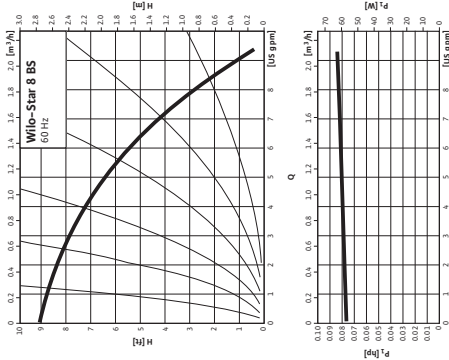
Wilo-Star 3 BS



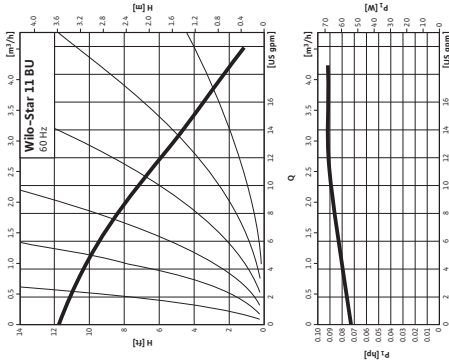
Wilo-Star 5 FX, BU, BFX



Wilo-Star 8 BS

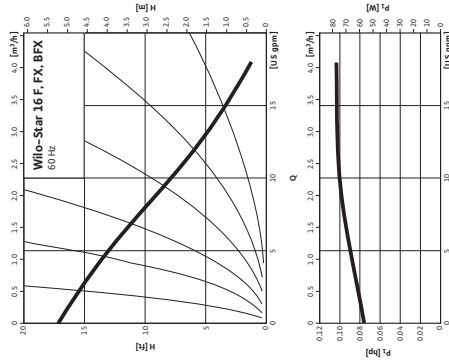


Wilo-Star 11 BU

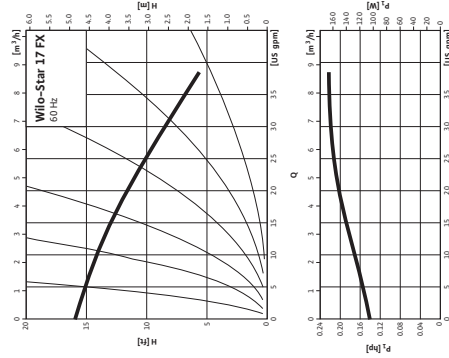


Pump curves Wilo-Star

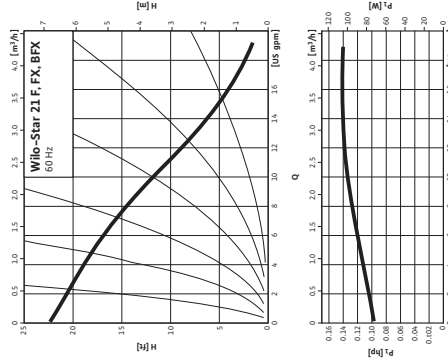
Wilo-Star 16 F. FX. BFX



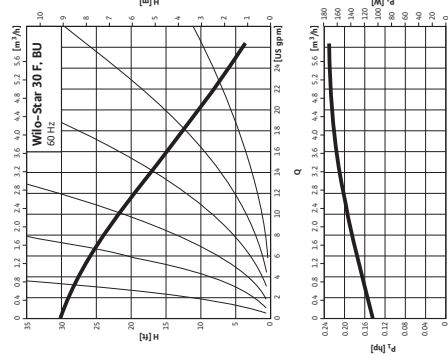
Wilo-Star 17 FX



Wilo-Star 21 F. FX. BFX

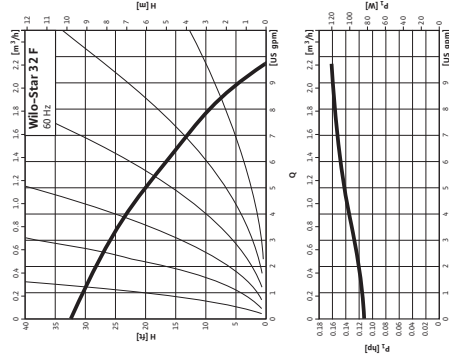


Wilo-Star 30 F. BU

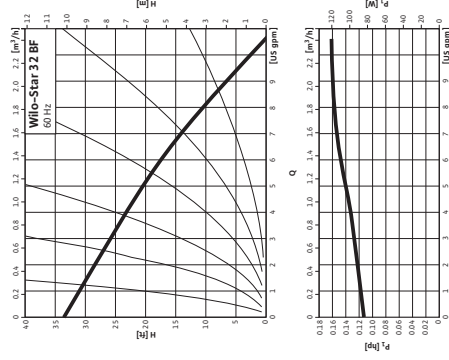


Pump curves Wilo-Star

Wilo-Star 32 F



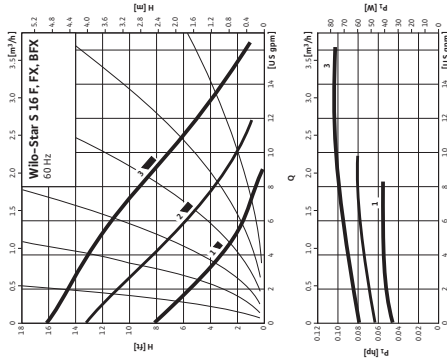
Wilo-Star 32 BF



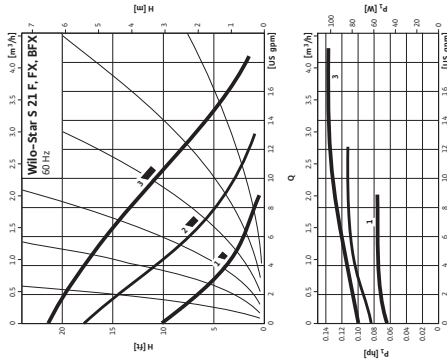


Pump curves Wilo-Star S

Wilo-Star S 16 F, FX, BFX

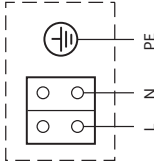


Wilo-Star S 21 F, FX, BFX



Wiring diagrams, motor data

Wiring diagramm



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

Motor data Wilo-Star

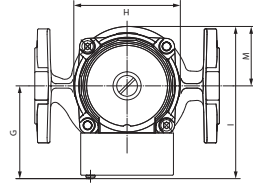
Wilo-Star...	Rated Power		Speed n	Power consumption		Current 1-115 V, 60 Hz	Motor protection	Capacitor
	P ₂ [hp]	[W]		P ₁ [hp]	[W]			
Star 3...	0.03	20	3400	0.07	50	0.49	–	[μF]
Star 5...	0.03	20	2700	0.07	50	0.49	–	7
Star 8...	0.03	20	3000	0.09	64	0.58	–	7
Star 11...	0.03	20	3000	0.09	64	0.58	not necessary (blocking-current-proof)	7
Star 16...	0.05	35	2700	0.11	80	0.66	–	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...

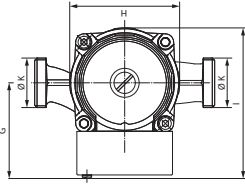
Wilo-Star S...	Rated Power		Speed n	Power consumption		Current 1-115 V, 60 Hz	Motor protection	Capacitor
	P ₂ [hp]	[W]		P ₁ [hp]	[W]			
Star S 16...	0.05	35	max. 2700	0.10	80	0.66	–	[μF]
Star S 21...	0.05	40	min. 1600	0.05	41	0.38	not necessary (blocking-current-proof)	7
			max. 2700	0.13	110	0.92	–	9

Dimension, weights

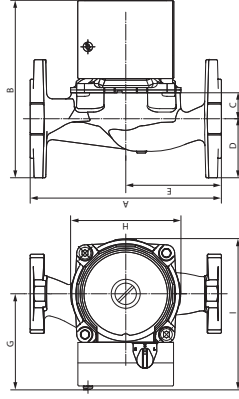
Wilo-Star, Drawing no.: 1



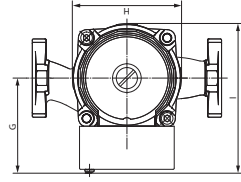
Wilo-Star, Drawing no.: 3



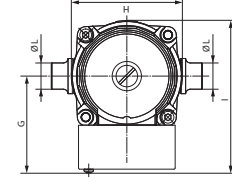
Wilo-Star S, Drawing no.: 5



Wilo-Star, Drawing no.: 2



Wilo-Star, Drawing no.: 4



Circulating Pumps
Wilo-Star/Star S

Dimension, weights

metric													
Wilo-Star...	A	B	C	D	E	F	G	H	I	Ø K	Ø L	M	Weight approx. [kg]
Star 2 BS 5	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	Draw- ing No.
Star 2 BS 5	127	125	24	23	64	15	81	93.5	128	16	22	-	3.0 4
Star 3 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 FFX	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 5 16 F	162	154	22	50	81	-	81	93.5	128	-	-	-	3.0 5
Star 5 16 FFX	162	154	22	50	81	-	81	93.5	128	-	-	-	3.0 5
Star 5 16 BFX	162	154	22	50	81	-	81	93.5	128	-	-	-	3.2 5
Star 5 21 F	162	154	22	50	81	-	81	93.5	128	-	-	-	3.0 5
Star 5 21 FFX	162	154	22	50	81	-	81	93.5	128	-	-	-	3.0 5
Star 5 21 BFX	162	154	22	50	81	-	81	93.5	128	-	-	-	3.3 5

Commercial Gauges

Type 1000, 2071A



The tradition of providing accurate, distinctive, reliable pressure instruments continues in Ashcroft 4 1/2" Type 1000 and type 2071A commercial gauges.

Ashcroft 4 1/2" Type 1000 gauges utilize a black steel case and ring, with a glass window. These gauges are appropriate for general industrial applications and can be customized to complement your equipment.

Ashcroft 4 1/2" Type 2071A, Contractor gauges, are constructed with a back flanged aluminum case, painted black, and a chrome ring with glass window. These gauges are designed to meet the needs of heating, ventilating, plumbing and air conditioning contractors. The accuracy of these gauges is ASME B40.1, Grade A, $\pm 2-1-2\%$.

Incorporated in both, Type 1000 gauges and Type 2071A gauges, is the PowerFlex™ movement. This movement provides superior resistance to shock, vibration, and pulsation; thereby assuring longer life for your pressure instrument.

True Zero™ indication, a standard feature on these gauges, reduces the potential risk of installing a damaged gauge on your equipment. Other benefits of this unique safety feature include reduced manufacturing and inspection costs.

As in all Ashcroft commercial instruments, the dial artwork is designed to provide gauges that are consistent in appearance, attractive, and easy to read.



Visit our website @ www.dresser.com/instruments/

Commercial Gauges

Product Specifications

Ashcroft Model Number: 1000, 2071A

Size: 4 1/2"

Case: 1000 - Black painted steel
2071A- Black painted aluminum with back flange

Ring: 1000 - Black painted steel, friction fit
2071A- Chrome plated steel, friction fit

Window: Glass

Dial: Black figures on white background, steel

Pointer: 1000 - Black, Aluminum
2071A- Adjustable, Black, Aluminum

Bourdon Tube: 1000 - Bronze
2071A- Bronze, soldered, siphon required for steam service

Movement: PowerFlex with polyester segment

Socket: Brass

Connection: 1/4" NPT lower

Ranges: Vacuum - 600 psi and compound

Accuracy: 1000 - ASME B40.1, Grade B, $\pm 3-2-3\%$

2071A- ASME B40.1, Grade A, $\pm 2-1-2\%$

Optional Features

Case: Case color (other than black)

Window: Plastic

Pointer: Adjustable (Type 1000)

Socket: Nickel Plated

Throttle plugs - 0.007" 0.013", 0.020", 0.063" orifices

Others: Customized dials

Chrome ring (Type 1000)

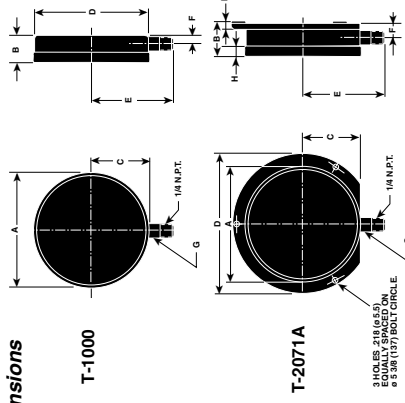
Black ring (Type 2071A)

Non-standard ranges

Special calibration on application

Specifications subject to change without notice.
Subject to standard terms and conditions of sale.
Copyright Instrument Division, Dresser Industries Inc., 595 CG 1021, 20M Rev 9/97

Dimensions



T-1000 4 1/2"	A	B	C	D	E	F	Wrench Fit G	Weight
Inches	4.75	1.13	2.34	4.69	3.38	0.34	9/16	12 oz.
mm	(121)	(29)	(60)	(119)	(86)	(9)	(14)	

T-2071A 4 1/2"	A	B	C	D	E	F	Wrench Fit G	I	Weight
Inches	4.75	1.41	2.38	5.81	3.38	0.47	9/16	0.42	0.25
mm	(121)	(36)	(60)	(148)	(86)	(12)	(14)	(11)	(6)
									16 oz.

How to Order

Dial Size: 4 1/2"
PowerFlex Movement
Case type number: 1000
Socket material: Brass
Connection size/location: 1/4" Lower
Option: Adjustable Pointer
Range: 100 psi

Domestic Headquarters

Berea, Kentucky

Harrison Road
Berea, KY 40403
Tel: (606) 986-9333
FAX: (606) 986-9333
FAX 1-800-288-3732
email: dresser-berea-mkt@dsph.com

International Headquarters

Stratford, Connecticut

250 E. Main Street
Stratford, CT 06497
Tel: (203) 378-8281
FAX: (203) 385-0499

Sales Offices

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Suite 316
Roselle, IL 60772-3392
Tel: (630) 980-9030
FAX: (630) 980-9440

Houston, Texas

3838 I. Sam Houston
Parkway East, Suite 120
Houston, TX 77032
Tel: (281) 590-1092
FAX: (281) 590-7100

Los Angeles, California

3831 MacArthur Blvd.,
Suite 202
Newport Beach, CA 92660
Tel: (714) 852-8948
FAX: (714) 852-8971

Hartford, Connecticut

1501 East Main St.
Meriden, CT 06450-2860
Tel: (203) 235-0450
FAX: (203) 235-0593

Mobile, Alabama

851 South Bellline Hwy., Suite 402, Mobile, AL 36606
Tel: (334) 473-1692 Fax: (334) 473-1782

4 1/2" Gauges Type 1000, Grade B, (3-2-3%) Type 2071A, Grade A, (2-1-2%)

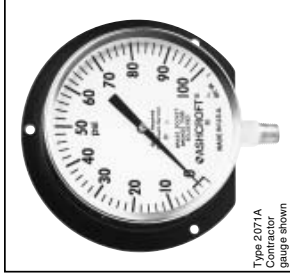
- Type 2071A contractor gauge offers aluminum-back flange case (black), with attractive chrome-plated steel ring
- Type 1000 gauge offers black steel case with black ring and glass window
- Adjustable pointer is standard on contractor gauges
- Patented PowerFlex™ movement with polyester segment
- True Zero™ indication, a unique safety feature

Ashcroft® Type 1000 gauges have a black steel case and ring with a glass window. These gauges are appropriate for general industrial applications and can be customized to complement your equipment.

Ashcroft contractor gauges (Type 2071A) are lightweight, highly sensitive and accurate. These gauges are designed to meet the needs of HVAC and plumbing contractors, and are tested against strict industry specifications. The aluminum case provides corrosion resistance.

The patented PowerFlex movement, in both Types 1000 and 2071A, provides the shock resistance needed for rough treatment.

True Zero indication reduces the potential risk of installing a damaged



Type 2071A
Contractor
gauge shown

gauge on your equipment. FlutterGuard™ is available to eliminate pointer flutter and extend gauge life.

GAUGE SPECIFICATIONS

	TYPE 1000	TYPE 2071A
Size:	4 1/2"	4 1/2"
Case:	Black-painted steel	Aluminum with back flange, painted black.
Ring:	Black-painted steel, friction fit	Chrome-plated steel, friction fit
Window:	Glass	Glass
Dial:	Black figures on white background	Black figures on white background
Pointer:	Black, aluminum	Adjustable, black, aluminum
Bourdon tube:	Bronze, soldered	Bronze, soldered (siphon required for steam service)
Movement:	Patented PowerFlex with polyester segment	Patented PowerFlex with polyester segment
Socket:	Brass	Brass
Connection:	1/4 NPT lower	1/4 NPT lower
Ranges:	Vacuum through 600 psi and compound	Vacuum through 600 psi and compound
Operating temperature:	-40°F to 150°F	-40°F to 150°F
Options:	Case color other than black Plastic window (PD) Chrome ring (13) FlutterGuard (SF) Adjustable pointer (AP) Nickel-plated socket (NP)	Case color other than black Plastic window (PD) Nickel-plated socket (NP) FlutterGuard (SF) Black steel ring Customized dials Throttle plugs: 0.007", 0.013", 0.020", 0.063" orifices Special calibration on application

TO ORDER THESE TYPE 1000/2071A GAUGES:

Select:

1. Dial Size: 4 1/2" _____

2. Patented PowerFlex™ Movement _____

3. Case Type Number: 2071A _____

4. Connection Size/Location: 1/4 NPT lower _____

5. Range: 300 psi _____

45 W 2071A 02L 300 #

Reference Bulletin CG-10/21

Consult factory for guidance in product selection
Phone (859) 986-9333, FAX 1-800-282-3732 or
visit our web site at www.ashcroft.com

MADE IN U.S.A.

For Commercial Water Heater Applications

Job Name

Contractor

Job Location

Approval

Engineer

Contractor's P.O. No.

Approval

Representative

Series 40, 140, 240 & 340
Automatic Re-seating T&P Relief Valves

The combined 2-in -1 Temperature & Pressure relief valve provides the least expensive and proven means for protection against both excessive temperature and pressure emergency conditions.
Fully automatic temperature and pressure relief protection for domestic hot water supply tanks and heaters based on the latest ANSI Z21.22 Listing Requirements for temperature discharge capacity.

40XL with test lever and extension thermostat for installation in hot water outlet within the allowable distance from the top of the tank based on latest ANSI Z21.22. Sizes: ¾" and 1" (19-25mm).
40L with test lever and short thermostat for installation directly in available tank tapings. Sizes: ¾" and 1" (19-25mm).

Series 140, N240 and 340 have the same basic body construction and advanced design features as the 40 Series and are identical to the 40 Series except for discharge capacity and size of inlet and outlet connections. For complete specifications (including specifications for the 40 Series) see other side. Sizes: 1", 1¼", 1½" and 2" (25, 32, 38 and 50mm).

FEATURES

- Bronze body construction.
- Non-mechanical seat-to-disc alignment.
- Thermostat is accurate and proven. Exclusively designed and manufactured by Watts.
- Tamper-resistant bonnet screws.
- Series 40 and 140 feature a unique thermostat with a special thermo-bonded coating.
- 1" (25mm) and above sizes Model M15, M2 and M4 are standardly furnished with stainless steel thermostat tube.

SPECIFICATIONS

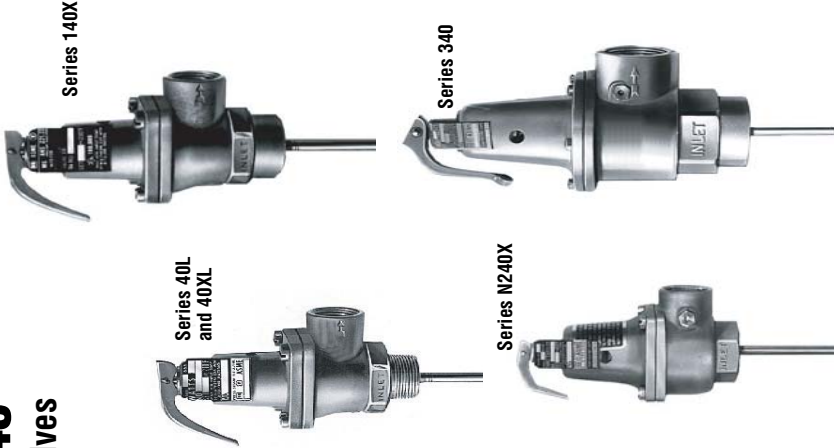
Temperature & Pressure Relief Valves
Each hot water storage heater shall be equipped with an automatic temperature and pressure relief valve to protect the heater from excessive pressure and excessive temperature. The device shall be certified as meeting the requirements of ASME low pressure heating boiler code and ANSI Z21.22. The BTU discharge capacity of the device shall be in excess of the BTU input rating of the heater. Watts Regulator Company Series 40, 140, 240 and 340.

STANDARDS

ASME Rated, ANSI Z21.22. Design certified and listed by CSA and meet current FHA requirements and ANSI Z21.22 in addition to Military Spec. MIL-V-136-12D, Type 1.

PRESSURE - TEMPERATURE

Temperature relief 210°F (98.9°C).
Pressure range 75-150 psi (5.17-10.34 bars).
Standard setting 75, 100, 125 and 150 psi (5.17, 6.9, 8.61 and 10.34 bars).



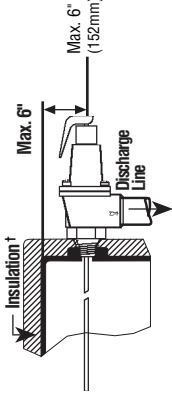
Following installation, the valve lever MUST be operated AT LEAST ONCE A YEAR by the water heater owner to ensure that the waterways are clear. Certain naturally occurring mineral deposits may adhere to the valve, blocking waterways, rendering it inoperative. WHEN THE LEVER IS OPERATED, HOT WATER WILL DISCHARGE IF THE WATERWAYS ARE CLEAR. PRECAUTIONS MUST BE TAKEN TO AVOID PERSONAL INJURY FROM CONTACT WITH HOT WATER AND TO AVOID PROPERTY DAMAGE.

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

Direct Side Tapping

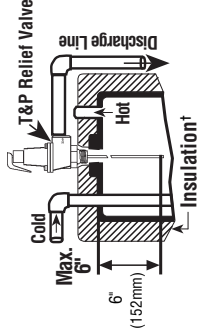
FOR EXTERNAL FLUE HEATERS
Use extra length extension thermostat to extend into water storage tank.

FOR INTERNAL FLUE HEATERS
Use short or standard length thermostat. Vertical discharge line must be installed with its direction downward.



For Heaters with Direct Top

Use standard or extra length extension thermostat.



GENERAL RECOMMENDATIONS†

For gas, electric or oil-fired storage water heaters between 180,000 to 200,000 BTU/Hr., rating: Use ¾" (19mm) Series 40, 140 tested under ANSI Z21.22 with ratings as certified and listed by CSA.

For gas or oil-fired storage water heaters between 200,000 and 730,000 BTU/Hr., rating and for compliance with applicable water heater labeling requirements: Use 1" (25mm) 40, 140, N240 Series tested under ANSI Z21.22 with ratings as certified and listed by CSA.

For installations of gas or oil-fired hot water supply boilers over 730,000 BTU/Hr., output heating domestic water and for steam coil storage water heaters:

Use Series 340, 342 tested under ANSI Z21.22 with rating as certified and listed by CSA.

SPECIAL MODEL; No. 340X-8 MAZ 1½" (38mm) size only. Pressure setting 175 psi (5.17 bars). Temp. 210°F (98.9°C). Certified by CSA only.

Type No.	Model	Inlet X Outlet (in.)	Thermostat Length (in.) (Below Inlet Thread)	Dimensions (in.)			CSA Temp. Rating BTU/Hr	**ASME Pressure Steam Rating BTU/Hr			
				Height (Less Thermostat)	Width	Weight Lbs.		@75psi set pres.	@100psi set pres.	@125psi set pres.	@150psi set pres.
40L-3	M15	¾" M x ¾" F	3	5½"	2½"	1¾"	180,000	777,600	997,600	1,217,600	1,437,600
40XL-5	M15	¾" M x ¾" F	5	5½"	2½"	1¾"	200,000	777,600	997,600	1,217,600	1,437,600
40XL-8	M15	¾" M x ¾" F	8	5½"	2½"	1¾"	200,000	777,600	997,600	1,217,600	1,437,600
140S-3	M15	¾" F x ¾" F	3	5½"	2½"	1¾"	180,000	777,600	997,600	1,217,600	1,437,600
140S-5	M15	¾" F x ¾" F	5	5½"	2½"	1¾"	200,000	777,600	997,600	1,217,600	1,437,600
140S-8	M15	¾" F x ¾" F	8	5½"	2½"	1¾"	200,000	777,600	997,600	1,217,600	1,437,600
40L-2	M15	1" M x 1" F	2	6¼"	2½"	2¼"	450,000	1,155,000	1,481,000	1,888,000	2,194,000
40XL-4	M15	1" M x 1" F	4	6¼"	2½"	2¼"	500,000	1,155,000	1,481,000	1,888,000	2,194,000
40XL-7	M15	1" M x 1" F	7	6¼"	2½"	2¼"	500,000	1,155,000	1,481,000	1,888,000	2,194,000
*140S-3	M15	1" F x 1" F	3	5½"	3	2¼"	570,000	1,670,000	2,140,000	2,610,000	3,085,000
*140X-6	M15	1" F x 1" F	6	5½"	3	2¼"	670,000	1,670,000	2,140,000	2,610,000	3,085,000
*140X-9	M15	1" F x 1" F	9	5½"	3	2¼"	670,000	1,670,000	2,140,000	2,610,000	3,085,000
*N240X-6	M2	1" F x 1" F	6	6½"	3½"	2½"	730,000	2,195,000	2,817,000	3,438,000	4,059,000
*N240X-9	M2	1" F x 1" F	9	6½"	3½"	2½"	730,000	2,195,000	2,817,000	3,438,000	4,059,000
*N241X-5	M2	1¼" M x 1" F	5	6½"	3½"	2½"	730,000	2,195,000	2,817,000	3,438,000	4,059,000
*N241X-8	M2	1¼" M x 1" F	8	6½"	3½"	2½"	730,000	2,195,000	2,817,000	3,438,000	4,059,000
*340-3	M2	1½" F x 1½" F	3	9¼"	4½"	7	1,150,000	3,450,000	4,426,000	5,403,000	6,379,000
*340X-8	M4	1½" F x 1½" F	8	9¼"	4½"	8	1,150,000	3,450,000	4,426,000	5,403,000	6,379,000
*342X-8	M4	2" M x 1½" F	8	9¼"	4½"	8	1,150,000	3,450,000	4,426,000	5,403,000	6,379,000

*Standardly furnished with stainless steel thermostat tube.

**ASME capacities are steam pressure ratings and do not reflect the CSA temperature relieving capacity of the valves for selection purposes.

†LL40XL and LLL40XL valves with extended inlet shanks should be used for water heaters that have extra thick insulation, Ask for ES-LL/LLL-40XL.

F = Female

M = Male

Temperature and Pressure Relief Valves should be inspected AT LEAST ONCE EVERY THREE YEARS, and replaced, if necessary, by a licensed plumbing contractor or qualified service technician, to ensure that the product has not been affected by corrosive water conditions and to ensure that the valve and discharge line have not been altered or tampered with illegally. Certain naturally occurring conditions may corrode the valve or its components over time, rendering the valve inoperative. Such conditions can only be detected if the valve and its components are physically removed and inspected. Do not attempt to conduct an inspection on your own. Contact your plumbing contractor for a reinspection to assure continuing safety.



USA: 815 Chestnut St., No. Andover, MA 01845-6088; www.wattsreg.com
Canada: 5435 North Service Rd., Burlington, ONT. L7L 5H7; www.wattscca.com



ES-40, 140, 240, 340 0130

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VACUUM BREAKERS

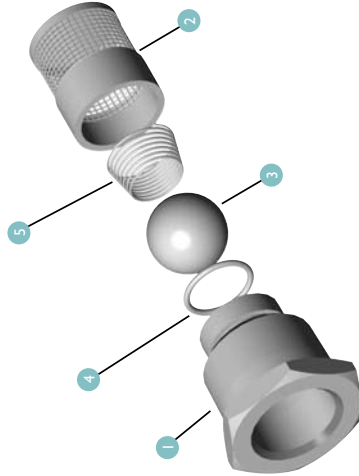
Johnson Vacuum Breakers provide a simple, dependable way to relieve unwanted vacuum which may develop in a closed vessel or pipeline. They can be used to prevent contamination from back siphonage in fluid handling systems, and to protect equipment against collapse or implosion. They combine tight closing with instant response, provide large air venting capacity, and are designed for easy installation and long service life.

OPERATING PARAMETERS

Temperature
Up to 365°F

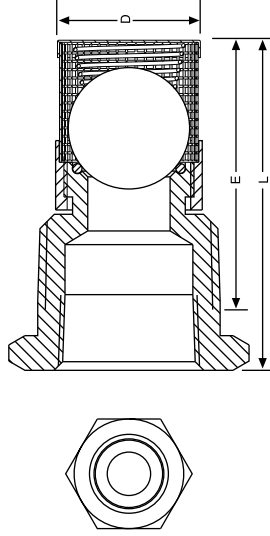
Pressure
Up to 300 psig

Note: Maximum limits vary in relation to changes in pressure, and temperature. Consult Johnson for safe limitations under your specific application conditions. Assembly dimensions are +/- 1/8".



- 1 Body
- 2 Retainer Tube
- 3 Ball
- 4 O-Ring
- 5 Spring

SERIES VB8 VACUUM BREAKERS



Catalog Number	Pipe Thread Size	Outlet Pipe Size	Total Length "L"	Engaged Length "E"	OD of Tube "D"	Hex Body Size	Diameter of Orifice	Diameter of Ball
VB8-38-BR-P-S-E	3/8	1/4	1-1/2	1-1/8	9/16	3/4	1/4	3/8
VB8-51-BR-P-S-E	1/2	3/8	1-3/4	1-3/8	11/16	1	9/32	1/2
VB8-76-BR-P-S-E	3/4	1/2	2-1/8	1-5/8	13/16	1-1/4	13/32	5/8
VB8-101-BR-P-S-E	1	3/4	2-3/8	1-7/8	1-1/6	1-1/2	19/32	7/8
VB8-126-BR-P-S-E	1-1/4	1	2-15/16	2-5/16	1-5/16	1-3/4	3/4	1-1/16
VB8-151-BR-P-S-E	1-1/2	1-1/4	3-1/16	2-1/2	1-9/16	2	7/8	1-3/16

Explanation of Catalog Numbers

Series	VB8 Vacuum Breakers
Size	38 = 3/8" 51 = 1/2" 76 = 3/4" 101 = 1" 126 = 1-1/4" 151 = 1-1/2"
Body	BR = Brass SS = Stainless Steel
Outlet	P = Plain T = Threaded
Ball	S = Stainless Steel
Seal	E = EPR (Specify alternate by name)

Vacuum Required to Open			Horizontal		Vertical		
			Top Outlet	Bottom Outlet	Top Outlet	Bottom Outlet	No Spring
VB8-38 3/8"	In. H ₂ O	70	4.3	10.5	4.3	10.5	3.5
	In. Hg	0.51	0.32	0.77	0.32	0.77	0.26
	PSI	0.25	0.16	0.38	0.16	0.38	0.13
VB8-51 1/2"	In. H ₂ O	9.3	10.6	18.0	10.6	18.0	4.4
	In. Hg	0.68	0.78	1.32	0.78	1.32	0.32
	PSI	0.34	0.38	0.65	0.38	0.65	0.16
VB8-76 3/4"	In. H ₂ O	15.3	15.0	25.0	15.0	25.0	5.1
	In. Hg	1.13	1.10	1.84	1.10	1.84	0.37
	PSI	0.55	0.54	0.90	0.54	0.90	0.18
VB8-101 1"	In. H ₂ O	10.0	5.9	19.5	5.9	19.5	6.6
	In. Hg	0.73	0.43	1.43	0.43	1.43	0.48
	PSI	0.36	0.21	0.70	0.21	0.70	0.24
VB8-126 1-1/4"	In. H ₂ O	10.5	7.1	21.0	7.1	21.0	6.9
	In. Hg	0.77	0.52	1.54	0.52	1.54	0.51
	PSI	0.38	0.26	0.76	0.26	0.76	0.25
VB8-151 1-1/2"	In. H ₂ O	10.0	4.9	20.3	4.9	20.3	7.9
	In. Hg	0.73	0.36	1.49	0.36	1.49	0.58
	PSI	0.36	0.18	0.73	0.18	0.73	0.29

Note: Stainless Steel Ball was used to arrive at all figures. Values given are averages of test results and may vary slightly.

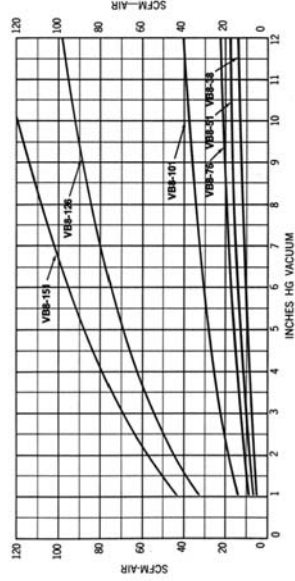
Dimensions are in inches and for reference only. Certified drawings are available on request.

Vacuum Breakers - page 2



Approximate Series VB8 Air Handling Capacities

The air handling capacity curves were plotted from calculations using the C_v factors of the vacuum breaker units. The C_v factor is a flow coefficient determined by actual test which mathematically gives the relationship between the rate of flow and the pressure drop. The flow formula used was recommended by the Fluid Controls Institute.



Note: Capacities will vary slightly due to position of installation or kind of ball.

Typical Installations—JOHNSON VACUUM BREAKERS

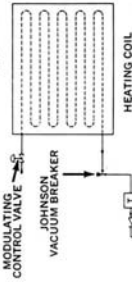


Figure 10 — Johnson Vacuum Breaker installed on heating coil. When the modulating control valve closes, the steam in the coil will collapse, a vacuum will exist in the coil with the vacuum breaker valve and positive pressure between the control valve and the coil.

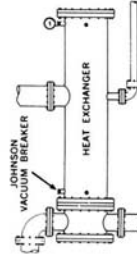


Figure 13—Typical installation of a Johnson Vacuum Breaker in a heat exchanger.

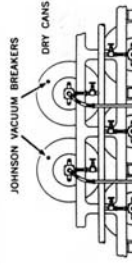


Figure 11—Textile dry cans, multiple alasher cylinders, print cans, etc., can be protected from water collapse with Johnson Vacuum Breakers.

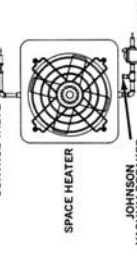


Figure 14—Typical space heater installation with Johnson Vacuum Breaker protection.

Typical Installations—JOHNSON VACUUM BREAKERS

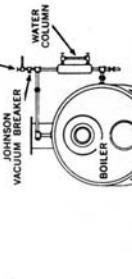


Figure 12—Typical application of a Johnson Vacuum Breaker as used on a steam boiler to break a vacuum imposed when a boiler is flooded. The vacuum breaker is installed in the boiler and creates a vacuum. This condition causes the boiler to be flooded by pulling in excess water from the return system. The vacuum breaker is installed at the top of the water column as illustrated.

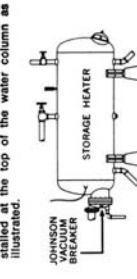
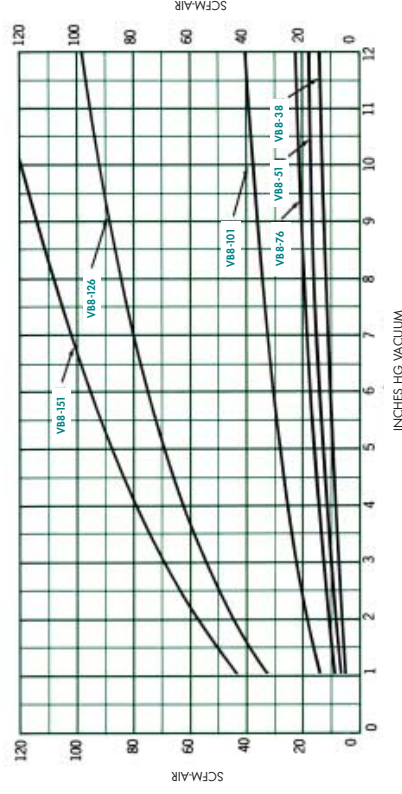


Figure 15—Horizontal storage heater with vacuum breaker protection by a Johnson Vacuum Breaker.

Approximate Series VB8 Air Handling Capacities

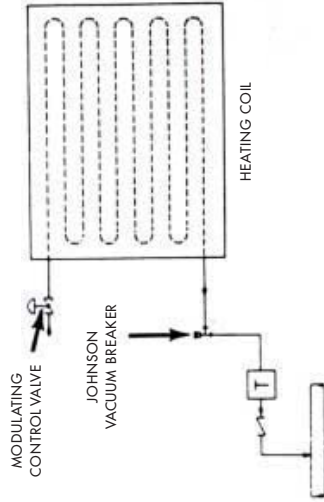
The air handling capacity curves were plotted from calculations using the C_v factors of the vacuum breaker units. The C_v factor is a flow coefficient determined by actual test which mathematically gives the relationship between the rate of flow and the pressure drop. The flow formula used was recommended by the Fluid Controls Institute.



NOTE: Capacities will vary slightly due to position of installation or kind of ball.

VACUUM BREAKERS

Typical Installations of Johnson Vacuum Breakers



Johnson Vacuum Breaker installed on heating coil. When the modulating control valve closes, the steam in the coil will condense. Actually, a vacuum can exist in the coil with the control valve partly open and positive pressure between the control valve and the coil.

THE JOHNSON CORPORATION

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VACUUM BREAKER INSTALLATION

Figure 1 – Standard Vertical Installation

Pipe as shown if possible for a preventative measure. If the outlet is exposed it can become fouled with dust and dirt. Upon operation this contamination can prevent the vacuum breaker from resealing.



Figure 2 – High Temperature or Hazardous Chemical Service

Pipe as shown for safety reasons. After undeterminable amount of time the vacuum breaker will fail. Having the outlet piped to a safe location eliminates a safety hazard. Although the installation shown is vertical with outlet on the bottom, this should be done regardless of the installation orientation.

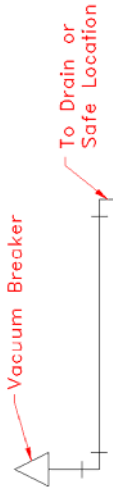


Figure 3 – High Temperature Installation

Piping the vacuum breaker as shown can eliminate the need for special high temperature seals. The temperature at the vacuum breaker varies depending the steam line temperature. The pigtail should be sized to have a flow area equal or greater than that of the vacuum breaker used.

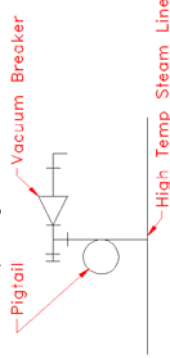
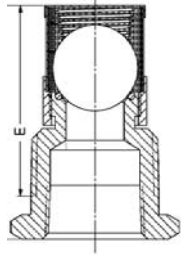


Figure 4 - Engaged Length

When piping in the vacuum breaker, attention should be given to the engaged length "E".

- The vacuum breaker should never be installed such that the screen is in the flow path. In instances of high velocities the correct operation can be disrupted as well as damage to the vacuum breaker.
- Vacuum breakers should be installed in pipe couplings to prevent damage on installation. An example of this would be installation in the short side of a pipe tee where the screen could be crushed.



Honeywell

L6006 and L6007

Aquastat® Controllers

Installation Instructions for the Trained Service Technician.

Application

These Aquastat® Controllers operate in response to temperature changes in hydronic heating systems. They provide spdt switching for three-wire applications.

The L6006A,B and L6007A combine low or high limit and circulator control; L6006C combines circulator control with low and high limit.

The L6006A,B are for horizontal insertion; the A model uses an immersion well; the B model uses a capsule compression fitting for direct immersion. The L6006C is for horizontal or vertical surface mounting. The L6007A is for horizontal or vertical insertion using an immersion well.

If immersion well or capsule compression fitting must be ordered, refer to form 68-0040, Wells and Fittings for Temperature Controllers, for part numbers and ordering information.

ELECTRICAL RATINGS (A):

	120 Vac	240 Vac
Full Load	8	5.1
Locked Rotor	48	30.6
Inductive Current	0.25 at 1/4 to 12 Vdc	

Installation

WHEN INSTALLING THIS PRODUCT...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.



WARNING

CAN CAUSE PROPERTY DAMAGE, SEVERE INJURY OR DEATH.

This product is intended for use only in systems with a pressure relief valve.



CAUTION

Disconnect power supply before connecting wiring to prevent electrical shock or equipment damage.

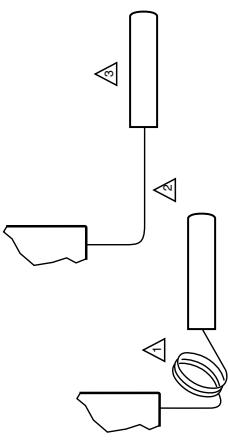
IMPORTANT: Controller can be used with or without immersion well. If used, well must snugly fit sensing bulb for good thermal response. Bulb should be inserted until it rests against bottom of well, and then held there while the tubing clamp is tightened.

NOTE: Some models have an adjustable tubing length to 3 in. (76 mm). In these models, extra tubing inside the case can be pulled out, if needed. See Fig. 1.

The manufacturer usually provides a tapping for insertion of the controller sensing element. This tapping is located at a point where typical water temperature can be measured. Depending on model, the element is inserted in an immersion well or directly immersed through a capsule compression fitting.

Follow the instructions furnished by the system manufacturer, if available; otherwise, refer to the appropriate following procedure.

Fig. 1—Adjusting the capillary length.



CAUTION:
EXCESSIVE HANDLING OR SHARP BENDS CAN DAMAGE THE CAPILLARY.

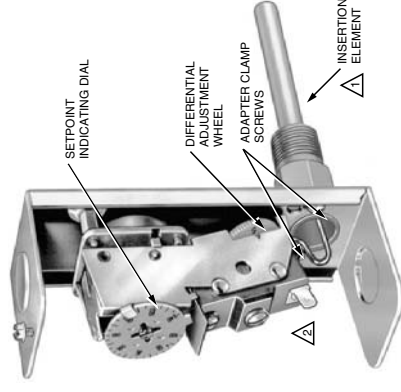
- △ SENSING ELEMENT IS FACTORY FORMED FOR 1.5 INCH INSULATION WELL ASSEMBLIES.
- △ FOR 3 INCH INSULATION WELL ASSEMBLIES, PULL OUT SUFFICIENT CAPILLARY TO ASSURE THAT THE CAPSULE BOTTOMS IN THE WELL.
- △ STRAIGHTEN CAPILLARY SUFFICIENTLY SO IT DOES NOT INTERFERE WITH INSERTING THE CAPSULE INTO THE WELL.

INSTALLING IMMERSION WELL MODELS (L6006A, L6007A)

On existing installation, shut off the power and remove the old control. If the old immersion well appears suitable, and the adapter clamp on the Aquastat® Controller fits the old well spud, do not replace.
1. If the system is filled, drain system to a point below the boiler tapping.

2. Remove plug (or old well) from boiler tapping.
3. Install the immersion well included with the controller. If boiler tapping is greater than 1/2 in., use a reduction fitting to adapt the boiler opening to the 1 in. threads that are standard with the well or fitting. Fittings with 3/4 in. threads are also available.
4. Fill the system. Make sure that the well is screwed in tightly enough to prevent leakage. Do not tighten after controller is secured to well because of possible excessive force on the case.
5. Loosen screw (at top of case, above scale setting), and remove cover. Loosen two screws that secure adapter clamp. See Fig. 2.
6. Insert the sensing element into the immersion well.
7. Fasten the case of the Aquastat® Controller to the well with the adapter clamp. Make certain that the clamp is properly positioned over the groove of the well spud. Also, be sure the flange at the opening of the well fits snugly into the opening of the case. The sensing element bulb must bottom in the well.

Fig. 2—Internal view of L6006A,B (L6006C and L6007 are similar in appearance).



- △ WITH VERTICAL MOUNTING OF IMMERSION WELL, ELEMENT IS ATTACHED TO BOTTOM OF THE CASE.
- △ SELECT MODELS HAVE SCREW TERMINAL, NOT TAB TERMINAL.

INSTALLING DIRECT IMMERSION MODELS (L6006B)

- Install fitting in boiler tapping as follows:
1. Be sure sealing washer is in place as shown in Fig. 3. Make sure that spud of capsule compression fitting is screwed in tightly enough to prevent leaking.
 2. Insert immersion bulb (sensing element) through capsule compression fitting. Adjust the adapter clamp so that it fits over the groove of the opening of the capsule compression fitting.
 3. Tighten adapter clamp screws so the Aquastat® Controller is firmly attached to the capsule compression fitting.

INSTALLING SURFACE-MOUNTED MODEL (L6006C)



CAUTION

- Do not replace immersion type Aquastat® Controller with strap-on Aquastat® Controller.
- When mounting the L6006C, do not secure drain nut so tight that retainer clamp could collapse tubing.

NOTE: When mounting the L6006C on piping, use 1 in. (25.4 mm) diameter or larger pipe for accurate temperature sensing. Remove any insulation from the pipe. Thoroughly scrape off all scale, rust, or paint. Mount the controller using the adjustable bracket furnished.

The L6006C is designed for surface mounting on piping or tanks. Mount the L6006C directly on the tank surface using the adjustable mounting bracket as shown in Fig. 4. The control can be mounted in any position. (If mounting the L6006C on piping, see NOTE above.)

WIRING

Disconnect power supply before connecting wiring to prevent electrical shock or equipment damage. All wiring must comply with local electrical codes and ordinances.

Fig. 5 and 6 show typical wiring diagrams of Aquastat® Controllers used in heating systems.

When the W terminal on the device being replaced is a 1/4 in. tab terminal, use the existing wiring harness terminals to install the replacement device. When the W terminal on the device being replaced is a screw terminal, connect the provided wire harness adapter on the 1/4 in. tab terminal of the replacement device. Connect the existing wire to the adapter harness using the provided wire nut.

Operation

For proper selection of settings, follow the boiler manufacturer recommendations.

High limit controller—shuts off burner when water temperature exceeds high limit setting. Burner restarts when temperature drops to high limit setting, less differential.

Low limit controller—maintains minimum boiler temperature for domestic hot water. Turns on burner at temperature setting, minus differential.

Circulator controller—prevents circulation of water that is not hot enough. Breaks circulator circuit at temperature setting minus differential; remakes the circuit when the temperature setting is reached.

Switching action is as follows:
Upon a drop in boiler water temperature (to dial setting, less differential), makes R to B burner contact; breaks R to W contact, preventing circulator operation. Upon a rise in boiler water temperature (to dial setting), breaks R to B burner contact, makes R to W circulator contact.

Adjustment

Set the differential to correspond with the boiler manufacturer recommendations. To adjust models with adjustable differential, rotate the wheel on the back of the snap switch until the desired reading is aligned with the V notch in the frame. The wheel provides an adjustment from 5°F to 30°F (3°C to 17°C). Replace the cover on the Aquastat® Controller.

Adjust control point to correspond with the boiler manufacturer recommendations. To adjust, insert a screwdriver in the slotted screw type head located beneath the window in the cover. Turn the scale to the desired control point.

Fig. 3—Direct immersion model with bulb compression fitting partially removed.

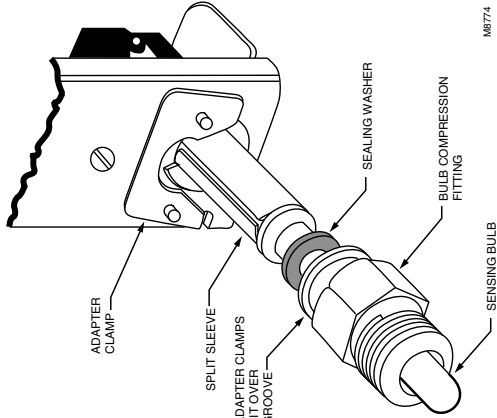


Fig. 4—Mounting L6006C on pipe or tank.

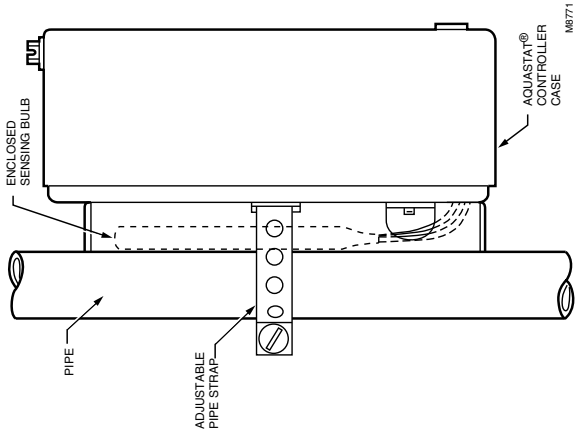
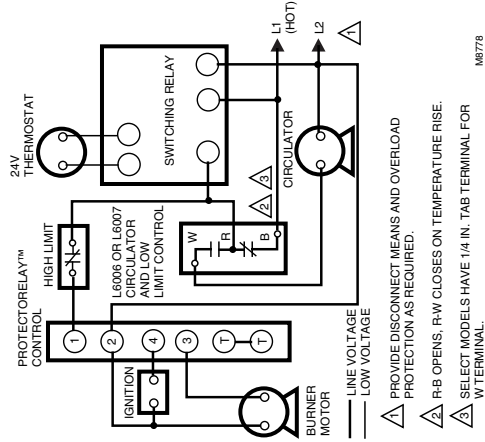


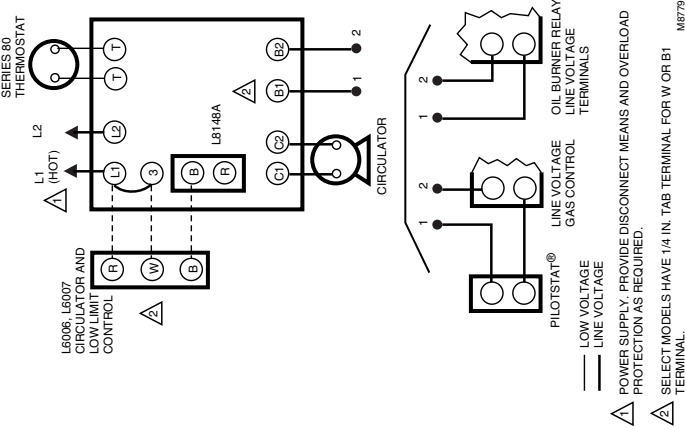
Fig. 5—Typical wiring hookup using the L6006 or L6007 for low limit and circulator control in oil-fired hydronic system.



Checkout

Check to make certain that the Aquastat® Controller is installed and adjusted properly. Put the system into operation and observe the action of the device through several cycles to make certain that it provides proper low and/or high limit and circulator control.

Fig. 6—Typical wiring hookup using L6006 and L6007 with L8148A.



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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

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SO # _____

Serial No. _____

Model No. _____