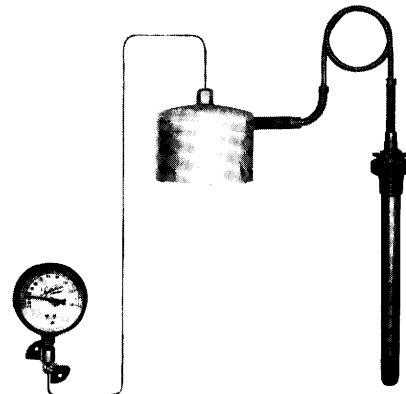
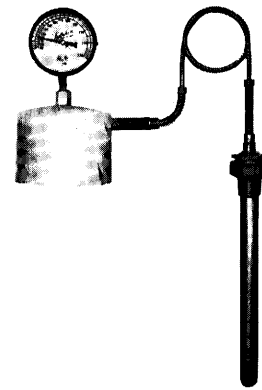


**RT-1009-A1**  
Without Thermometer



**RT-1009-B1**  
Integral Thermometer



**RT-1009-C1**  
Remote Thermometer

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## INSTRUCTIONS FOR INSTALLATION AND OPERATION RT-1009 SERIES TEMPERATURE REGULATOR

**NOTE TO INSTALLER:** Carefully read entire instructions before attempting installation. After installing the regulator and making final adjustments, give this instruction folder to the operating personnel or see that it is filed for future reference.

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**INSTRUCTION MANUAL NUMBER**

**P-2076**

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## PRINCIPLE OF OPERATION

This regulator automatically controls flow of the medium passing through its valve by responding to temperature changes at the remote bulb. The bulb contains a volatile liquid which vaporizes when heated. Vapor pressure thus generated in the bulb is transmitted through the capillary tube to the bellows which in turn positions the valve plug to control flow of the medium through the valve. Control or set point is governed by opposing spring adjustment.

The RT-1009 regulator is equipped with a hand crank by which the valve can be manually operated independent of the regulator thermostatic assembly. It can be returned to automatic control.

Should the thermostatic assembly become inoperative due to damage, the regulator valve can be manually opened, closed or positioned while the thermostatic assembly is removed for replacement. An indicator shows the position of the valve plug. See "Thermostatic Assembly."

This regulator is active only within the temperature range on its nameplate and may be adjusted to operate at any point within that range; however, the control is best with the setpoint located in the upper third of the range. Action at this point is proportional.

## VALVE INSTALLATION

Regulator valves should be sized to the actual demand of heater or other unit to be controlled and are frequently smaller than the supply line size.

When making the installation, do not remove the valve from the regulator yoke unless absolutely necessary.

## CAUTION

If valve seat leakage can cause a problem or a hazard, the following should be taken into consideration. Maximum leakage of new valves: single-seated (type A) — 0.05% of the full open valve capacity; single-seated, balanced (type MA or MAS) — 0.01%; double-seated (type FA, etc.) — 0.05%. This leakage will usually increase somewhat as the valve seats wear in service.

The regulating valve should be installed as close as possible to the unit to be controlled and a pipe line strainer should be placed just ahead of the valve. Preferably, the regulator should be installed vertically (with valve below the regulator yoke). Regulator sizes 3" and larger must be installed vertically. Install valve so that flow is in the direction of the arrow on the valve body.

When controlling steam, provision should be made to drain the coil or other condenser through a steam trap of adequate capacity and, if possible, with a good fall to the trap and no back pressure. Best control is obtained where coil or condenser is kept dry.

When controlling brine in cooling applications, the valve should be installed on the return end of the unit where it is least subject to frosting. See Figures 32 and 33.

When controlling the flow of water used for cooling, the valve is usually on the supply end but may be on either end of the unit, depending on the nature of the installation, particularly with regard to back-up full line pressure in the vessel. Figure 27 shows a cooling application where the regulator is installed in the return water line where control is applied to the combustion engine jacket cooling.

## CONNECTIONS FOR TYPE "WBI" OR "WD" VALVE

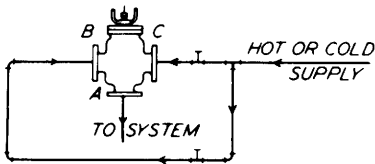


Figure 2

Showing how connections would be made where it is desired to shift from heating service to cooling service by manually opening and closing proper valves in the supply line.

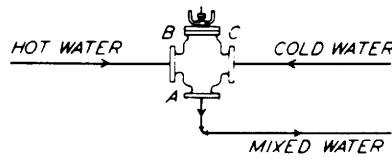


Figure 3

Illustrating a simple means for mixing hot and cold water where a rough mixing is suitable.

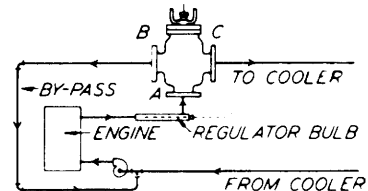


Figure 4

The drawing above illustrates the most widely used method of cooling water control for internal combustion engines.

## CONNECTIONS FOR TYPE "WA" VALVE

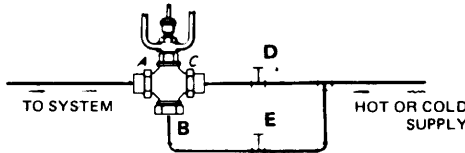


Figure 5

Showing how connections would be made where it is desired to shift from heating service to cooling service by manually opening and closing proper valves in the supply line.

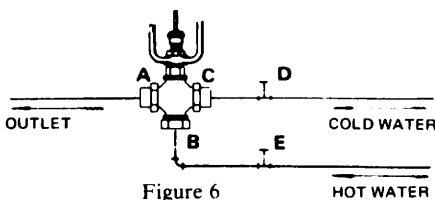


Figure 6

Illustrating a simple means for mixing hot and cold water where a rough mixing is suitable.

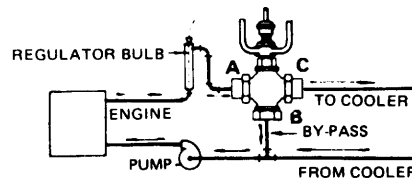


Figure 7

The drawing above illustrates the most widely used method of cooling water control for diesel engines.

Cooling regulators are reverse-acting and open with downward stroke on rise in temperature at the bulb. On applications where by-pass control only is utilized, a direct-acting valve is utilized.

### 3-WAY WA, WBI AND WD VALVE ASSEMBLIES

Particular care must be taken when installing the three-way valve assembly to make sure pipe connections are proper to obtain the control desired. The drawings on page 2 show the direction of flow through the valve when used for the purposes stated. You can identify the connections on the WA or WBI by the letters A, B, and C stamped on the valve assembly. The A port is "common" on the WA and WBI valves. On the WD valve the letter E is used instead of A.

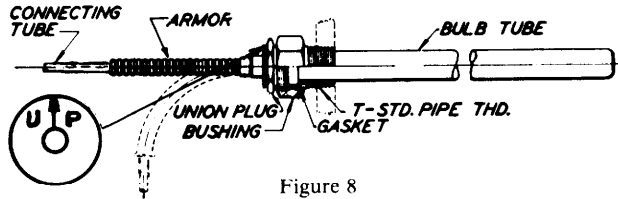


Figure 8  
12B bushed type bulb for temperature control of liquids.

### BULB INSTALLATION

**IMPORTANT** — Correct bulb location and installation is the most important aspect of regulator action. The bulb should be installed at a point of true representative temperature and should be in good circulation. If a thermometer is used, it should be placed adjacent to the bulb. The recommended position is horizontal, with the bulb rotated so that the arrow on the position disc, at the bulb head, is pointing UP. Installation with the union connection end above the horizontal position is possible, but with a change in control.

**CAUTION**

Do not install the bulb with the union connection end below the horizontal position, unless specifically ordered for such installation prior to manufacture. See Figures 8 and 9.

NOTE: Placing the bulb higher or lower than the regu-

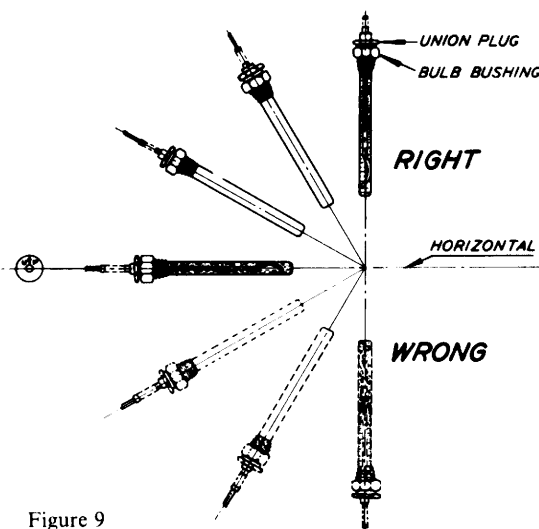


Figure 9

Showing RIGHT and WRONG way to install bulb. Positions from horizontal to vertical, inclusive, are correct if arrow on head plate points UP. For positions below horizontal, marked WRONG, a special bulb must be ordered.

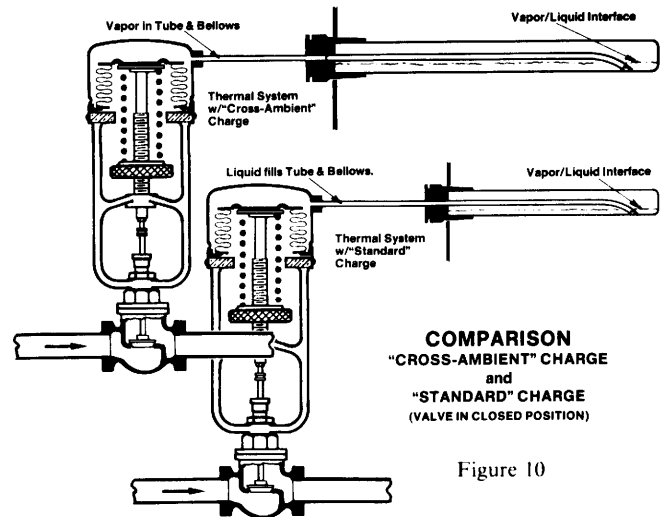


Figure 10

lator head will affect the temperature range of the regulator. This is due to the pressure of the liquid column in the capillary tube between the regulator head and the bulb.

### Example:

The effect on the temperature range of a regulator with a range starting above 120° on an installation where the bulb is always hotter than the capillary tube or regulator head is as follows:

1. Range lowered if the bulb is above the regulator.
2. Range raised if the bulb is below the regulator.

NOTE: When the ambient temperature around the regulator and/or the capillary tube is greater than the temperature at the bulb, a Class IIC (cross-ambient, ranges normally starting at or below 120°) charged unit must be used. Units that have a cross-ambient charge should be installed with the regulator head and the bulb at the same elevation. See Figure 10.

### LIQUID CONTROL — Type 12

The bulb for liquid control is of smooth tubular form with a threaded bulb bushing as shown by Figure 8. To install this bulb, loosen the union connection until the bulb bushing turns freely on the bulb. Insert the bulb and bushing into the selected opening and screw the bulb bushing up tight. Turn the bulb until the arrow on the position disc points UP. Tighten the union connection, making sure not to turn the bulb from the UP position. The bulb bushing can be removed from the bulb by screwing the union connection all the way out, and in like manner, the bulb may be removed from its installed position without disturbing the bulb bushing.

The bulb may be installed horizontally or upright or at any angle between these positions. But in all cases, the arrow and/or the word UP on the position disc MUST be uppermost (see "Right", Figure 9). Unless specifically ordered for such installation, the bulb should never be installed with the bushing end downward or below the horizontal position (see "Wrong", Figure 9).

### NOTE:

A horizontal bulb orientation or position provides faster response time since the surface area of the volatile liquid is larger. See Figure 10.

A bulb in gravity circulation heaters should be above

the heating surface, but not closer than 4" at any point. See Figure 24.

For instantaneous heaters, the bulb should be in the heater outlet line and as close as possible to the point where this line connects to the heater. See Figure 25. For such installation, the pipe line should be at least twice the bulb diameter to obtain free flow around the bulb. See Figure 11. The flow of the medium should be from the tip end of the bulb to the connection end (see arrows, Figure 11).

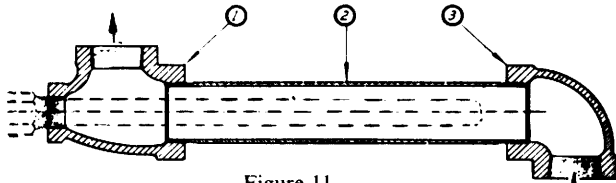


Figure 11

The drawing above shows how the regulator bulb may be installed in the pipe line. The pipe size (detail 2) should be at least twice the bulb diameter so that free flow can be had around the bulb. Where the pipe line is not of sufficient diameter to accommodate the bulb, an enlarged section with proper fittings could be provided.

A bulb should never be installed in a tank or storage heater where cold inlet water will flow directly on it, or where it will be otherwise affected by false temperatures. See Figure 24.

#### LIQUID CONTROL — Type 6

This is a plain type bulb, without a bushing or other means for its support. It is normally installed over the sidewall of a vat, tank, etc.

The bulb should be installed vertically below the surface of the liquid.

NOTE: Never lay the bulb on the bottom of the tank. However, the bulb may be installed in a horizontal position if it is securely mounted to the side of the tank and the word "TOP" on the tube end is up.

The bulb should be located away from work area inside the tank and should be supported and protected by suitable means.

#### AIR CONTROL — Type 54-A Plain, 54-J Bushed and 54-K Flanged

This bulb is an externally finned type for greater sensitivity. The bulb should be installed at a right angle to the air movement and at a location where average temperatures are encountered. See Figures 28, 29 and 31. Preferably, the bulb should be installed horizontally, but it may be installed vertically, or at any angle between these positions, providing the union connection end is uppermost. Never install the bulb with the union connection end downward, unless specifically ordered for such installation. See Figure 9. Bulbs have a position disc attached to the union connection end (see Figure 8) to indicate by arrow the proper bulb position when the bulb is installed "Right", Figure 9.

#### SEPARABLE WELL — Type GA

The separable thermowell serves as protection to the bulb and allows the bulb to be removed without concern for liquid levels or pressure in tanks, etc.

To install, insert the thermowell into the selected opening and tighten. Insert the bulb in the well and tighten the union connection. Be sure the arrow on the

position disc (see Figure 8) is pointing UP as the connection is tightened.

#### CONNECTING TUBING

The flexible capillary tubing connecting the bulb and the regulator must not be cut, kinked, mashed, or unduly twisted. It may be bent on a 3½" or larger radius. Tubing may be fastened in a permanent fashion to a rigid location but not fastened to steam pipes or other locations where subject to extreme temperatures. A loop of tubing next to the regulator head is recommended to absorb vibrations occurring in the pipe line.

#### TEMPERATURE INDICATION

##### RT-1003-E1 INTEGRAL MOUNTED

#### CAUTION

Do not turn the integral thermometer on the regulator head.

To position the indicating thermometer of the RT-1003-E1 regulator to facilitate easier reading, use the following steps:

1. Shut off the supply pressure to the regulator valve.
2. Remove the bulb and place it, horizontally, in a suitable container and heat or cool to open the valve.
3. Loosen lock nut "E" (Figure 13) and rotate the regulator yoke until the thermometer dial is in the desired reading position. DO NOT rotate the yoke with the plug seated as this will cause scoring or grooving of the contact faces.
4. Tighten lock nut "E" and place the regulator back in service.

##### RT-1009-C1 REMOTE MOUNTED

When the setpoint adjustment range begins below 120°F., the regulator head, the remote thermometer and the remote sensing bulb should be installed at the same elevation.

When the setpoint adjustment range begins above 120°F., installed differences in elevation between the regulator head, the remote thermometer and the remote sensing bulb may affect the control of the regulator. Check with the factory as necessary.

The indicating pointer "P" is adjustable to compensate for elevation differences. To adjust, remove the bezel ring and cover glass by loosening screws "H", then turn screw "R" until pointer indicates temperature corresponding to the temperature actually measured by the remote bulb.

Handle the thermometer carefully. Avoid twisting the capillary tubing "C". If this tubing gets twisted,

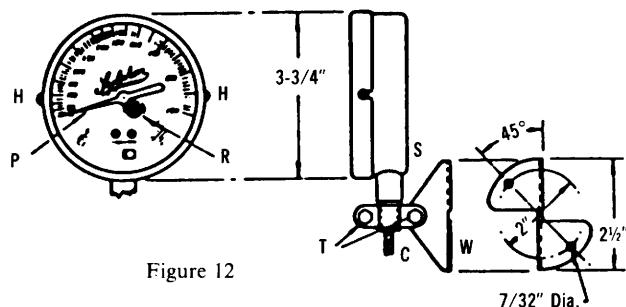


Figure 12

mashed or otherwise damaged, the complete thermostatic assembly must be replaced.

The thermometer case "S" should not be installed in a location where vibration is sufficient to move the indicating pointer "P". The case of the thermometer should be mounted at the selected location. Fasten bracket "W" securely to the mounting surface by using screws or bolts through the flange holes provided. Next, loosen swivel clamp screws "T" and move the thermometer to the position of best visibility; then tighten screws "T" securely.

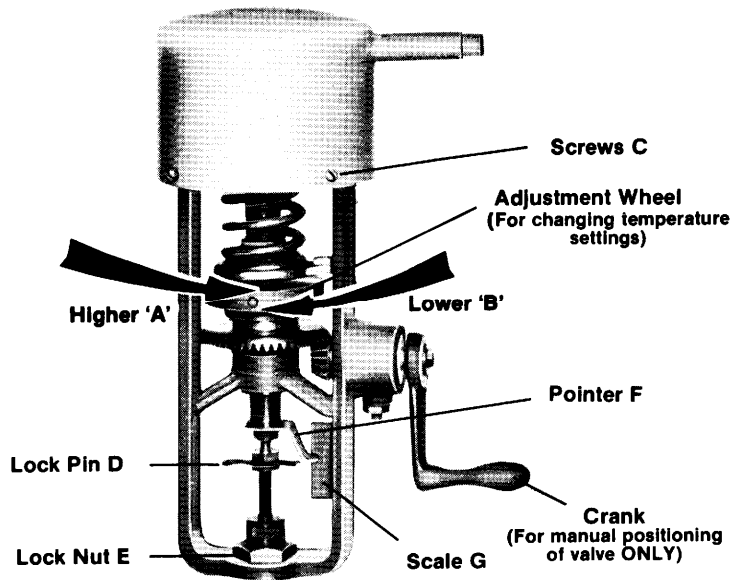


Figure 13

## TEMPERATURE ADJUSTMENT

This regulator can be set to control at any temperature within the limits of the temperature range stamped on its nameplate; however, it is recommended that the setpoint be in the upper third of the range for best control.

The hand crank mechanism of the RT-1009 Series regulator is provided for MANUAL opening or closing of the regulator valve.

Set the pointer "F" (Figure 13) to "Automatic" on scale "G" (Figure 13). In this position the regulator valve is operated automatically from the temperature changes affecting the remote bulb. When manual operation of the valve is desired or necessary, turn the crank to open or close the valve. DO NOT force the manual operator when the pointer is at the highest or lowest mark on the scale — this will damage the regulator.

After placing the regulator in service, allow about 30 minutes to reach stable operation, then observe temperature. If not correct, change the temperature setting in the manner directed below.

To RAISE the temperature setting, turn the adjustment wheel to the RIGHT (see arrow "A", Figure 13).

To LOWER the temperature setting, turn the adjustment wheel to the LEFT (see arrow "B", Figure 13).

Make new settings as necessary until the desired temperature is obtained, but allow about 30 minutes between adjustment changes.

The regulator has a scale to indicate the position of the adjustment. This feature is helpful in resetting the adjustment when frequent changes are necessary. Scale graduations are not in degrees of temperature.

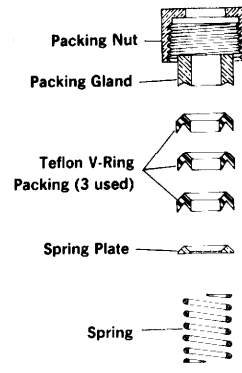


Figure 14  
Packing as used for steam or heating applications (2-way direct acting)

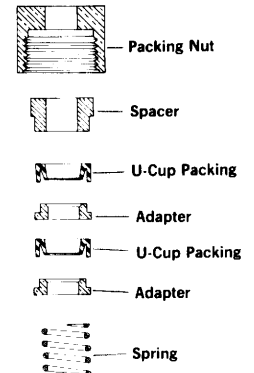


Figure 15  
Packing as used for cooling applications (2-way reverse acting & 3-way)

## MAINTENANCE

This regulator, when properly installed and used, should require very little attention or maintenance; however, every piece of mechanical equipment deserves some care.

### WARNING

The following procedures must be performed with the regulator valve disconnected from service, either by the use of a by-pass or by an upline shut-off valve. Bodily injury could result if these measures are not taken.

### VALVE STEM PACKING

Valve stem packing nut should be kept only FINGER TIGHT. If valve stem packing must be replaced, follow the steps below (see figures 13, 14, & 15).

1. Remove lock pin "D", Figure 13.

### CAUTION

Do not rotate the yoke with the valve pressed firmly on-seat, as such rotation may cause galling or scoring of the sealing surfaces.

2. Remove locknut "E" (Figure 13) and separate the regulator yoke from the valve.
3. Remove packing nut and packing follower.
4. Remove bonnet from valve.
5. Remove packing assembly.
6. Clean out packing box with a clean rag or soft paper.
7. Wipe off stem with clean rag or fine steel wool. DO NOT attempt to polish. If stem is scratched or nicked around packing area, it should be replaced.
8. Replace bonnet on valve.
9. Carefully place new packing in box. If Chevron or U-cup packing is not available, in an emergency, repack with a good grade of graphited string packing. Put a small amount of good packing lubricant in the packing box while repacking. This packing, however, should be replaced with Teflon\* Chevron or U-cup packing as soon as possible.

10. Replace the packing follower.
11. Replace the packing nut and tighten (FINGER-TIGHT).
12. Connect the regulator toke to the valve and tighten locknut "E".
13. Insert lockpin "D".

\*Teflon is a registered tradename of the DuPont Company.

### THERMOSTATIC ASSEMBLY

The thermostatic assembly consists of the bulb, the flexible tubing and the bellows assembly. This unit contains the volatile liquid charge. In the event this charge is lost as a result of damage, or otherwise, the thermostatic assembly must be ordered and installed as a unit. It is not repairable in the field.

#### CAUTION

**Never remove or install the thermostatic assembly unit when the temperature of the bulb is above the lowest temperature of the stated range on the nameplate.**

To remove the thermostatic assembly, follow the steps below:

#### WARNING

**Determine if a thermowell is in use. If not, lower the liquid level and/or remove pressure before turning the union connection.**

1. Remove the bulb from its location by screwing the union connection all the way out.
2. If room temperature is more than 10 degrees above the highest temperature of range stated on the nameplate, place the bulb in a container of cool water, ice or dry ice.
3. Turn the adjusting wheel to the left (see arrow "B", Figure 13) until the wheel is all the way down.
4. Remove screws "C" (Figure 13) and lift off assembly.
5. If regulator is RT-1009-C1, remove the thermometer assembly from its mounting.
6. To install the thermostatic assembly, reverse the above steps.

### REMOVING AND INSTALLING VALVE ASSEMBLY

#### WARNING

**Make sure supply pressure has been cut off.**

1. Remove lock pin. (DO NOT disturb the lock nut located above the stem connector.)
2. Remove the yoke to bonnet lock nut "E" and lift the regulator yoke above the valve body. Carefully set aside.
3. Remove the valve from line.
4. To install the valve, reverse the above steps.

### REFACING VALVE SEAT

Under certain conditions, the valve seat may be lapped with the valve plug. However, this should be done only by an experienced person. If valve plug or seat ring is badly scored, it should be replaced.

If valve is to be lapped, remove the regulator from the valve, remove the bonnet and place a small amount of extremely fine grinding compound on the valve seat ring face. In lapping, every effort should be made to avoid scoring or grooving the contact faces. Wipe plug and seat ring thoroughly with a clean rag after each operation.

Use light pressure in lapping, even to the extent of holding up part of the weight of the plug as it is rotated. Frequently lift off plug to check surface.

Heavy pressures cause the grains to become embedded in the material and will produce deep grooves or scores.

When seating face of the plug is smooth, grooves or lapping scores in the seating face of seat ring, if not too deep, do not particularly harm and in some cases seem to assist in getting a quick seat. Wipe away all compound from the valve plug and seat rings.

### TROUBLESHOOTING

This regulator is designed to operate within the temperature range stated on the nameplate. If the regulator does not function properly immediately after completing the installation, and you are unable to correct the trouble, contact the factory or the nearest field office, and outline your difficulties.

If the regulator has been operating satisfactorily for some time and trouble develops, the following information may be of assistance.

#### HEATING

If no heat or insufficient heat is obtained with the highest temperature setting, make sure that hand valves ahead of the regulating valve are open and that steam of sufficient pressure is passing to the regulator valve. Blow, or otherwise clean the line strainers. Clean all traps and see that they are in working order. If the return line to the trap is cool, the steam coils may be clogged.

In all cases, the packing nut should be only FINGER-TIGHT. The valve stem must be free to move up and down without undue friction.

The usual cause of overheating is the collection of scale or other foreign matter on the valve seat or seats. Such matter may hold the plug off the seat and in time cause the seat or plug to become scored. To inspect seats and plug, remove regulator from service and remove the valve bonnet. Slightly scored seats or plugs may be reground. Valve repair kits and/or replacement valves are available from the factory. Overheating may be caused by failure of the thermostatic assembly. See "Thermostatic Assembly" below.

#### COOLING

If the regulator is used for cooling purposes, such as controlling circulation of water or brine, and sufficient cooling is not obtained, make sure that proper circulation is possible through the cooling circuit. All lines, strainers, valves and passages in heat exchanger should be open. If over-cooling is experienced, scale or other foreign matter may be present on the valve seat or seats, preventing the plug from seating and thus allowing excessive flow of the cooling medium or the supply pressure may be excessive. To inspect the plug

and seats, make sure valve assembly is out of service and disassemble the valve.

In all cases, the packing nut should be only FINGER-TIGHT. Valve stem must be free to move up and down without undue friction.

Overheating may be caused by failure of the thermostatic assembly. See "Thermostatic Assembly" below.

Regulators controlling the circulation of brine should be inspected for frost on the valve stem or frozen stem in packing follower.

### THERMOSTATIC ASSEMBLY

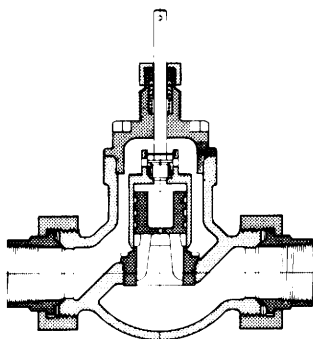
Failure of the thermostatic assembly is indicated by failure of the regulator to respond to temperature changes affecting the bulb. With such failure the valve stem would be up and a direct-acting valve would be open. A reverse-acting valve would close on thermostatic failure.

NOTE: Failure of controlling action may be due to a change in the ambient temperature around the regulator head and/or the connecting tube. (See note on cross-ambient regulators under the heading "Bulb Installation.")

To test the thermostatic assembly, observe the valve stroke by totally submerging the bulb, horizontally, in a suitable, liquid filled container (make sure the arrow on the position disc is UP) where it can be quickly heated with steam or hot water and cooled with cold water or crushed ice. If the regulator does not readily respond, it has lost its volatile liquid charge and a new thermostatic assembly must be installed.

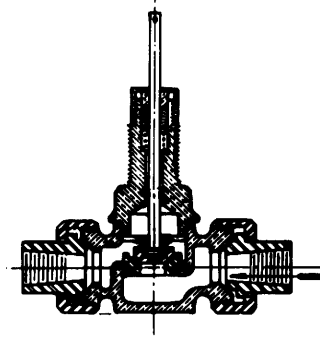
NOTE: When contacting a field office or the factory, be sure to give the serial number and other information appearing on the nameplate.

### VALVE TYPES



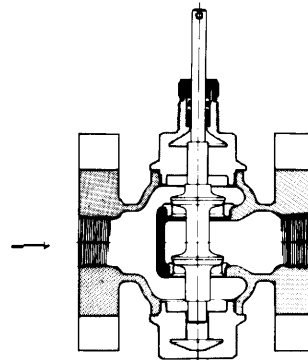
Type "MA"  
Direct Acting Only  
Balanced  
Bronze Body, St. St. Union  
End 3/4" - 1 1/2", 2" Bz. Class 150  
Or Cast Iron Class 125 Flanges

Figure 16



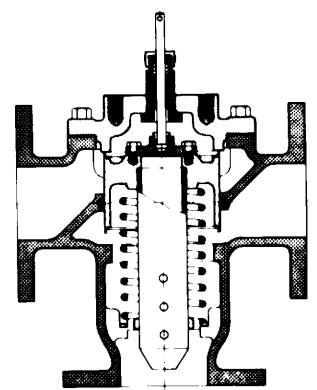
Type "A"  
Direct-Acting  
Unbalanced  
1/4" - 1"  
Bz. Body, St. St. Trim  
Union End

Figure 17



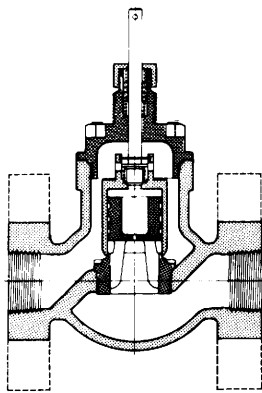
Type "FA"  
Direct-Acting  
Semi-Balanced  
Cast Iron Body, SS Trim  
Class 125 Flanges, 2 1/2" - 4"  
Bronze Body, Monel Trim  
Class 150 Flanges, 2 1/2" - 4"

Figure 18



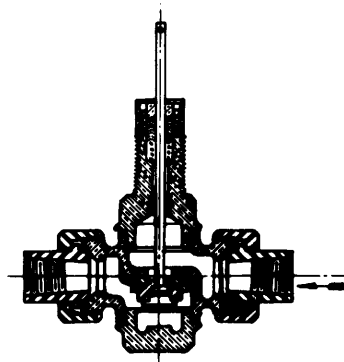
Type "WD"  
3 Way  
Balanced  
2" - 6"

Figure 19



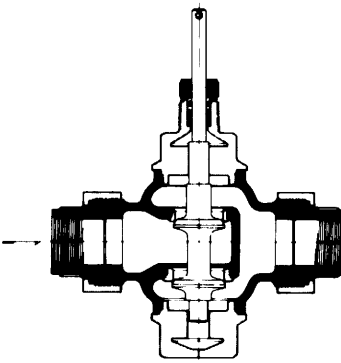
Type "MAS"  
Direct-Acting Only  
Balanced  
Cast Steel body, St. St. Trim  
3/4" - 1 1/2" Female Threaded Ends  
1" - 2" Class 300 Flanges

Figure 20



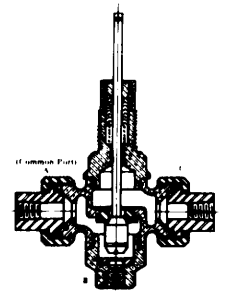
Type "A"  
Reverse-Acting  
1/4" - 1 1/2"  
Bz. Body, St. St. Trim  
Union End

Figure 21



Type "FA"  
Reverse-Acting  
Semi-Balanced  
Bronze Body, Monel Trim  
Union End  
3/4" - 1 1/2",  
2" - 4" Cast Iron w/SS Trim  
with Monel

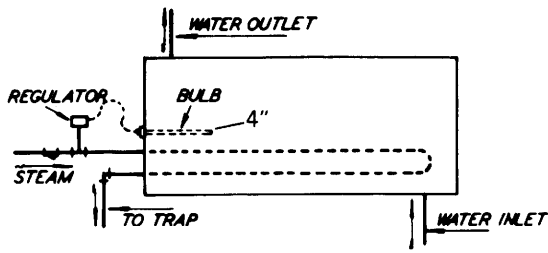
Figure 22



Type "WA"  
3 Way  
1/2" - 1 1/2"

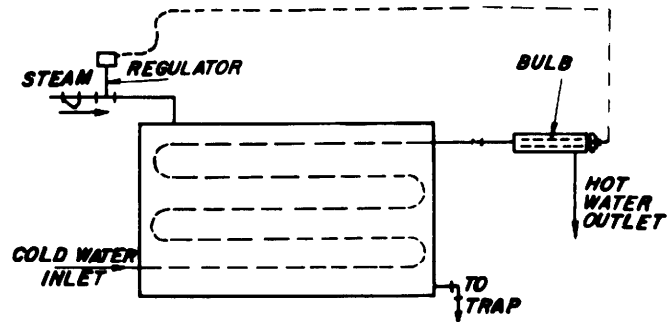
Figure 23

# TYPICAL INSTALLATIONS



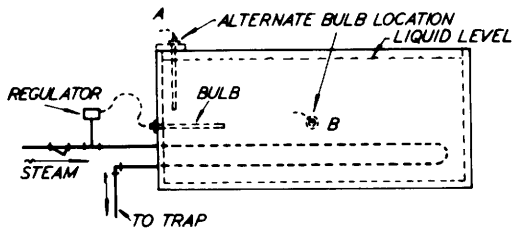
**CLOSED TANK OR STORAGE HEATER**

Figure 24



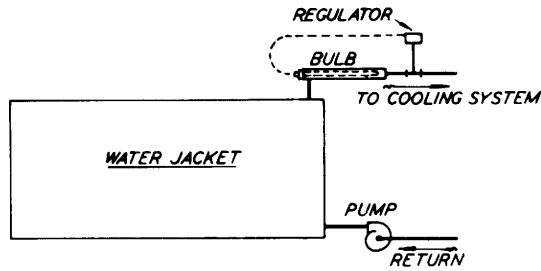
**INSTANTANEOUS HEATER**

Figure 25



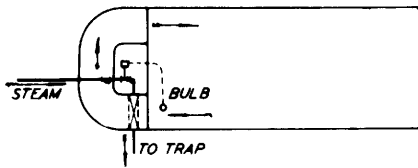
**OPEN TYPE TANK**

Figure 26



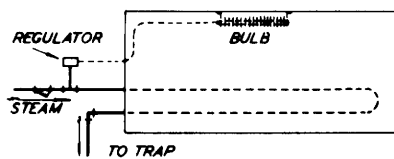
**ENGINE JACKET COOLING**

Figure 27



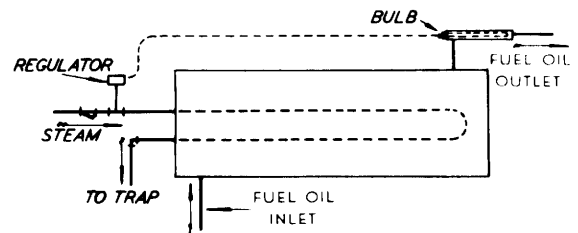
**CIRCULATING DRYER**

Figure 28



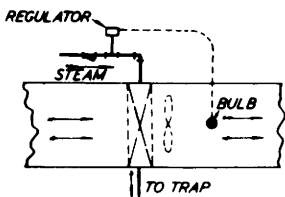
**DRY ROOM**

Figure 29



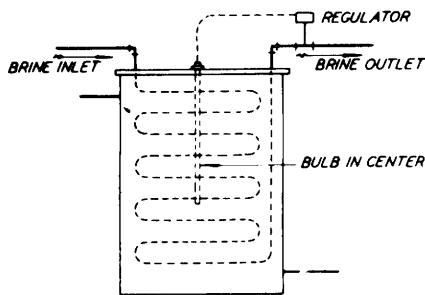
**FUEL OIL PREHEATER**

Figure 30



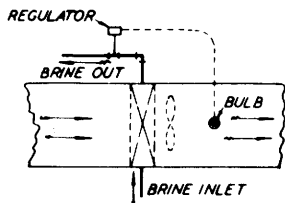
**HEATING DUCT**

Figure 31



**LIQUID COOLER**

Figure 32



**COOLING DUCT**

Figure 33

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