Instruction Sheet

010-5001

Water Piping
For Liquid Cooled, Eddy-Current Equipment

Dynamatic

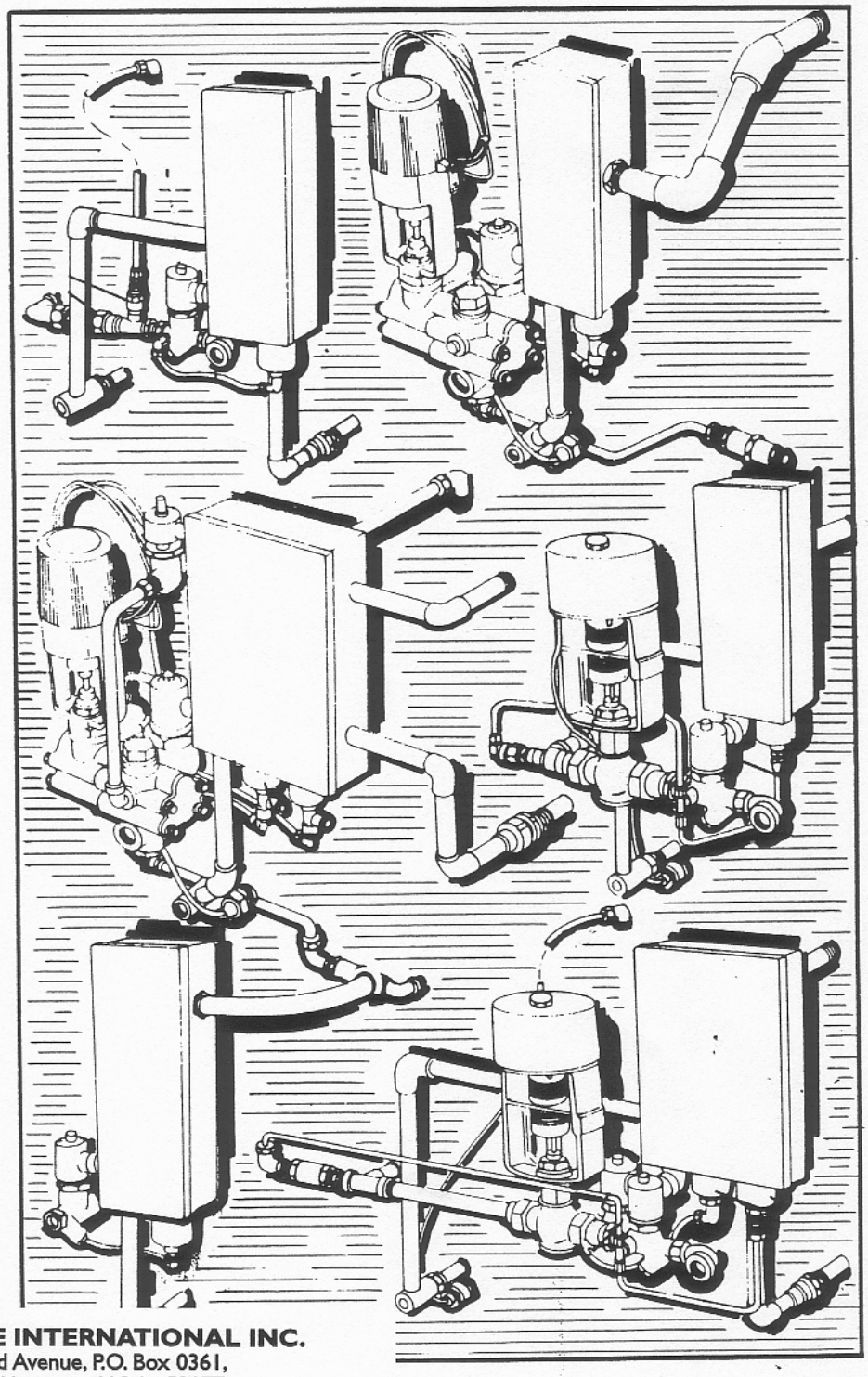
Caution:

Rotating shafts and above ground eletrical potentials of Dynamatic eddy-current equipment can be hazardous. Therefore, it is strongly recommended that all electrical work, installation, and maintenance be performed only by qualified personnel... preferably factory trained.

Because high level, above ground potentials exist, electrical work, conforming to National Electrical Codes and local regulations, should only be handled by qualified electricians. Only factory recommended test procedures, included in the instruction manual, should be followed. Electric power should always be disconnected before working inside of the control enclosure.

Even when the output shaft is motionless, it should be considered "alive" as long as its motor, or prime mover, is running; keep hands away from the output shaft until the motor has completely stopped.

Note:
Since improvements are continually being made to available equipment, the enclosed data is subject to change without notice. Any drawings are for reference only, unless certified. For additional information contact your nearest Sales Office or Representative listed in the Yellow Pages under "Power Transmission Equipment".



DRIVE SOURCE INTERNATIONAL INC.
7900 Durand Avenue, P.O. Box 0361,
Sturtevant, Wisconsin, U.S.A. 53177
Tel.: 262.554.7977 • Fax: 262.554.7041
Toll Free: 800.548.2169
E-mail: drivesourceusa.com

Preface

The purpose of this instruction manual is to provide the necessary information required to install, operate and maintain standard components used in the water piping system shown on the accompanying water piping drawing.

Use the parts list on the water piping drawing to determine which components listed in the Table Of Contents on this page are required in the water piping system. Refer to the respective pages for the necessary description, installation and maintenance information of applicable components.

Table of Contents

WARNING
pH of Cooling Water

The pH of water indicates the degree of acidity or alkalinity, seven being neutral. Values above seven—alkaline; below—acid. **Under no circumstances operate Dynamatic water cooled equipment with cooling water that has a pH of less than 7 (acid).**

Premature rusting of all steel parts occurs very rapidly as will chemical attack of coil containers, bearing seals, etc. Eaton warranty is void if cooling water with a pH of less than 7.0 to 7.8 pH is used.

In the event water with a pH of 8 (alkaline) is used,outlet temperatures must be reduced to a maximum of 110°F. to avoid rapid scaling.

The dissolved solids consisting of carbonates, sulfates and chlorides should be limited to 400 parts per million (23.36) grains per U.S. gallon.

Outlet Water Piping

DO NOT PERMIT ANY RESTRICTION OF OUTLET

(1) By using a pipe reducer in tapped outlet of coupling.

(2) By piping incorrectly with respect to rotation.

(3) By piping in any manner that would permit accumulation of water to occur or remain in the base or well of unit.

If these simple requirements are not observed, a delayed or improper sensing of the regulator valve and overtemperature switch will result.

Rapid accumulation of lime, scale and possible unbalance will develop on the drum, even with normally favorable water conditions.

It should be evident that a considerable volume of heated water from the drum would have to mix with sumped water for the sensing temperature to give true indication of drum temperature within the unit, thus giving undesirable results as described.

The Water Piping System

General

The layout and parts list of the water piping system required to properly cool this unit are shown on the water piping drawing. The water piping system is wired into the control starting circuit which is shown on the wiring diagram and explained in the Operating Instructions.

Semi-Automatic Piping System

A typical semi-automatic water piping system, which is shown in Figure 1A, includes a strainer, solenoid valve, water pressure switch, constant flow valve and water temperature switch. The solenoid valve, pressure switch and temperature switch are shown schematically in the starting circuit of Figure 2. When contact is closed and the **Run** button is pressed, the water solenoid valve is energized, allowing water to flow into the unit. As water begins flowing, the pressure builds up until it is sufficient to close the pressure switch. In practice, this is almost instantaneous.

If the components of the water piping system are exposed to greater pressure than they were designed for, they will fail to function properly. Conversely, if the pressure fails or temporarily falls below the minimum specified, the pressure switch will open, thereby de-energizing the starting circuit.

The bulb of the temperature switch is installed in the unit so it is covered with discharge water. If the temperature of the water exceeds the predetemined setting of the temperature switch, it opens and de-energizes the starting circuit and removes excitation from the unit. The unit cannot be re-energized as long as the temperature switch remains open. The temperature switch will not operate properly unless it is covered with water.

Automatic Piping System

When it is desirable to conserve water and not use more than is necessary to cool the unit, or where a large quantity of water is required, a fully automatic water piping system, similar to the one shown in Figure 1B, is used. The typical automatic water piping system contains the same components as the semi-automatic water piping system, plus a water control valve and a by-pass line. With this system a constant flow valve is used in the by-pass line. On some units a constant flow valve is used in the main line to limit maximum water flow.

When the solenoid valve is energized, and the pressure and temperature switches are closed, a fraction of the

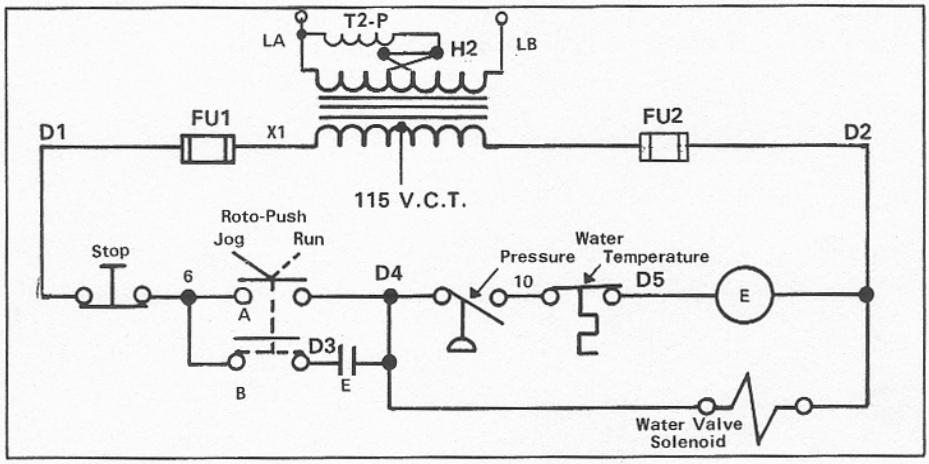
available water flows through the bypass line into the unit. The water control valve, which is normally closed, is connected by a capillary tubing to a temperature-sensitive bulb installed in the unit. The bulb is located in the unit so the discharge water completely covers it. As the temperature of the discharge water begins to rise, the bulb reacts so as to admit additional water to flow into the unit as required for proper cooling.

Water Supply Requirements

A satisfactory water supply, which fulfills the requirements of pressure, temperature and purity, must be made available to properly cool this unit.

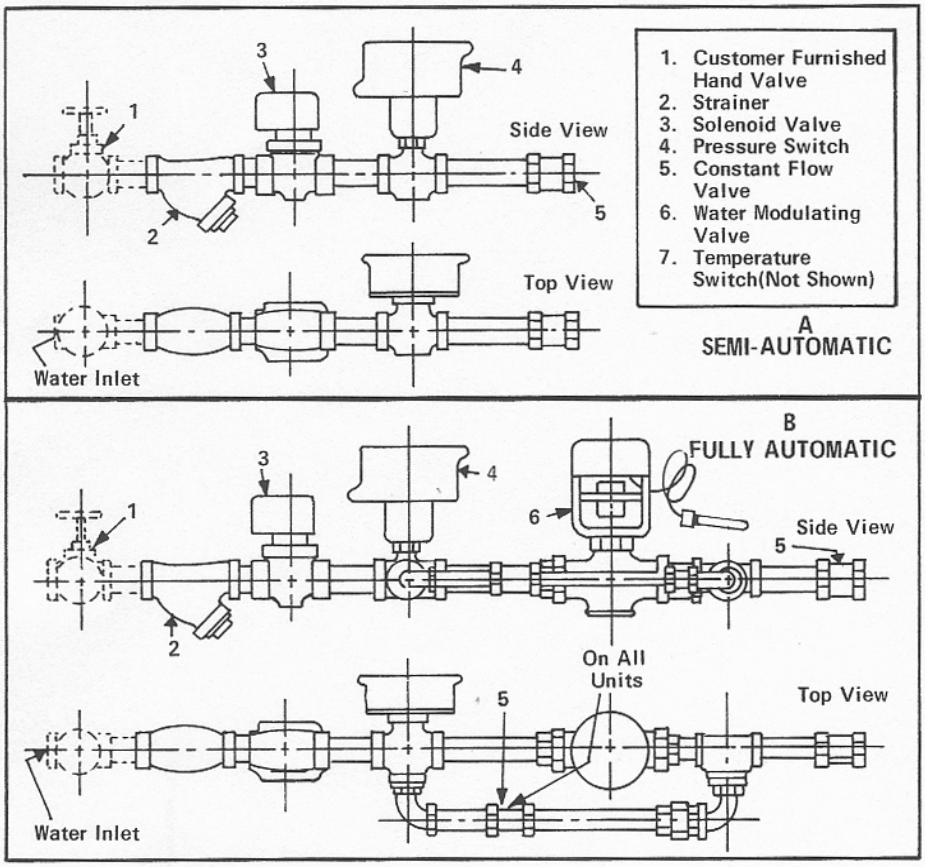
Typical Control Starting Circuit

Figure 2



Typical Water Piping Systems

Figure 1



Chemical Analysis - Maximum Values

Table 2

Maximum Water Content	Parts Per Million	Grains Per U.S. Gal.
Total carbonate	200	11.68
Total sulphate	150	8.76
Total alumina	75	4.38
Total iron	75	4.38
Total chloride	50	2.92

If your local water condition exceeds these values consideration should be given to either treating the water, or regularly removing the scale deposits.

Water obtained from the Great Lakes usually has a pH range of 7.0 to 7.9; with a maximum total solid content of 160 parts per million, or 9.35 grains per gallon. Total solids are made up of carbonates, 132 parts per million; sulphates, 23 parts per million; and total chloride (salt), 6 parts per million. It has been our experience that this water is perfectly satisfactory for use in our water cooled machines, resulting in practically no deposition or corrosion.

Direct cooled (water-in-gap) machines are not affected as much by scale deposits as are indirect cooled (dry gap) machines, since the building of scale is impeded by water erosion; however, if the water is acid, serious corrosion may take place on the inductor drum, resulting in increased air gap. The acid water condition, therefore, must be watched carefully.

Indirect cooled machines require more careful attention, since their heat dissipation capacity is decreased as deposits are formed in the cooling rings. Two methods for eliminating scale may be used: (1) by treating the water, thus preventing the deposit, and (2) by allowing the deposit to form but regularly removing through the use of approved scale removing agents.

The minimum water pressure required by the unit (usually 35 PSI) is specified on its nameplate and on the title page of this instruction manual. In order to operate the unit the pressure of the water supply must be above the minimum specified pressure, but below 100 PSI. If the pressure is too high, a pressure regulator must be installed (a reduction of unit pressure to 40 PSI is recommended).

The temperature of the cooling water entering the unit should not be higher than 90°F. Water discharged from the unit should not exceed 140°F., thus minimizing scale deposits.

Internal components of water cooled units are protected by a corrosion-resistant coating. Listed in Table 2 are the maximum water solid content values for water, which we would consider satisfactory for use in our equipment, although these figures should not be considered absolute limits.

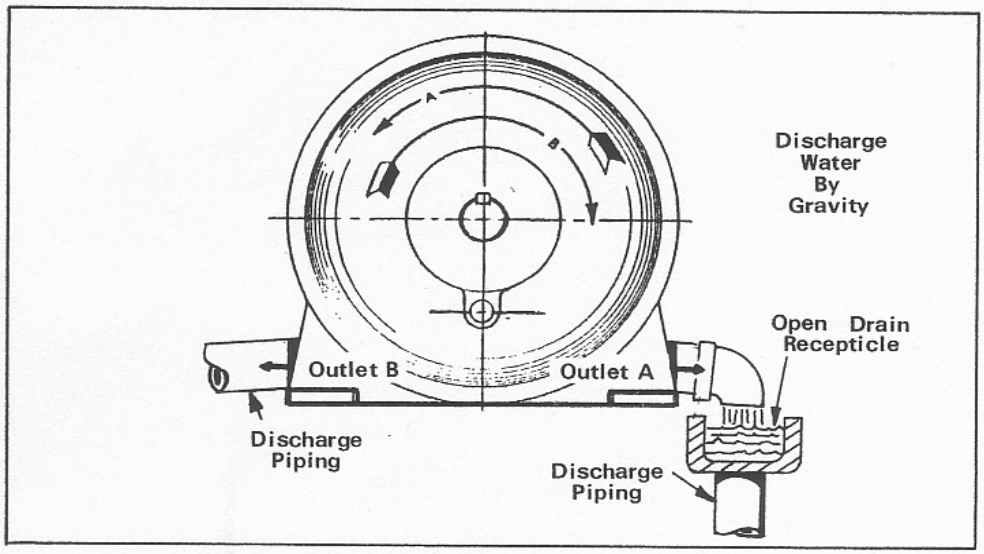
Deposits of solids are dependent upon cooling water temperature. Scale deposition (in areas of high solids contents) may thus be reduced by decreasing the outlet water temperature. Satisfactory operation may be obtained when using water with total solids of 1000 ppm, provided the outlet water temperature is held below 125° F.

Dynamatic drives are equipped with adjustable water control valves with a temperature range of 80°F. to 140°F. Self regulating valves are usually set to start opening at 95°F. ± 5°F. Power assist valves are usually set to regulate water temperature at 135°F. ± 5°F. These settings should be reduced where solids contents are high.

How to Install Water Piping System

If the automatic water piping system is not assembled or is not installed on the unit, it will be necessary to do so before putting the unit into operation. Figure 1 clearly show the location of each part. The location of water inlets and outlets are clearly marked on the unit and are shown on the drawings. Figure 3 shows the outlet to use in relation to the direction of the drum rotation, where arrows 'A' and 'B' indicate directions of drum

Direction of Water Flow **Figure 3**



rotation and direction of water flow. When rotating in direction 'A', outlet 'A' must be used; when rotating in direction 'B', outlet 'B' must be used. However, if the drum is to be rotated in both directions, the use of both water outlets ('A' and 'B') is required.

When installing discharge water piping, do not use pipe of a smaller diameter than that for which the water outlet hole has been tapped. If the piping from the outlet of the unit to the drain is more than eight feet long, increase the pipe diameter to the next standard size with each successive, eight-foot length.

WARNING: Discharge water must be permitted to flow freely, by gravity, from the water outlet in the sump of the unit. Discharge water piping must not impose restrictions of outlet water in any way which would allow excessive accumulation and back-up in the base of the unit; this must be avoided to prevent flooding inside.

PIPING SYSTEM COMPONENTS

Strainer

Description

A strainer is included in the water piping system to filter the water and prevent foreign matter from damaging the water piping components or the unit. Figure 4 shows a section view of a typical strainer. In a modular piping system, the strainer is constructed as a part of the solenoid valve.

Installation

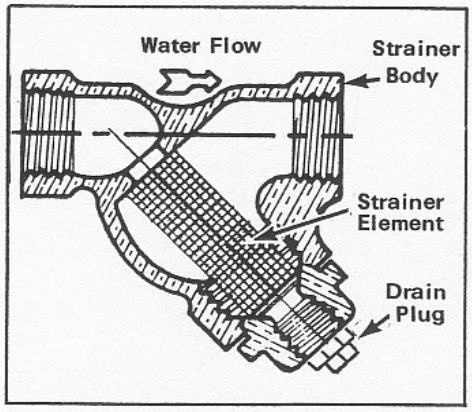
If a strainer is not installed in the water piping system, it is important to do so before running water through the water piping or the unit. Install the strainer as shown on the water piping drawing. The arrow on the strainer body indicates the direction of water flow.

WARNING: Coat the threads with sealing compound before installation to ensure effective sealing without excessive tightness. Tighten only enough to prevent leakage.

Maintenance

The strainer element must be checked periodically for accumulation of foreign particles since water flow will be reduced by a plugged strainer element. To clean the strainer, remove the drain plug and strainer element. Clean the strainer element and place it back into the strainer body. Install the drain plug. Strainer element material - monel particle retention .020.

Strainer **Figure 4**



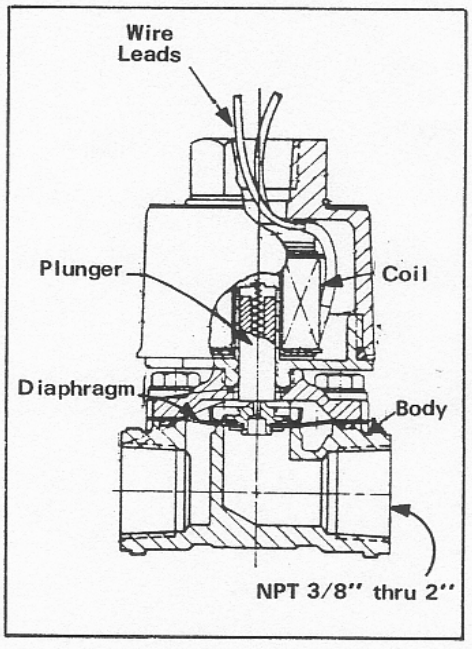
Solenoid Valve

Description

To ensure that the operator doesn't forget to turn the water on, a solenoid valve is included in the water piping system. The solenoid valve is energized by the starting control circuit, shown in the wiring diagram. The solenoid valve's construction is explosion proof and watertight.

A section view of a typical normally closed diaphragm type solenoid valve is shown in Figure 5 While the coil is de-energized, the pilot orifice is closed, and full line pressure is applied to the top of the diaphragm, providing seating force for tight closure. The spring holds the pilot orifice closed. When the coil is energized, the pilot orifice is opened, releasing pressure on top of the diaphragm to the outlet

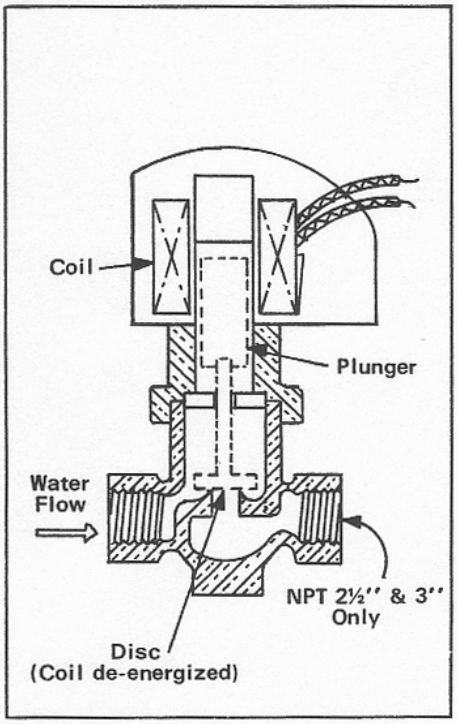
Typical Solenoid Valve N.C. Diaphragm Type **Figure 5**



side of the valve. Line pressure raises the diaphragm to open the main orifice and allow water to flow.

Figure 6 is a section view of a typical normally closed piston type solenoid valve. Until the coil is energized, the disc is in the position that is represented by the dotted lines in the figure, and held there by the spring, thus allowing no water to flow. However, when the coil is energized, the plunger and disc assembly is pulled upward and the water is permitted to flow.

Typical Solenoid Valve N.C. Piston Type **Figure 6**



Installation

Before energizing the unit the water valve solenoid must be installed according to the accompanying water piping drawing. Connect the wires of the solenoid to the control starting circuit, as shown on the accompanying wiring diagram, so the solenoid is energized when the **Run** button is pressed. The solenoid voltage is stamped on the nameplate.

WARNING: Coat the threads with sealing compound before installation to ensure effective sealing without excessive tightness. Tighten only enough to prevent leakage.

Water Pressure Switch

Description

The water pressure switch is in its normally open position whenever the pressure applied to its bellows is less than 11 PSI. Pressure in excess of its setting closes the switch, thus permitting excitation (see Figure 2). 11 PSI is the pressure required to entirely cover the temperature switch at minimum slip. If the temperature switch is not covered with discharge water from the drum, it will not accurately detect an excessively hot drum, and thus remove excitation by opening the electrical circuit at the temperature it is set for. At maximum slip, or load, an input of 35 PSI of pressure is usually required. Since line pressure variations may be great enough to momentarily reduce the pressure below 11 PSI and remove excitation, a recommended supply pressure into the water piping system is 35 to 100 PSI.

Installation

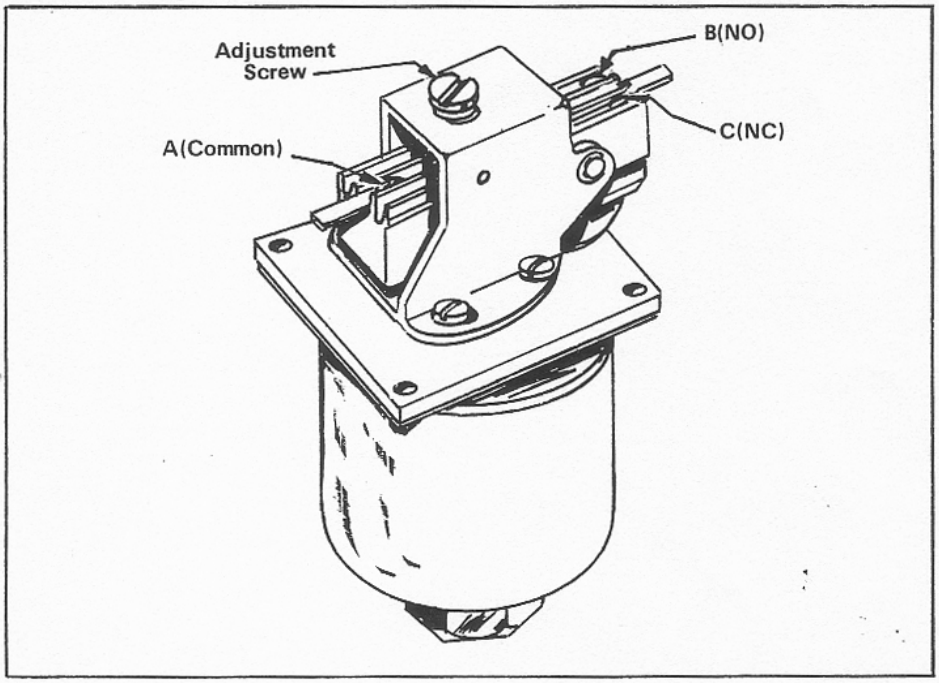
The water pressure switch must be installed in the water piping system as shown on the water piping drawing. One type of pressure switch used is shown in Figure 7. Terminal 'A' is the common lead terminal of the switch and should be connected directly to the terminal of the relay contacts (D4 in the typical starting circuit of Figure 2). Terminal 'B', the normally open contact of the switch, which is open when water pressure is not sufficient to close the switch, should be connected to the common terminal of the temperature switch. Terminal 'C' is the normally closed terminal and is not used in the control circuit of this unit.

NOTE: The water pressure switch is sensitive to pressure drops in the water supply system. Demands on the system by other machinery or equipment may cause temporary or prolonged pressure drops, opening the pressure switch and cutting off power to the unit. Do not attempt to correct this situation by by-passing the pressure switch or decreasing the setting of the switch below the required minimum pressure without approval from the Engineering Department at the factory. Make certain that the water supply system is adequate to maintain proper cooling water pressure under all conditions.

Adjustments

The pressure switch is factory adjusted to open when the water pressure drops below a nominal 11 PSI. If the setting must be changed, rotate the adjustment screw, shown in Figure 7, until the switch opens between 10 and 12 PSI with decreasing pressure. With the pressure switch adjusted properly, it will not close again when the pressure is increased to the same setting because there is a differential between the opening and closing pressures. But, it will open at a slightly higher pressure.

Typical Water Pressure Switch **Figure 7**



WARNING: Coat the threads with sealing compound before installation to ensure effective sealing without excessive tightness. Tighten only enough to prevent leakage. The water pressure switch is installed in the system for insuring ample flow of water to safeguard the unit. Do not by-pass this switch when making electrical installations.

Constant Flow Valve

Description and Installation

In many applications a constant flow valve is installed in the main line just ahead of the water inlet to the unit. Its purpose is to maintain a con-

stant water flow for line pressures from 35 to 100 PSI.

If a constant flow valve is installed in a by-pass line around a water modulating valve, it will maintain a fixed by-pass flow to the unit at all times with line pressure variation from 35 to 100 PSI.

Be sure to install each constant flow valve as shown on the water piping drawing. Install with the arrow pointing in the direction of water flow.

WARNING: Coat the threads with sealing compound before installation to ensure effective sealing without excessive tightness. Tighten only enough to prevent leakage.

Water Modulating Valve

NOTE: Since the water piping system on Dynamatic liquid cooled machines may include a modulating valve from one of several manufacturers, specific instructions vary inasmuch as the operation is the same. Therefore, if the instructions do not completely correspond with your valve, compare the intent of the instructions with your valve to determine how to obtain the required effect. If you still have problems, refer the manufacturer's name, along with Dynamatic PRO number of your Dynamatic drive, to the factory for more specific instructions.

Description

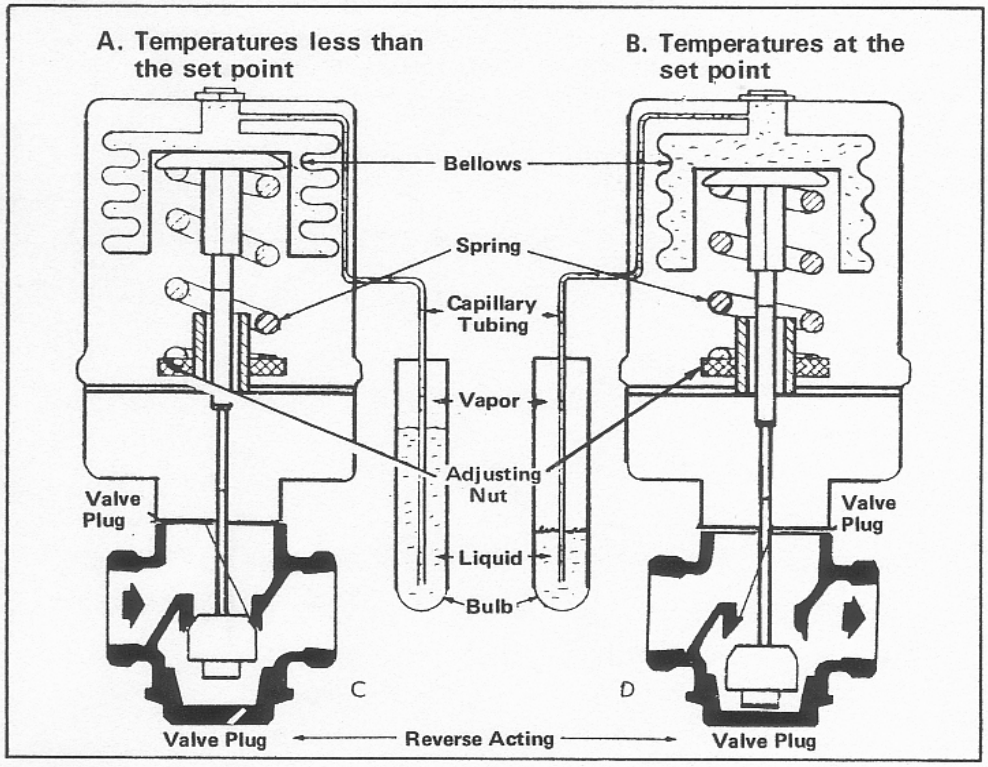
General

An automatic water piping system requires a water modulating valve (Figure 8) to regulate water flow to the unit. A by-pass line provides a steady supply of water to cover the temperature switch and modulating valve's thermostatic bulb which are installed in the unit. As a rise in temperature is sensed by the bulb, the modulating valve begins opening and supplies additional water (as required) to the unit. There are essentially two types of modulating valves used by Eaton: self-regulated and air-regulated.

Self-Regulated

A self-regulated modulating valve is composed of a bellows operated valve and a thermostatic bulb joined together with a length of capillary tubing. The thermostatic bulb, installed in the liquid cooled unit, encloses a volatile fluid. When the water discharge temperature increases, the volatile fluid in the bulb, expands. When the temperature rises to approximately 90°F., the expanded gas transmits pressure to the modulating valve's bellows through the capillary tubing, causing the valve to open (See Figure 8). If the temperature continues to rise, the valve opens wider. If the discharge water temperature rises to approximately 130°F., the valve is fully open. Consequently, further temperature increases result in no additional flow of water. If the temperature continues to rise, the temperature switch will open, and remove excitation from the unit.

Typical Modulating Valve **Figure 8**



Air-Regulated

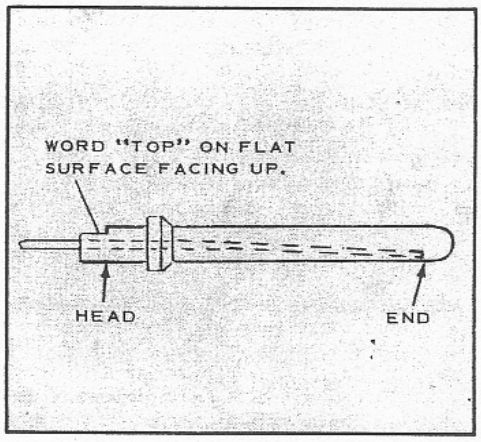
An air-regulated modulating valve system consists of a diaphragm operated valve and an air regulator. The position of the diaphragm determines the amount of water that flows. Initially, the regulator, which contains a temperature-sensitive tube and is installed in the unit to detect temperature changes, adjusts the air pressure on the diaphragm to 15 to 20 PSI, thus keeping the modulating valve closed. When the temperature of the discharge water rises above the setting of the temperature adjust knob on the regulator, the regulator bleeds off some of the air, which results in a reduction of air pressure on the valve diaphragm. With less than 15 to 20 PSI of air pressure exerted on the diaphragm, the modulating valve opens sufficiently to admit the required amount of additional water to the unit.

Installation

When the water piping is installed at the Dynamatic Plant, no further installation will be required. If not, consult the water piping print furnished for the locations of the modulating valve and bulb.

The valve either has an arrow cast on its body or the inlet and outlet sides are clearly marked. It is necessary that the valve be installed in the same direction as the flow of water. Also, if the bulb has a flat surface, as shown in Figure 9, it must be installed with the word "Top" facing upwards.

Standard Bulb **Figure 9**



The bulb must be installed with the word "Top" facing upward. The bulb should either lie horizontally, or, with the end lower than the head. The end should never be higher than the head.

WARNING: Coat threads with sealing compound before installation to ensure effective sealing without excessive tightness. Tighten only enough to prevent leakage.

Coil the extra capillary tubing (1½ inch minimum radius), and place it in a position such that it is protected and does not interfere with any operation (the recommended position is found on the water piping print).

Do not twist, bend, vibrate, heat, or kink the tubing unnecessarily.

Do not cut or disconnect the tubing from the bulb or valve unit top.

Adjustments

Testing Self-Regulated Modulating Valves – Stop water flow through the valve.

Raise the Temperature of the Bulb –

Direct Acting Regulators: raise the temperature to the control point so the valve plug is seated.

Reverse Acting Regulators: raise the temperature until the valve is fully open.

Record the Valve Position: place a ruler on top of the packing gland and mark the position where the ruler touches the stem.

Lower the Temperature of the Bulb –

Direct Acting Regulators: cool the bulb 30° below the control point so the valve is fully open.

Reverse Acting Regulators: cool the bulb to the control point so the valve is seated.

Record the Valve Position: place a ruler on top of the packing gland and mark the position where the ruler touches the stem.

Compare the High and Low Marks –
The distance between the marks is the valve plug travel; it should coincide with the specified temperature extremes given.

NOTE: Partial or no movement represents a defective modulating valve, which requires replacement or servicing.

Temperature Adjustment – The valve should be in operation at the time of adjustment at the desired operating temperature at the operating pressure of the system, since a difference in pressure will affect the control point of the adjusting nut.

To Raise Temperature - Insert an adjusting rod into a hole in the adjusting nut (Figure 8) and turn **right to left** (on some models this can be done by hand).

To Lower Temperature – Turn from **left to right.**

Maintenance

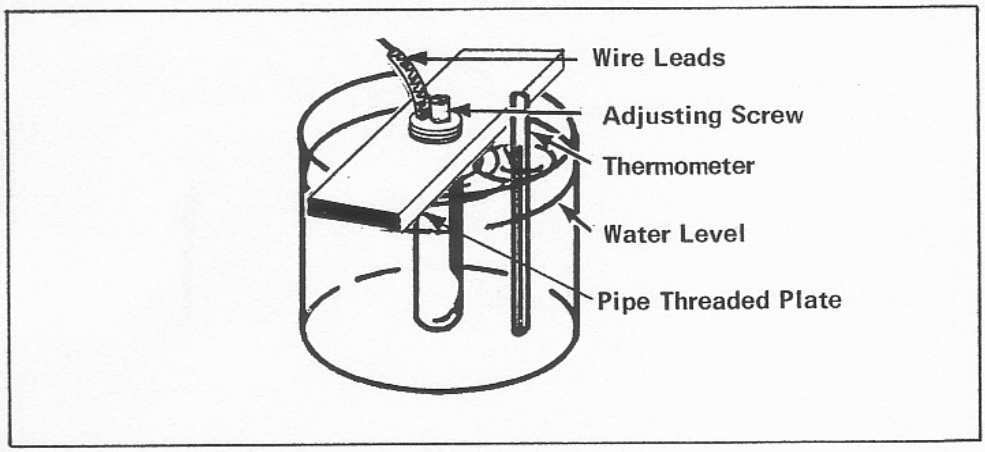
If a drop of water develops, tighten the packing gland or lubricator assembly (if included) **finger tight** to lubricate (Figure 8). If the gland dries up, a drop or two of oil in the gland is recommended.

Water Temperature Switch

Description

The water temperature switch, shown in Figure 10, is a normally closed, temperature-sensitive switch. The switch opens when the discharge water temperature exceeds its set temperature, which is adjustable by means of the slotted temperature adjusting screw. The differential between the opening and closing temperatures is approximately 0.2°F. The bulb must be covered with water in order to detect excessive temperatures in the unit. The temperature switch is equipped with a temperature locking device for vibration and tampering.

Temperature Switch In a Jar of Water **Figure 10**



Adjustments

The temperature switch is factory adjusted to open when exposed to a nominal temperature of 165°F. This setting should not be disturbed unless a check of the switch indicates that the setting is incorrect. To check the setting of the temperature switch, install the switch in a pipe-threaded plate to assimilate actual installation of the switch unit into the base wall of the Dynamatic machine. Tighten the thread engagement to a normal degree as when actually installing in machine. This procedure is recommended to achieve a setting which will be accurate under normally tightened conditions upon installation in the machine housing. Then immerse the complete bulb (up to the threaded portion) and a thermometer into a container of water, as shown in Figure 10, and connect the wire leads to an ohmeter or a continuity tester. At room temperature the switch should appear as a short circuit. While agitating the water, increase the temperature until the switch opens. If the temperature is not between 162 and 168°F. when the switch opens, the position of the slotted adjusting screw must be changed. Clockwise rotation of the screw causes the switch to open at a lower temperature and counter-clockwise rotation causes the switch to open at a higher temperature.

WARNING: The switch must open by the time the water temperature at the bulb reaches 168°F. Do not increase the setting beyond this point.

Installation

If it is necessary to install the water temperature switch, do so in the position shown in the water piping drawing and wire the leads into the control starting circuit as shown in the wiring diagram. The temperature switch bulb is located in the unit so it will always be covered with water even at minimum water flow. The wire leads are connected into the starting circuit so the switch is in series with the **Stop** button. Therefore, the starting circuit will be open when the water temperature switch is open.

WARNING: Coat the threads with sealing compound before installation to ensure effective sealing without excessive tightness. Tighten the switch only enough to prevent leakage. The temperature setting may be affected by excessive tension on the pipe threads. The water temperature switch is installed in this unit to protect the equipment against overheating. Do not by-pass this switch when making electrical installations.

CORRECTIVE MAINTENANCE

If Open Starting Circuit Is Inoperative – Check:

1. Fuse. Replace.
2. For short circuits and grounds.
3. Thermal overload.
4. Pressure switch. Low water pressure may not be opening switch.
5. Strainer. May be plugged.
6. Solenoid valve for proper opening.
7. Incoming water pressure.
8. Incoming line voltage.