

# Honeywell

THE T475A IS AN OPERATING CONTROLLER FOR EITHER HYDRONIC (hot water) OR WARM AIR HEATING SYSTEMS. IT IS ALSO USED ON FORCED AIR HEATING SYSTEMS USING THE MIXED AIR METHOD OF ZONE CONTROL.

THE T475A HAS TWO TEMPERATURE SENSING BULBS. ONE BULB MOUNTS INDOORS, IMMERSSED IN THE HOT WATER BOILER OR INSERTED IN THE FURNACE PLENUM. THE OTHER BULB MOUNTS OUTDOORS. AS THE OUTDOOR TEMPERATURE DROPS BELOW 70 F [21 C], THE CONTROLLER CORRESPONDINGLY INCREASES (according to reset ratio) THE TEMPERATURE CONTROL POINT OF THE HEATING MEDIUM. THE RESULT IS A MORE CONSISTENT HEAT LEVEL IN THE LIVING SPACE. THE T475A IS NOT INTENDED FOR SYSTEMS THAT REQUIRE RESETTING FOR OUTDOOR TEMPERATURES ABOVE 70 F [21 C].

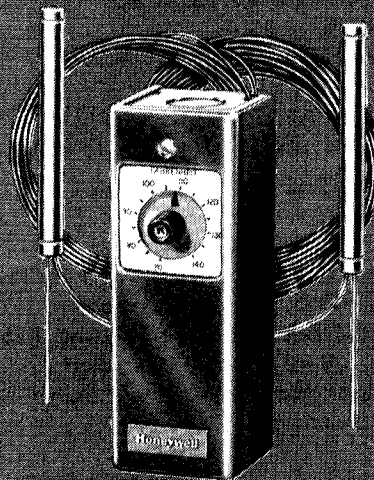
THE T475A CAN ALSO REPLACE ANY TWO-WIRE (line voltage, low voltage, or millivoltage) OPERATING CONTROLLER WHICH VARIES TEMPERATURE OF THE HEATING MEDIUM ACCORDING TO OUTSIDE TEMPERATURE. IT SHOULD NOT BE USED ON HYDRONIC SYSTEMS WHERE SERVICE HOT WATER IS PROVIDED BY THE BOILER, OR WHERE DAY-NIGHT TEMPERATURE CONTROL IS USED. THE T475A DOES NOT REPLACE THE SAFETY HIGH LIMIT CONTROL.

- ☐ Three reset ratios available: 1 to 1, 1 to 1-1/2, and 1-1/2 to 1.
- ☐ Case and capillary are ambient compensated.
- ☐ Scaleplate and adjustable temperature dial located on front of control case.
- ☐ Adjustable switch differential.
- ☐ Control may be mounted in any position for convenience. The sensing bulbs may be mounted above or below the control.
- ☐ 10 ft [3 m] of tubing with the indoor (heating medium) bulb and 30 ft [9 m] of tubing with the outdoor bulb permit mounting control in most suitable location.
- ☐ Small diameter sensing bulb provides rapid response to heating medium and outdoor temperatures.
- ☐ Outdoor bulb guard and plug provide mounting means and protection for outdoor bulb.

M.W.  
Rev. 10-81•

Form No.  
60-2219-3

## OUTDOOR RESET CONTROL



# T475A

**epc**  
Energy Products Center

# SPECIFICATIONS

MODEL: T475A Outdoor Reset Control.

TEMPERATURE RANGE: 70 F to 140 F [21 C to 60 C] (when the outdoor bulb and tubing is at 70 F [21 C]).

DIFFERENTIAL: Adjustable 6 F to 20 F [3 C to 11 C].

ELECTRICAL RATING (amperes):

	120 Vac	240 Vac	277 Vac
Full Load	8.0	5.1	4.2
Locked Rotor	48.0	30.6	25.2

Inductive current at 24 Vac—2 A.  
0.25 to 12 Vdc—0.25 A.  
Pilot Duty—125 VA at 120-277 Vac.

RESET RATIOS AVAILABLE (Specify when ordering.  
To determine which reset ratio to order, refer to  
SELECTING THE CORRECT RESET RATIO):

- 1 to 1; outdoor bulb—3-9/16 in. [90.5 mm] long,  
3/8 in. [9.5 mm] diameter.
- 1-1/2 to 1; outdoor bulb—2-1/2 in. [63.5 mm]  
long, 3/8 in. [9.5 mm] diameter.
- 1 to 1-1/2; outdoor bulb—5-5/16 in. [134.9 mm]  
long, 3/8 in. [9.5 mm] diameter.
- All indoor (heating medium) bulbs—3-9/16 in.  
[90.5 mm] long, 3/8 in. [9.5 mm] diameter.

NOTE: First number of ratio refers to outdoor bulb.  
For each degree drop in outdoor temperature (below  
70 F [21 C]), corresponding change in indoor (plenum  
or boiler) bulb temperature is determined by control-  
ler ratio. Example: For a 1-1/2 to 1 ratio controller,  
each 1-1/2 degree drop in outdoor temperature (be-  
low 70 F [21 C]) causes a 1 degree increase in plenum  
or boiler control point above its dial setting.

MOUNTING MEANS:

CASE—Screws through three mounting holes in back  
of case.

OUTDOOR BULB—Guard with supporting clip and  
wood plug for wall seal (furnished).

INDOOR BULB (order accessories separately)—

1. Warm air: 107324A Bulb Holder (Fig. 5).

2. Hot water: Boiler fittings (Figs. 8 and 9):

	1/2 NPT	3/4 NPT
Insertion Well	121371P	121371Q
Comp. Fitting	7617ABY <sup>a</sup>	104484B <sup>a</sup>

<sup>a</sup>Has a water pressure rating of 50 psi and an air  
pressure rating of 15 psi when used with the  
T475A.

(continued on page 3)

## ORDERING INFORMATION

WHEN PURCHASING REPLACEMENT AND MODERNIZATION PRODUCTS FROM YOUR TRADELINE  
WHOLESALE OR YOUR DISTRIBUTOR, REFER TO THE TRADELINE CATALOG OR PRICE SHEETS FOR  
COMPLETE ORDERING NUMBER, OR SPECIFY—

1. Order number.
2. Accessories, if desired.

IF YOU HAVE ADDITIONAL QUESTIONS, NEED FURTHER INFORMATION, OR WOULD LIKE TO COMMENT ON OUR  
PRODUCTS OR SERVICES, PLEASE WRITE OR PHONE:

1. YOUR LOCAL HONEYWELL RESIDENTIAL GROUP SALES OFFICE (CHECK WHITE PAGES OF PHONE DIRECTORY).

2. RESIDENTIAL GROUP CUSTOMER SERVICE  
HONEYWELL INC., 1885 DOUGLAS DRIVE NORTH  
MINNEAPOLIS, MINNESOTA 55422 (612) 542-7500

(IN CANADA—HONEYWELL CONTROLS LIMITED, 740 ELLESMERE ROAD, SCARBOROUGH, ONTARIO M1P 2V9)  
INTERNATIONAL SALES AND SERVICE OFFICES IN ALL PRINCIPAL CITIES OF THE WORLD.

**MAXIMUM INDOOR BULB TEMPERATURE:** The application should not permit the indoor bulb to be reset to a temperature higher than 270 F [132 C].

**CAPILLARY TUBE LENGTHS:**

Outdoor Bulb—30 ft [9 m].

Indoor Bulb—10 ft [3 m].

**LISTING BODIES:** T475A controls are listed by Underwriters Laboratories Inc.

**FINISH:** Gray enamel.

**CONTROL CASE DIMENSIONS:** Refer to Fig. 1.

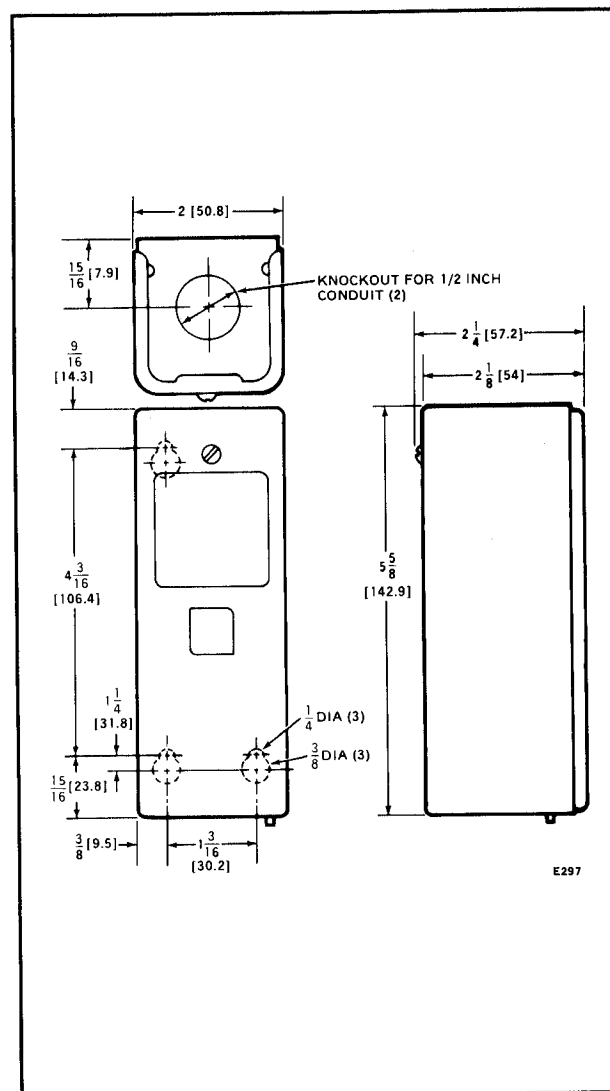


FIG. 1—MOUNTING DIMENSIONS OF T475A IN in. [mm IN BRACKETS].

## SELECTING THE RESET RATIO

Obtain the design temperatures of the heating system involved. The manufacturer or contractor should provide these on request. Using the design temperatures obtained, determine the correct reset ratio by referring to either Table I or the graphs in Figs. 2, 3, and 4.

Sometimes experience indicates that the reset ratio determined will not compensate for a system variable such as the heating plant recovery rate, duct sizing, or other special circumstance. In such cases, the ratio selection should be modified to meet the situation.

TABLE I—SELECTION OF RATIO

OUTDOOR DESIGN TEMPERATURE	DESIGN HEATING MEDIUM TEMPERATURE					
	100 F [38 C]	120 F [49 C]	140 F [60 C]	160 F [71 C]	180 F [82 C]	200 F [93 C]
50 F [10 C]	1:1-1/2	—	—	—	—	—
30 F [-1 C]	1-1/2:1	1:1	1:1-1/2	—	—	—
10 F [-12 C]	—	1-1/2:1	1:1	1:1-1/2	—	—
0 F [-18 C]	—	1-1/2:1	1:1	1:1	1:1-1/2	—
-10 F [-23 C]	—	—	1-1/2:1	1:1	1:1-1/2	1:1-1/2
-20 F [-29 C]	—	—	1-1/2:1	1:1	1:1	1:1-1/2
-30 F [-34 C]	—	—	1-1/2:1	1:1	1:1	1:1

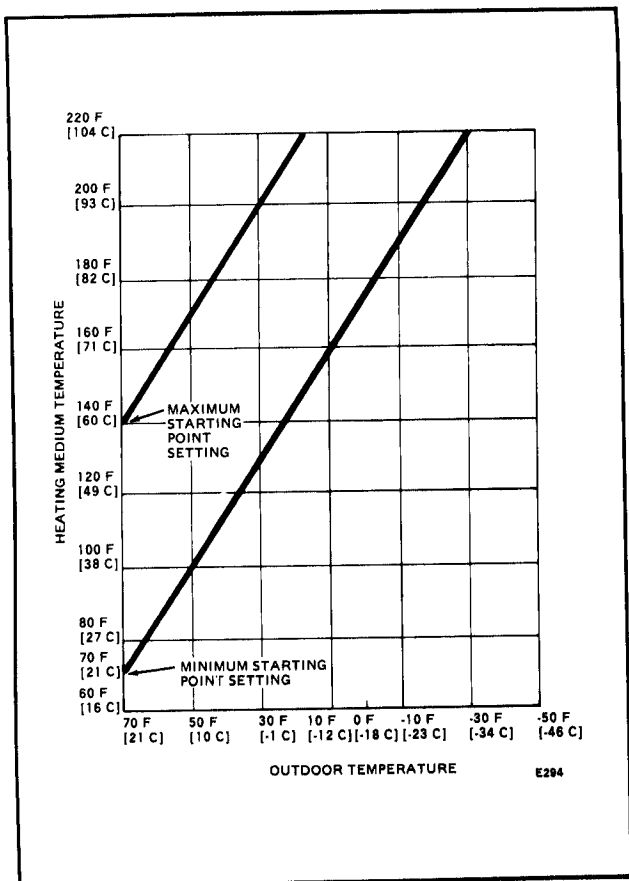


FIG. 2—GRAPH FOR 1:1-1/2 RATIO.

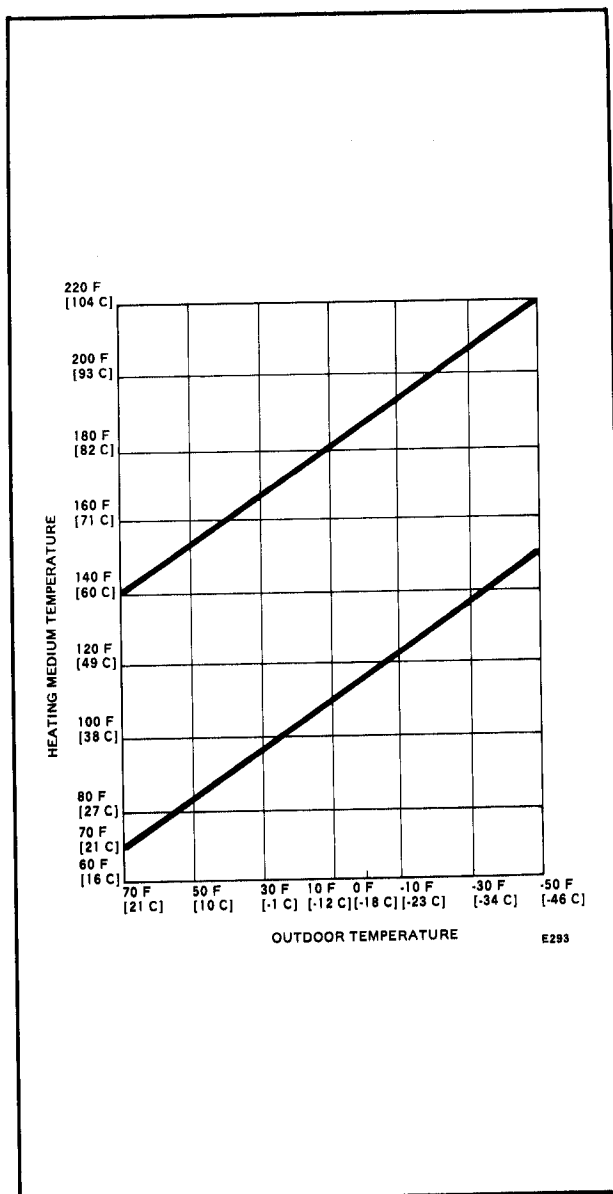


FIG. 4—GRAPH FOR 1-1/2:1 RATIO.

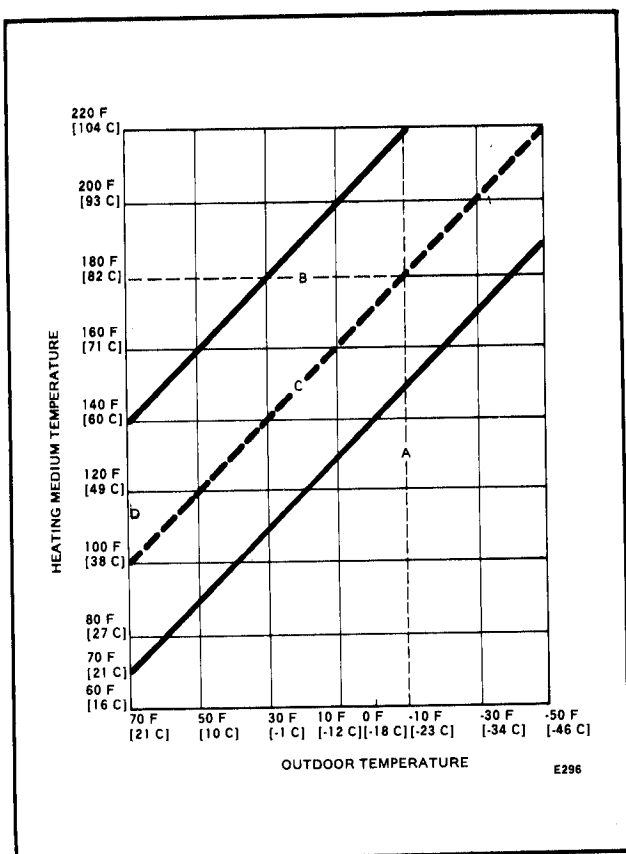


FIG. 3—GRAPH FOR 1:1 RATIO.

### USING THE GRAPHS

The graphs (Figs. 2, 3, and 4) describe the response characteristics of the three reset ratios available. Unless experience dictates otherwise, try the graph for the 1:1 ratio first. Use the following procedure to determine which ratio should be used for the application.

1. Find the outdoor design temperature point on the scale at the bottom of the graph and draw a vertical line to the top of the graph (as line A, Fig. 3).
2. Find the design heating medium temperature for the system and draw a horizontal line at that point (as line B, Fig. 3). Lines A and B will cross.
3. From the point of intersection of A and B, draw a line parallel to the minimum and maximum lines on the graph (as line C). Point D is the proper temperature set point. If this setting is not within the limits of the device, select the reset ratio that seems to be indicated, and repeat procedure.

# 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.

**NOTE:** The case of the controller should be mounted where the temperature during the heating season will remain close to 70 F [21 C]. The length of tubing on either bulb may limit the choice of bulb locations.

Follow instructions or recommendations supplied by the equipment manufacturer, if available.

## MOUNTING THE CONTROLLER

Refer to Fig. 1 for location of mounting holes. Remove the cover from the controller and fasten the case securely to a flat surface. The controller may be mounted in any position.

## MOUNTING THE INDOOR SENSING BULB

(Indoor bulb has 10 ft [3 m] of tubing.)

### WARM AIR APPLICATION

The plenum bulb should be mounted inside the plenum chamber of the furnace where the hot air has free circulation around it, far enough from the combustion chamber to prevent it from being affected by direct radiation. To prevent excessive air leakage and capillary tube damage, the bulb holder accessory is used as shown in Figs. 5-7.

### TO INSTALL THE BULB HOLDER:

1. Find a suitable location on the plenum air chamber for the bulb holder. Make sure bulb will not touch surface of the combustion chamber or heat exchanger.

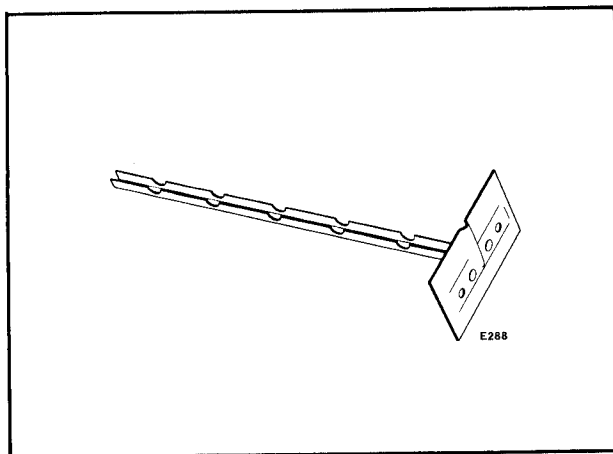


FIG. 5—PLENUM BULB HOLDER ACCESSORY.

2. Punch a hole in the plenum at the mounting location large enough to admit bulb and holder. Also drill holes for the bulb holder mounting screws.

3. Shorten bulb holder, if necessary, by bending channel back and forth with pliers at one of the notches until it separates.

4. Place the capillary of the indoor bulb (bulb with 10 ft [3 m] of tubing) in channel of holder. Make sure bulb is close to channel end of the holder. Pinch top edges of channel together with pliers as shown in Fig. 6.

5. Insert holder with bulb into plenum through mounting hole. Secure holder mounting plate to plenum with two screws.

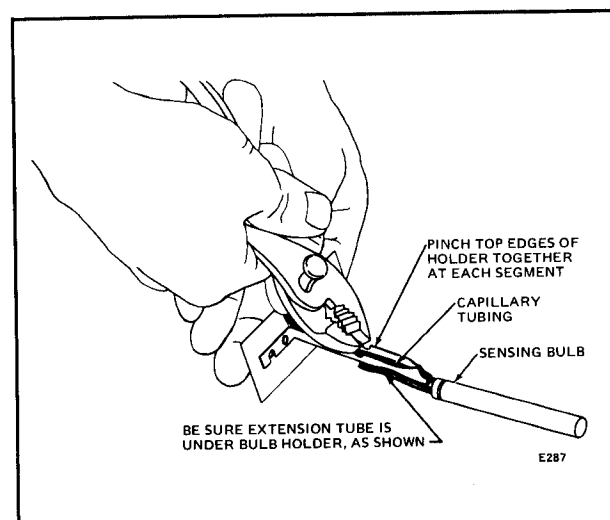


FIG. 6—INSTALLATION OF BULB IN PLENUM BULB HOLDER.

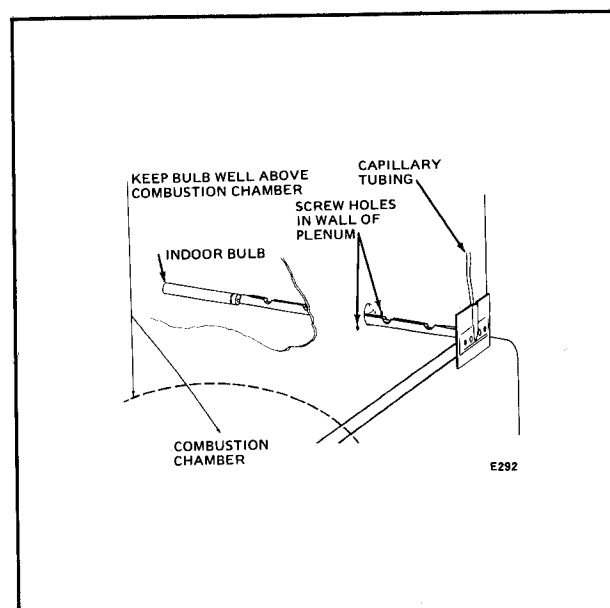


FIG. 7—MOUNTING THE BULB HOLDER IN FURNACE PLENUM.

## HOT WATER BOILER INSTALLATIONS

The indoor bulb must be immersed in the boiler of hydronic heating systems. To mount the bulb, use an immersion well accessory (Fig. 8) or a compression fitting accessory (Fig. 9), or other mounting means recommended by boiler manufacturer. An immersion well should be used if high water turbulence or vibration is encountered at the bulb location.

These mounting accessories must be ordered separately. Refer to the SPECIFICATION section.

1. If necessary, drain boiler so that water line is below boiler or pipe tapping.
2. Remove plug from tapping. Make sure threads of tapping are clean.
3. Apply a moderate amount of dope to the immersion well threads and screw well into tapping.

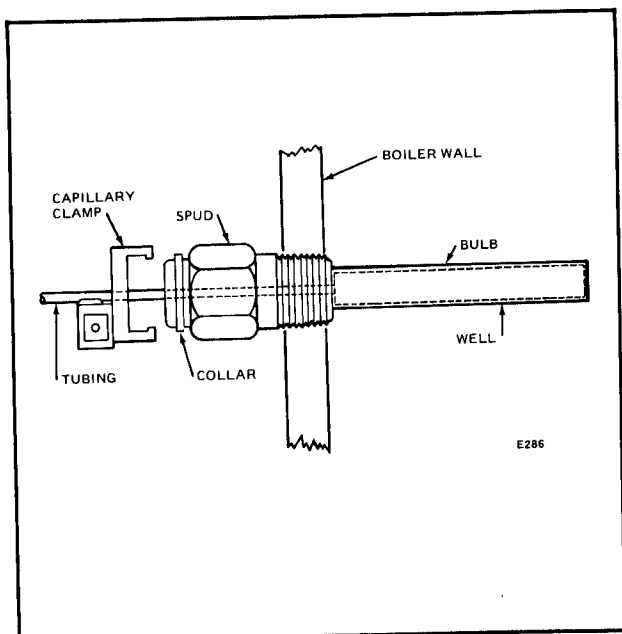


FIG. 8—IMMERSION WELL ACCESSORY.

4. Slide indoor bulb (bulb with 10 ft [3 m] of tubing) completely into well.

5. Attach capillary clamp to the immersion well collar so that tubing is in between "V" of clamp. Tighten clamp screw enough so that bulb cannot be easily pulled from well.

6. Fill boiler with water. After the T475A is completely installed and the boiler water is heated, check for water leaks around the well fitting.

Install compression fitting:

1. If necessary, drain boiler so that water line is below boiler or pipe tapping.
2. Remove plug from tapping. Make sure threads of tapping are clean.
3. Apply a moderate amount of dope to the compression fitting threads. Screw fitting into tapping.
4. Place packing nut on tubing.
5. Slide indoor bulb (bulb with 10 ft [3 m] of tubing) into compression fitting but not completely through fitting. The fill tube and part of the bulb should remain inside the fitting in order to support the bulb.

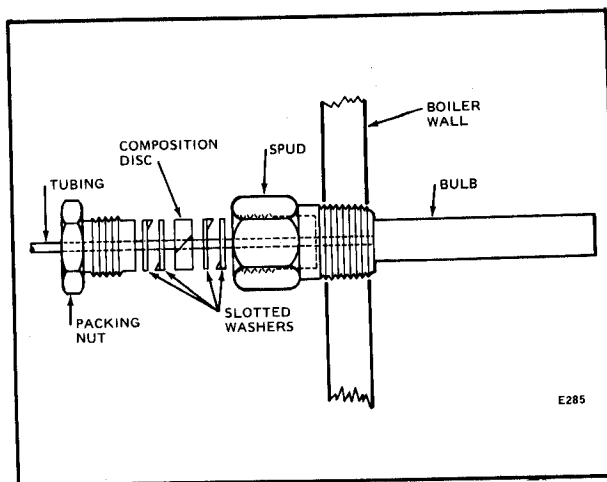


FIG. 9—COMPRESSION FITTING ACCESSORY.

6. Place composition disc and four slotted washers on tubing in order shown in Fig. 9. Turn washers so that slots are 180 degrees apart.

7. Insert seal assembly into boiler fitting. Tighten packing nut.

8. Fill boiler with water. After the T475A is completely installed and the boiler water is heated, check for water leaks around the compression fitting.

## STRAP-ON MOUNTING

This section describes a strap-on mounting procedure for installing T475A Outdoor Reset Temperature Controller in hot water systems. In this type of installation, the indoor temperature controller bulb is mounted externally on the boiler discharge pipe rather than in an immersion well with a compression fitting. All other installation information in the literature accompanying this unit is applicable.

In retrofit applications, the strap-on mounting eliminates the costs and time consumed in draining the boiler and the system, installing the immersion well and bleeding the air from the system after refilling.

## LOCATION

The indoor bulb portion of the controller should be located at a point on the boiler discharge pipe that is approximately 3 ft [0.9 m] from the boiler. The controller and outdoor bulb should be mounted as indicated in the applicable installation sheet.

## OPERATION

External mounting of the sensor produces a slight offset in the temperature control point. Typically, the control temperature is increased up to 5 F [2.8 C] with a bare sensor strapped to the discharge pipe. Applying insulation around the sensor and pipe results in a decreased offset.

## MOUNTING

Mount the indoor bulb on the discharge boiler pipe as follows.

1. Secure controller bulb to pipe with duct hanger wire or metal hose clamps (Fig. 10, top).

## CAUTION

Do not overtighten clamps to point of distorting sensor bulb. Overtightening clamps will cause a significant shift in calibration.

(Steps 2 and 3 are optional and are to be used if large fluctuations in the ambient temperature occur near the pipe.)

2. Cover bulb and pipe with foam rubber insulation extending at least 6 in. [152 mm] beyond both ends of bulb (Fig. 10, bottom).

3. Secure foam rubber with duct tape. DO NOT ALLOW DUCT TAPE TO CONTACT PIPE.

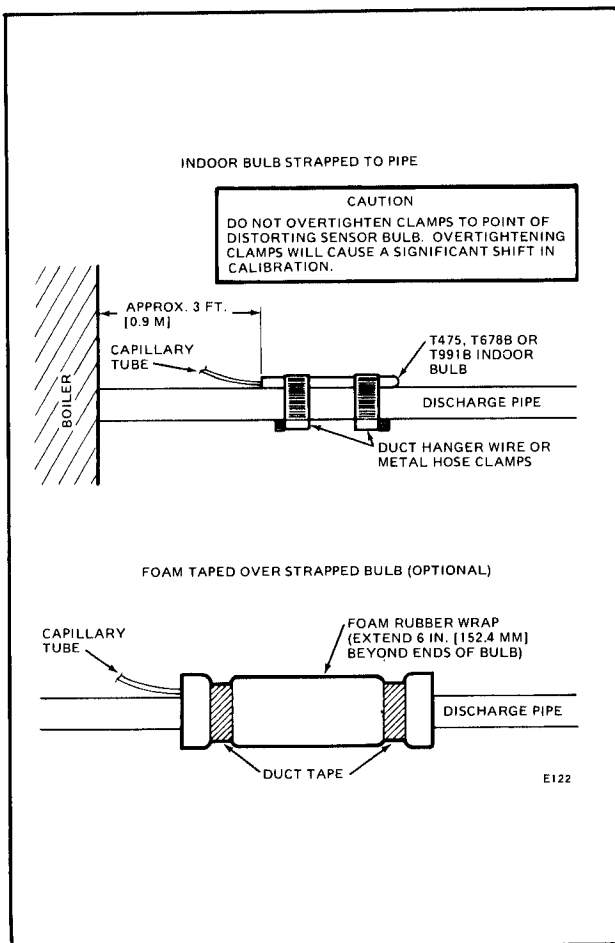


FIG. 10—STRAP-ON MOUNTING OF T475A INDOOR BULB ON A BOILER DISCHARGE PIPE.

## MOUNTING THE OUTDOOR BULB

(Outdoor bulb has 30 ft [9 m] of tubing.)

The outdoor bulb should be installed in the shield and mounted with the shield in a horizontal position as shown in Figs. 11, 12, and 13. Locate bulb where it will sense average weather conditions. However, structures with large glass areas absorb more radiant heat from the sun, and it may be preferable to mount the outdoor bulb where it will pick up the same sun effect. Mount it high enough to prevent tampering or covering with snow, ice, or debris. Avoid vents from the house.

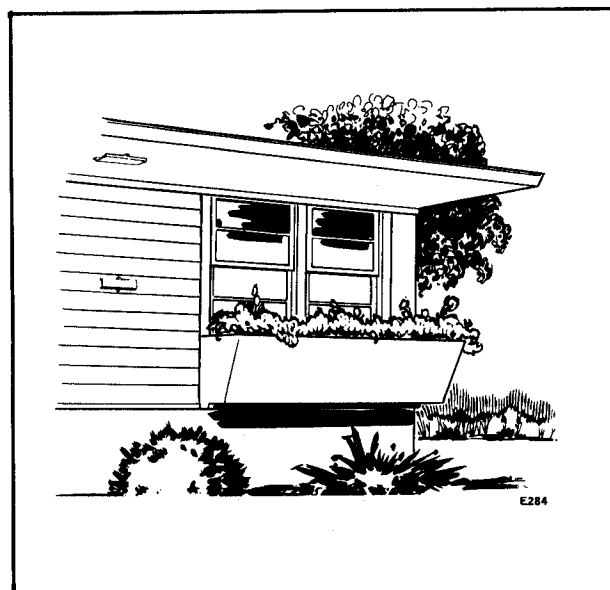


FIG. 11—TYPICAL LOCATIONS OF OUTDOOR BULB GUARD.

Install the outdoor bulb and bulb guard:

1. Drill a 3/4 in. [19.1 mm] hole in the outside wall at the mounting location as shown in Fig. 12. Make sure that hole is located between studs.

2. Route the bulb and capillary from the T475A through the hole. To provide maximum protection and neatness, the capillary should be brought through the inside of wall and/or between floor joists to the mounting location.

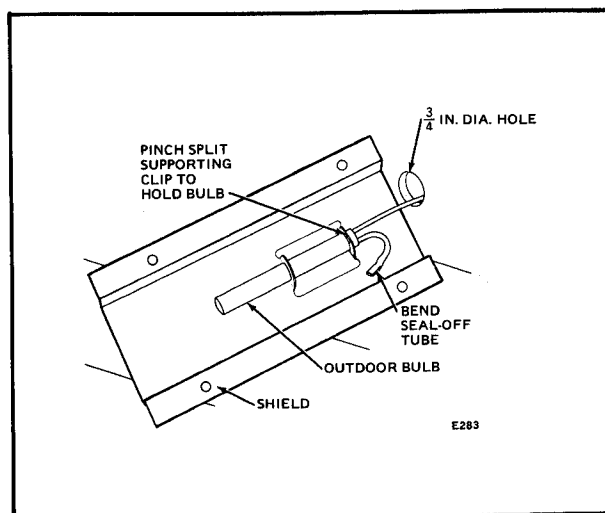


FIG. 12—INSTALLATION OF BULB IN OUTDOOR BULB GUARD.

3. Slip the outdoor bulb through supports in guard (supplied) and pinch the supporting clip so that the bulb is held firmly in position.

4. If the seal-off tube protrudes from under the guard, carefully bend it under as shown in Fig. 12.

5. Turn the guard over and position it over the hole so that a small radius bend is formed in the capillary tubing.

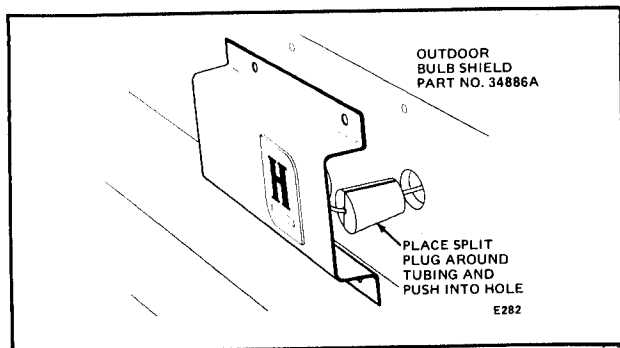


FIG. 13—MOUNTING THE OUTDOOR BULB GUARD TO WALL.

6. Place the split plug (supplied) around tubing and move guard into mounting location as a unit. Refer to Fig. 13. The split plug and hole should be covered by the guard.

7. Push the split plug into the hole until it is wedged securely in place. Fasten guard to the wall with the four mounting screws provided.

## WIRING

### CAUTION

Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.

Wiring must comply with local codes and ordinances. The case of the control is provided with a 1/2 in. [12.7 mm] conduit knockout in the top and one in the bottom for ease of wiring.

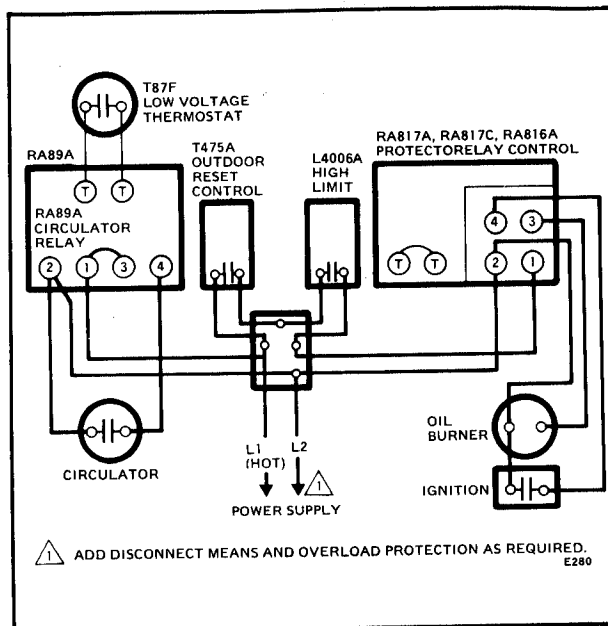


FIG. 14—HOOKUP FOR A SINGLE ZONE FORCED HOT WATER SYSTEM WITH THE T475A OUTDOOR RESET CONTROL.

## SETTING

### TEMPERATURE DIAL SETTING

The temperature dial may be set at any point along the scale from 70 F to 140 F [21 C to 60 C]. A setting of 90 F [32 C] should be satisfactory for most systems. Further adjustments of the temperature dial may be made at any time as the system requires. Also refer to OPERATION AND CHECKOUT section.

### DIFFERENTIAL ADJUSTMENT

The differential adjustment dial (Fig. 15) is factory set at the minimum setting, approximately 6 degrees, which should be correct for most systems.

If it is necessary to widen the differential, move the differential dial until the notch is directly over the desired number of degrees of differential.

DO NOT WIDEN THE DIFFERENTIAL SO MUCH THAT THE HEATING MEDIUM NEVER REACHES THE POINT AT WHICH THE SWITCH REMAKES THE CIRCUIT.

The differential is subtracted from the control point (switch breaks the circuit) to obtain the point at which the switch remakes the circuit. Also refer to OPERATION AND CHECKOUT section.

In most cases the temperature dial setting will have to be raised after the differential has been widened.

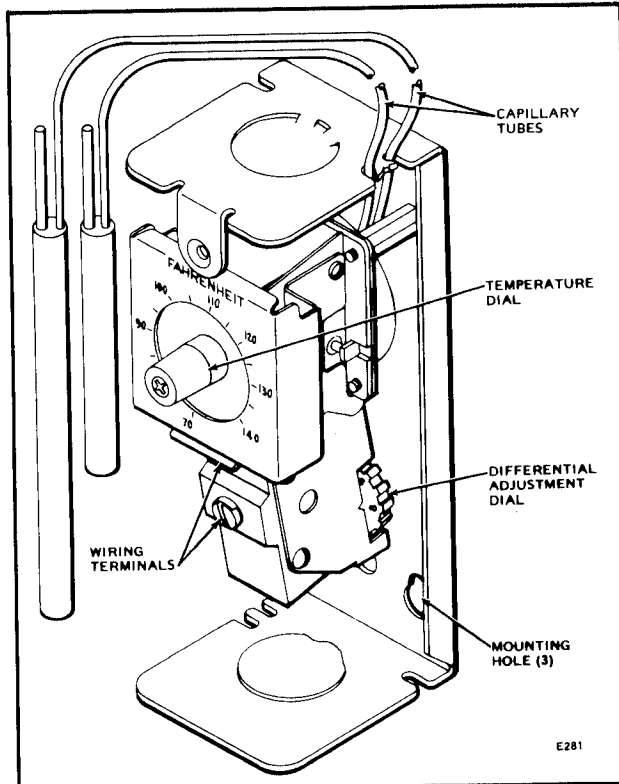


FIG. 15—INTERNAL VIEW OF THE T475A.



# OPERATION AND CHECKOUT

The T475A senses outdoor conditions that result in a need for more or less heat indoors. The furnace or boiler is controlled to compensate for the sensed outdoor temperature changes. The result is a more consistent comfort level in the living space.

The T475A has two sensing elements—one senses the outdoor temperature; the other senses the temperature of the furnace or boiler. When outdoor temperature falls, the Outdoor Reset Control provides increased burner operation. Consequently, more heat is available to the living space when needed.

## SWITCHING ACTION

The T475A consists of a MICRO SWITCH snap-acting switch operated through a lever mechanism by a combination of two liquid filled sensing elements. With a constant outdoor temperature, the switch breaks the circuit at the control point on a rise in temperature at the indoor bulb. On a fall in outdoor temperature, reset produces a rise in control point. The control point is always the sum of the temperature dial setting plus the amount of reset. The switch remakes the circuit on a fall in temperature at the control point minus the differential.

## RESET

With each change in outdoor temperature below 70 F [21 C], the T475A causes a related change in the heating medium temperature through increased or decreased burner operation.

Outdoor temperature rises—heating medium temperature decreases.

Outdoor temperature falls—heating medium temperature increases.

To produce this action, the outdoor reset control shifts its control point in the direction opposite the outdoor temperature change. This shift in control point is known as reset. Reset does not cause a change in the temperature dial setting; it shifts the point at which the switch breaks the circuit.

The amount of reset that occurs in any case depends upon the difference between the actual outdoor temperature and 70 F [21 C], and the reset ratio of the T475A.

## TEMPERATURE DIAL SETTING

When the outdoor bulb and tubing is 70 F [21 C], the temperature dial setting indicates the control point of the T475A.

## DIFFERENTIAL

The differential is the difference, in degrees, between the point at which the switch breaks the circuit and the point at which it remakes the circuit (outdoor temperature remaining constant). When the heating medium temperature is raised to the control point (dial setting plus reset) the switch breaks the circuit to turn off the

burner. The switch remakes the circuit when the heating medium has cooled a certain number of degrees below the control point. This is the differential. The differential of the T475A is adjustable from 6 F to 20 F (3 C to 11 C) (approximate).

## RESET RATIO

The reset ratio is the fixed relationship between the outdoor temperature and the resulting control point. The shift in control point resulting from a definite amount of outdoor temperature change depends upon the reset ratio of the controller.

Three reset ratios are available—1 to 1, 1-1/2 to 1, and 1 to 1-1/2. The first number in each ratio refers to the outdoor bulb temperature.

A 20 F [11 C] change in outdoor temperature would result in the following shifts in control point at the various ratios:

Reset Ratio	Shift in Control Point
At 1 to 1	20 F [11 C]
At 1-1/2 to 1	13-1/3 F [7 C]
At 1 to 1-1/2	30 F [17 C]

The reset ratio of the T475A in a specific situation should be correctly matched with the heating system. Refer to page 3 to determine the proper reset ratio for a specific heating system.

## EXAMPLES OF T475A OPERATION

Listed are operational examples of the T475A in a representative situation. FOR PROBLEM SIMPLIFICATION, EXAMPLE A IS DESCRIBED USING FAHRENHEIT SCALE; EXAMPLE B PRESENTS THE SAME CONDITIONS USING CELSIUS SCALE ROUNDED TO NEAREST WHOLE DEGREE.

Conditions:	Example A	Example B
Outdoor Temperature	10 F	[-12 C]
Temperature Dial Setting	90 F	[32 C]
Differential	6 F	[3 C]
Reset Ratio	1:1	1:1

To find the control point (switch breaks circuit):

1. The control point equals the dial setting plus reset.
2. The amount of reset depends upon the amount of outdoor temperature change and the reset ratio.

- a. The outdoor temperature change is the difference between actual outdoor temperature and 70 F [21 C].

### EXAMPLE A—

Subtract: 70 F minus 10 F = 60 F of outdoor temperature decrease.

### EXAMPLE B—

Subtract: [21 C minus (-12 C) = 33 C] of outdoor temperature decrease.

- b. At the reset ratio of 1:1, 60 F [33 C] of outdoor temperature decrease will result in a 60 F

[33 C] increase in control point, or degrees of reset.

3. The control point equals the dial setting plus the reset.

EXAMPLE A—

Add: 90 F plus 60 F = 150 F (switch breaks the circuit).

EXAMPLE B—

Add: [32 C plus 33 C = 65 C] (switch breaks the circuit).

4. The burner would turn off when the heating medium temperature reaches 150 F [65 C].

To find the point at which the switch remakes the circuit:

1. The switch remakes the circuit at the control point minus the differential (outdoor temperature constant).

EXAMPLE A—

Subtract: 150 F minus 6 F = 144 F (switch remakes the circuit).

EXAMPLE B—

Subtract: [65 C minus 3 C = 62 C] (switch remakes the circuit).

2. The burner will turn on unless there is a break at some other point in the circuit.

Under these conditions, a heating medium temperature of approximately 150 F [65 C] will result at 10 F [-12 C] outdoor temperature.

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