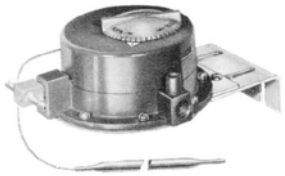
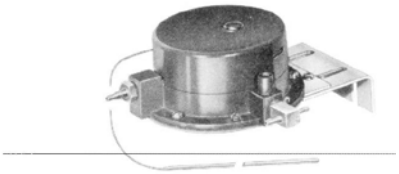
24-4703-1, Rev. A
Technical Bulletin T-3100, T-3200, T-3300
Issue Date February 2016

T-3100, T-3200 and T-3300 Series Installation Data

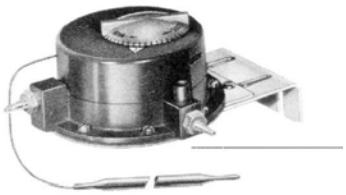
These instructions cover the installation, calibration, routine maintenance, troubleshooting and servicing of the Johnson T-3100, T-3200 and T-3300 series instruments. These instructions are on the three types of thermostats and mountings available. The table on page 2 lists the available standard models. Shown below are the configurations covered by these instructions.



T-3100 Remote Mounted Thermostat with External Adjustment Dial and Bulb Element



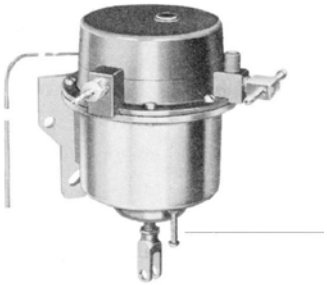
T-3200 Remote Mounted Low Limit Thermostat with Concealed Adjustment and Averaging Element



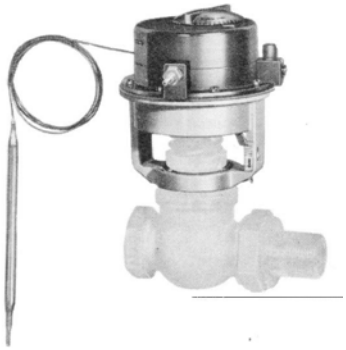
T-3300 Remote Mounted Thermostat with External Adjustment Dial, and Bulb Element



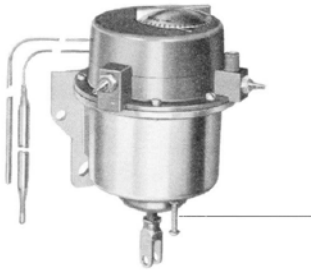
T-3110 Valve Top Thermostat and Integral Actuator with External Adjustment Dial and Bulb Element (Shown with Optional Valve Position Indicator)



T-3250 Piton Top Damper Actuator and Low Limit Thermostat with Concealed Adjustment and Averaging Element



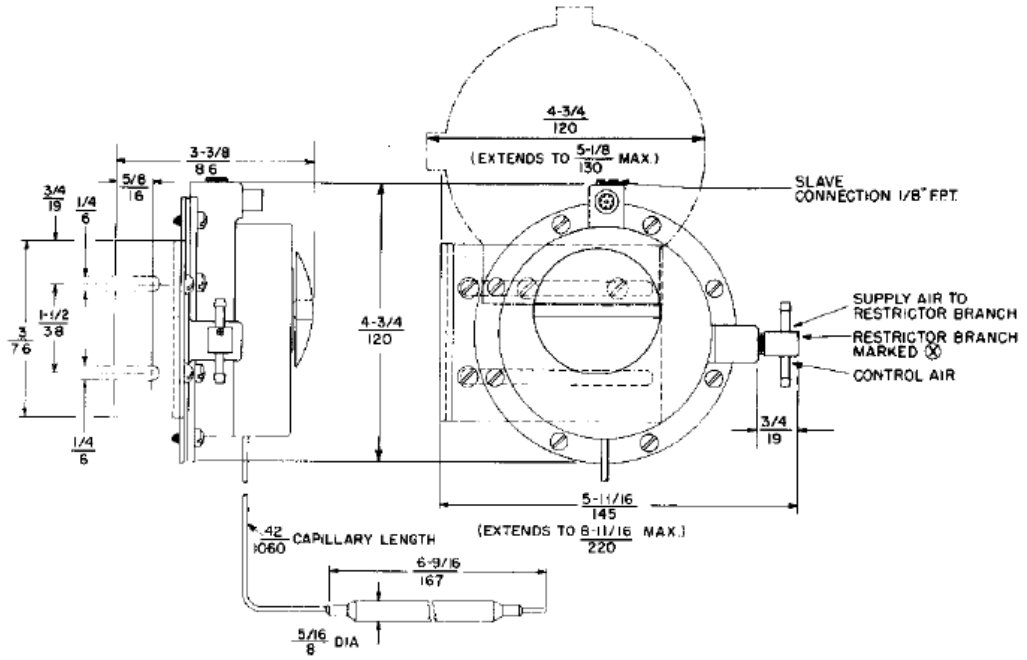
T-3310 Valve Top Thermostat and Integral Actuator with External Adjustment and Bulb Element (Shown with Optional Valve Position Indicator)



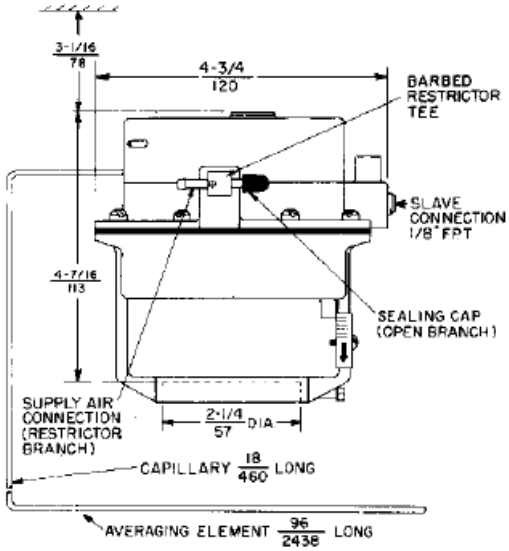
T-3350 Piton Top Damper Actuator with External Adjustment Dial and Bulb and Averaging Element

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Part No. 24-4703-1, Rev. A
Code No. LIT-7171155X

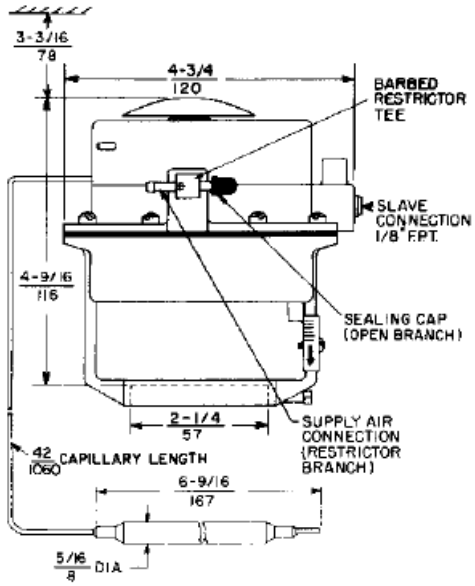
Product	Code No.	Action (Proportional)	Element	Set Point Adjustment	Spring Range	Mounting	Application
T-3100-	2	Direct Acting	Bulb	External		Remote	Single Temperature
	3	Reverse Acting					
T-3110-	2	Direct Acting	Bulb	External		Valve Top	Single Pressure
	3	Reverse Actins_ IS1rect Acting					
	6	Direct Acting	Averaging	Concealed			
T-3200-		DIR @ 15 & 20 PSIG (105 & 140 kPa). Inoperative @11 PSIG (75 kPa)	Averaging	Concealed	5 to 10 PSIG (35 to 70 kPa)	Remote Piston Top	Single Temperature Dual Pressure
T-3250-	16						
	21						
T-3300-	2	DIR @15 PSIG (105 kPa) REV @20 PSIG (140 kPa) DIR @20 PSIG (140 kPa) REV @15 PSIG (105 kPa)	Bulb	External		Remote	
T-3310-	2	DIR @15 PSIG (105 kPa) REV @20 PSIG (140 kPa) DIR @20 PSIG (140 kPa) REV @15 PSIG (105 kPa)	Bulb	External		Valve Top	Dual Temperature Dual Pressure
T-3350-	8	DIR @ 15 & 20 PSIG (105 & 140 kPa) REV @11 PSIG (75 kPa) Low Limit Inoperative @11 PSIG (75 kPa)	Averaging & Bulb	External	5 to 10 PSIG (35 to 70 kPa)	Piston Top	



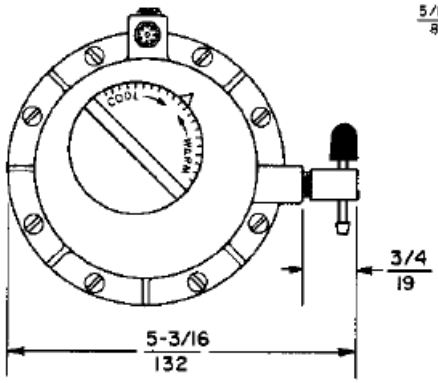
Dimensions $\frac{\text{in.}}{\text{mm}}$ and Mounting Details for T-3100



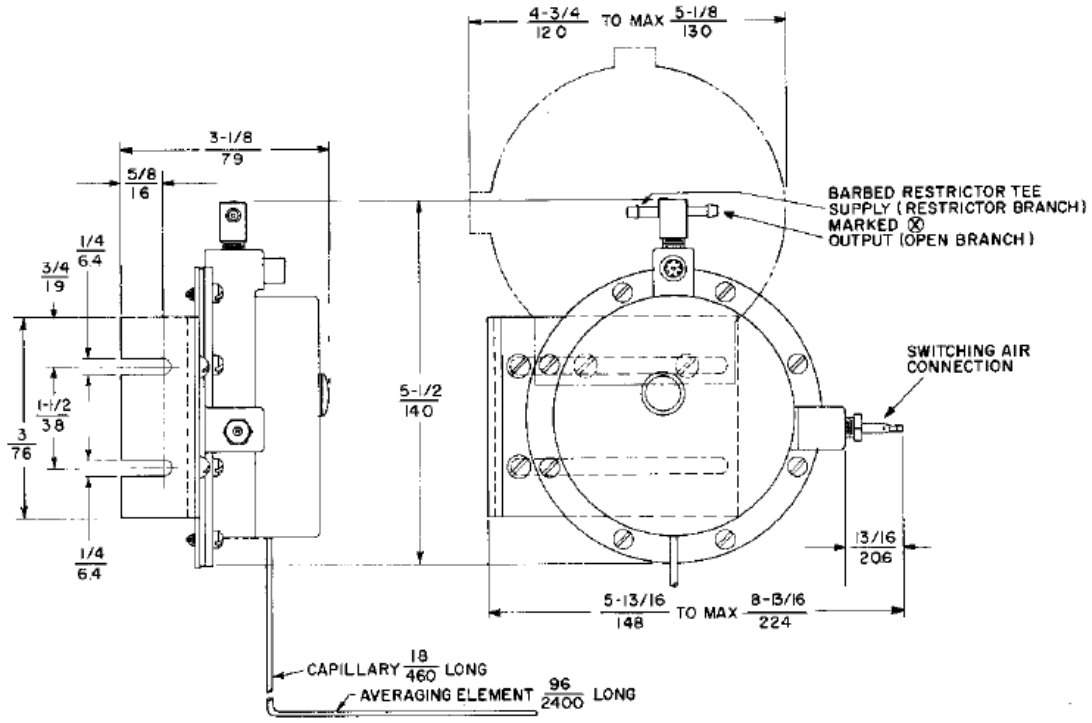
Concealed Adjustment



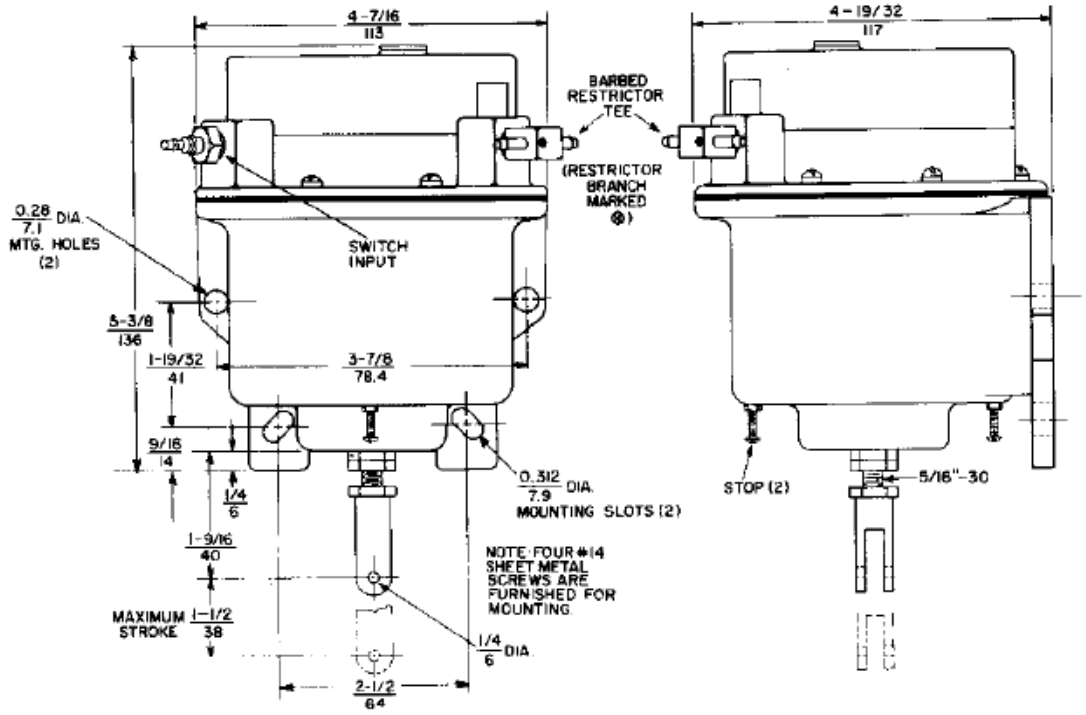
Exposed Adjustment



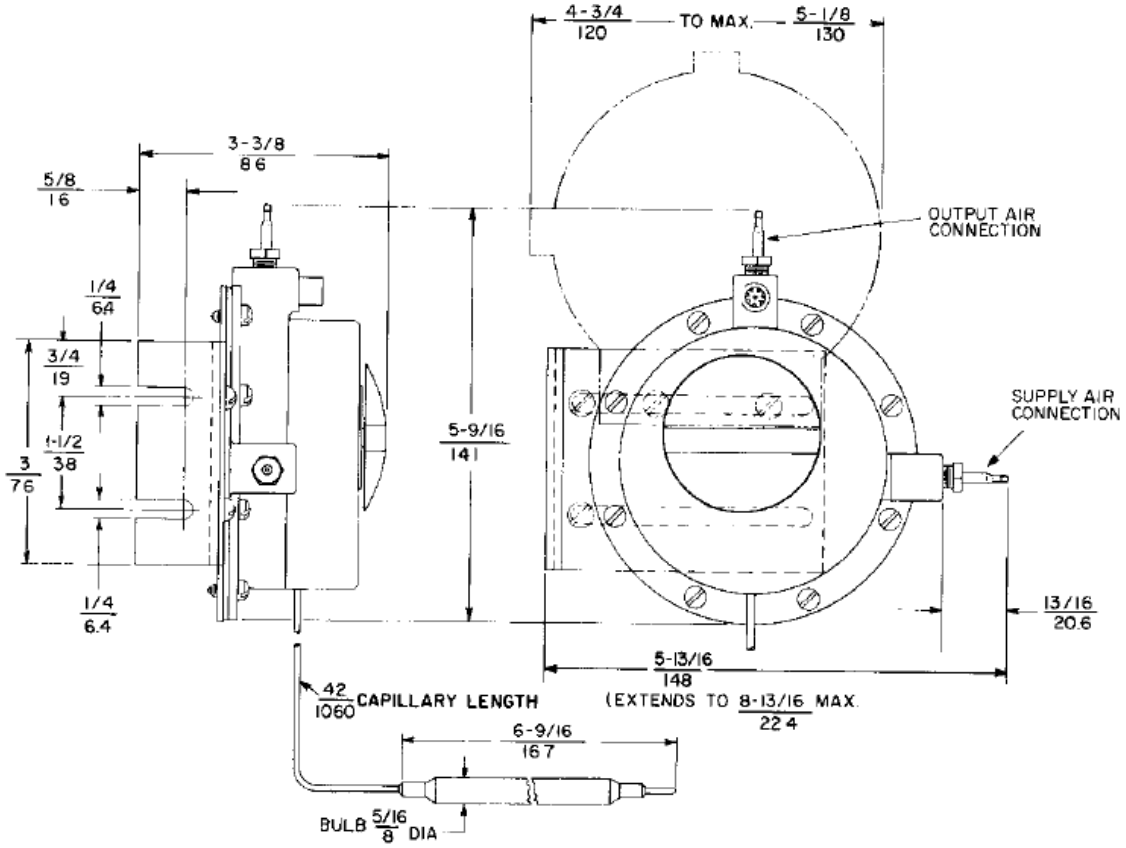
Dimensions $\frac{\text{in.}}{\text{mm}}$ and Mounting Details for T-3110



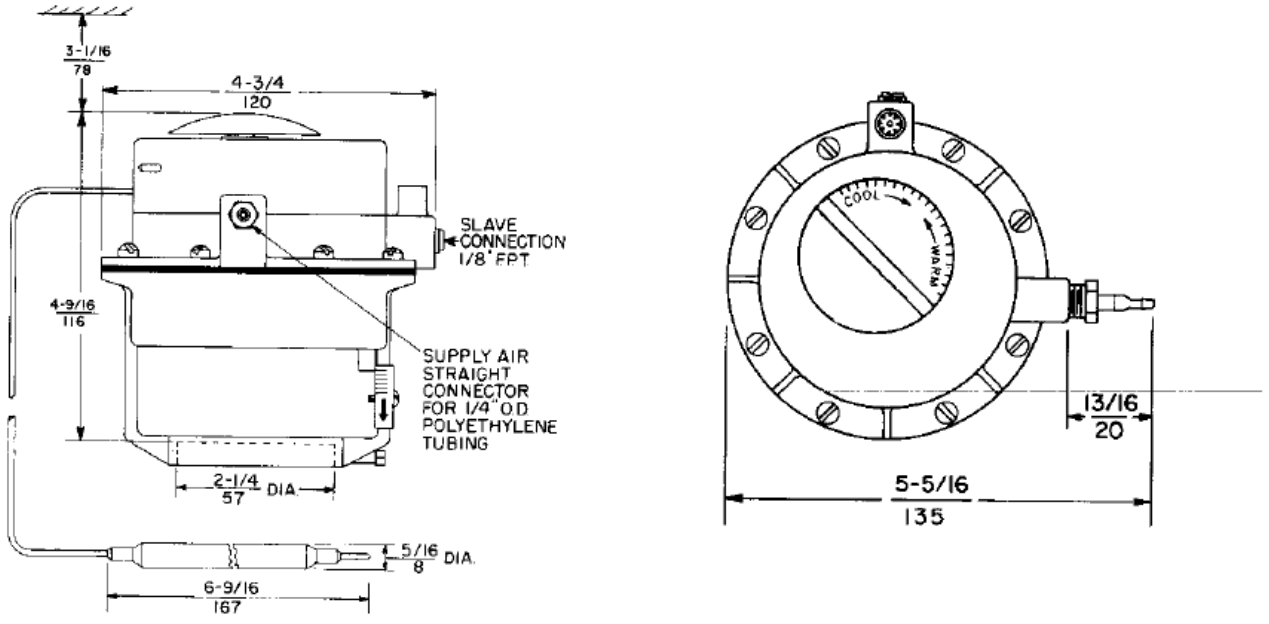
Dimensions In. / mm and Mounting Details for T-3200



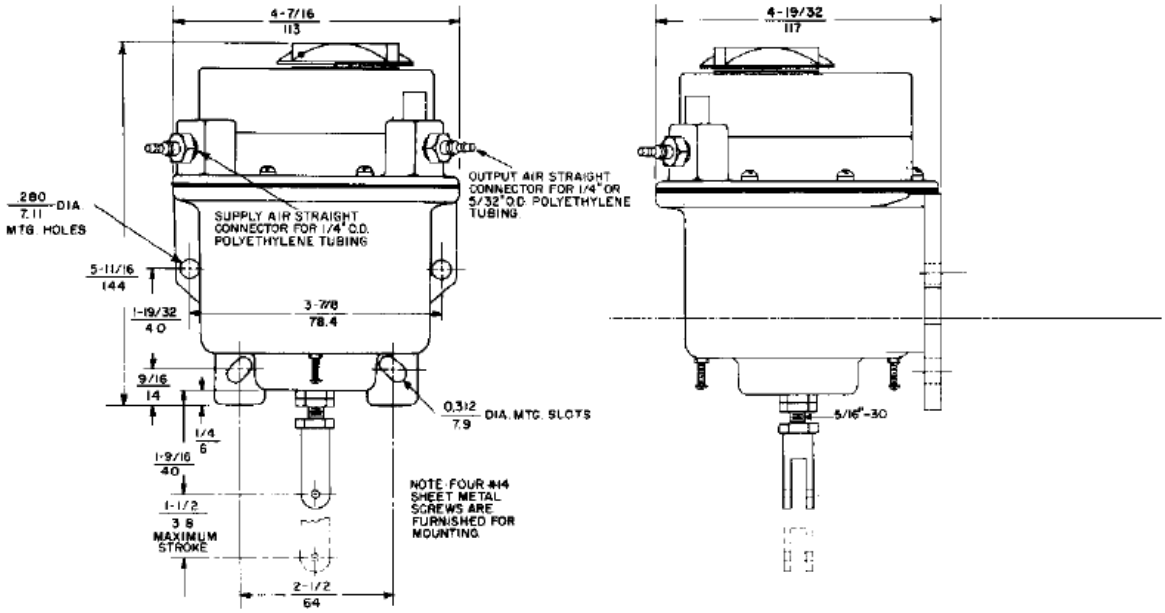
Dimensions In. / mm and Mounting Details for T-3250



Dimensions In. / mm and Mounting Details for T-3300



Dimensions In. / mm and Mounting Details for T-3310



Dimensions $\frac{\text{in.}}{\text{mm}}$ and Mounting Details for T-3350

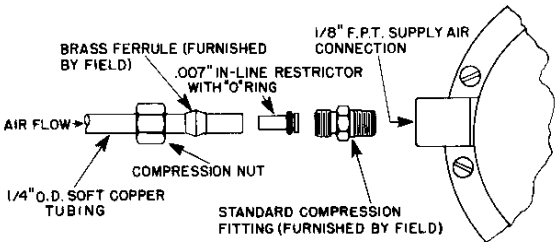
Installation

T-3100, T-3200 and T-3300 series thermostats are supplied with barbed fittings for the supply and output air connections. "FR" type polyethylene tubing is to be used on the barbed fittings.

NOTE: Cut tubing off square for a good fit on the barbed fitting.

If "HP" or copper tubing is used, the barbed fitting(s) must be removed and replaced with a compression fitting, and in-line restrictor when necessary.

NOTE: "HP" tubing installation is the same as the drawing below except brass ferrule is replaced with a thermoplastic ferrule supplied with the R-3710-1007 restrictor.



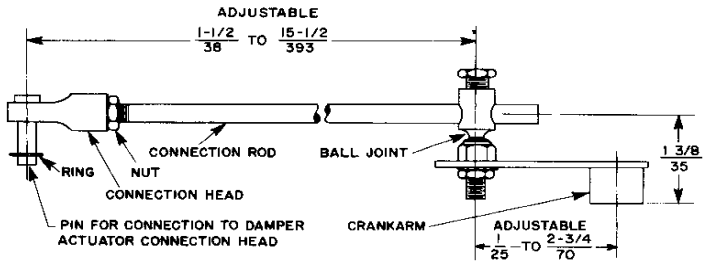
Copper Tubing Installation
(Use R-3710-1007 In-Line Restrictor)

Linkage Assembly with Ball Joint for Type "W" Connection to Damper Shaft

Linkage Assembly with:

3/8 in. Diameter Crankarm (D-3000-1071)
7/16 in. Diameter Crankarm (D-3000-1072)
1/2 in. Diameter Crankarm (D-3000-1073)

NOTE: For applications which require two (2) Ball Joints, order Ball Joint Code No. D-251-6008 and Connection Head Code No. D-3000-1077.

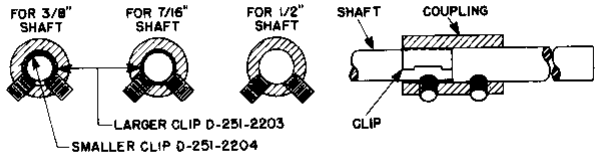


T-3350 Damper Actuator Stop Adjustment

For correct stroke adjustment of a damper actuator, the stop screws should be turned in so that the end of the piston seats against the screws at the moment the damper blades reach the desired position. The piston will not move further and no strain is placed on the actuator shaft or the linkage interconnecting the actuator and damper. The force of the air pressure acts against the stops which are designed to carry the force safely. It is very important that both stop screws be adjusted equally or the piston will tilt within the cylinder. Be sure the lock nuts are loosened prior to and tightened after adjustments are made.

Damper Shaft Modification

A D-251-2202 Shaft Extension Kit is available to increase the damper shaft diameter and extend the shaft. The kit consists of a 1-1/2 in. long coupling, 1/2 in. to 1/2 in.; a 1/2 in. diameter shaft extension, 4-3/4 in. long; and D-251-2203 and D-251-2204 clips.



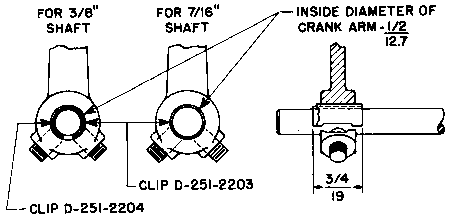
D-251-2202 Shaft Extension Kit

A D-251-2203 clip is available to increase the diameter of a damper shaft from 7/16 in. to 1/2 in.

A D-251-2204 clip is available to increase the diameter of a damper shaft from 3/8 in. to 7/16 in.

NOTE: Both clips are required to increase diameter of 3/8 in. shaft to 1/2 in.

NOTE: A D-251-2203 clip can be used to increase the size of a 10 mm shaft sufficiently to use the D-251-2202 shaft extension kit.



Dimensions: in. / mm

D-251-2203 and D-251-2204 Clips

Installation of Sensing Elements

Both the bulb and the averaging sensing elements must be carefully located so they measure only the intended air temperature. The majority of terminal air conditioning units are very compact and little clearance exists between coils. Also, the air flows are of widely varying temperature. Before selecting an element location, study the unit interior and make certain that the sensing element will not be affected by undesirable temperatures or mechanical damage.

Avoid extremely sharp bends in the capillary which could obstruct the liquid flow.

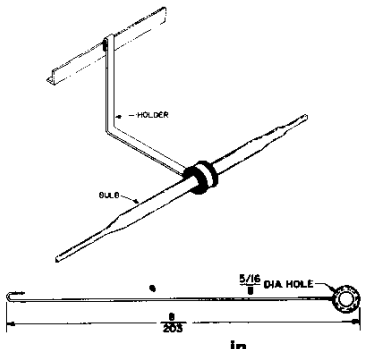
Route the capillary so it is not in contact with extremely high or low temperature sources such as steam lines, water pipes, coils, etc.

Be sure to route the element and capillary so that routine maintenance can be performed on the terminal unit without disturbing the element.

Bulb Element

In most cases, a bulb element will be installed in the return air chamber of the unit in the following manner.

1. Install the element behind the protective screen or grille and in a location where normal maintenance may be performed on the unit without interference.
2. Be sure the bulb will sense only the return air and will not be influenced by other air temperatures.
3. Secure the bulb by using holder T-275-100 which can be hung or fastened in place and bent to the desired position.



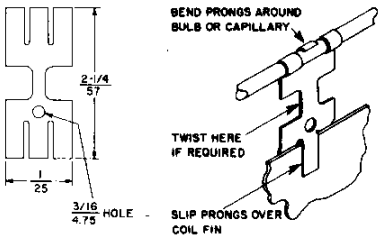
Dimensions: in. / mm

T-275-100 Bulb Element Holder

Averaging Element

In most cases, an averaging element will be installed in the discharge air chamber of the unit in the following manner:

1. Install the element in a serpentine fashion across the top of the unit coil.
2. Secure the element along the entire length by using T-275-101 holders so that no part of the element touches the coil. The holder is very flexible and can be bent to any desired position.
3. On face-and-bypass units, the element must be placed in the space where a mixing of coil discharge air (face) and coil bypass air takes place. Install the element as close as possible to the bottom side of the discharge air grille. The element should be secured by using T-275-101 holders fastened to the unit casing.



Dimensions: In. / mm

T-275-101 Averaging Element Holder

For ASHRAE Cycle III applications, the element must be installed in the mixed air (outside and return) rather than in the discharge air. Install the element so it will receive the best possible sampling of the mixture temperature using holders (T-275-101) fastened to the unit casing.

Calibration

All Johnson instruments are carefully tested and calibrated at the factory before shipment. If required, field calibration should not be started until all installation procedures are complete. If, during calibration, the temperature at the measuring element fluctuates, place the element in a stable, well controlled temperature area such as a bucket of water, preferably 75F.

Be sure supply air to the instrument is clean and free of moisture.

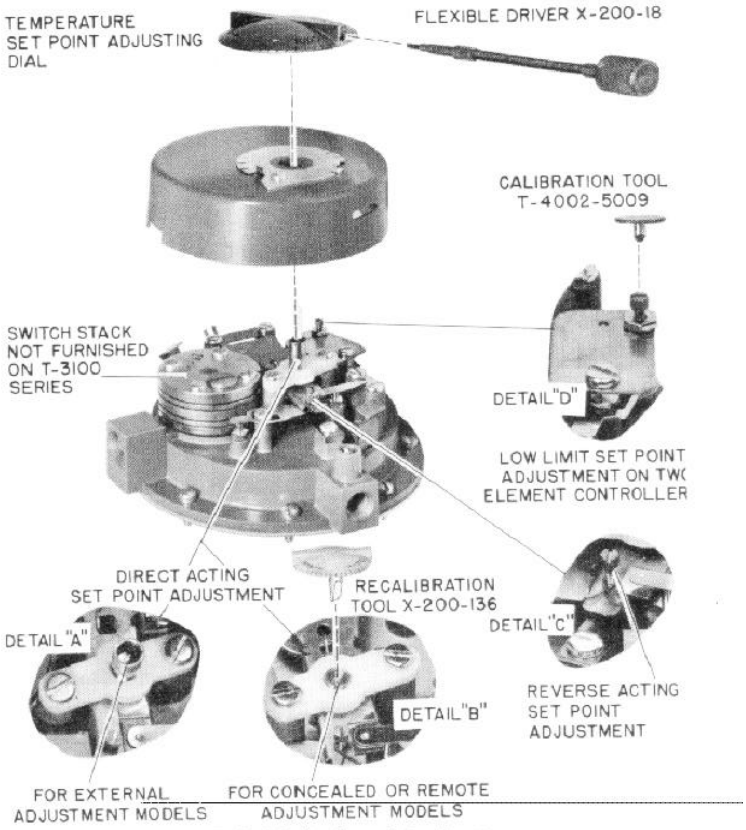
The adjusting dial is graduated in 1F° increments and is removed with flexible hex driver X-200-18. It is recommended that the middle graduation be used to represent the desired temperature set point. Instructions for restricting the set point adjustment are given later.

The adjusting screw for externally adjusted, direct acting (DIR) models is located inside the dial post and is accessible by removing the dial only (see detail "A"). For DIR models with concealed adjustment, it is necessary to remove the small metal button in the cover (see detail "B"). Recalibration tool X-200-136 should be used for set point adjustment of these models.

It is necessary to remove the dial and cover for models with either reverse acting (REV) or low limit adjustments. Use calibration tool T-4002-5009 for low limit adjustment on the T-3350 (see detail "D") and for reverse acting adjustment of the T-3100 and T-3300 series thermostats (see detail "C").

Be sure each T-3100 and T-3110 thermostat has a 0.007 in. in-line restrictor installed in the supply air connection.

For T-3200 and T-3250 instruments there must be a 0.007 in. in-line restrictor in the air line between the instrument and the room thermostat.

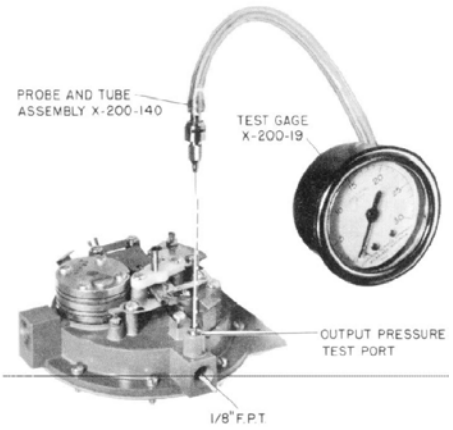


Set Point Adjustment Features (Pictured is the Controller Portion of the T-3350 with Two Elements)

Temperature Set Point Adjustments

T-3100 Series and T-3200 Series

1. Supply the instrument with the proper supply air pressure.
2. Insert the test gage (X-200-19) and the probe assembly (X-200-140) into the output test port.
3. Turn the set point adjustment screw until the pressure reading is approximately in the middle of the operating range of the actuator. For example, a 5 to 10 psig operating range would require an output pressure reading of 7.5 psig.
4. Remove the test gage and probe assembly.
5. Determine the temperature at the measuring element.
6. Place the dial on the dial post (do not tighten) and position it to the temperature at the element. Remember that each dial increment represents one Fahrenheit degree. For models with concealed adjustment, use calibration tool X-200-136.



Test Gage Insertion Instructions

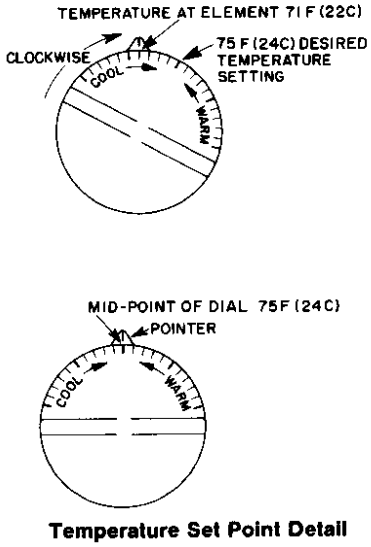
7. Tighten the dial and turn it to the desired set point.

Example: Assume the desired temperature set point is 75F and the temperature at the element is 71F. Place the dial on the dial post (do not tighten) and position it to 71F or four graduations (75F-71F±4F°) clockwise from the middle graduation (75F), the desired set point.

NOTE: For T-3200 Series, Low Limit Set Point is 56F. Use Calibration Tool X-200-136; each graduation is 9F° (5C°).

T-3300 Series

1. Supply the instrument with the appropriate air pressure for the direct acting (DIR) operation.
2. Insert the test gage and probe assembly into the test port.
3. Turn the DIR screw until the output pressure is in the middle of the actuator operating range.
4. Change the supply air pressure to that required for the reverse acting (REV) operation.



Temperature Set Point Detail

5. Turn the REV adjusting screw until the output pressure is in the middle of the actuator operating range.
6. Remove the test gage and probe assembly.
7. Determine the temperature at the element.
8. Place the dial on the dial post (do not tighten) and position it to the temperature at the element.
9. Tighten the dial and turn to the desired set point.

NOTE: If the set points of several instruments are to be adjusted before switching the supply pressure, be absolutely sure that the temperature at the element will not change during both stages of adjustment.

Two Element Controllers

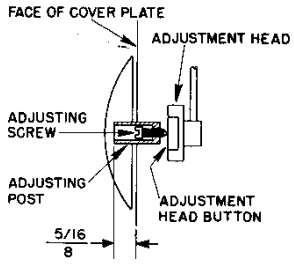
On the T-3350 thermostat with two elements, the averaging element (low limit) is usually located in the unit discharge air and the bulb element is in the return air chamber.

1. Insert the test gage and probe assembly into the test port.
2. Turn all adjusting screws until the output pressure reading is at maximum.
3. Turn the low limit adjusting screw until the output pressure is in the middle of the actuator operating range.
4. Determine the temperature at the low limit element.
5. Using adjusting tool T-4002-5009 (each graduation represents 3-1/2F° for this application), turn the low limit adjusting screw counterclockwise to obtain a set point of 56F.
6. Proceed with the DIR and REV set point adjustment(s) as previously outlined.

Restricted Adjustment

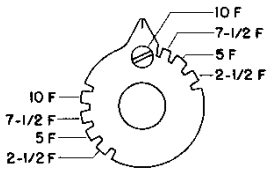
The dial pointer on externally adjusted models has tabs which are factory set to restrict the dial adjustment to a span of 15F° (7-1/2F° on either side of the pointer). The restriction can be changed to the spans indicated in table below by bending up the appropriate tabs and flattening the factory set tabs.

SPAN		TAB	
F°	C°	F°	C°
20	11.1	±10	±5.6
15	8.3	±7½	±4.2
10	5.6	±5	±2.8
5	2.8	±2½	±1.4



Dimensions: in. / mm

Side View of Adjustment Head



Restricted Adjustment

Routine Maintenance and Troubleshooting

These instruments are designed so that a minimum of routine maintenance is required. The following procedures should be used to insure proper operation and to locate malfunctioning components.

1. Check **all** air lines, connections and diaphragms for air leaks. Be sure that the in-line restrictors are not defective.
2. Check the operation of the thermostat to be sure it is passing the correct control signal and that it is functioning properly. Be sure it has the proper supply air pressure and that air is exhausting from the control port. The port must exhaust continuously to insure proper operation of the thermostat.
3. Be sure the temperature measuring element has not been damaged or moved from its intended sensing position.
4. Be sure the actuator is stroking properly. Do not lubricate the actuator shaft; it slides in a factory lubricated bearing. Be sure all stops and locking devices are tight and have not moved.
5. Check all linkages to be sure there is no binding and that operation is free and unrestricted throughout the entire stroke.
6. Be sure the damper blades are not obstructed and are in good repair. Clean all pivots and remove any rust corrosion or paint from the blade edges.
7. Be sure the valve packing nut is tight enough to prevent leaks, but not so tight that the packing becomes distorted and binds the stem; usually finger tight is sufficient. If the valve is leaking around the centerpiece, tighten it with the appropriate wrench.
8. Be sure the valve seats completely when the actuator is fully stroked. If there is fluid flow after the plug is seated, the seat, plug or disc may be worn or scored and should be repaired or replaced.
9. If there are subordinate actuators, be sure they are operating in the proper sequence and adjusted correctly.

Service and Repair

Descriptions and specifications for the T-3100, T-3200 and T-3300 Series instruments with and without integral actuators, and for Johnson valves and damper actuators are found in their respective Product Data sheets. It is important that the instrument be identified before servicing so that related literature such as repair parts sheets can be reviewed. All jobs have control diagrams and records on file that list the exact units used in the control system according to Product Data sheet number, function, and in the case of actuators, spring range. Reference must always be made to the Repair Parts Catalog for all replacement parts, subassemblies and complete assemblies.

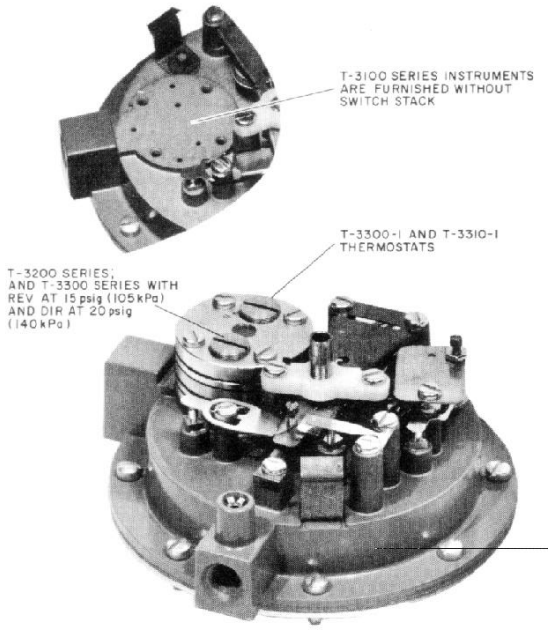
The tool section of the catalog should be consulted for the appropriate tools to use when performing the various service functions. In addition to the instructions in this bulletin, in the Operator's Manual, and in other Johnson Controls publications, most repair kits contain specific instructions. These instructions must be followed exactly if proper installation of the part is to be accomplished.

Thermostats

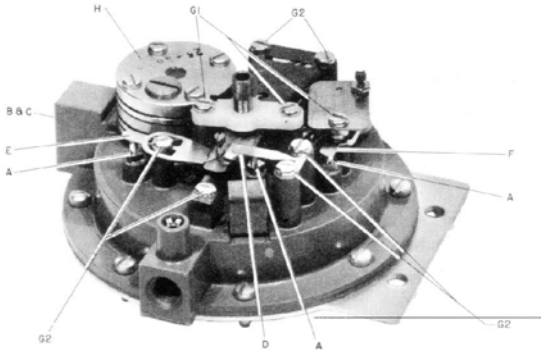
The following repair parts are available for this series of instruments from the factory:

A. Control Port(s) - T-4002-600
To remove and install this item use control port wrench X-200-16. In most cases it will be necessary to remove the associated lid.

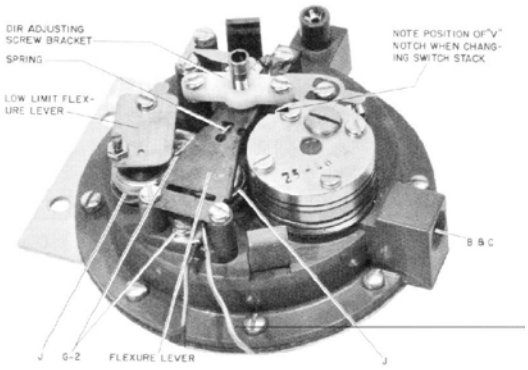
B. Orifice Filter - T-3100-605
Use a sharp, pointed instrument to remove this item when plugged with dirt. Use the eraser end of a pencil or some other blunt device to install the new filter.



Adjusting Screw Location



Repair Parts Location



Repair Details

C. In-Line Restrictor - R-3710-1007 Required as a replacement for restrictor "T" fittings on copper tubing installations. Installation instructions covered on page 6. "T" fitting W/.007" restrictor R-3710-3107 to replace restrictor "T" on T-3100, T-3110, T-3200 and T-3250 thermostats.

D. Direct Acting Lid - T-3100-601

E. Reverse Acting Lid - T-3100-606

F. Low Limit Lid - T-3100-602 It will be necessary to remove the low limit flexure lever and the spacer below it in order to remove this item.

G. Screw Kit - T-3100-600 This kit consists of three (3) screws 5/16 in. long, indicated by G1 and seven (7) screws 3/16 in. long, indicated by G2 in the illustrations above.

H. Switch Stacks for T-3200 Series:
T-3200-600 switches at 17 psig
T-3250-600 switches at 13 psig

Switch Stacks for T-3300 Series:
T-3300-600 switches at 13 psig
T-3350-600 switches at 17 psig

1. Before removing the four mounting screws, carefully note the position of the "V" notch of the stack in relation to the thermostat assembly. The new stack must be placed in the same position.
2. After placing the new stack in the correct position, tighten the four mounting screws in a crisscross pattern so that the gasket is loaded evenly.

I. Element Assembly T-285-600 Averaging Element (used as low limit element on two element controllers) T-275-602 Bulb Element T-276-600 Remote Adjustment Assembly including Bulb Element.

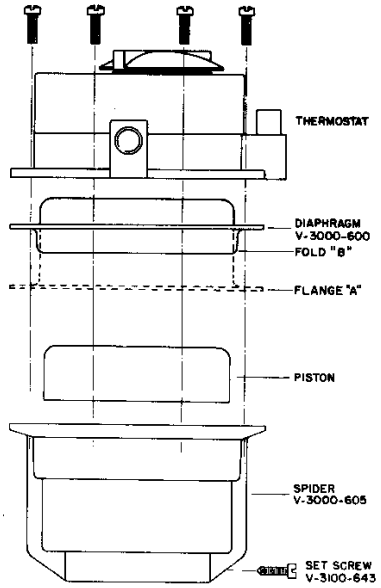
1. Remove the DIR adjusting screw bracket; the DIR lid; the REV lid; the screws (2) holding the flexure lever; and unhook the spring holding the flexure lever.
2. Remove the flexure lever exposing the clip and screw holding the element capillary. Also remove the clip and screw.
3. Remove and save the element spacer button, and lift the element from the socket.

4. If the instrument has two elements and the low limit element must be replaced:
   a. Remove the screw (1) holding the low limit flexure lever, spacer and lid.
   b. Remove the clip and screw. Also remove and save the element spacer button.
   c. Lift the element from its socket.
5. Remove and discard the new element's holding clip and spacer button.
6. Insert the new element into the socket and replace the spacer button, holding clip and screw.
7. Reassemble the flexure lever, spring, lids and bracket.

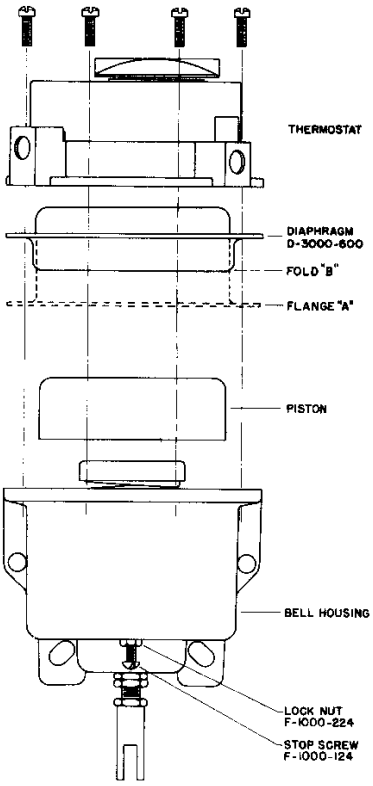
Actuators

The following instructions outline the correct procedure for changing the diaphragm on this series of instruments:

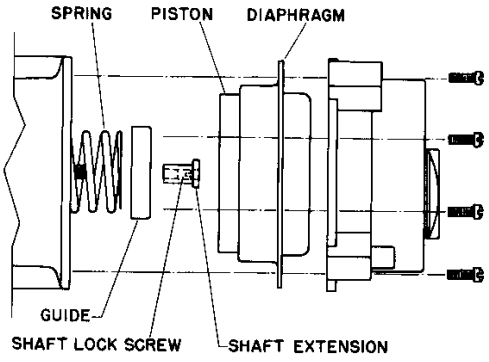
1. Remove the eight (8) screws holding the thermostat to the integral actuator.
2. Lift the thermostat, exposing the diaphragm. On piston top and valve top instruments, also remove the piston.
3. Turn new diaphragm inside out, place over piston, smooth out all wrinkles and release any air trapped between the head of the piston and the diaphragm and pull flange up. Diaphragm will assume shape as shown in drawing.
4. On piston top valve and damper actuators, place the piston exactly straight within the new diaphragm and insert into the bell housing.
5. Replace the thermostat.
6. Replace all screws and tighten equally.
7. Place the instrument in operation and check its action.



Diaphragm Installation for T-3110 and T-3310



Diaphragm Installation for T-3250 and T-3350



Actuator Spring Detail

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GERMANY

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