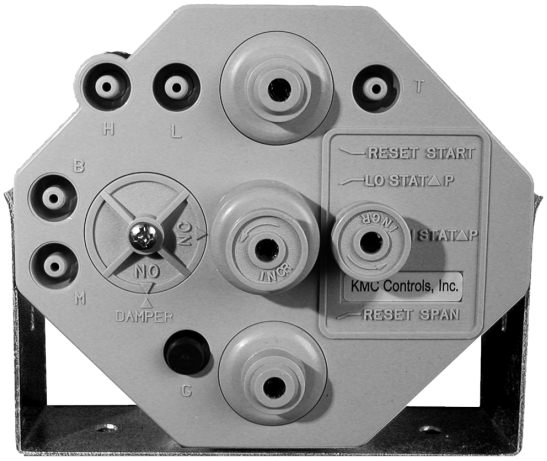
Pneumatic VAV Reset Volume Controllers

CSC-3000 Series*

*(*These instructions do **not** apply to the CSC-3014 or the CSC-3501/3505.*)



Applications Guide

General Information

CSC-3000 Series Overview

These CSC-3000 series reset volume controllers are designed for use on heating or cooling systems with (normally open or normally closed) VAV terminal units and (direct or reverse acting) thermostats.

They are sub-master air velocity controllers. Each is equipped with separate adjustment knobs for minimum and maximum airflow setpoints. Models are available with various reset start points. A master controller, typically a room thermostat, resets the CSC between the minimum and maximum velocity setpoints.

The universal design of the CSC-3000 series is intended for new or replacement applications that call for direct or reverse acting reset on normally open or normally closed VAV terminal units.

NOTE: These controllers are used on single and dual duct applications. When working on dual duct applications, it may be necessary to work on one duct at a time.

NOTE: Any sequencing with other controllers, valves, or pneumatic-electric relays must be done with the controller's reset range, NOT the actuator's spring range.

Mounting

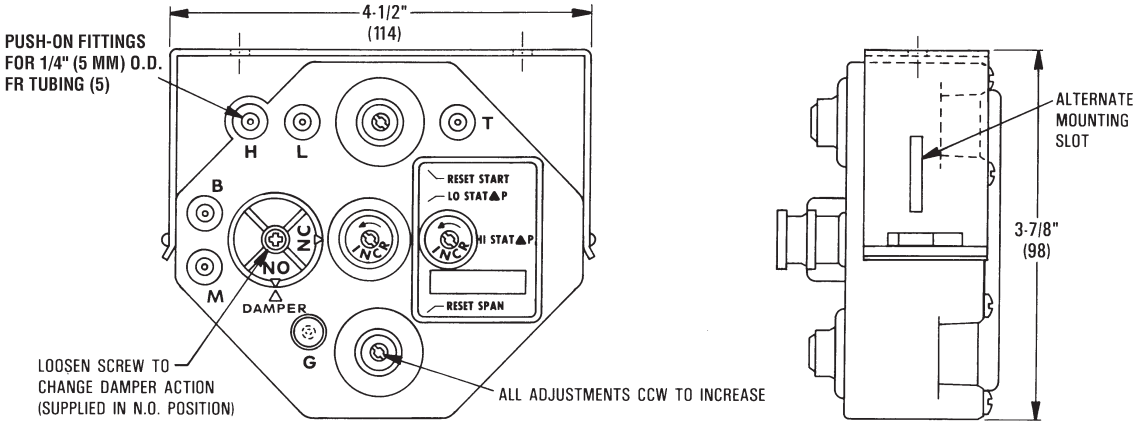
The CSC-3000 Series are position sensitive. They must be mounted and calibrated in either the horizontal or vertical plane.

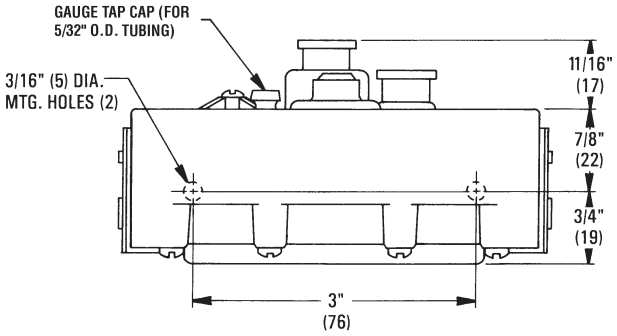
1. As near to the flow sensor pickup as is feasible, connect the mounting bracket to the mounting surface with two self-threading screws in the two 3/16" (5 mm) mounting holes. Be sure to leave enough room to make connections.
2. Insert the controller, face down, up, right or left. The controller must be installed and adjusted in the same plane or readjustment will be necessary.

More Information

For additional **specifications**, see the Data Sheet for these controllers.

This Application Guide does not apply (completely) to the CSC-3014 (designed to work with CTC-2100 Thermostats) or the CSC-3501/3505 (Linear Volume Reset Controllers). See their separate Data Sheets and Installation Guides.





All dimensions are in inches (mm).

Connections

For all models of the CSC-3000 series, use 1/4" (5 mm) O.D. "FR" tubing on the following push-on fittings:

1. Connect the clean, dry, oil-free main air supply to Port "M" (15 to 30 psig).
2. Connect the damper actuator to Port "B".
3. Connect the thermostat output to Port "T".
4. Connect the high pressure tap on the airflow sensor to Port "H".
5. Connect the low pressure tap on the airflow sensor to Port "L".
6. Check for proper connections. **Make sure all tubes are snug on their fittings**. If loose, trim the end of the tubing and reconnect it to ensure there are no leaks.

NOTE: Over time, the tube may stretch or develop microcracks. Trim the end of tube back to undamaged material and reconnect. Replace the tubing if it is brittle or discolored.

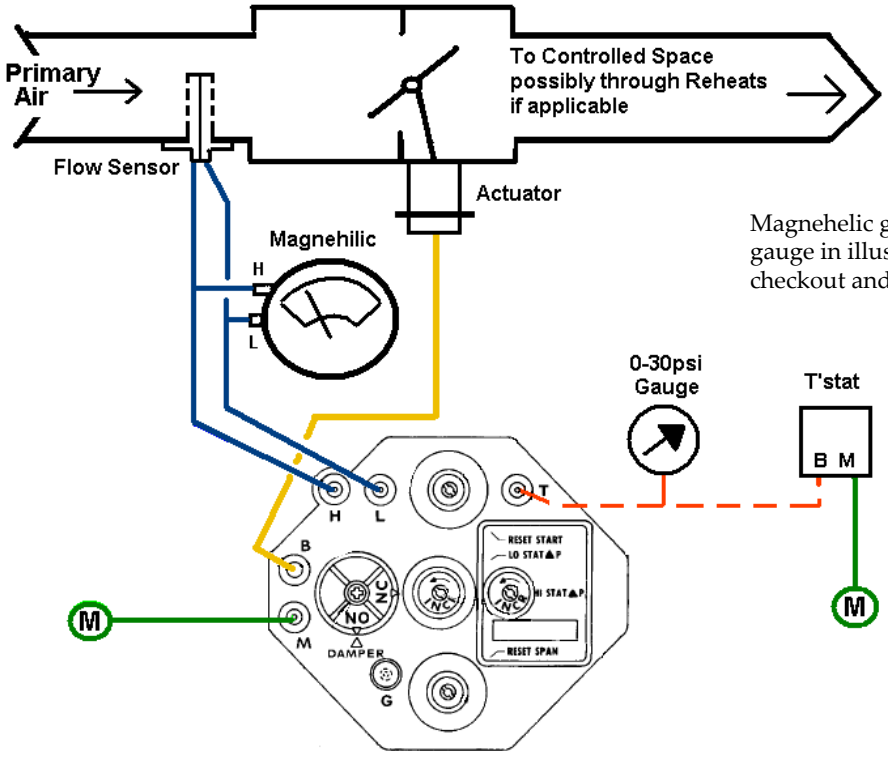
NOTE: You can easily test for leaks with a squeeze bulb to ensure there are no leaks at the actuator diaphragm or fittings.

7. Use a flow hood or "tee" a Magnehelic® (or equivalent) differential pressure gauge between the controller and the ΔP pick-up to determine airflow rates.

⚠ CAUTION

Pneumatic devices must be supplied with clean, dry control air. Any other medium (e.g., oil or moisture contamination) will cause the device to fail.

(*These instructions do **not** apply to the CSC-3014 or the CSC-3501/3505.*)



Magnehelic gauge and 0–30 psi gauge in illustration added for checkout and calibration purposes.

Typical CSC-3011 Application and Connections

Adjustments and Calibration

Damper Action

The damper action is factory-set at Normally Open (N.O.). To change to Normally Closed (N.C.), perform the following steps:

1. Loosen the damper selection screw.
2. Turn the selection dial clockwise until the "NC" arrow aligns with the "DAMPER" arrow.

NOTE: Accuracy in the alignment of the arrows is very important. Make this adjustment as exact as possible.

3. Tighten the selection screw. **Be sure the screw is tight** (2 to 4 in-lbs. of torque), **but if overtightened, the plastic will strip out.**

Determining the Type of Reset

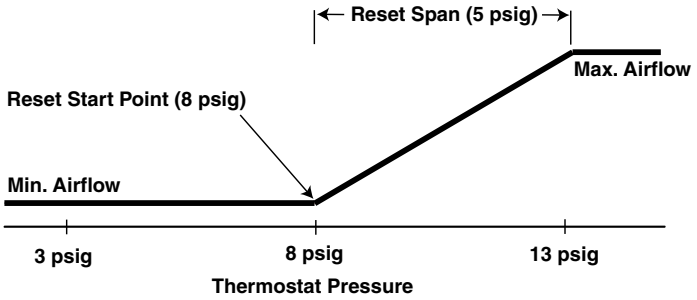
The following table shows when Direct Reset or Reverse Reset is required. Determine the reset type based on the temperature of the primary air entering the VAV box and whether the thermostat in the space is direct or reverse acting.

Primary Air	Thermostat	Reset Type
Cooling	DA	Direct Reset
	RA	Reverse Reset
Heating	DA	Reverse Reset
	RA	Direct Reset

Adjusting Minimums and Maximums

When adjusting the minimum and maximum airflow settings, the output responds slowly to changes in the setpoint. Wait for the flow rate to stabilize after making an adjustment (usually 20 to 30 seconds) before making further adjustments. Also, if the damper position is all the way closed or open when starting this step, turn the adjustment one full turn, and then wait 20 to 30 seconds for a change in the flow reading of the Magnehelic gauge. If no change occurs after this time, repeat until the flow rate changes.

DIRECT RESET Minimum and Maximum



NOTE: The direct reset illustration above assumes no relays are connected between the thermostat and "T" port.

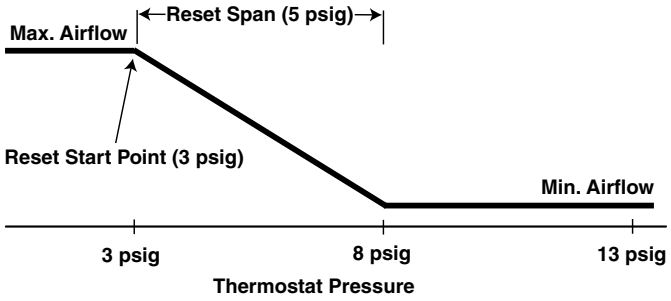
For Direct Reset (DA thermostat for cooling or RA thermostat for heating), perform the following steps:

1. Adjust the thermostat to a setting that will cause the output pressure to be as high as possible (15 psi or more). This can be done in the following manner:
   a. For **Direct** Acting thermostats, lower the setting to the **lowest** possible setting.
   b. For **Reverse** Acting thermostats, raise the setting to the **highest** possible setting.
2. On the CSC-3000, disconnect the "T" port. Temporarily plug the tubing. (Do NOT plug the port.)
3. Adjust the LO STAT ΔP (center dial) one adjustment (1/4 to 1/2 knob rotation) at a time until the desired **Minimum** airflow is read at the Magnehilic gauge and is stable.

NOTE: If the LO STAT ΔP Limit must be set at "0" (zero minimum), do not turn the LO STAT ΔP knob fully clockwise. The knob will adjust one and one-half turns after a zero minimum is reached. Turning the LO STAT ΔP knob fully clockwise will result in a negative reset condition. This means that when the controller begins to reset at the reset start point it must first overcome the negative adjustment and will not begin to reset from "0" until a higher thermostat reset pressure is reached. This negative reset will also reduce the effective range of the controller by reducing the low end reset; narrowing the reset span. If a zero minimum is required, adjust the LO STAT ΔP knob until the controller just begins to crack the damper open, then back-off **one-quarter** turn and verify zero airflow. (This is typically 2-1/2 knob rotations counterclockwise from the fully clockwise position.)

4. Reconnect the thermostat tubing to the "T" port. This will put 15 PSI or more on the "T" port.
5. Adjust the HI STAT ΔP (dial on right) one adjustment (1/4 to 1/2 knob rotation) at a time until the desired **Maximum** airflow is read at the Magnehilic gauge and is stable.
6. Repeat Steps 2 through 5 to verify the settings to be correct and fine tune if necessary.

REVERSE RESET Minimum and Maximum



NOTE: The reverse reset illustration above assumes no relays are connected between the thermostat and "T" port.

For Reverse Reset (RA thermostat for cooling or DA thermostat for heating), perform the following steps:

1. Adjust the thermostat to a setting that will cause the output pressure to be as high as possible (15 psi or more). This can be done in the following manner:
   a. For **Direct** Acting thermostats, lower the setting to the **lowest** possible setting.
   b. For **Reverse** Acting thermostats, raise the setting to the **highest** possible setting.
2. On the CSC-3000, disconnect the "T" port and leave it open. Temporarily plug the open tubing.
3. Adjust the LO STAT ΔP (center dial) one adjustment (1/4 to 1/2 knob rotation) at a time until the desired **Maximum** airflow is read at the Magnehilic gauge and is stable.
4. Reconnect the thermostat tubing to the "T" port. This will put 15 PSI or more on the "T" port.
5. Adjust the HI STAT ΔP (dial on the right) one adjustment (1/4 to 1/2 knob rotation) at a time until the desired **Minimum** airflow is read at the Magnehilic gauge and is stable.

NOTE: If the HI STAT ΔP Limit must be set at "0" (zero minimum), do not turn the HI STAT ΔP knob fully clockwise. The knob will adjust past where a zero minimum is reached. Turning the HI STAT ΔP knob fully clockwise will result in a negative reset condition. This means that the controller will get to zero before going through the whole reset span. If a zero minimum is required, adjust the HI STAT ΔP knob until the controller just begins to crack the damper open, then back off slightly and verify zero airflow.

6. Repeat Steps 2 through 5 to verify the settings to be correct and fine tune if necessary.

Reset Start Point

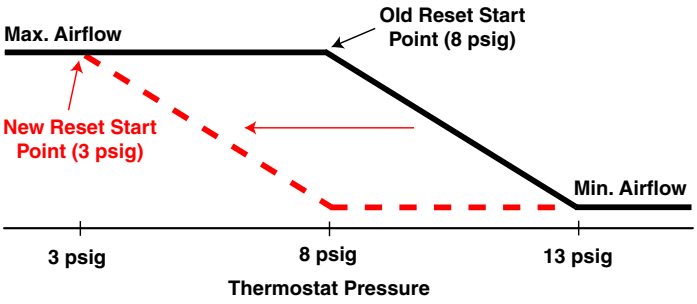
The reset start point is the pressure from the thermostat at which the controller begins to reset from the LO STAT to the HI STAT setting.

Models of the CSC-3000 series come with reset start points factory-set at 3, 8, or 10 psig. (See the chart on the next page.) These are standard in most applications and typically do not require adjustment.

If a reset start point is needed other than the default setting, all models are field adjustable between 0 and 10 psig. (If the reset start point is changed, the reset span may need to be adjusted as well.) To adjust the reset start point, carry out the following steps:

1. Put the thermostat pressure at the desired start point pressure (e.g., 3 psig).
2. Remove rubber plug at the "G" port and read pressure at "G" with a 0–30 psi gauge (requires 5/32" O.D. tubing).
3. With a small flat-blade screwdriver, adjust (counterclockwise to increase; clockwise to decrease) the reset start point control (at the top of the controller) until the pressure read at "G" port is just beginning to move off zero (0) psig.

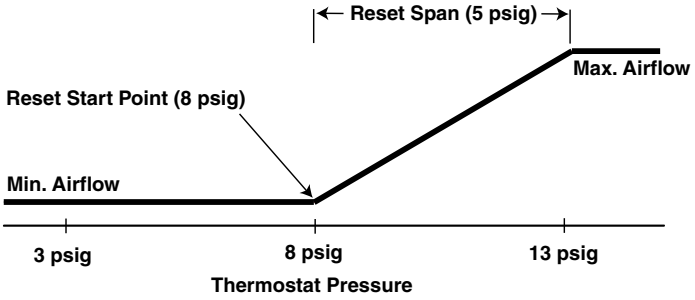
NOTE: If the controller does not respond correctly after all adjustments have been made, it may be necessary to correct the reset span adjustment.



(Reverse) Reset Start Point Adjusted from 8 to 3 psig

Reset Span

The reset span is the thermostat's effective reset range for the controller. A reset span of 5 psig means that it will take a 5 psig pressure change measured from the reset start point to reset the flow rate of the VAV box.



NOTE: Reset span is the pressure change at 'T' above the reset start point that causes the flow setpoint to move from one extreme to the other. In a direct reset application, the flow setpoint will change from minimum to maximum flow above the start point. In a reverse reset application, the reset will change from maximum to minimum flow above the start point.

The CSC-3000 series are factory set with a reset span of 5 psig. This is standard in most applications and does not typically require adjustment. Leaving this adjustment at the factory setting is recommended.

If necessary, the reset span can be adjusted (between 0 and 10 psig). If the reset span is changed, the minimum and maximum flows may need to be readjusted.

To adjust the reset span to another value, perform the following steps:

1. Adjust the thermostat to a higher pressure, beyond working range (20 psig is best).
2. Attach a pressure gauge to the "G" port (requires 5/32" O.D. tubing).
3. With a small flat-blade screwdriver, adjust (counterclockwise to increase; clockwise to decrease) the reset span control (at the bottom of the controller) until pressure at the "G" port equals the desired reset span pressure. Pressure read at this port will always be between 0 and the active reset span setting.

Troubleshooting

The CSC-3000 series are position sensitive. Be sure to mount the controller with the correct orientation. See the Mounting section. If the controller is calibrated in a position other than the final mounting position, the calibration (minimum and maximum flow limits) will be off.

The spring range of the actuator does not matter. However, sufficient main air is required to provide the actuator with enough force to operate the damper/linkage. Also, there can be no leaks in the actuator since even small leaks can cause the actuator to not stroke. You can easily test for leaks with a squeeze bulb to ensure there are no leaks at the actuator diaphragm or fittings.

Any sequencing with other controllers, valves, or pneumatic-electric relays must be sequenced with the controller's reset range, **not** the actuator's spring range.

These controllers are typically used on single-duct applications but may be found in dual-duct applications. When working on dual-duct applications it may be necessary to work on one duct at a time.

Maintenance

No routine maintenance is required. Each component is designed and manufactured for reliability and performance. Careful installation and use will ensure long-term dependability.

⚠ CAUTION

Pneumatic devices must be supplied with clean, dry control air. Any other medium (e.g., oil or moisture contamination) will result in the device's eventual failure.

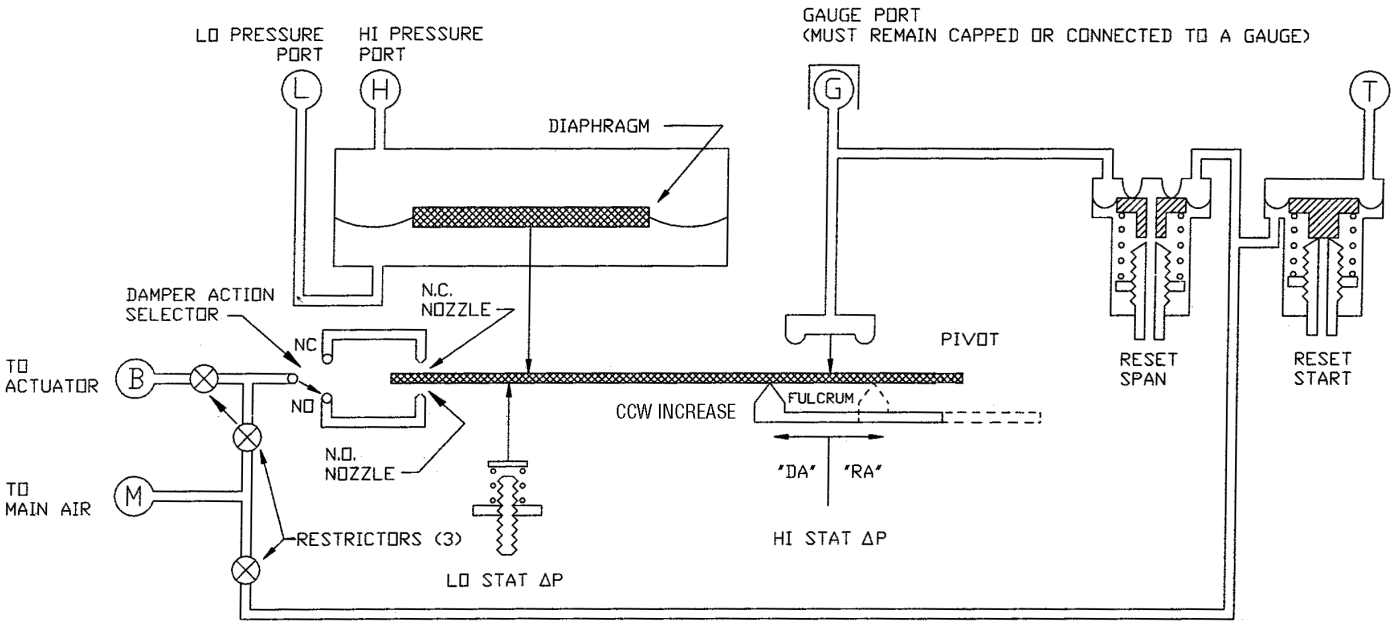
Pressure Independent Operation Principles

Differential pressure is sensed via a ΔP pick-up mounted ahead of the damper (VAV terminal inlet). The ΔP pick-up is a dual pressure pick-up sensing both high and low pressures. The high pressure is connected to the "H" port and the low pressure is connected to the "L" port. These two pressures are compared across the diaphragm. (No air is transferred between the "H" and "L" port.) The diaphragm positions a reset lever relative to the pressure difference between the force of the LO STAT ΔP spring and the position of the HI STAT ΔP setting.

Turning the LO STAT ΔP knob counterclockwise (to increase) repositions the reset lever away from the normally open nozzle and towards the normally closed nozzle. LO STAT ΔP adjustments must be done with the "T" port pressure being less than the RESET START pressure.

- "**NO**" DAMPER selection (normally open dampers)—turning the LO STAT ΔP knob counterclockwise (increase) will reposition the reset lever away from the normally open nozzle, decreasing the "B" port pressure and increasing airflow through the terminal unit.
- "**NC**" DAMPER selection (normally closed dampers)—turning the LO STAT ΔP knob counterclockwise (increase) will reposition the reset lever towards the normally closed nozzle, increasing the "B" port pressure and increasing the airflow through the terminal unit.

Turning the HI STAT ΔP knob counterclockwise (to increase) repositions the fulcrum towards the nozzles. HI STAT ΔP adjustments must be done with the "T" port pressure being greater than the RESET START pressure plus the RESET SPAN pressure.

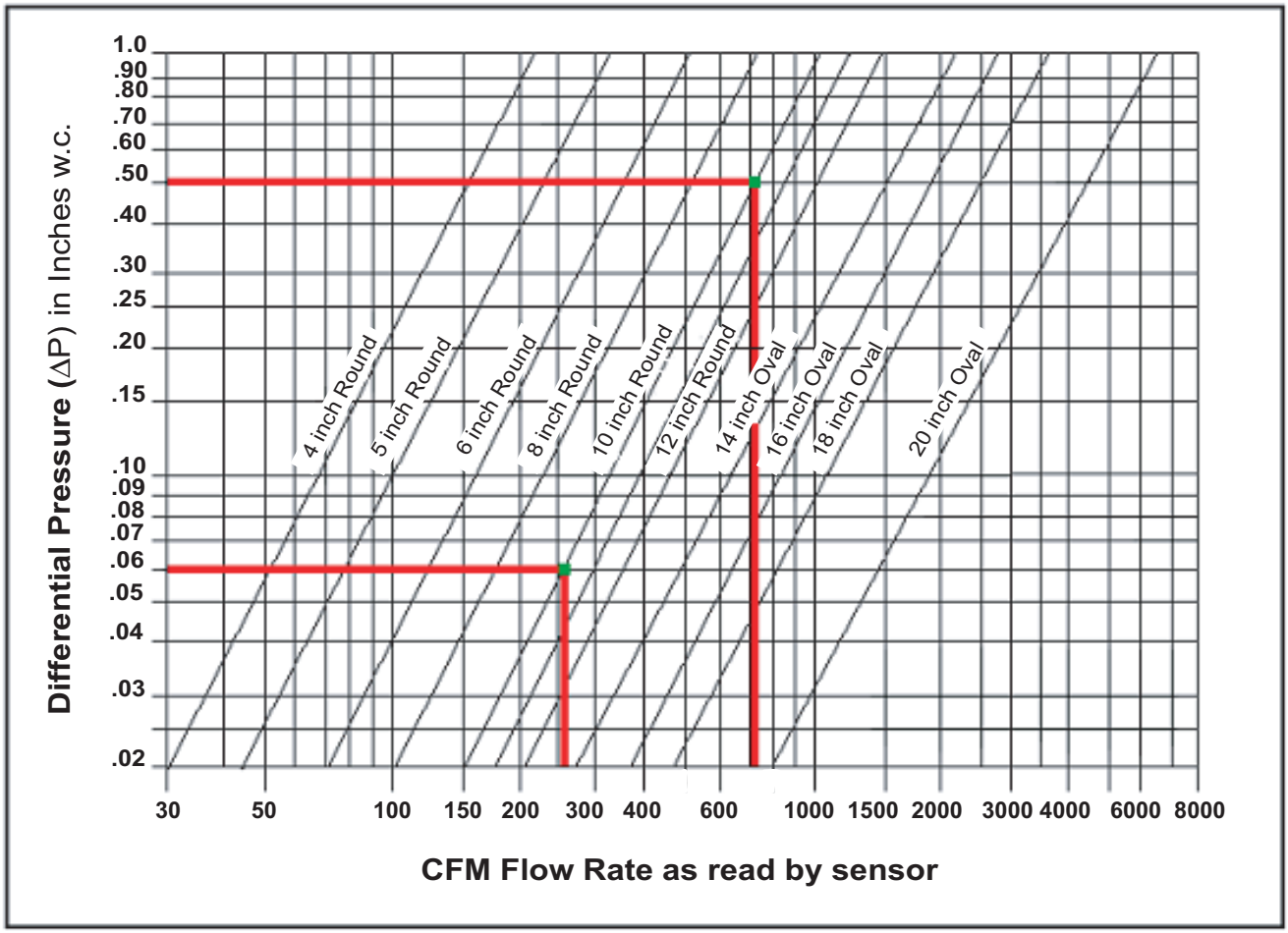


(*These instructions do **not** apply to the CSC-3014 or the CSC-3501/3505.*)

Magnehelic Gauge to Airflow Rate Chart

This airflow chart is an **example** of the charts usually affixed to the VAV box. Each chart is *specific for the type of flow sensor* located in the inlet side of the VAV box. Read the differential pressure of the Magnehelic gauge, follow the line horizontally until it crosses the diagonal inlet size of box. Read straight down from this intersection to determine the flow rate.

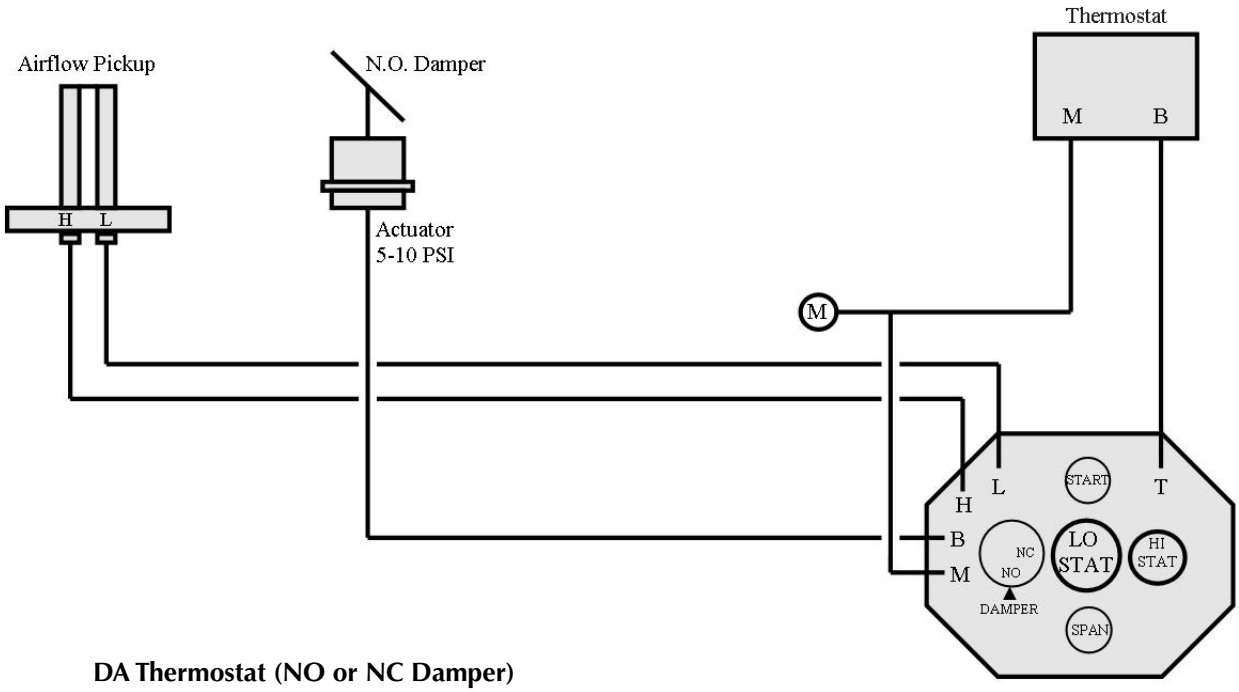
NOTE: **This chart is for illustration only! Do not use this chart to obtain your values.** It is NOT intended for calibration of your Minimum and Maximum adjustments.



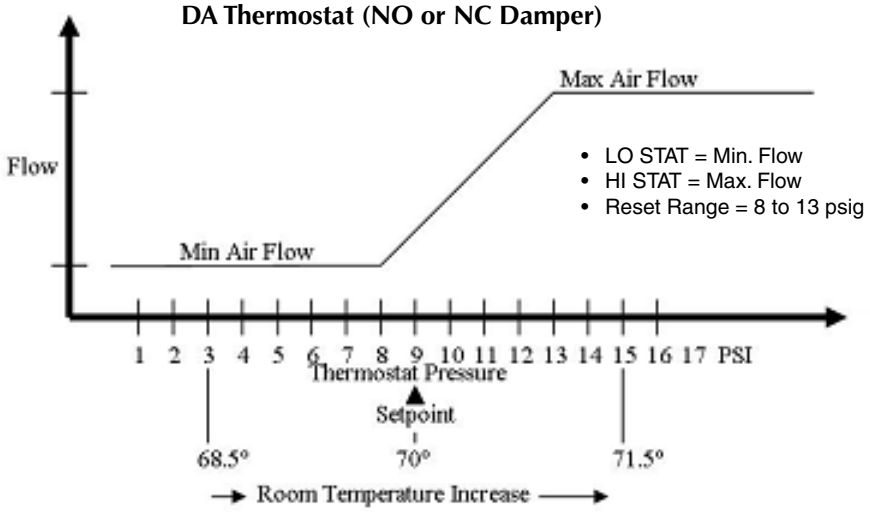
VAV Airflow Rate by Duct Size

Applications

Cooling



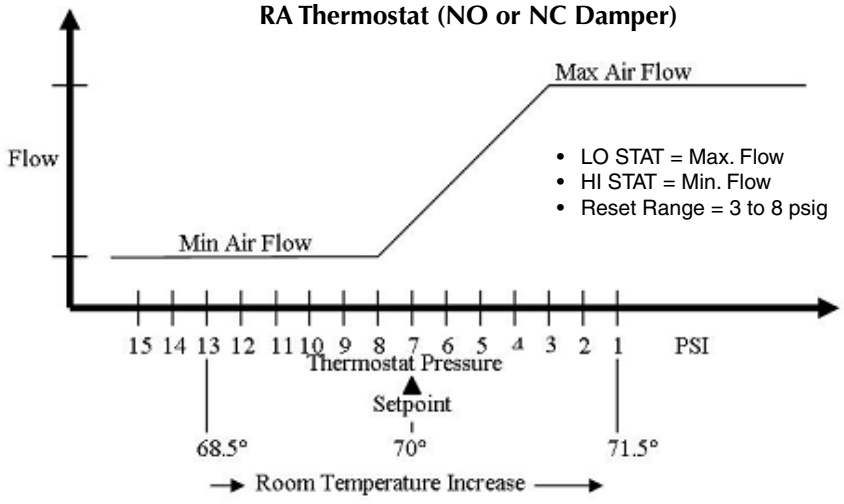
DA Thermostat (NO or NC Damper)



- LO STAT = Min. Flow
- HI STAT = Max. Flow
- Reset Range = 8 to 13 psig

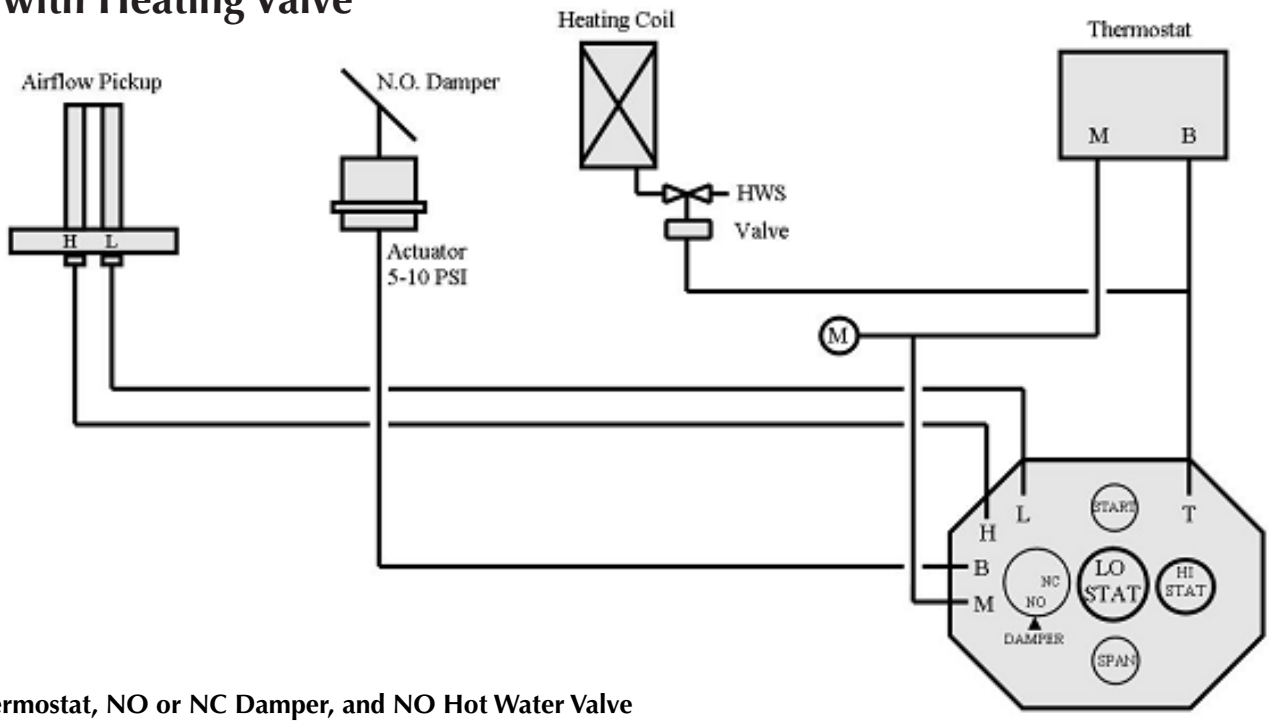
(*These instructions do **not** apply to the CSC-3014 or the CSC-3501/3505.*)

RA Thermostat (NO or NC Damper)



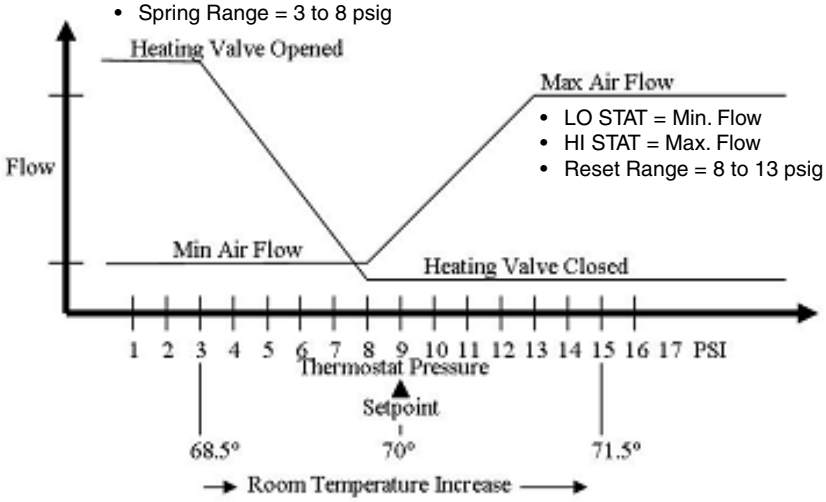
- LO STAT = Max. Flow
- HI STAT = Min. Flow
- Reset Range = 3 to 8 psig

Cooling with Heating Valve



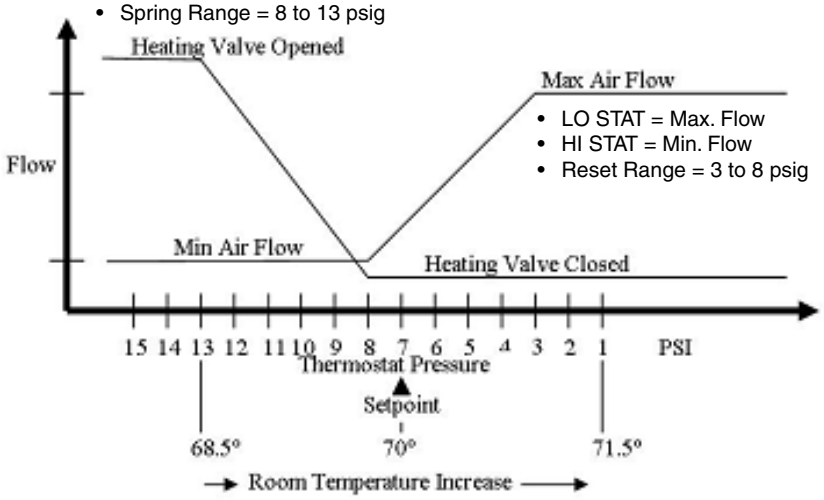
DA Thermostat, NO or NC Damper, and NO Hot Water Valve

- Hot Water Valve = NO
- Spring Range = 3 to 8 psig

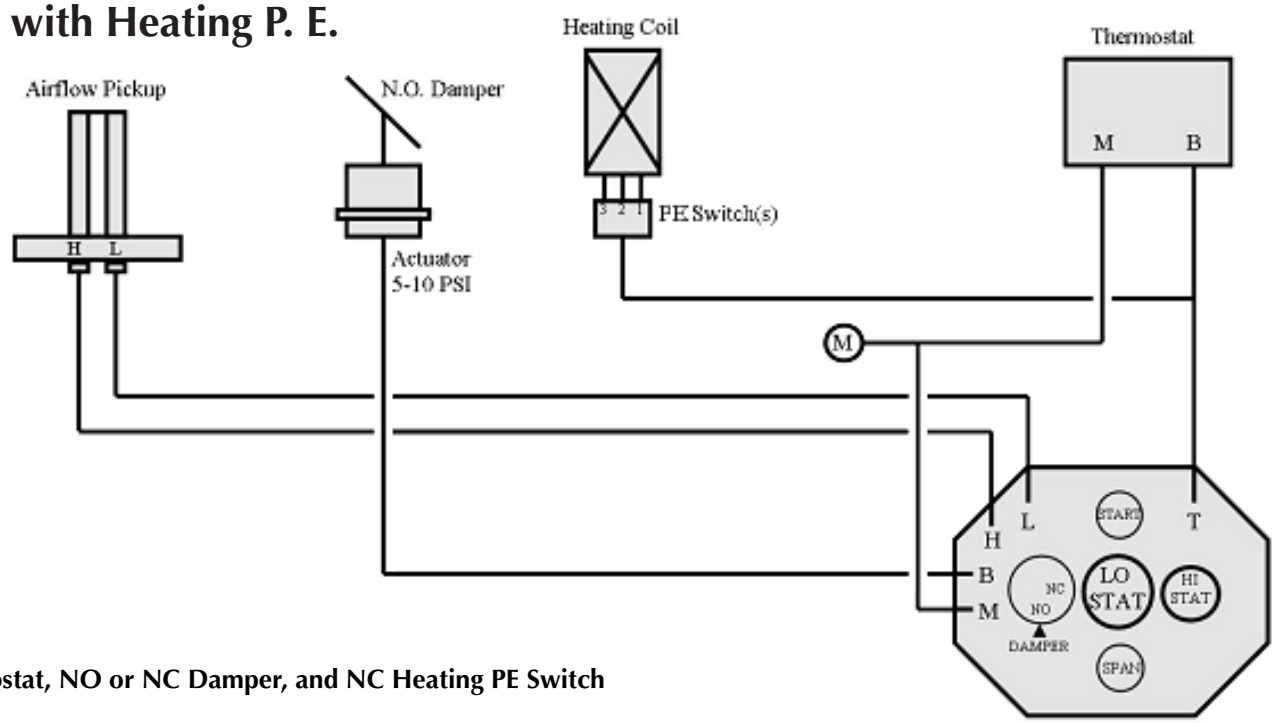


RA Thermostat, NO or NC Damper, and NC Hot Water Valve

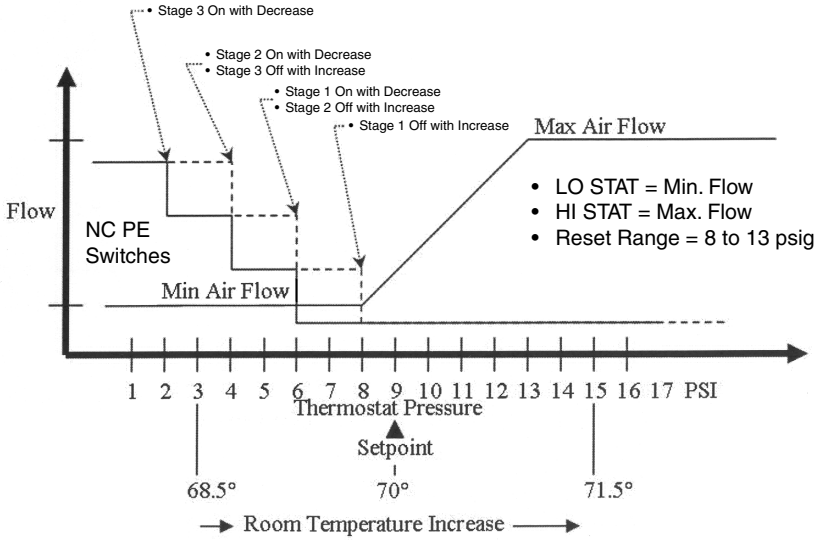
- Hot Water Valve = NC
- Spring Range = 8 to 13 psig



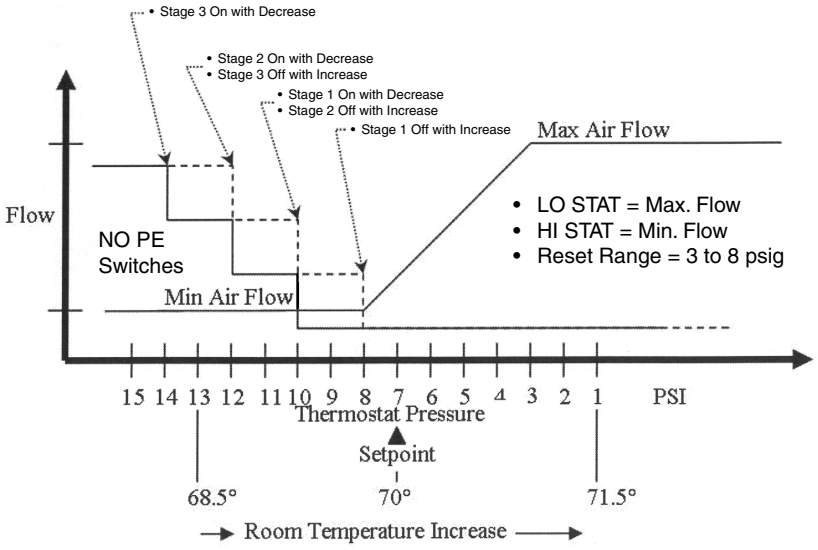
Cooling with Heating P. E.



DA Thermostat, NO or NC Damper, and NC Heating PE Switch



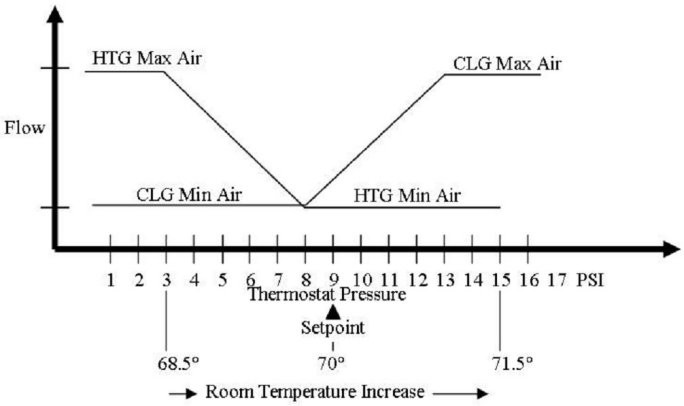
RA Thermostat, NO or NC Damper, and NO Heating PE Switch



Dual Duct

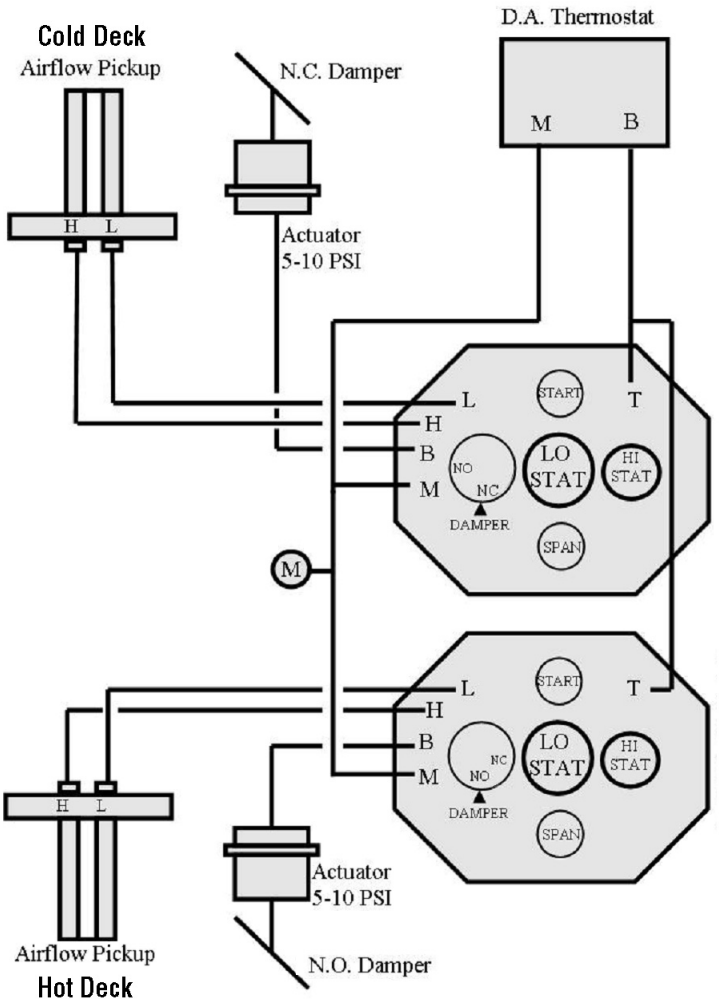
Cold Deck CSC-3011-10

- Damper = NC
- LO STAT = Min. Flow
- HI STAT = Max. Flow
- Reset = 8 to 13 psi



Hot Deck CSC-3011-10

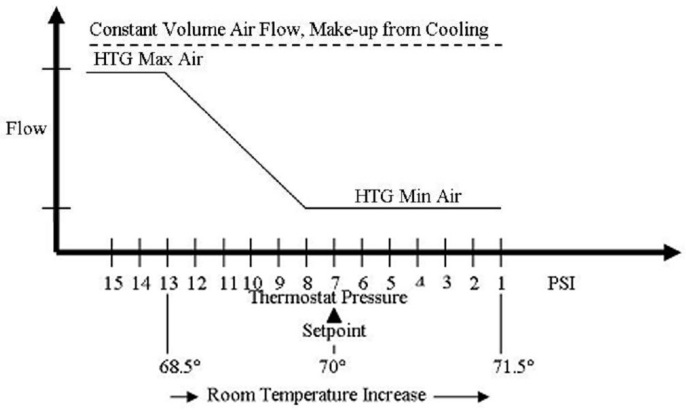
- Damper = NO
- LO STAT = Max. Flow
- HI STAT = Min. Flow
- Reset = 3 to 8 psi



Dual Duct, Constant Volume

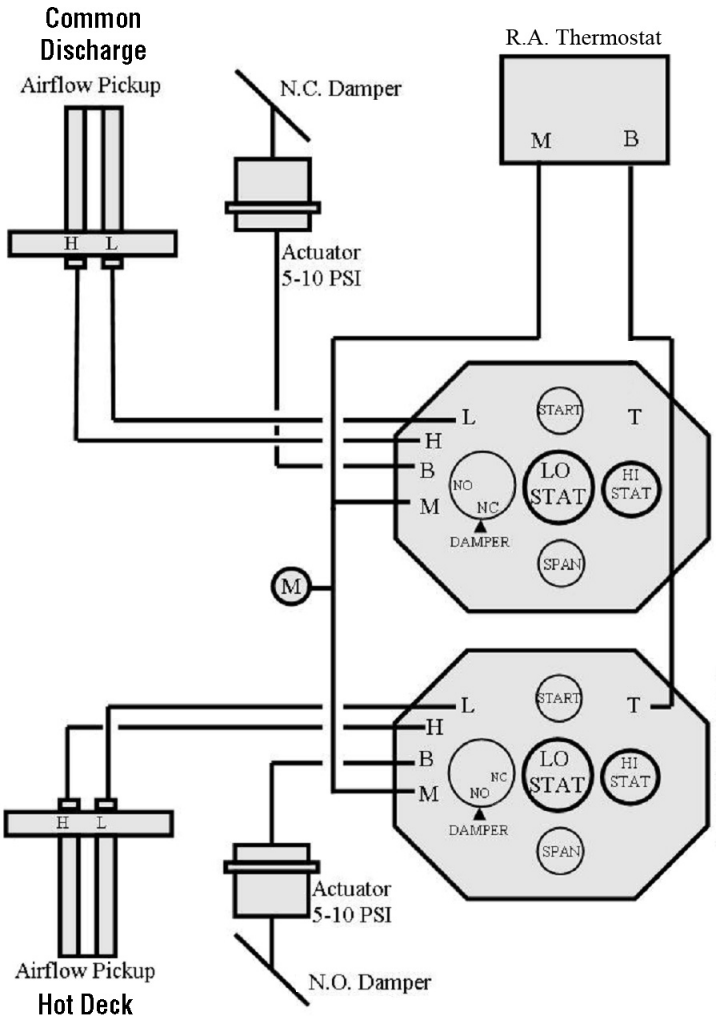
Cold Deck/Common Discharge CSC-3011-10

- Damper = NC
- LO STAT = Constant Volume Flow
- Reset = 8 to 13 psi



Hot Deck CSC-3011-10

- Damper = NO
- LO STAT = Min. Flow
- HI STAT = Max. Flow
- Reset = 13 to 8 psi



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