CRTWOPOS010A00
CRTWOPOS011A00
CRTWOPOS014A00

SMALL ROOFTOP UNITS
TWO POSITION OUTDOOR AIR DAMPER
2 to 15 TONS
(50/60 Hz)

Installation Instructions

TABLE OF CONTENTS

PACKAGE CONTENTS 1
PACKAGE USAGE 1
SAFETY CONSIDERATIONS 1
GENERAL 1
INSTALLATION 2
SEQUENCE OF OPERATION 6
SERVICE 6
WIRING DIAGRAM 7

IMPORTANT: Read these instructions completely before attempting to install the accessory outdoor air damper.

PACKAGE CONTENTS

QTY	CONTENTS
2	Hood side
1	Hood top
1	Hood divider
1	Aluminum filter*
1	Bottom panel
1	Damper assembly
1	Hardware bag

* 014A has 2 filters, 1 filter divider and 2 rain shield angles

PACKAGE USAGE

UNIT SIZE	UNIT FOOTPRINT SIZE	PART NUMBER
2 to 6 Tons (small cabinet)	46–3/4" x 74–3/8"	CRTWOPOS010A00
7–1/2 to 12–1/2 Tons (large cabinet)	58–1/2" x 88–1/8"	CRTWOPOS011A00
12–1/2 to 15 Tons (extra large cabinet)	63–3/8" x 115–7/8"	CRTWOPOS014A00

SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform basic maintenance functions of cleaning coils and filters and replacing filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

Follow all safety codes. Wear safety glasses and work gloves.

Recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, and CAUTION. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies a hazard which **could** result in personal injury or death. CAUTION is used to identify unsafe practices which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

GENERAL

These 2 position outdoor air packages can be used in either a vertical or horizontal airflow configuration. The damper assembly travel can be adjusted to allow from 25% to 100% outdoor air for the applicable rooftop unit.

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INSTALLATION

To install the outdoor damper, perform the following:

IMPORTANT: Follow all applicable local and national electrical codes when installing this accessory.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Before installing accessory, disconnect power supply and install lockout tag.

1. Determine quantity of outside ventilation air required for building and the return air negative static pressure with the indoor fan running at design conditions. Record these values for use in Step 6 and 13.
2. Turn off unit power supply and install lockout tag. For gas units, turn off the gas supply.
3. Remove filter access panel by raising panel and swinging panel outward. Panel is now disengaged from track and can be removed. No tools are required to remove filter access panel. Remove the outdoor-air opening/indoor coil access panel. (See Fig. 1.)

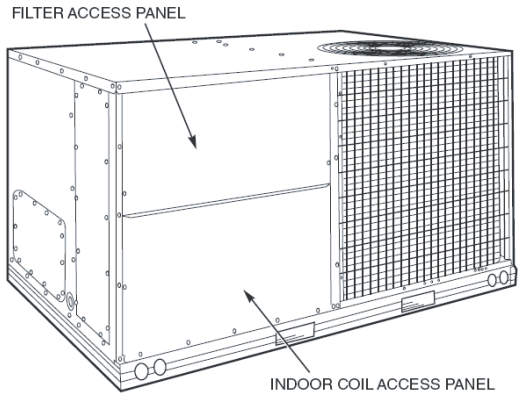

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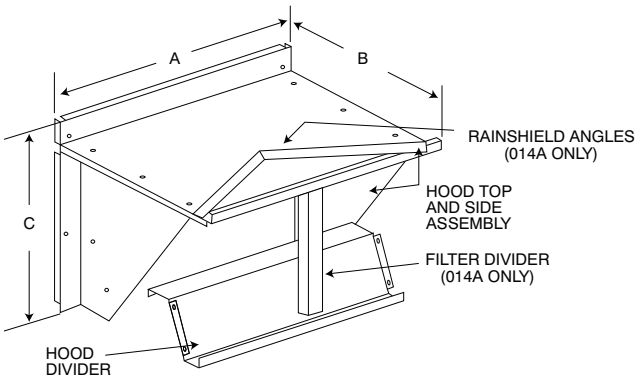
Fig. 1 - Rooftop Unit Panels (2-6 ton unit shown-small cabinet)

4. Assemble outside-air hood top, sides and divider as shown in Fig. 2. Do not install hood at this time.

NOTE: For the 014A00 kit (extra large cabinet), also assemble the filter divider and rain shield angles.

5. Install galvanized, insulated bottom panel per Fig. 3, with the slot at the top of the panel. The lip of the slot should fit behind the corner post as shown. Screw in place.



DAMPER P/N	A	B	C
CRTWOPOS010A00	33.37″	17.43″	19.05″
CRTWOPOS011A00	40.37″	22.28″	24.48″
CRTWOPOS014A00	52.92″	30.35″	33.37″

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Fig. 2 - Damper Hood Panels

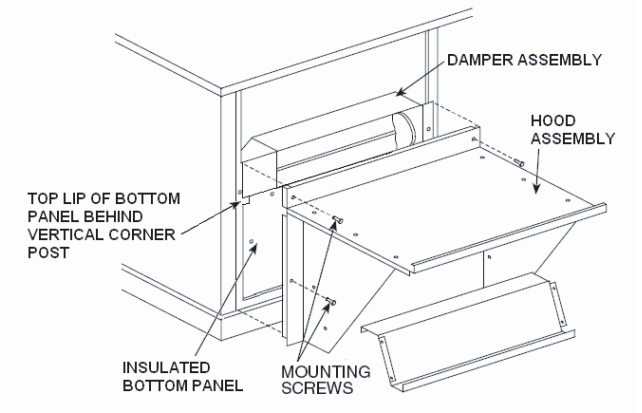

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Fig. 3 - Damper and Hood Panel Installation

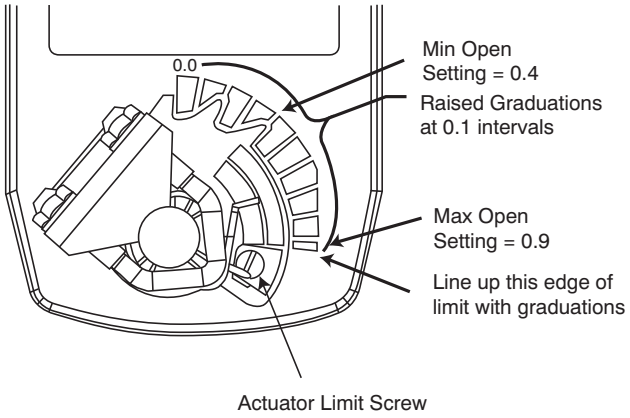

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Fig. 4 - Adjusting Actuator Limit Screw

6. Adjust the actuator limiter to limit the maximum open position of the damper to the amount of desired outside ventilation air from Step 1 using Fig. 6 or 7 or 8 to determine desired damper position setting. This method is typically used because it is the fastest method, however, it is also the least accurate method. Optional Step 13 later will allow a more accurate setup, if desired.
   The adjustment is made by setting the set screw on the end of the actuator to the desired position. Tighten screw firmly to hold in place. (See Fig. 4.)
7. Lift damper assembly and set in place over the top of the bottom panel, per Fig. 3. Secure the damper assembly in place with provided screws.
8. Remove the jumper plug shipped attached to the economizer harness in the HVAC unit. DO NOT DISCARD. Connect the plug from the damper actuator assembly to the economizer plug in the HVAC unit. Set the jumper plug aside in case it is determined at a later date that the two position damper is no longer required, at which time the jumper plug can be reinstalled.

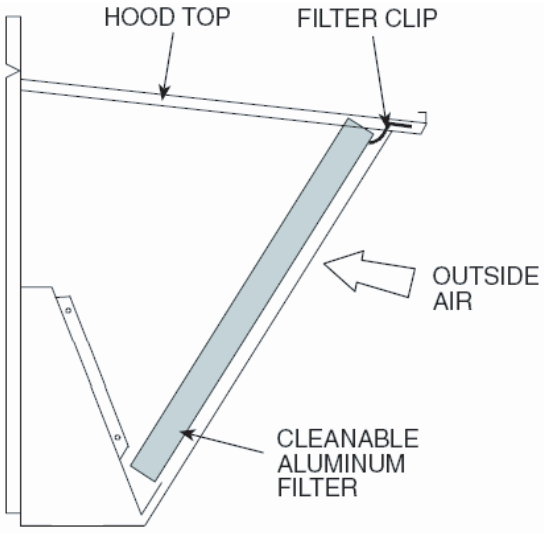

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Fig. 5 - Filter Installation

9. Install the assembled outside-air hood onto the HVAC unit, covering the damper assembly. Screw in place.
10. Install the provided aluminum filter into the hood. Lock in place with top filter clips. (See Fig. 5.)
11. Replace the top filter access panel.
12. Remove lockout tag and restore base unit to operation.
13. (Optional) For a more accurate damper position setting, a temperature balance measurement must be used. The airflow through a two position damper is a direct result of the suction pressure from the rooftop's unit indoor fan, which is affected by the static pressure of the return duct work as well as the setting of the two position damper itself.

⚠ WARNING

ELECTROCUTION HAZARD

Failure to follow this warning could result in personal injury or death.

Verify that there are no high voltage power wires lying next to the low voltage damper control wires. Verify that there is no high voltage present in any wires or interior unit parts before touching.

a. Set up to measure the three air temperatures used in the calculation in substep D. You will want to measure them at least twice, so figure out how to do it with a minimum of unit disassembly. Outside air temperature should be measured near the damper inlet, in the shade and out of the wind to the extent possible. Return air temperature should be measured upstream of any mixing with outside air from the damper. Mixed air temperature should be measured after the indoor coil and before the indoor fan. You will need a mixed air temperature sensor capable of detecting differences of 0.25°F (0.14°C) or less.
b. Set the unit controls so that the indoor fan is running but the compressors and any heaters are not. All panels, filters and screens must be in place. The two position damper should be fully open at the stop point set in step 6. Allow the unit to run a few minutes to get to a steady state condition.
c. Measure and record the outdoor, return and mixed air temperatures.
d. Calculate the theoretically correct mixed air temperature (T_m) using the following formula:
   (T_o) x (OA) + (T_r) x (RA) = T_m

   Where:
   T_o = Outdoor air temperature
   OA = Volume fraction of outdoor air desired
   T_r = Return air temperature
   RA = Volume fraction of return air = 1.00 - OA
   T_m = Mixed air temperature

   For example, say local codes require 10% outdoor air during occupied conditions and this works out to 2000cfm (known from step 1).
   Duct losses cause a negative return air pressure of 0.2-in.wg (known from step 1)
   Outdoor air temperature is 60°F
   Return air temperature is 75°F
   Our initial setting for the damper in step 6 is 0.6 (from Fig 7, the line intersecting 0.2 in.wg and 2000 CFM).

Then the theoretical mixed air temperature should be:
(60 x 0.10) + (75 x 0.90) = 73.5°F

e. Compare the theoretical mixed air temperature calculated in substep D to the measured value from substep C. Continuing the example above, the measured value might be 72.75°F. In this case, outdoor air is colder than indoor air so a measured T_m lower than the calculated value would indicate too much outside air. The dampers should be closed. Solve for the actual outside air fraction using the *measured* values in the formula:

$$\frac{(T_m - T_{r)}}{(T_o - T_{r)}} = OA_{measured}$$

For our example, it would be (72.75 - 75)/(60 - 75) = 0.15

Now use this fraction to calculate the actual outside airflow using $OA_{desired}$ from substep D and the required CFM from Step 1 on pg. 2 as follows:
$CFM_{actual} = (OA_{measured}/OA_{desired}) \times CFM_{required}$
For our example, this is (0.15)/(0.10) x (2000) = 3000cfm

f. Go to the correct airflow chart (Figure 6 or 7) and determine the actual return air negative pressure from the intersection of the actual CFM and the initial damper setting from step 6. For our example, this would be the intersection of 3000 CFM and a damper setting curve of 0.6 for an actual return air negative pressure of about 0.5 in.wg on Figure 7. Duct losses were higher than we thought.

g. Now find the corrected damper setting from the intersection the actual return air negative pressure (from substep G) and the required outside air CFM (from step 1). For our example, this would be the intersection of 2000 CFM and 0.5-in.wg on figure 7, which is about halfway between the 0.4 and 0.5 curves. The corrected damper setting would be halfway between the 0.4 and 0.5 graduations on the actuator.

h. Readjust the damper maximum open position setting to the value calculated in substep G. Since the damper is now installed in the unit, you will need to get to the damper actuator to adjust it.
For vertical return applications, the easiest way to access the actuator is probably to remove the rooftop unit's horizontal return panel. Unplug the actuator, adjust it, plug it back in, replace the panel, and let the system stabilize again before rechecking the temperatures.
For horizontal returns it may be similarly possible to unscrew and lean on the horizontal duct. If not, remove the filter access panel and reach in from the top. Unplug the actuator. You cannot see the actuator face without a mirror, but the manufacturer has thoughtfully raised the graduations on the dial. You can count them off with your fingernail or a screwdriver. Loosen the limit screw (preferably with a magnetized screwdriver, just in case) and slide the actuator stop into position by feel. Plug the actuator back in, replace the filter access panel, and let the system stabilize again before rechecking the temperatures.

i. Repeat the above procedure again from substeps C to E. Because adjusting the damper changes the outside airflow which changes total air flow, the fan operating point, the return air negative pressure, and then the outside air flow thru damper itself, the revised damper position calculated from the 1st set of measurements will not be perfect, but will probably be close. If you do not think it is close enough, repeat the rest of the procedure and get closer.

T_R = Return-Air Temperature

RA = Percent of Return Air

T_M = Mixed-Air Temperature

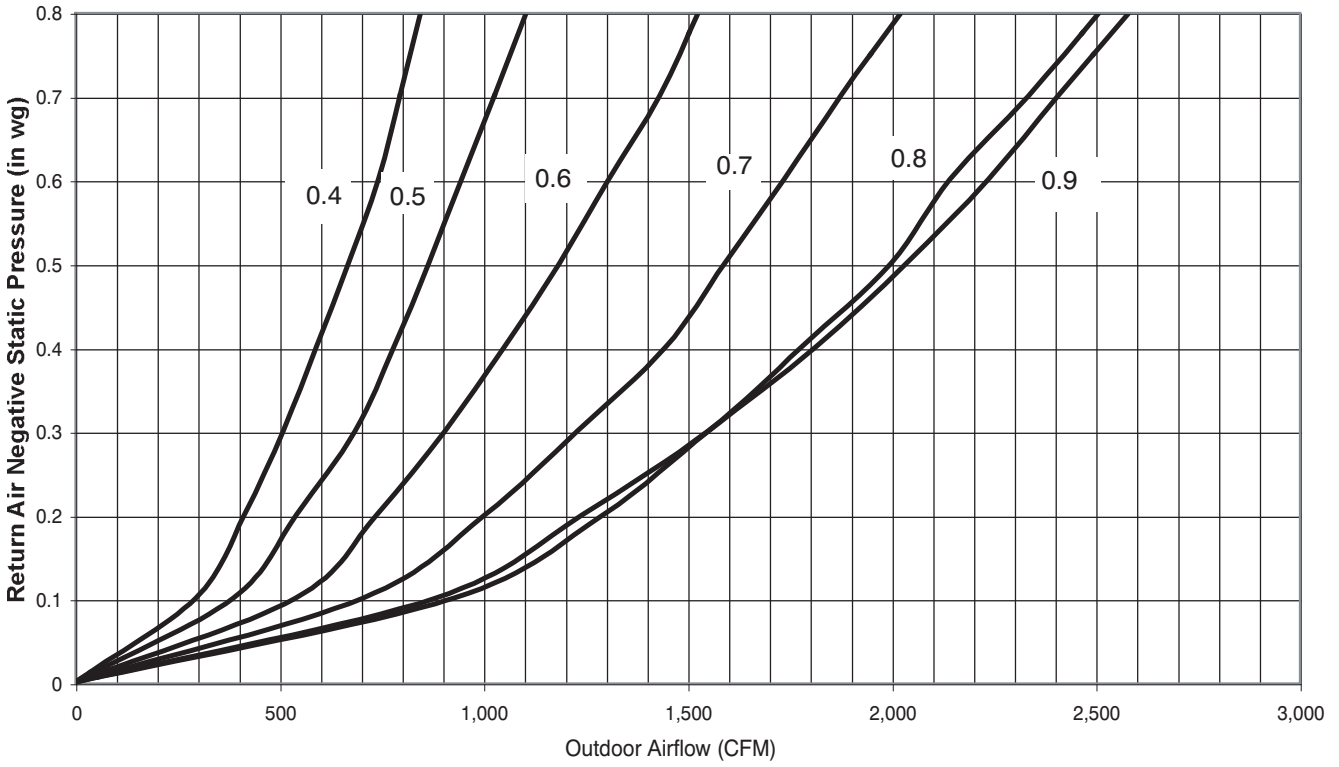

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Fig. 6 - Damper Performance (2-6 Ton Units Small Cabinet)
CRTWOPOS010A00

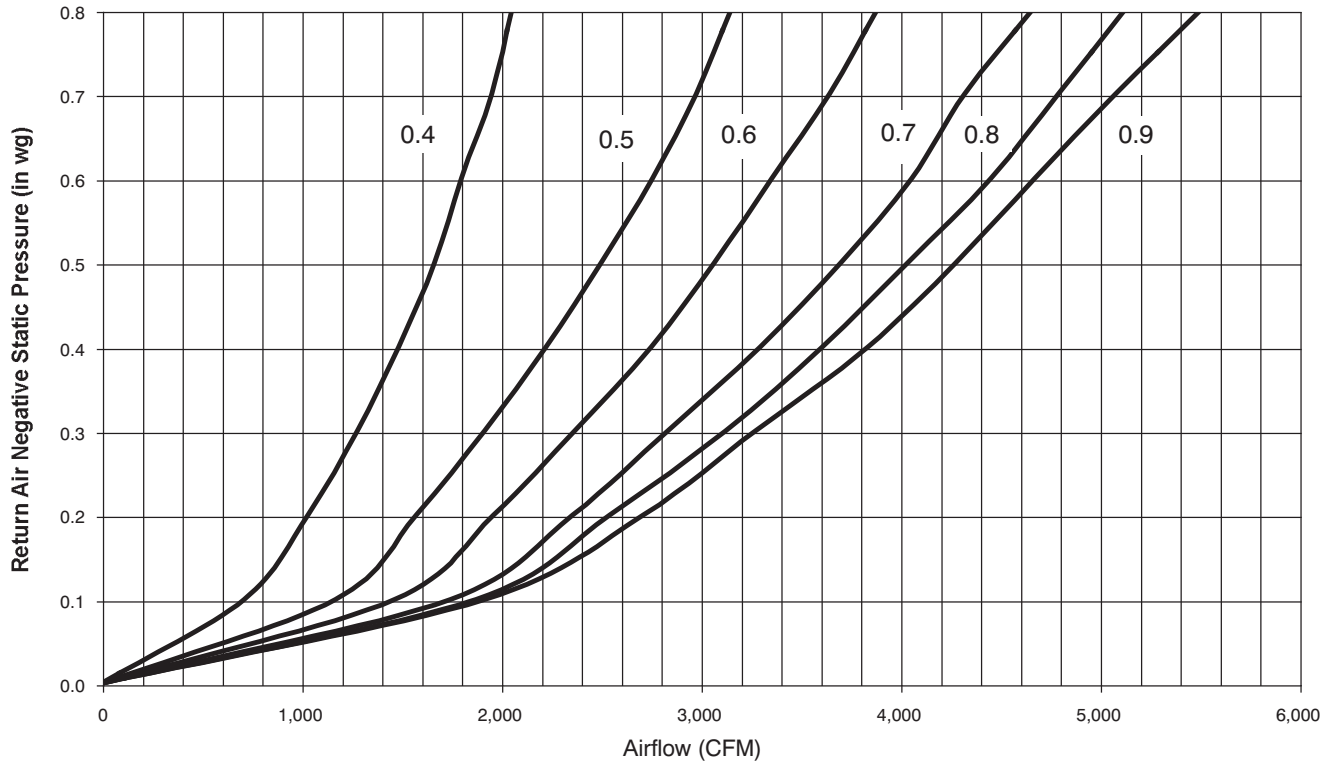

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Fig. 7 - Damper Performance (7.5-12.5 Ton Units Large Cabinet)
CRTWOPOS011A00

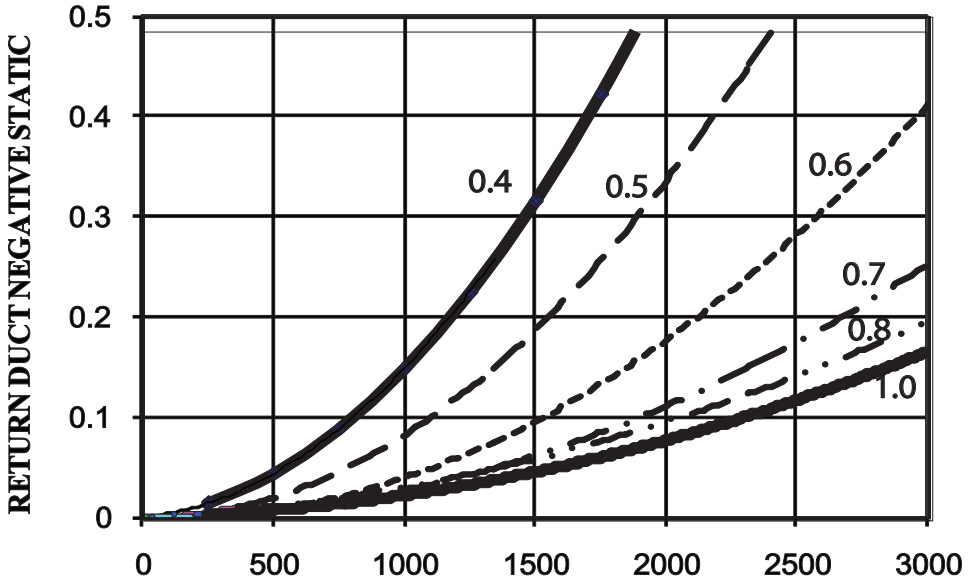

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Fig. 8 - Damper Performance (12.5-15 Ton Units Extra Large Cabinet)
CRTWOPOS014A00

SEQUENCE OF OPERATION

Cooling

When the room thermostat calls for cooling, the cooling controls are energized as described in the base unit installation, start-up and service instructions. The indoor-fan motor is energized and the two-position damper moves to the set position. When the indoor-fan motor is de-energized, the two-position damper moves to the fully closed position.

Heating

When the room thermostat calls for heating, the heating controls are energized as described in the base unit installation, start-up and service instructions. The indoor-fan motor is energized and the two-position damper moves to the set position. When the indoor-fan motor is de-energized, the two-position damper moves to the fully closed position.

Ventilation (Continuous Fan)

The two-position damper remains at set position as long as the indoor fan is energized. When the indoor fan is cycled off, the two-position damper moves to the fully closed position.

Low Temperature Lockout (Optional)

If desired, a temperature lockout switch can be field installed to over ride the damper signal and keep it closed if the outside air temperature falls below a specified air temperature. The recommended method is to use an outside air lockout switch or thermostat to make/break the red wire on the damper actuator harness.

NOTE: In the event of a power failure or if the disconnect to the unit is shut off, the damper will close due to the internal spring in the actuator.

SERVICE

Once each heating or cooling season or as conditions require, perform the following:

1. Inspect the two-position damper blade to ensure it is clean and moves freely.
2. Visually verify that the damper opens upon a call for cooling or heating and shuts when the unit is cycled off.
3. Inspect the actuator limit screw on the damper actuator. Verify it is still in the desired position, and that it has not slipped. Adjust as required.

WIRING DIAGRAM

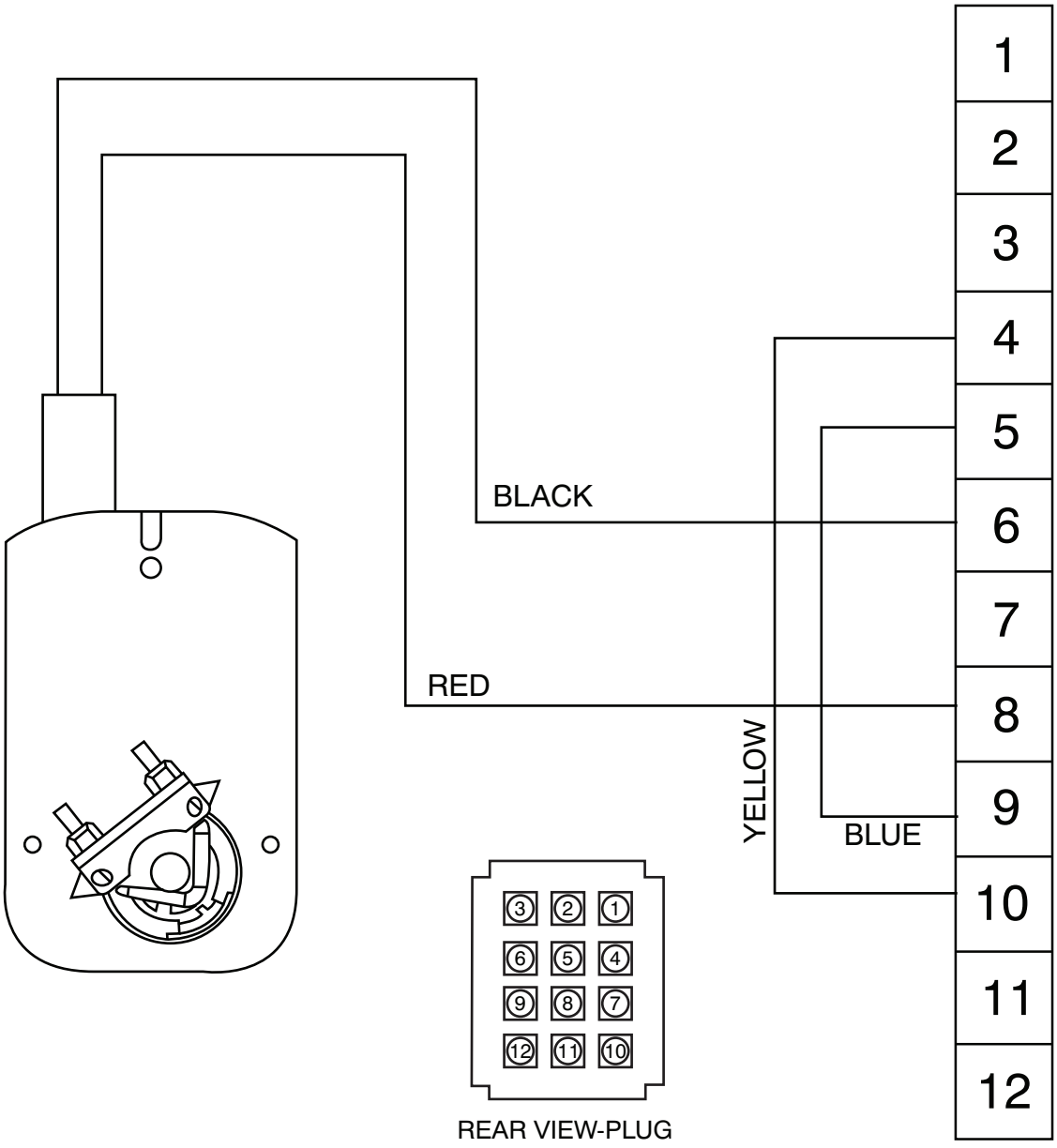

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Fig. 9 - CRTWOPOS010A00, CRTWOPOS011A00, CRTWOPOS014A00 Wiring