

# AIR CONDITIONER FROST BUILDUP

## A. PURPOSE

The formation of a light coat of frost is possible on a properly operating air conditioner, just prior to the cold (freeze) control shutting off the compressor. This is normal when the cold control function is correct; however, this may be an indication that the unit (1) is installed improperly, (2) maintained or operated improperly by the user, or (3) has a mechanical problem.

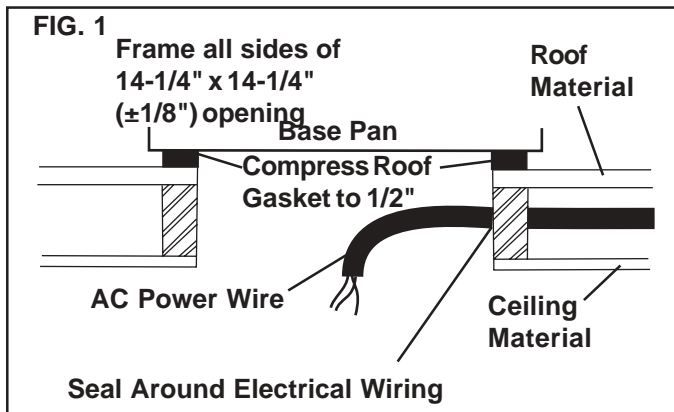
The first two items listed above are the most frequent causes of frost formation, and they are NOT covered under the Dometic Warranty policy.

**⚠ WARNING**

**This unit must be serviced by a qualified technician. Modification of the appliance can be extremely hazardous and could lead to death or serious injury.**

## B. IMPROPERLY INSTALLED UNITS

1. The 14-1/4" x 14-1/4" (±1/8") opening must be framed to seal off the roof cavity. Holes used to route electrical wiring must be sealed. See FIG. 1. The 14-1/4" x 14-1/4" (±1/8") opening is part of the return air duct and must be finished in accordance with NFPA standard 501C, Standard for Recreational Vehicles, Section 2-7.



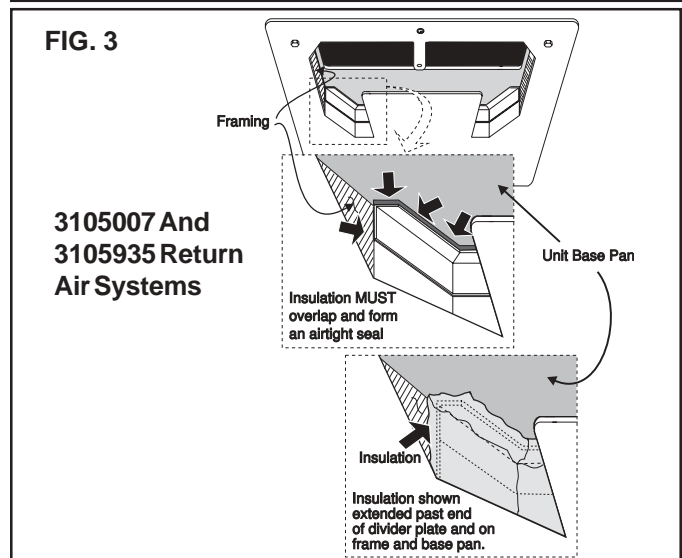
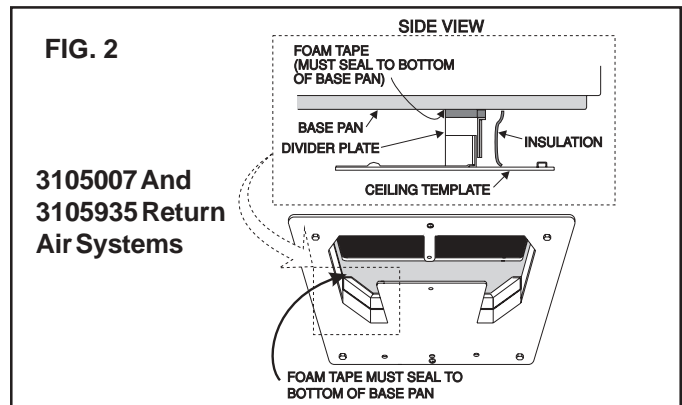
**REVISION**

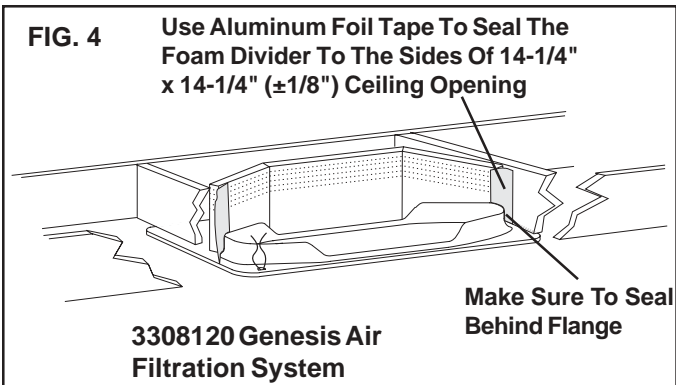
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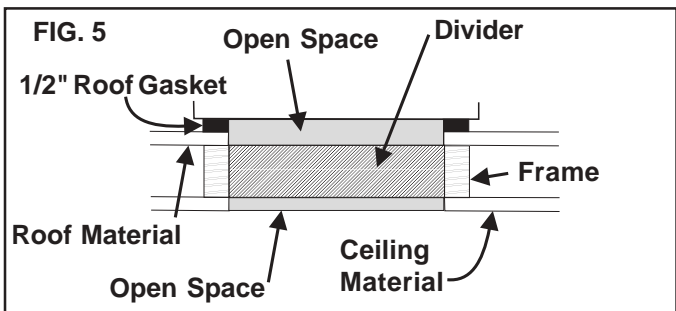
The most commonly found installation problem is the improper sealing of the 14-1/4" x 14-1/4" (±1/8") opening in the roof cavity. The cooled discharge and warm return air are mixed in the roof cavity and produce conditions that are excellent for frost production.

2. The best framing job is not going to stop frost from occurring if the cold air discharge is allowed to enter into the return air portion of the 14-1/4" x 14-1/4" (±1/8") opening. Duo-Therm's return air kits are designed to be installed tightly to the bottom of the base pan and ceiling template. Insulation supplied in the kit not only stops condensation from forming on the divider plate, but prohibits air leaking around it as well. The insulation is purposely oversized to be attached to the sides of the 14-1/4" x 14-1/4" (1/8") opening, the base of the air conditioner and ceiling template. Make sure the data plate does not get covered with insulation. See FIGS. 2, 3 & 4.

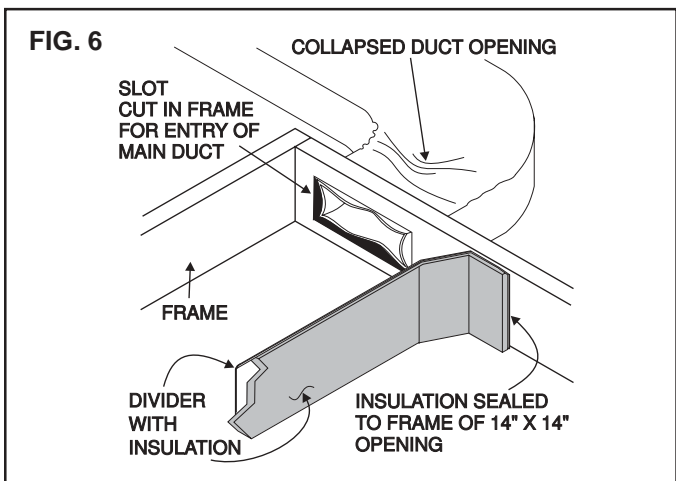




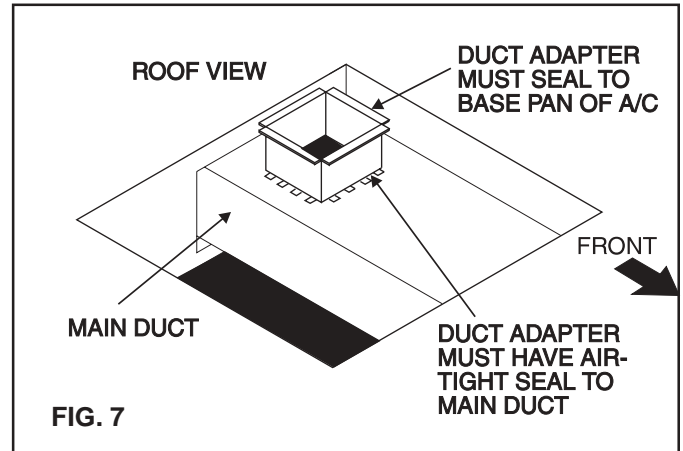
- In some installations, the OEM supplies their own return air kits. In some cases, both the return and the discharge air are ducted to and from the 14-1/4" x 14-1/4" ( $\pm 1/8$ ") opening. The bottom of the 14-1/4" x 14-1/4" ( $\pm 1/8$ ") opening can be covered with ceiling material. In this type of installation the 14-1/4" x 14-1/4" ( $\pm 1/8$ ") opening is divided in half. The divider must completely seal between the base of the unit and ceiling material. A gasket, etc., must be used to fill up the open space to reduce recirculation. See FIG. 5.



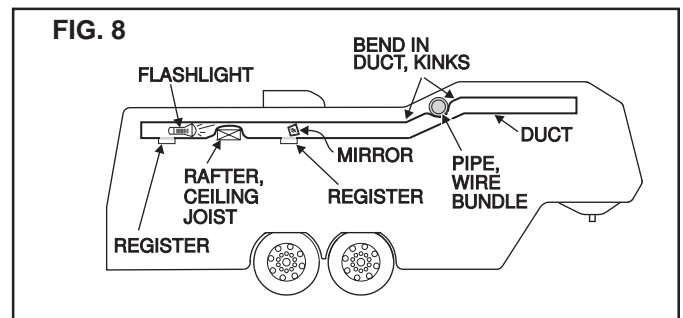
- Another method of connecting the discharge air to the coach's main duct uses Duo-Therm's return air kits. One-half of the 14-1/4" x 14-1/4" ( $\pm 1/8$ ") opening is discharge plenum and one-half is return air plenum. If the duct openings are not clean, restriction of air can cause the coil to freeze. The opening of the duct should be as large as possible to make the air distribution better in the coach and reduce freeze-up. See FIG. 6.



- The final method of installation dumps the discharge air directly into the RV's main duct. The duct is routed through the 14-1/4" x 14-1/4" ( $\pm 1/8$ ") opening. A duct adapter is used to connect the air conditioner to the main duct. If this connection is not made properly, cold air can migrate back into the return air path and make conditions right for freeze-up. Be sure the duct adapter is sealed to the main duct and air conditioner. See FIG. 7.



- Restrictions at the connection to the air conditioner is the most common, but blockage in the main duct runs can also cause freeze-up. Blockages commonly occur in the areas where the duct changes direction. Other obstacles that can cause a change in the duct (air) path include rafters, vent pipes, wire bundles, etc. (See FIG. 8)



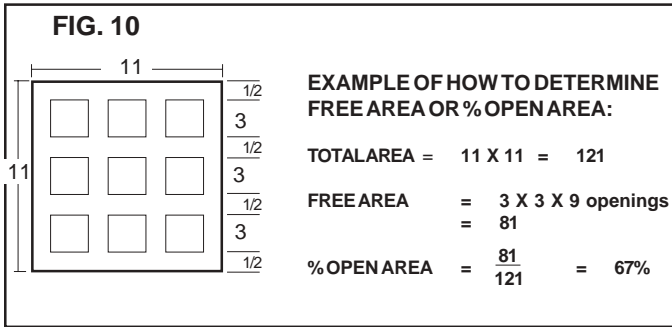
A good way to check for duct blockage is with a flashlight and a mirror. Remove ceiling register cover to allow a flashlight to be put in the duct and use a mirror to view the flashlight from the next register opening. A blockage will be visible in the mirror. See FIG. 8.

Duo-Therm has available return air kits that will allow the cooled air to be discharged directly out of the air conditioner. This will bypass any restrictions in the coach duct system. (3105935 Quick Cool and, 3308120 Genesis Air Filtration System available in Shell or Polar White colors.)



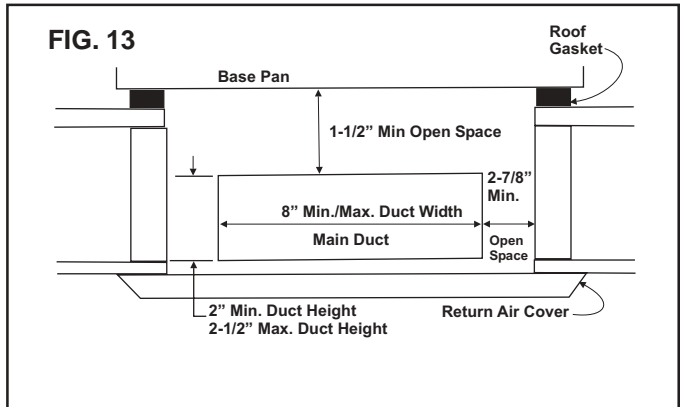
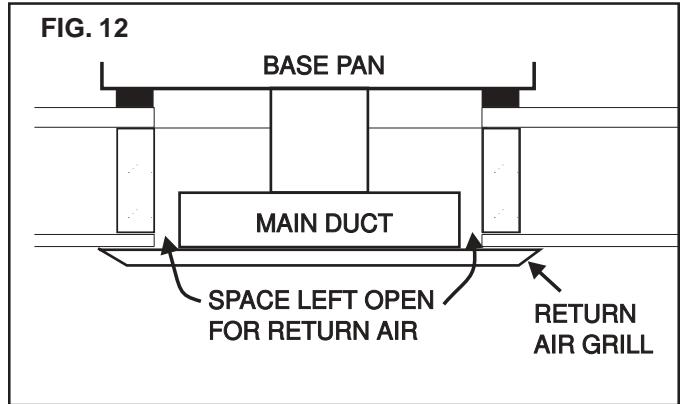
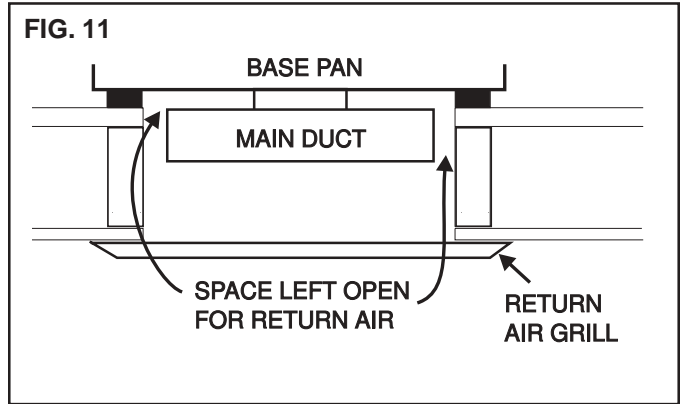
8. Up to this point we have mainly covered the discharge side; however, restrictions of the return air can result in frost buildup. The Duo-Therm air conditioner requires a minimum of 40 square inches of FREE AREA.

FREE AREA – is the opening that remains in a grill or louvered panel after the restrictions are taken away. For example, an opening of 10 x 20 inches has 200 square inches. When this opening is covered with a grill that is 67 percent open, the FREE AREA is (200 x 0.67), 134 square inches. Dometic return air kits are designed to have the correct free area; however, some manufacturers use their own grills. If a manufacturer’s grill is used, it must use the above formula to make sure the return air is sufficient to reduce the chances for freeze-up. The filter material must also be considered as a restriction and subtracted from the FREE AREA. See FIG. 10. (Refer to Section: D. USER MAINTENANCE AND OPERATION)



Main ducts running through the 14-1/4" x 14-1/4" (±1/8") opening must leave space between the duct and return air grill or duct and bottom of the air conditioner. (See FIGS. 11–13 Page 4). The gap between the top of the main duct to the bottom of the air conditioner should be a minimum of 1-1/2". See FIG. 13 .

If the return air is ducted into the 14-1/4" x 14-1/4" (±1/8") opening, the system must equal the 40 sq. inches of free air required by the air conditioner. Grills or registers used in this duct must be equal to or greater than the duct in square inches. 9.

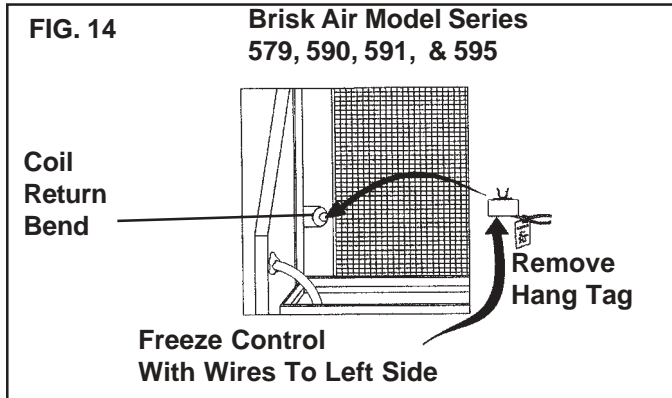


The control system used by Duo-Therm Air Conditioner is designed with a low temperature switch that will shut off the compressor and allow air to flow through the coil to melt the frost. A properly operating cold control may allow a slight coating of frost to form on the evaporator coil before it turns off the compressor. If the cold control is not installed in its intended mounting location, frost buildup can block all air flow through the evaporator coil and stop cooling inside the R.V. The cold control has clips that allow it to be snapped onto the turn/bends of the evaporator coil, or directly to the face of the coil fins. See FIGS. 14, 15, 16, & 17 on Pages 5 & 6 for the correct location.

## C. FREEZE CONTROL INSTALLATION

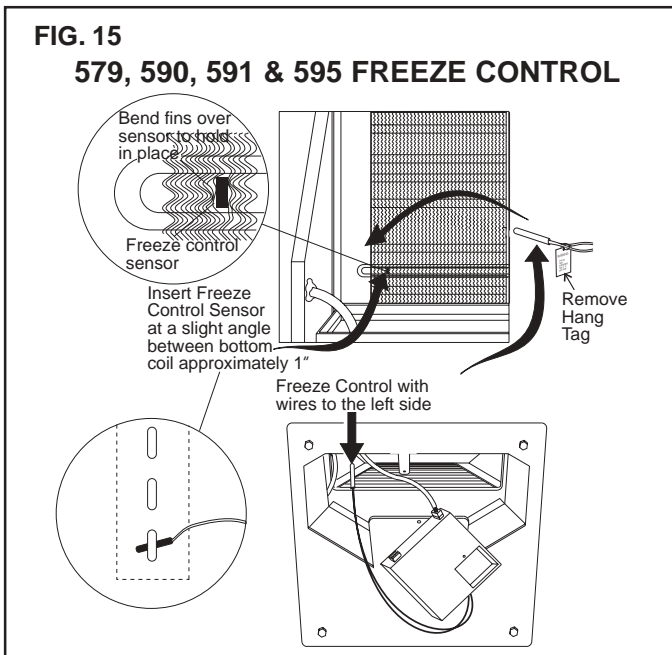
### 1. 579, 590, 591 & 595 SERIES:

- a. Analog Controls (wall thermostat or hand held remote) Snap freeze control into place on return bend located at left side of evaporator coil as follows:
  - Locate "D" shaped notch in flange of evaporator coil.
  - Place the horseshoe end of freeze control through this notch and snap onto coil return bend. When positioned correctly, control wires will be 90° to direction of coil fin surface. Refer to FIG. 14.



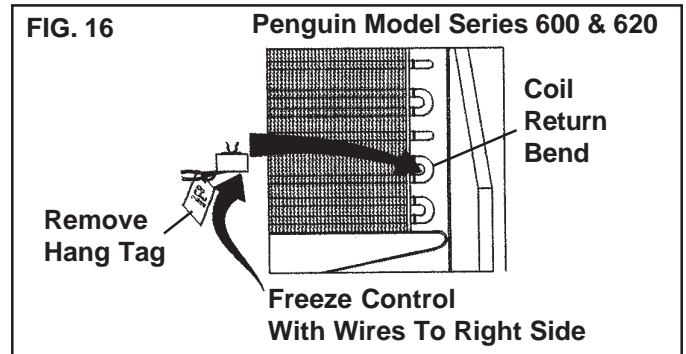
**NOTE: Some heat pump coils will not have the "D" slot in the coil header.**

- b. Comfort Control Center Control System
  - Insert the Freeze Control Sensor approximately 1" into the fins of the evaporator coil as shown in FIG. 15.
  - Bend fins closed to secure sensor in place.

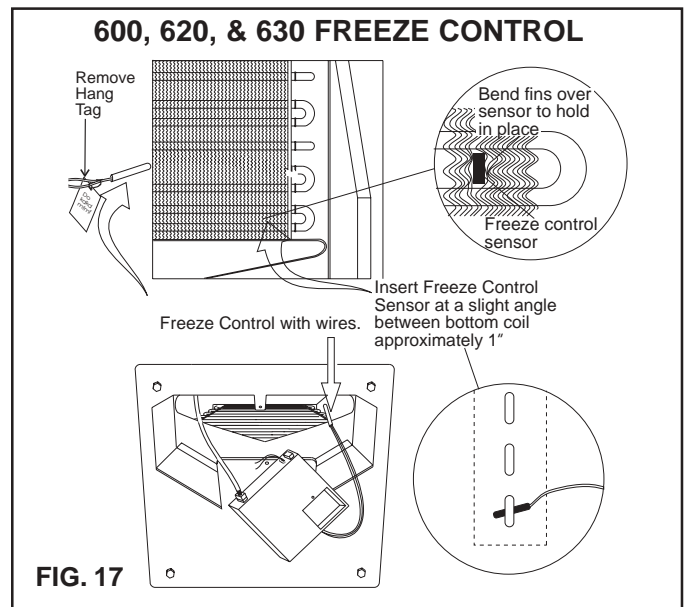


### 2. 600, 620 & 630 SERIES:

- a. Analog Controls (wall thermostat or hand held remote) Snap the freeze control into place on return bend located at right side of evaporator coil as follows:
  - Locate vertical return bend at lower right of evaporator coil.
  - Place the horseshoe end of freeze control onto this coil return bend and snap into place. When positioned correctly, control wires will be 90° to direction of coil fin surface (Refer to FIG. 16).



- b. Comfort Control Center Control System
  - Insert the Freeze Control Sensor approximately 1" into the fins of the evaporator coil as shown in FIG. 17.
  - Bend fins closed to secure sensor in place. See FIG. 17.



## D. USER MAINTENANCE AND OPERATION

1. The air conditioner can be installed flawlessly, but if the user does not maintain it properly, freeze-up can still occur. Simply not cleaning air filters on a regular schedule can cause a blockage of return air. This will lower the coil temperature and freeze-up will result. Filters should be cleaned approximately every one hundred hours or sooner. This will depend upon climate, area, etc.
2. Another way the user can cause freeze-up is by closing registers to prevent cold air discharge. This will restrict air flow in the same manor as a dirty filter.

## E. AIR CONDITIONER PROBLEM

Clear ice or hard ice on the surface of the evaporator coil indicates the cold control is not operating properly. This is the only condition which should be considered a true freeze-up.

### 1. Causes of clear or hard ice on the evaporator surface are:

- a. **Cold Control** not installed or improperly installed. See FIGS. 14, 15, 16 & 17 for proper placement of the cold control.
- b. **Low Refrigerant Charge:** In the early stages of frost buildup, frost will usually appear on the lower part of the evaporator coil and will also be indicated by a lower amperage reading.
- c. **Plugged or Restricted Capillary Tube(s)** can cause formation of clear or hard ice on the evaporator coil. If you suspect a blocked capillary tube, check for a temperature difference between the capillary tubes. (On a single capillary tube system, the point of restriction is cool or cold to the touch.) Sweating or frost can form at the restrictions.
- d. **Defective Cold Control:**  
Three types of cold controls have been used in the controls on Duo-Therm Air Conditioners and Heat Pumps.

- Contact points closed (show continuity) in the operating position. Contacts open when frosting condition is sensed. This cold control is in series with the AC power to the common terminal on the compressor.
- Contact points open (show no continuity) in the operating position, when frosting condition is sensed the contacts close. This cold control is clipped on the evaporator coil turn bends and plugged directly to the relay circuit board.

- Freeze Control Sensor is a thermistor that is inserted into the face of the evaporator coil. Use a digital ohmmeter to check the thermistor, placed in a glass of ice slush for 2-3 minutes. This would be a temperature of 32 °F and should be +/- 10% when compared to the chart below:

TEMPERATURE	OHM READING
25°F	27271
30°F	23528
35°F	20348
40°F	17642
45°F	15334
50°F	13360
55°F	11667

### e. Defective Relay Board:

During normal operation, the Relay Board will supply power to the compressor.

- In the event the clip on cold control senses a frosting condition, its contact points close. Closed points on the cold control energize a circuit on the relay board that turns off power to the compressor. If the cold control has continuity and the compressor is still on, the relay board is defective.
  - If frosting conditions are experienced, with the thermistor type cold sensor, and the ohmmeter readings match with the chart, then the relay board is defective.
- f. Air flowing through the evaporator bulkhead and across the clip on cold control will influence it's ability to sense the coil temperature (models 6204XX). Insulation placed on top and around the cold control will eliminate the air movement and allow the cold control to monitor the true coil temperature. See FIGS. 18 & 19.

FIG. 18

Place 1/2" Foam Block With Double Stick Tape On Cold Control

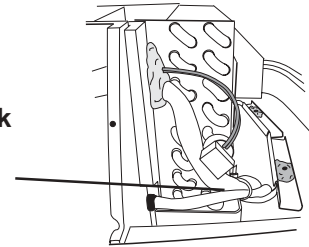
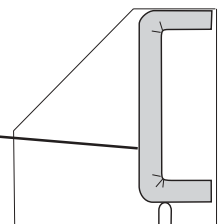


FIG. 19

Form An Air Dam Out Of 1-1/4" x 1-1/4" x 12" Foam Strip



For further diagnostic assistance, please call:

**Dometic Corporation**  
 Technical Service Dept.  
 509 South Poplar St.  
 LaGrange, IN 46761  
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 (260) 463-2191

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I hope this resource makes your RV repairs easier, as it has mine, but please be careful and follow proper safety practices when attempting to repair your own RV.

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