



# SATURN

RESOURCE MANAGEMENT

## 8.16 SEALING DUCT LEAKS

*SWS Detail: 5.0106 Duct Sealing; 5.0106.1 General Duct Sealing; 5.0106.2 Duct Sealing - Spray Polyurethane Foam (SPF);*

Ducts located outside the thermal boundary or in an intermediate zone like a ventilated attic or crawl space should be sealed. The following is a list of duct leak locations in order of their relative importance. Leaks nearer to the air handler are exposed to higher pressure and are more important than leaks further away.

## 8.16.1 Duct Repair and Sealing Methods

*SWS Detail: 5.0106 Duct Sealing; 5.0106.1 General Duct Sealing; 5.0106.2 Duct Sealing - Spray Polyurethane Foam (SPF)*

### Duct Repair and Fastening

Before you air seal ducts, make necessary repairs using these general guidelines.

- ✓ Attach flex duct to metal duct or duct board with a rigid metal coupling, using two tensioned tie bands per joint.
- ✓ Fasten round ducts to round ducts or fittings with a minimum of three equally spaced galvanized or stainless steel fasteners.
- ✓ Fasten duct board to duct board, using overlapping joints, UL 181 fiber mesh tape or aluminum tape, mastic, stitch staples, or other approved products.
- ✓ Fasten duct boots to wood using a minimum of 1 stainless steel or galvanized fastener per side.
- ✓ Fasten duct boots to drywall with mesh tape or a duct-boot hanger, if the boot is accessible.
- ✓ Support flexible and duct board ducts and plenums with 1- $\frac{1}{2}$ -inch wide or greater material, installed every 4 feet or less. Don't pinch the duct or reduce its interior dimensions.
- ✓ Support metal ducts with  $\frac{1}{2}$ -inch-wide or greater eighteen-gauge metal straps, 12-gauge galvanized wire, or metal rods every 10 feet or less.

### General Duct-Sealing Methods

Duct sealers install duct mastic and fiberglass mesh to seal duct leaks. When they need reinforcement or temporary closure, the duct sealers use tape or sheet metal. Observe these standards.

- ✓ Remove any substance that would prevent sealant adhesion (tape, oil, dirt) using appropriate methods and solvents.
- ✓ Seal seams, cracks, joints, and holes, less than  $\frac{1}{4}$  inch using mastic and fiberglass mesh.
- ✓ Bridge seams, cracks, joints, holes, and penetrations, between  $\frac{1}{4}$  and  $\frac{3}{4}$  inch, with sheet metal or tape. Then cover the metal or tape completely with mastic reinforced by mesh at seams.
- ✓ Repair leaks larger than  $\frac{3}{4}$  inch using a rigid duct patch. Mechanically fasten patch before applying mastic. Install mesh and mastic over seams, overlapping repair joint by at least one inch on all sides
- ✓ Overlap the mastic and mesh at least one inch beyond the seams, repairs, and reinforced areas of the ducts.

## 8.16.2 Sealing Return Ducts

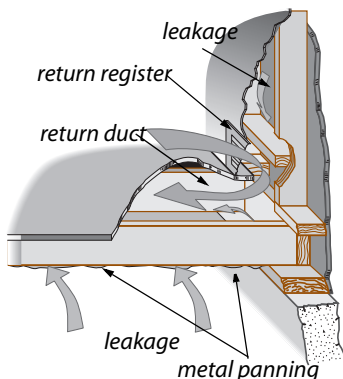
*SWS Detail: 5.0106 Duct Sealing; 5.0106.1 General Duct Sealing; 5.0106.2 Duct Sealing - Spray Polyurethane Foam (SPF)*

Return leaks are important for combustion safety and for efficiency. Use the following techniques to seal return ducts.

- ✓ First, seal all return leaks within the combustion zone to prevent this leakage from depressurizing the combustion zone and causing backdrafting.
- ✓ Seal all return ducts in crawl spaces for indoor air quality.
- ✓ Seal filter slots with a tight-fitting, durable, user-friendly filter-slot cover to allow easy removal for filter-changing.
- ✓ Seal the joint between the furnace and return plenum with a removable sealant such as foil tape.



**Lining a panned cavity:** Foil-faced foam board, designed for lining cavities is sealed with duct mastic to provide an airtight return.



**Panned floor joists:** These return ducts are often very leaky and may require removing the panning to seal the cavity.



**Pedestal return air:** These return plenums are often very leaky and may require removing a panel to seal the leaks from inside.

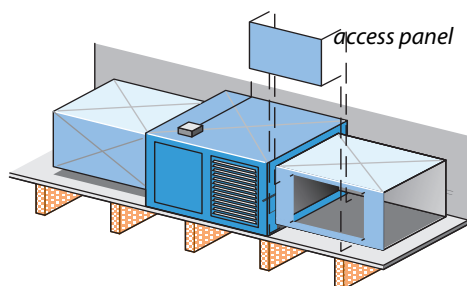
## 8.16.3 Sealing Supply Ducts

*SWS Detail: 5.0106 Duct Sealing; 5.0106.1 General Duct Sealing; 5.0106.2 Duct Sealing - Spray Polyurethane Foam (SPF); 5.0106.3 Duct Sealing - Proprietary Spray Application*

Inspect these places in the duct system and seal them as needed.

- ✓ *Plenum joint at air handler:* Technicians might have had problems sealing these joints because of a lack of space. Seal these plenum connections thoroughly even if you must cut an access hole in the plenum. Use silicone caulk-

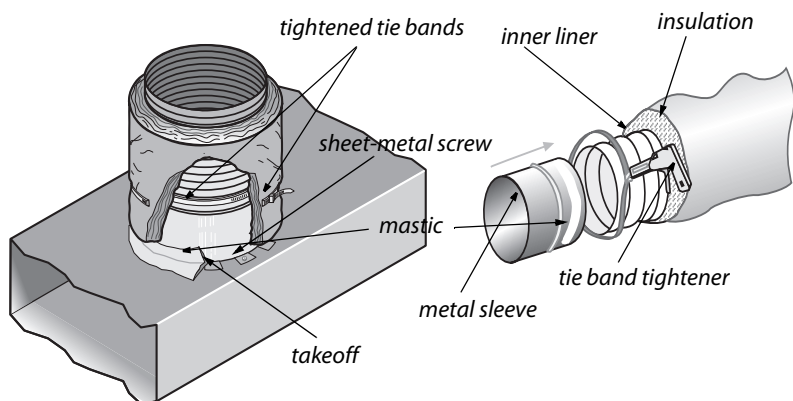
ing or foil tape instead of mastic and fabric mesh here for future access — furnace replacement, for example.



**Plenums, poorly sealed to air handler:** When air handlers are installed in tight spaces, plenums may be poorly fastened and sealed. Cutting a hole in the duct may be the only way to seal this important joint.

**Sectioned elbows:** Joints in sectioned elbows, known as gores, are usually leaky and require sealing with duct mastic.

- ✓ *Joints at branch takeoffs:* Seal these important joints with a thick layer of mastic. Fabric mesh tape should cover gaps and reinforce the seal at gaps.
- ✓ *Joints in sectioned elbows:* Known as gores, these are usually leaky and require sealing with duct mastic.
- ✓ *Tabbed sleeves:* Attach the sleeve to the main duct with 3-to-5 screws and apply mastic plentifully. Or better, remove the tabbed sleeve and replace it with a manufactured take-off.
- ✓ *Flexduct-to-metal joints:* Apply a 2-inch band of mastic to the end of the metal connector. Attach the flexduct's inner liner with a UL-181-approved tie band, tightening it with a tie-band tensioner. Attach the insulation and outer liner with another tie band.
- ✓ *Damaged flex duct:* Replace flex duct when it is punctured, deteriorated, or otherwise damaged.
- ✓ *Deteriorating ductboard facing:* Replace ductboard, preferably with metal ducting, when the facing deteriorates because this deterioration leads to a lot of air leakage.



**Flexduct joints:** Flexduct itself is usually fairly airtight, but joints, sealed improperly with tape, can be very leaky. Use methods shown here to make flexduct joints airtight.

- ✓ Consider closing supply and return registers in unoccupied basements or crawl spaces.
- ✓ Seal penetrations made by wires or pipes traveling through ducts.
- ✓ Seal the joint between the boot and the ceiling, wall, or floor between conditioned and unconditioned areas.

## Duct Support

- ✓ Support rigid ducts and duct joints with duct hangers at least every 5 feet or as necessary to prevent sagging of more than one-half inch.
- ✓ Support flexible ducts and duct board every 4 feet using a minimum of 1 ½" wide support material.



**Sealing register boots:** Seal between the boot and floor. Seal joints inside the boot.

## 8.16.4 Materials for Duct Sealing

Duct mastic is the best duct-sealing material because of its superior durability and adhesion. Apply mastic at least  $\frac{1}{16}$ -inch thick, and use reinforcing mesh for all joints wider than  $\frac{1}{8}$ -inch or joints that may move. Install screws to prevent joint movement or separation.

Aluminum foil or cloth duct tape aren't good materials for duct sealing because their adhesive often fails. Consider covering tape with mastic to prevent tape's adhesive from drying out and failing.

## 8.17 DUCT INSULATION

*SWS Detail: 5.0107 Duct Insulation; 5.0107.1 General Duct Insulation; 5.0107.2 Duct Insulation - Spray Polyurethane Foam (SPF)*

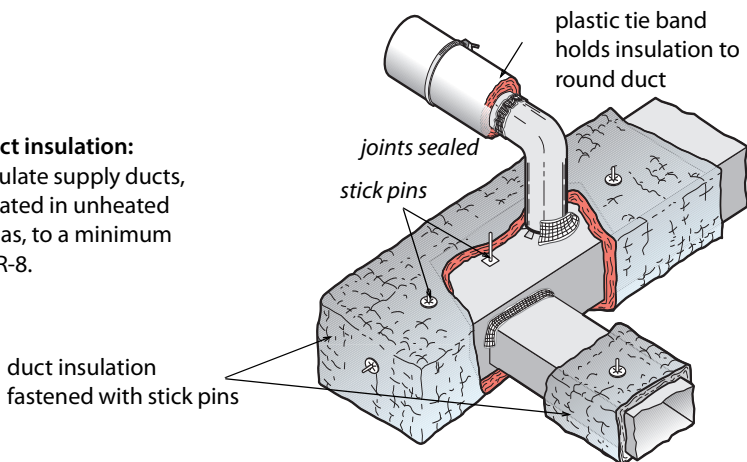
Insulate supply ducts, located in unconditioned areas outside the thermal boundary, such as crawl spaces, attics, and attached garages. Use vinyl- or foil-faced duct insulation or SPF. Don't insulate ducts that run through conditioned areas unless they cause overheating in winter or condensation in summer. Use these best practices for installing insulation.

- ✓ Always perform necessary duct sealing before insulating ducts.

- ✓ Duct-insulation R-value must be  $\geq R-8$  indoors and  $\geq R-12$  outdoors.
- ✓ Select insulation with a flame spread and smoke developed index listed at 25/50.
- ✓ Insulation should cover all exposed supply ducts, with no significant areas of bare duct left uninsulated.

#### Duct insulation:

Insulate supply ducts, located in unheated areas, to a minimum of R-8.



- ✓ Insulation's compressed thickness must be more than 75% of its uncompressed thickness. Don't compress duct insulation excessively at corner bends.
- ✓ Fasten insulation using mechanical means such as stick pins, twine, staples, or plastic tie bands.
- ✓ Cover the insulation's joints with UL 181 tape to seal all gaps.
- ✓ Install the duct insulation 3 inches away from heat-producing devices such as recessed light fixtures.
- ✓ Post a dated receipt, signed by the installer, that includes: Installed insulation type, coverage area, installed thickness, and installed R-value.

**Caution:** Burying ducts in attic insulation is common in some regions and it reduces energy losses from ducts. However, condensation on ducts in humid climates is common during the air-



conditioning season, so don't allow cellulose to touch metal ducts to avoid corrosion from cellulose's Borate fire retardant.

**Important Note:** Tape can be effective for covering joints in the insulation to prevent air convection, but the tape fails when expected to resist the force of the insulation's compression or weight. Outward-clinch staples or plastic tie bands can help hold the insulation facing and tape together.

### 8.17.1 Spray Foam (SPF) Duct Insulation

*SWS Details: 5.0107.2 Duct Insulation - Spray Polyurethane Foam (SPF)*

High-density spray foam insulation is also a good duct-insulation option, assuming it is listed as ASTM E-84 or UL 723. Spray foam is effective in areas where the foam can seal seams and insulate in one application. However, the spray foam application is limited by the available space around the duct compared to wrapping ducts with fiberglass blankets because the installer needs room to spray.

- ✓ Select foam insulation with a flame spread and smoke developed index listed at 25/450.
- ✓ Prepare surfaces to satisfy manufacturer's specifications for cleanliness, moisture content, and temperature.
- ✓ Cover all holes, cracks, and gaps where SPF may enter the duct with a backing material, such as foil tape.
- ✓ Separate foam insulation from living spaces with a thermal barrier or ignition barrier as required by local codes.
- ✓ Post a dated receipt, signed by the installer, that includes: Installed insulation type, coverage area, installed thickness, and installed R-value.