SATURN

RESOURCE MANAGEMENT

8.23 Evaluating Ducted Central Air-Conditioning Systems

SWS Details: 5.0108.1 Air-to-Air Split System; 5.0108.2 Air-to-Air Package Unit; 5.0108.3 Mini-Split System; 5.0109 Clean and Tune; 5.0101.1 Thermostat Replacement; 5.8801 Equipment Removal

An energy-efficient home shouldn't need more than a ton of air-conditioning capacity for every 1000 square feet of floor space. Evaluate window shading, attic insulation, and airtightness together with air-conditioner performance.

The following four installation-related problems are characteristic of central air conditioning systems.

1. Inadequate airflow
2. Duct air leakage
3. Incorrect charge
4. Oversizing

Refrigerant-charge tests and adjustment come after airflow measurement and improvement, and after duct testing and sealing. Manufacturers recommend that you verify adequate airflow before checking and adjusting the refrigerant charge.

The recommended airflow rate for central air-conditioning systems is between 350 CFM and 450 CFM per ton of refrigeration capacity. Heat pump airflow rate should be between 400 CFM and 450 CFM per ton.

Table 8-16: Compiled Research Results on HVAC Performance[a]

Installation-Related Problem	%[b]	Savings Potential
Duct air leakage (avg. 270 CFM_{25})[c]	70%	17% avg.
Inadequate airflow	70%	7% avg.
Incorrect charge	74%	12% avg.
Oversized by 50% or more	47%	2–10%

a. Report sponsored by Environmental Protection Agency (EPA) and compiled from research from Multiple Field Studies
b. Percent of tested homes found with a significant problem.
c. The number of homes of the duct-leakage studies was around 14,000; the number for the other problems was over 400 each.

8.23.1 Central Air-Conditioner Inspection

SWS Details: 5.0102.1 Condensate Removal; 5.0109.1 Condensers; 5.0109.2 Air Handlers; 5.0109.3 Evaporators; 5.0109 Clean and Tune; 5.0103 Refrigerant Loop

Verify proper function and safety of the following system elements: fan motor, compressor, outdoor temperature sensors, bearings, safety devices, electrical disconnect, electrical wiring, contactors, capacitors, fan blades, refrigerant access ports.

On the equipment or in a conspicuous location, post a list of all systems and components inspected and services performed. Include in this list: service technician's name, contact information, and service date.

Cleaning the Air Handler

Air conditioners move a lot of air, and that air contains dust. The filter in the air handler catches most large dust. However some dust travels around or through the filter, depending on the type of filter and its mounting assembly.

- ✓ Check the filter for dirt and replace it if dirty.
- ✓ Check the filter-mounting hardware for a close fit to avoid dirt moving around the filter and on to the blower and heat exchanger. Repair if necessary.
- ✓ Consider providing a supply of filters for occupants to change.
- ✓ Inspect the blower and clean it if dirty.
- ✓ Clean the blower compartment.

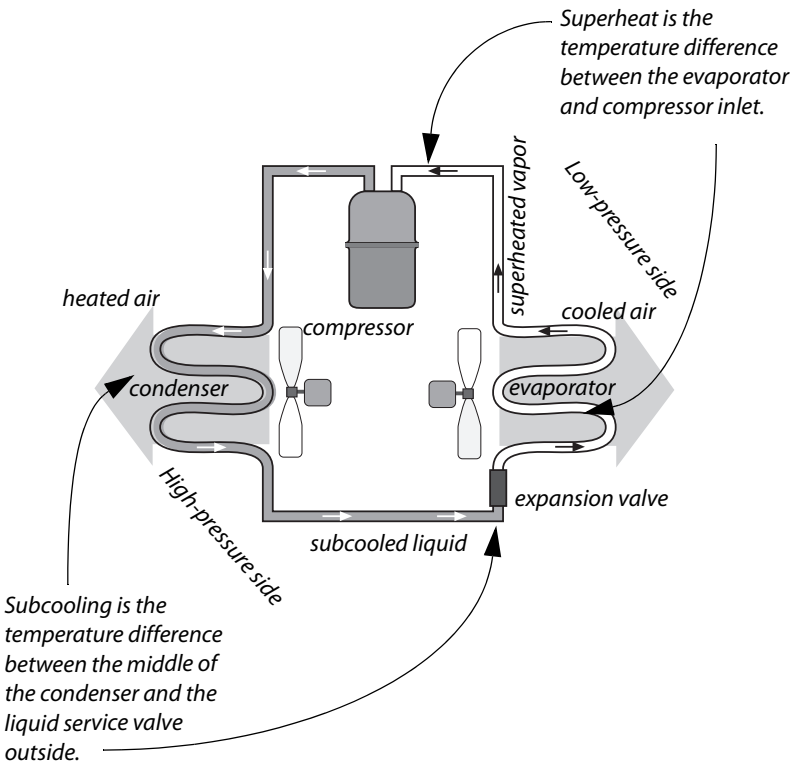
See also "Ducted Air Distribution" on page 347.

Cleaning the Condenser Coil

The condenser coil outdoors isn't protected by a filter and is usually quite dirty.The goal of this procedure is to drive the dirt

out by spraying inside to outside. With high-pressure water, however, you can drive the dirt through the coil and into the cabinet where it drains out through drain holes.

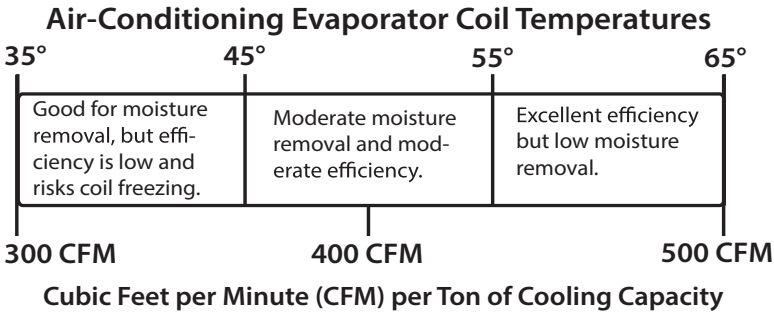
- ✓ Clear foliage, grass, and other debris from within 3 feet of the unit.
- ✓ Inspect the condenser coil and know that it is probably dirty even if it looks clean on the outside. Take a flat toothpick and scrape between the fins. Can you scrape dirt out from between the fins?
- ✓ Apply a biodegradable coil cleaner to the outside of the coil. Then spray cold water through the coil, preferably from inside the cabinet. Many coils can tolerate a high-pressure spray but others require low-pressure spray to avoid bending the fins.
- ✓ Lubricate the blower motor.
- ✓ Straighten bent fins with a fin comb.



Cleaning the Evaporator Coil

Dirt enters the filter, blower, and coil from the return plenum.

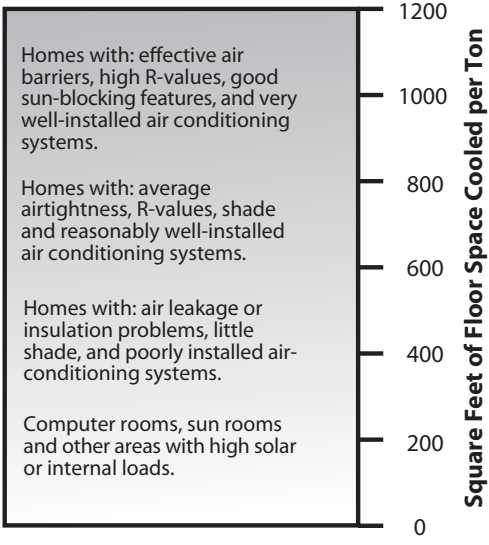
- ✓ Inspect the filter slot in the air handler or the filter grille in the return air registers. Do the filters completely fill their opening? Are the filters dirty?
- ✓ Inspect the blower in the air handler after disconnecting power to the unit. Can you remove significant dirt from one of the blades with your finger? If the blower is dirty, then the evaporator coil is also dirty.
- ✓ Clean the blower and evaporator. Rake surface dirt and dust off the coil with a brush. Then use an indoor coil cleaner and water to clean between the fins.
- ✓ Straighten bent fins with a fin comb.



Coil temperature and airflow: The ideal airflow and coil temperature vary by the average relative humidity of a local climate.

8.23.2 Air-Conditioner Sizing

Calculate the correct size of an air conditioner before purchasing or installing it. The number of square feet of floor space that can be cooled by one ton of refrigeration capacity is determined by the home's energy efficiency. Air-conditioners provide cooling most cost-effectively when they are sized accurately and run for long cycles.



Air-conditioner sizing: An energy-efficient home shouldn't need more than a ton of air-conditioner capacity per 1000 square feet of floor area.

The cooling-cost reduction strategy should focus on making the home more energy efficient and making the air conditioner work more efficiently. Making the home more efficient involves shading, insulation, and air-leakage reduction. Making the air conditioner more efficient involves duct sealing, duct insulation, and a quality installation.

8.23.3 Duct Leakage and System Airflow

Unfortunately, duct leakage and poor airflow afflict most air-conditioning systems. The testing and mitigation of these problems was covered earlier in this chapter.

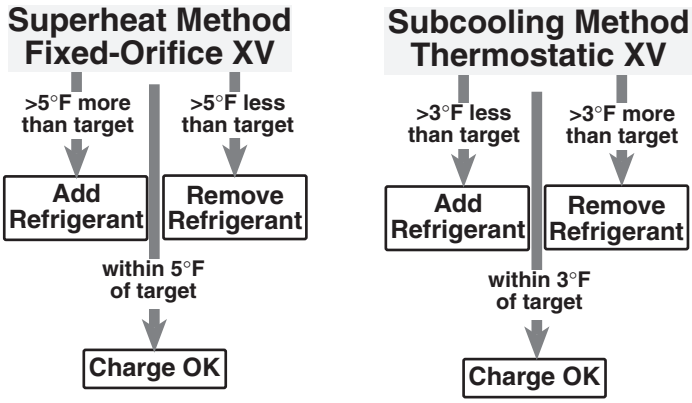
1. *See "Evaluating Duct Air Leakage" on page 364.*
2. *See "Ducted Air Distribution" on page 347.*

8.23.4 Evaluating Air-Conditioner Charge

SWS Details: 5.0103.2 Refrigerant Charge; 5.0103.1 Refrigerant Lines; 5.0103.3; Thermostatic Expansion Valve (TXV); 5.0103.4 Compressors; 5.0109.3 Evaporators

Air-conditioning replacement or service includes refrigerant charge-checking. The efficiency of the air-conditioning system is directly related to the amount of refrigerant. HVAC technicians evaluate refrigerant charge by two methods depending on what type of expansion valve the air conditioner has.

1. If the expansion valve has a fixed orifice, perform a superheat test.
2. If the valve is a thermostatic expansion valve (TXV), perform a subcooling test.



Charge-checking: Two methods help technicians judge whether the charge is correct. The remedy for incorrect charge is to either add or remove refrigerant.

Checking and Correcting Charge

Superheat and subcooling tests indicate whether the amount of refrigerant in the system is correct, or whether there is too much or too little refrigerant. In the refrigerant is low, test for refrigerant leaks.

Perform charge-checking after you complete the airflow tests, airflow adjustments, and duct-sealing. Do charge-checking while the air conditioner operates during the cooling season.

- ✓ In the refrigerant is low, test for refrigerant leaks.
- ✓ Verify that indoor and outdoor temperatures are in the allowable testing range when you test.
- ✓ Add or remove refrigerant as necessary.
- ✓ Weigh in calculated refrigerant charge if outdoor conditions prevent accurate charge-checking according to manufacturer's refrigerant-weight specifications.
- ✓ Document your charge-checking and charge-correction and post the document on or near the equipment.