8.14 Ducted Air Distribution

SWS Detail: 5.01 Forced Air; 5.0101 Controls; 5.0104 Duct Installation; 5.0105 Duct Repair; 5.0106 Duct Sealing; 5.0107 Duct Insulation

The forced-air system consists of an air handler (furnace, heat pump, air conditioner) with its heat exchanger along with attached ducts. The annual system efficiency of forced-air heating and air-conditioning systems depends on the following issues.

- Duct leakage
- System airflow
- Blower operation
- Balance between supply and return air
- Duct insulation levels

8.14.1 Sequence of Duct Improvements

The evaluation and improvement of ducts has a logical sequence of steps.

✓ Solve the airflow problems because a contractor might have to replace ducts or install additional ducts, which would possibly waste your efforts at retrofitting.

✓ Determine whether the ducts are located inside the thermal boundary or outside it.

✓ Evaluate the ducts' air leakage, and decide whether duct-sealing is important and if so, find and seal the duct leaks.

✓ If supply ducts are outside the thermal boundary or if condensation is an air-conditioning problem, insulate the ducts.

8.14.2 Solving Airflow Problems

SWS Detail: 5.0104 Duct Installation; 5.0105 Duct Repair; 5.0106 Duct Sealing; 5.0107 Duct Insulation

You don't need test instruments to discover dirty blowers or disconnected branch ducts. Find these problems before measuring duct airflow, troubleshooting the ducts, or sealing the ducts. These steps precede airflow measurements.

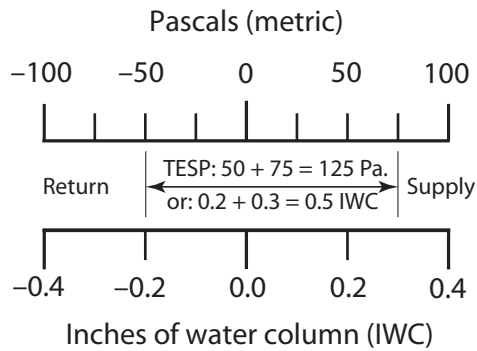
1. Ask the client about comfort problems and temperature differences in different rooms of the home.
2. Based on the clients comments, look for disconnected ducts, restricted ducts, and other obvious problems.
3. Inspect the filter(s), blower, and indoor coil for dirt. Clean them if necessary. If the indoor coil isn't easily visible, a dirty blower means that the coil is probably also dirty.
4. Look for dirty or damaged supply and return grilles that restrict airflow. Clean and repair them.
5. Look for closed registers or closed balancing dampers that could be restricting airflow to uncomfortable rooms.
6. Notice moisture problems like mold and mildew. Moisture sources, like a wet crawl space, can overpower air conditioners by introducing more moisture into the air than the air conditioner can remove.

Measuring Total External Static Pressure (TESP)

The blower creates the duct pressure, which is measured in inches of water column (IWC) or pascals. The return static pressure is negative and the supply static pressure is positive. Total external static pressure (TESP) is the sum of the absolute values of the supply and return static pressures. Absolute value means that you ignore the positive or negative signs when adding sup-

ply static pressure and return static pressure to get TESP. This addition represents the distance on a number line as shown in the illustration here.

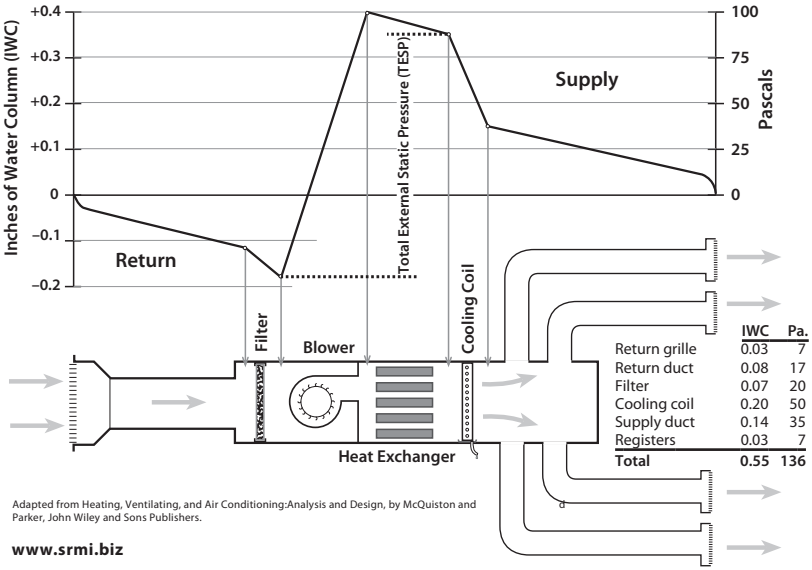
TESP number line: the TESP represents the distance on a number line between the return and supply ducts.



TESP gives a rough indicator of whether airflow is adequate. The greater the TESP, the less the airflow. The supply and return static pressures by themselves can indicate whether the supply or the return or both sides are restricted. For example, if the supply static pressure is 0.10 IWC (25 pascals) and the return static pressure is –0.5 IWC (-125 pascals), you can assume that most of the airflow problems are due to a restricted or undersized return. The TESP give a rough estimate of airflow if the manufacturer's graph or table for static pressure versus airflow is available.

1. Attach two static pressure probes to tubes leading to the two ports of the manometer. Attach the high-side port to the probe inserted downstream of the air handler in the supply duct. The other tube goes upstream of the air handler in the return duct. The manometer adds the supply and return static pressures to measure TESP.
2. Consult manufacturer's literature for a table of TESP versus airflow for the blower or the air handler. Find airflow for the TESP measured in Step 1.
3. Measure pressure on each side of the air handler to obtain both supply and return static pressures sepa-

rately. This test helps to locate the main problems as related to either the supply or the return.

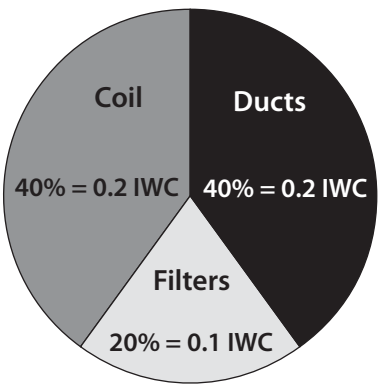


Visualizing TESP: The blower creates a suction at its inlet and a positive pressure at its outlet. As the distance between the measurement and blower increase, pressure decreases because of the system's lower resistance.

Static Pressure Guidelines

Air handlers deliver their airflow at TESPs ranging from 0.30 IWC (75 Pascals) to 1.0 IWC (250 Pascals) as found in the field. Manufacturer's recommended static pressure is usually a maximum 0.50 IWC (125 pascals) for standard air handlers. TESPs greater than 0.50 IWC indicate inadequate airflow in standard residential forced-air systems.

The popularity of pleated filters, electrostatic filters, and high-static high-efficiency evaporator coils, prompted manufacturers to introduce premium air handlers that can deliver adequate airflow at a TESPs of greater than 0.50 IWC (125 pascals). Premium residential air handlers can provide adequate airflow with TESPs of up to 0.90 IWC (225 pascals) because of their more powerful blowers and variable-speed blowers. TESPs greater than 0.90 IWC indicate the possibility of inadequate airflow in these premium residential forced-air systems.



Static pressure budget: Typical static pressures in IWC and % for a marginally effective duct system.