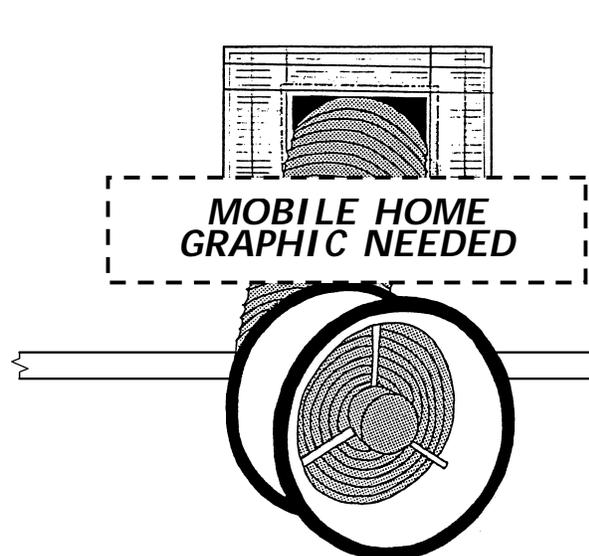


## DUCT TESTING STANDARDS

### 1. EQUIPMENT

- **Instrumentation Minimum Specifications**
  - Pressure Measurements
    - Measurement systems shall have an accuracy of  $\pm 0.2$  Pa or 1% of reading, whichever is greater, and
    - Shall utilize static pressure probes specified by the measurement equipment manufacturer.
  - Duct Leakage Measurements
    - Duct leakage testing shall have an accuracy of  $\pm 3\%$  of measured flow, and
    - Shall utilize digital gauges specified by the measurement equipment manufacturer.
  - Airflow Measurements
    - Airflow testing shall have an accuracy of  $\pm 7\%$  of measured flow, and
    - Shall utilize digital gauges specified by the measurement equipment manufacturer.
- **Approved Leakage Measurement Equipment**
  - Equipment shall meet the Title 24 requirements specified in the 2005 Residential ACM Manual, Appendices RC and RE.
  - May include, but is not limited to the following:
    - Duct pressurization system, e.g., Duct Blaster™.



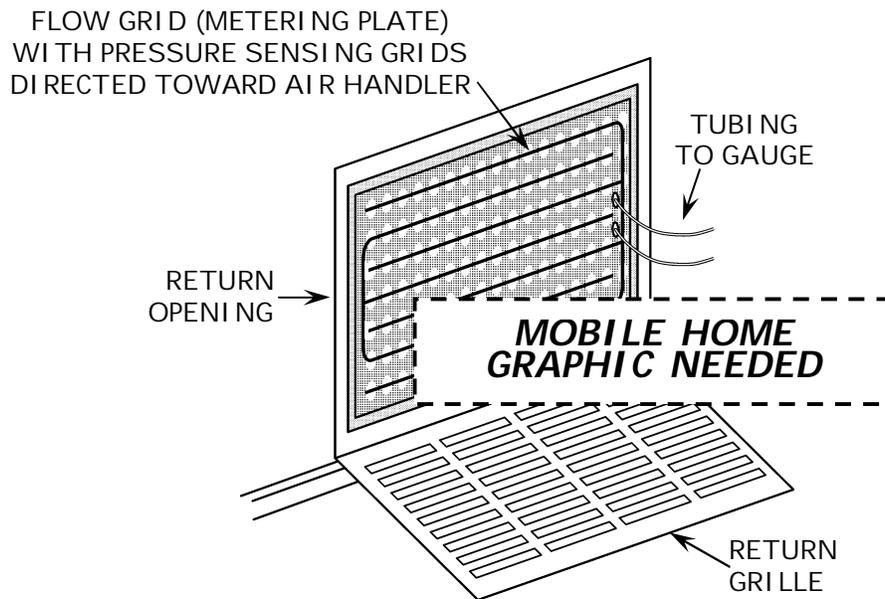
DUCTS PRESSURIZED WITH DUCT TESTER FAN



### 2. HVAC SYSTEM AIRFLOW (FAN FLOW) (continued)

#### - Flow Grid Measurement

- Equipment used for measurements shall meet the requirements specified in ACM Residential Manual Appendix RE-2005, §RE.3.1.3, “Flow Grid Measurement.”
- Measurements shall be in accordance with manufacturer’s instructions, which take precedence, and WIS Appendix -D-.



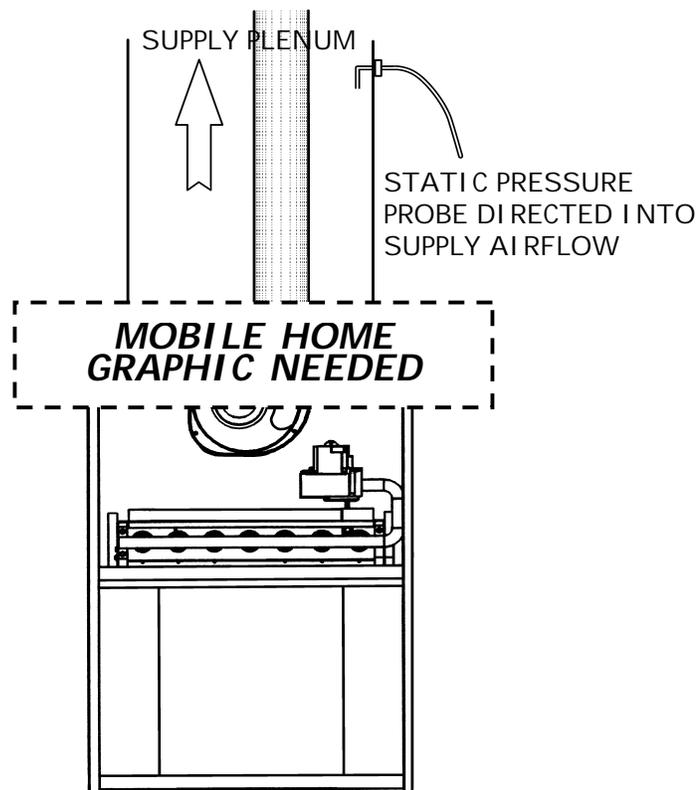
## Section 11

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### 2. HVAC SYSTEM AIRFLOW (FAN FLOW) (continued)

#### - Plenum Pressure Matching Measurement (Duct Tester Used as a Powered Capture Hood)

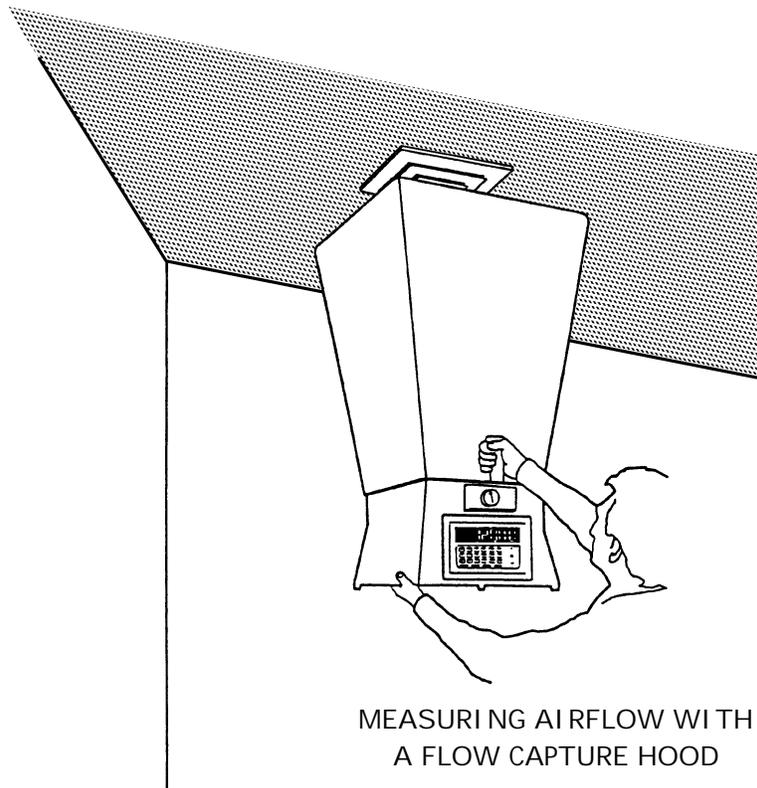
- Equipment used for measurements shall meet the requirements specified in ACM Residential Manual Appendix RE-2005, §RE.3.1.1, "Plenum Pressure Matching Measurement."
- Measurements shall be in accordance with manufacturer's instructions, which take precedence, and WIS Appendix -D-.



### 2. HVAC SYSTEM AIRFLOW (FAN FLOW) (continued)

#### - Flow Capture Hood

- Equipment used for measurements shall meet the requirements specified in ACM Residential Manual Appendix RE-2005, §RE.3.1.2, "Flow Capture Hood Measurement."
- Measurements shall be in accordance with manufacturer's instructions, which take precedence, and WIS Appendix -D-.



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### 3. TEST CONDITIONS FOR ALL DUCT LEAKAGE TESTS

#### - Equipment Operation

- The HVAC system must be operated briefly to determine that the FAU functions properly prior to performing any duct tests.
- Duct Testing shall not be performed if:
  - The FAU is inoperable, or
  - A hazardous conditions exists (e.g., burner/flame abnormality, high CO, cracked heat exchanger) that requires service/adjustment or repair/replacement per NGAT standards/policy.

#### - Air filters

- Filter(s) shall be removed from the duct system.

#### - Ventilation Air Intakes

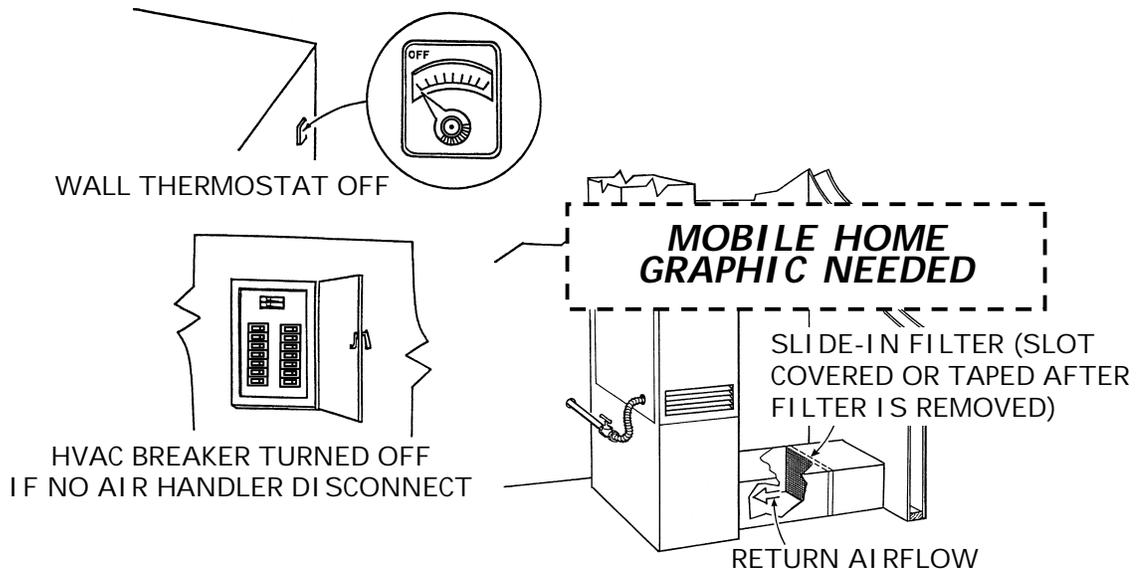
- Intakes connected to the duct system (e.g., makeup air, economizer venting damper, etc.) shall be temporarily sealed.

#### - All fan-equipped appliances shall be turned off, such as:

- HVAC equipment: FAU and room air conditioners.
- Exhaust devices: fans and clothes dryer vented outdoors.

#### - Duct system terminals shall be blocked as applicable.

- One return register or air handler access shall remain unblocked for installation of duct tester.
- All other supply registers and return grilles shall be blocked/sealed per Item 4.



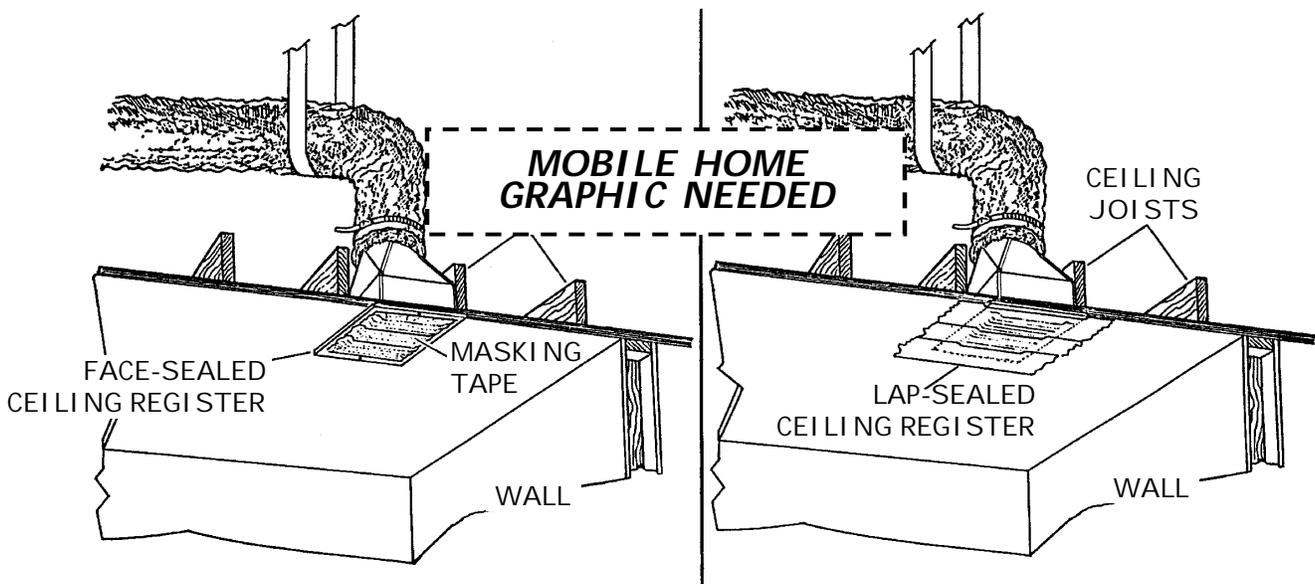
4. BLOCKING SUPPLY AND RETURN DUCT TERMINATIONS

- All Blocking Methods

- Terminations must be temporarily covered/blocked to achieve a complete seal during duct pressurization testing.
- Blocking/sealing methods and materials must not damage home finishes.
- The same blocking method shall be used for all tests.

- External Blocking Method

- Face Seal Register/Grille
  - The face of the supply register or return grille is covered with a temporary barrier material (register-sealing film, wide masking tape, etc.).
  - Barrier material is restricted to the face of the register/grille and must cover and seal all openings.
- Lap Seal Register/Grille
  - The register/grille is covered with temporary barrier material that laps onto the surrounding surface.
  - This method may not be used where damage to the surrounding surface will occur.
- Register/grille must seal completely.



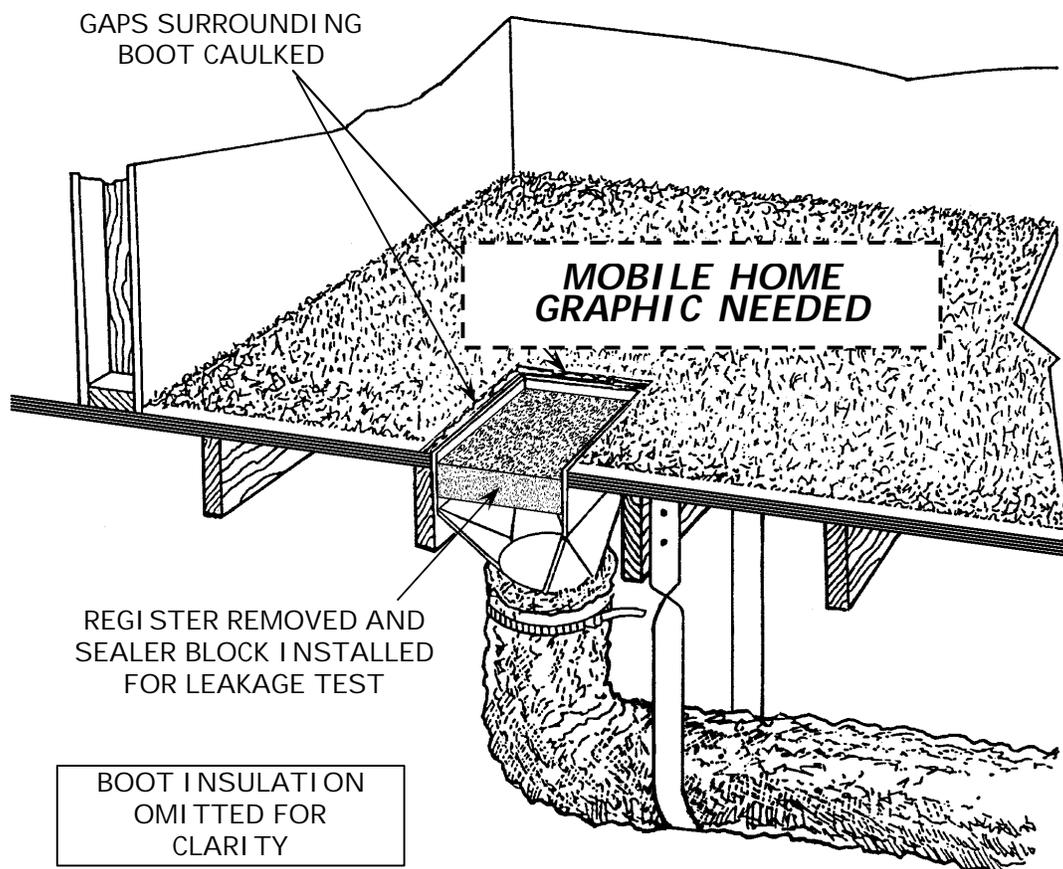
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### 4. BLOCKING SUPPLY AND RETURN DUCT TERMINATIONS (continued)

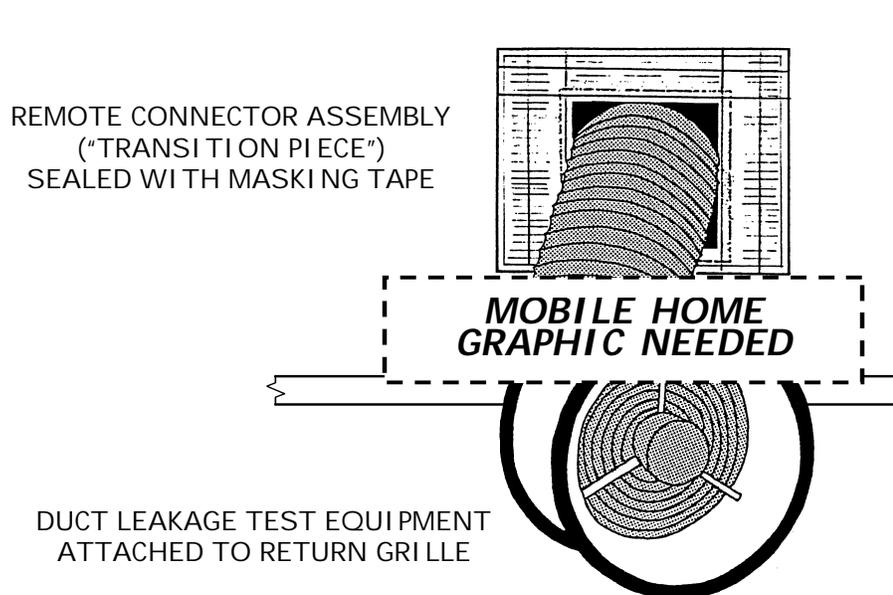
#### - Cover Pan Method

- The supply/return opening is covered with a sealed pan-shaped device held firmly in place.
- The edge/flange of the cover pan must be gasketed to achieve a complete seal.
- This method shall not be used where acoustical texturing is present.



### 5. DUCT TESTER INSTALLATION

- **Test equipment shall be set up, calibrated, and operated in accordance with manufacturer's instructions.**
- **General Guidelines for Duct Tester Fan Installation**
  - The duct tester fan housing or remote connector assembly (e.g., transition piece) is attached to the HVAC system.
  - The remote connector is attached to the return grille (minimum 1'x1' grille required), or to the air handler access.
  - 
  - The fan/connector is secured and sealed completely with temporary tape/film.
  - The duct-pressure sampling hose/probe is installed from the digital pressure gauge to inside the taped register nearest the supply plenum.
  - The Fan Pressure hose is installed from the digital pressure gauge to the duct tester fan pressure tap.

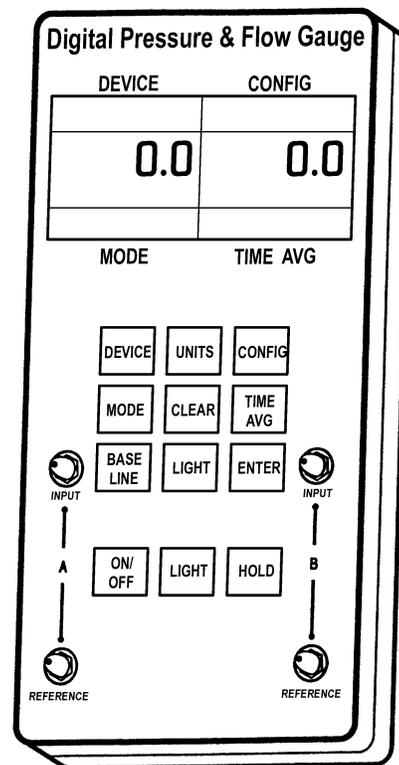


## Section 11

### 6. TOTAL DUCT LEAKAGE TEST

- Tests shall be performed in accordance with test equipment manufacturer's instructions.
- **Test Conditions and Preparation**
  - Test conditions shall be established per Item 3.
  - Supply and return duct terminations shall be blocked per Item 4.
  - Duct tester shall be set per Item 5.
- **Total Duct Leakage Test**
  - To prevent depressurization of the conditioned space by the duct tester fan, an entry door or large window shall be opened.
  - To prevent pressurization of an unconditioned space containing ducts, the space must communicate with outdoors (e.g., by opening vents, access cover/door, etc., as needed).
  - People and objects must be kept away from the front of, and at least one foot to the side of, the duct tester fan inlet during tests.
  - Digital pressure gauge Mode shall be set for one-second averaging, or as recommended by manufacturer.
  - Digital pressure gauge shall be set on high Range, or as recommended by manufacturer.

DIGITAL GAUGE FOR MEASURING  
PRESSURE AND AIRFLOW



**6. TOTAL DUCT LEAKAGE TEST (continued)**

- **Pressurization test shall be performed per manufacturer's instructions, using flow control device (e.g., "Flow Ring") as needed.**
  - Duct Tester fan shall be adjusted to pressurize ducts to 25 Pa.
  - Flow control device shall be changed as needed to keep Fan Pressure within an acceptable range, as indicated in Table 10-1 for the Minneapolis Duct Blaster™.
- **Total Duct Leakage**
  - Total Duct Leakage CFM<sub>25</sub> shall be determined.
  - For digital pressure gauges that do not automatically convert fan pressure to fan flow, manufacturer's conversion tables and procedures shall be utilized to calculate Total Duct Leakage in cfm.
  - Total Duct Leakage in cfm shall be divided by Forced Air System Airflow in cfm and converted to a percentage:  

$$[\text{Total Leakage} \div \text{System Airflow}] \times 100 = \% \text{ of System Airflow}$$
  - Target Total Duct Leakage is <15% of System Airflow, or as specified in the program P&P (see Item 7).
- **Very Leaky Systems**
  - When a Duct Pressure of 25 Pa cannot be achieved, and the digital gauge does not automatically estimate cfm at 25 Pa, manufacturer's instructions shall be followed.

**TABLE 11-1: FAN FLOW CONTROL**

<b>FAN CONFIGURATION</b>	<b>FLOW RANGE (CFM)</b>	<b>MIN. FAN PRESSURE (PA)</b>
<b>Open</b>	<b>1,500 to 600</b>	<b>25</b>
<b>Ring #1 Installed</b>	<b>800 to 225</b>	<b>25</b>
<b>Ring #2 Installed</b>	<b>300 to 90</b>	<b>25</b>
<b>Ring #3 Installed</b>	<b>125 to 20</b>	<b>10</b>

## Section 11

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### 7. DUCT SEALING PROTOCOL

- **Start Criteria**
  - Duct repair and sealing work may begin only if the *Initial* Total Duct Leakage satisfies the Start Criteria in the Program Policy & Procedures.
- **Stop Criteria**
  - One of the following LIEE P&P requirements shall be satisfied (per Table 11-2):
    - Target Leakage (stop) criteria, or
    - Economic Stop criteria.
- **Required data shall be recorded on the data form, including:**
  - Total Duct Leakage (or Leakage to Outside) CFM<sub>25</sub> from the *Initial* test, performed before starting duct repair and sealing work.
  - Total Duct Leakage (or Leakage to Outside) CFM<sub>25</sub> from the *Final* test performed after completing duct repair and sealing work.

**TABLE 11-2: DUCT SEALING TARGET LEAKAGE**

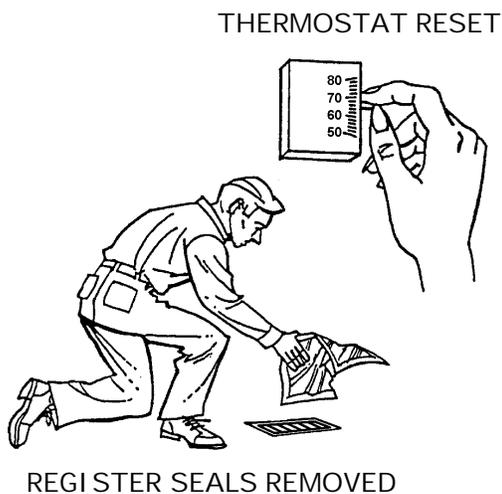
<b>MEASUREMENT METHOD</b>	<b>TARGET LEAKAGE (STOP CRITERIA)</b>
<b>(A) Total Duct Leakage</b>	<b>&lt;15% of System Fan Flow</b>
<b>(B) Duct Leakage Reduction</b>	<b>&gt;60% Leakage Reduction<sup>1</sup></b>
<b>(C) Prescriptive Default</b>	<b>Target Not Met but All Accessible Ducts are Sealed<sup>2</sup></b>
<b>(D) Economic Stop Criteria</b>	<b>As prescribed in P&amp;P</b>

<sup>1</sup>Final duct leakage compared to Initial duct leakage, with a smoke test to confirm that all accessible leaks have been sealed.

<sup>2</sup>When leakage target cannot be met, all accessible leaks must be sealed, as confirmed by a smoke test.

### 8. WRAP-UP PROCEDURE

- **Following completion of duct testing, the HVAC system, appliances and the home shall be returned to original condition.**
- **Temporary sealing removed:**
  - All temporary sealing and blocking materials (register-sealing film, temporary tape, foam plugs, etc.) shall be removed.
  - Ventilation air intakes (see Item 3) shall be restored to normal.
- **Air filter(s) reinstalled:**
  - Filters removed for testing shall be reinstalled.
  - Dirty filters shall be cleaned before reinstallation.
- **Appliances and furnishings restored:**
  - Wall thermostat, water heater control, HVAC/air handler power, windows, doors, fans, room air conditioners, etc. returned to pre-test settings.
  - Home furnishings returned to original locations.
  - All test equipment, tools, supplies, and trash removed from the home.



## Section 10

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# NONFEASIBILITY CRITERIA FOR DUCT TESTING

To Be Determined