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PRACTITIONERS’ GUIDE TO MEETING ENERGY STAR 3.0
Heating, Ventilation and Air Conditioning (HVAC) System Contractors Checklist Part A

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**HVAC System Quality Installation**


**Complete HVAC System**

- Three fundamental procedures
  - ACCA Manual J Load Calculation
  - ACCA Manual S Equipment Selection
  - ACCA Manual D Duct Design
- Plumbers and Installers must be Energy Star Certified

*Air Conditioning Contractors of America (ACCA)*
Manual J Load Calculation

First step in the design process of a new heating and air conditioning system

HVAC designers are able to:
  - Determine the total amount of heat that is lost through the exterior of a home during cooler months
  - Determine the heat that is gained through the exterior of a home during the warmer months

Analyze all aspects of the thermal characteristics of every wall, floor, ceiling, door and windows
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Manual J Load Calculations (cont.)

- HVAC Load Calculation takes into consideration other factors
  - Home's geographic location
  - Orientation of the sun
  - Envelope tightness
  - Duct leakage
  - Light and appliances

- Calculates the amount of heat and humidity that each occupant of the house will add to the interior of the home

Manual J Load Calculations (cont.)

- Two types of Manual J Load Calculations
  - Whole House (Block) HVAC Load Calculations
  - Room-by-Room Load Calculations
Whole House (Block) HVAC Load Calculations

- Provide the heating and cooling loads for the entire house
- Used when there is no need to design or modify an existing duct system
- Commonly used to determine the correct HVAC equipment size
- Match-up that is require when replacing the HVAC system in an existing home

Room-by-Room Load Calculations

- Provide the heating and cooling loads for each individual room within the home
- Determines the amount of air that is required to heat and cool each individual room
- Critical when determining the individual duct size as well as the size and overall layout of the duct system
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Manual S Equipment Selection

Manual S Equipment Selections

- Once Manual J Load Calculation has been completed
  - HVAC designed will have the information required to accurately select the proper HVAC equipment
  - Equipment selection is based on performance criteria such as:
    - The equipment's total capacity to remove heat and moisture from air as well as how much total air
    - At what pressure the system can produce
    - A 3 ton system that is installed in Maryland performs differently than an identical installed in Houston
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Manual D Duct Designs

- Is the ACCA method to determine the overall duct lay-out including the individual duct sizes
  - Must have completed a Room-by-Room Manual J load calculation and Manual S equipment selection
  - Due to the ever growing present of new building materials, advanced insulation systems, and efficient ventilation systems, it's impossible to use rule-of-thumb.
    - Complains of temperature
    - Complains of excessive noise
HVAC System Quality Installation Contractor Checklist

HVAC System Quality Installation Contractor Checklist (cont.)
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### Contractor’s Checklist

- Whole-Building Mechanical Ventilation Design
- Heating and Cooling System Design
- Selected Cooling Equipment
  - If cooling equipment to be installed
- Selected: Heat Pump
  - If heat pump to be installed
- Selected Furnace
  - If Furnace to be installed

### Contractor’s Checklist (cont.)

- Refrigerant Tests
  - If cooling equipment to be installed
- Refrigerant Calculations
- Electrical Measurements
- Air Flow Test
- Air Balance
- System Controls
- Drain Pan
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### Whole-Building Mechanical Ventilation Design

- **Ventilation System:**
  - Meet ASHRAE 62.2-2010 requirement
  - Does not utilize an intake duct to return side of the HVAC system
    - Unless the system is designed to operate intermittently and automatically based on timer and a restrict outdoor air intake when not in use
  - Documentation is attached with ventilation system type, location, design rate
  - Continuously-Operating vent & exhaust
  - Intermittently-operating whole-house ventilation system
    - Operate at least once per day
    - Least 10% of every 24 hours

### Heating and Cooling System Design

- **Heat Loss/Gain Method**
- **Duct Designed Method**
- **Equipment Selection Method**
- **Outdoor Design Temperatures**
- **Orientation of Rated Home**
- **Number of Occupants Served by the System**
- **Conditioned Floor Area**
- **Window Area**

- **Predominant Window SHGC**
- **Infiltration Rate**
- **Design Latent Heat Gain**
- **Design Sensible Heat Gain**
- **Design Total Heat Gain**
- **Design Total Heat Loss**
- **Design Air Flow**
- **Design Duct Static Pressure**
- **Full Load Calculations Report Attached**
### Selected Cooling Equipment

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condenser Manufacture &amp; Model</td>
<td>Listed System: Total Capacity at Design Cond.</td>
</tr>
<tr>
<td>Evaporator/Fan Coil Manufacture &amp; Model</td>
<td>Listed System: Latent Capacity</td>
</tr>
<tr>
<td>AHRI Reference Number</td>
<td>○ (Value 3.8) &lt; Design Latent Heat Gain (Value 2.12)</td>
</tr>
<tr>
<td>Listed Efficiency</td>
<td>Listed System: Total Capacity</td>
</tr>
<tr>
<td>Metering Device Type</td>
<td>○ (Value 3.8) is 95-115% of Design Total Gain (Value 2.14)</td>
</tr>
<tr>
<td>Refrigerant Type</td>
<td>AHRI Certificate Attached</td>
</tr>
<tr>
<td>Fan Speed Type</td>
<td></td>
</tr>
<tr>
<td>Listed System: Sensible Capacity at Design Cond.</td>
<td></td>
</tr>
</tbody>
</table>

### Selected Heat Pump Equipment

- AHRI Listed Efficiency
- Performance at 17°F
- Performance at 47°F
### Selected Furnace

- Furnace Manufactures & Model
- Listed Efficiency
- Listed Output Heating Capacity
  - Heating Capacity (Value 5.3)" is 100-140% of Design Total Heat Loss (Value 2.15) or next nominal size

### Refrigerant Tests

Run system for 15 minutes before testing
- Outdoor ambient temperature at condenser
- Return-side air temperature inside duct near evaporator
- Liquid line pressure
- Liquid line temperature
- Suction line pressure
- Suction line temperature
**Refrigerant Calculations**

- **For System with Thermal Expansion Value (TXV):**
  - Condenser saturation temperature
  - Subcooling value
  - OEM subcooling goal
  - Subcooling deviation

- **For System with Fixed Orifice:**
  - Evaporator saturation temperature
  - Superheat value
  - OEM superheat goal
  - Superheat deviation
  - Value 7.4 value ± 3°F or value 7.8 is ± 5°F

**Electrical Measurements**

- **Taken at electrical disconnect while component is in operation**
  - Evaporator or furnace air handler fan
  - Condenser unit
  - Electrical measurements within OEM-specified tolerance of nameplate value
### Air Flow Tests

- Air volume at evaporator
- Test performed in which mode
  - Heating
  - Cooling
- Return duct static pressure
- Supply duct static pressure
- Test hole location are well-marked and accessible
- Airflow volume at evaporator

### Air Balance

- Balancing report prepared and attached indicating the room name and design airflow
- Measured by contractor using ANSI/ACCA
- Measured, document, and. Verified by a Rater per item
Drain Pan

- Corrosion-resistant drain pan
- Property slope to drainage system
- HVAC component that produces condensate
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Reference Materials

- [www.ruralhome.org](http://www.ruralhome.org)
- [www.energystar.gov](http://www.energystar.gov)
- [www.epa.gov/watersense](http://www.epa.gov/watersense)
- [www.usgbc.org](http://www.usgbc.org)
- [greenhomeguide.com/program/leed-for-homes](http://greenhomeguide.com/program/leed-for-homes)
- [youtu.be/czlCD00oScs](http://youtu.be/czlCD00oScs)

Discussion
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Thank you for your participation in today’s webinar.