ENERGY STAR® Qualified Homes

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

EPA

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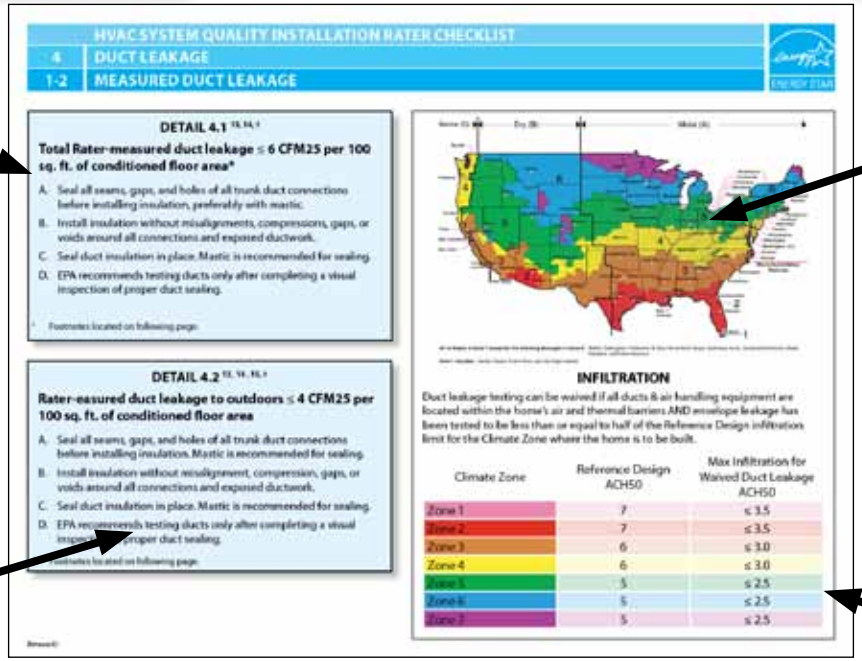
HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

WHAT ARE GUIDE DETAILS?

This Guide for Home Energy Raters presents Guide Details that serve as a visual reference for each of the line items in the HVAC System Quality Installation (QI) Rater Checklist. The details are great tools for Rater education and will help Raters answer contractor and subcontractor questions. Together, the HVAC System QI Rater Checklist and these Guide Details provide a comprehensive process for ensuring that building professionals meet all aspects of the ENERGY STAR V3 requirements. This page illustrates what Raters will see throughout this Guide on every odd (or right hand) page.

Each of the details is listed top left, followed by the actions the Rater should present to the applicable trade to successfully complete the detail.

This image illustrates the detail along with arrows to indicate steps necessary to complete it.



Front Page

This area presents applicable footnotes. Alternately, footnotes that require additional space will be located on a third sheet.

A list of applicable trades appears at the bottom to remind Raters which building professionals need to apply the detail.

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

WHAT ARE GUIDE DETAILS? (CONTINUED)

This page illustrates what Raters will see throughout this Guide on every even (left hand) page. The photos show the detailed actions that Raters must verify are completed according to the ENERGY STAR V3 requirements.

Images of both proper and improper installation are included along with a corresponding thumbs up or thumbs down symbol.

Note, some images of proper and improper installation are currently missing. In places where EPA has listed "picture needed," we are actively seeking examples from the residential construction community. Please send pictures to energystarhomes@energystar.gov.

Back Page

A letter corresponding to the front page is provided to help the reader understand which step of the process the photos present.

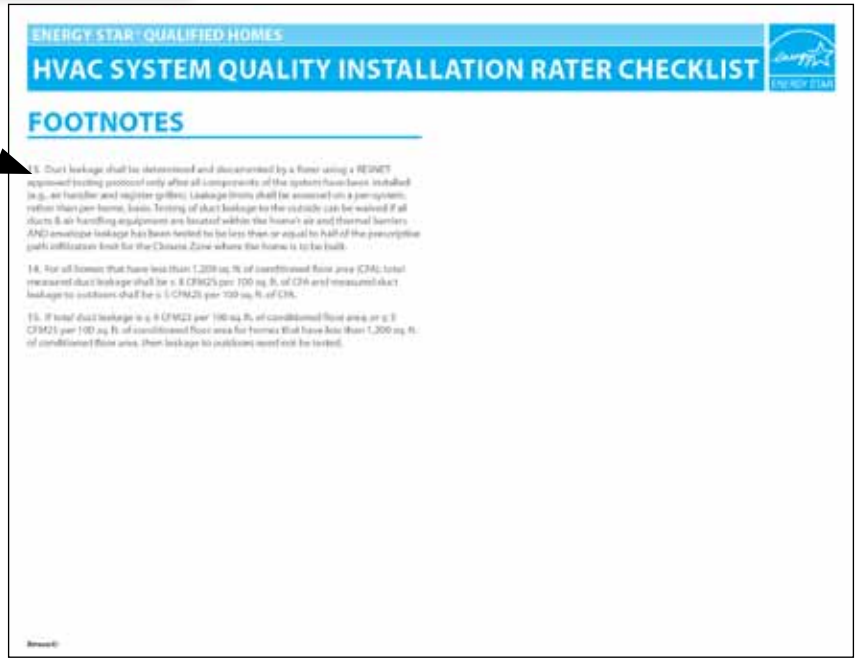
When necessary, additional tips, codes, or other helpful information appears in the lower half of the page.

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

WHAT ARE GUIDE DETAILS? (CONTINUED)

This page illustrates what Raters will see for certain ENERGY STAR V3 requirements. It contains footnotes pertinent to the requirement that did not fit on the first page.

A list of footnotes pertinent to the specific requirement are listed here.


ENERGY STAR® QUALIFIED HOMES

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

FOOTNOTES

Third Page

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HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

CONTENTS

SECTION 1. Review Of HVAC System Quality Installation Contractor Checklist

SECTION 2. Duct Quality Installation

SECTION 3. Duct Insulation

SECTION 4. Duct Leakage

SECTION 5. Whole-Building Delivered Ventilation

SECTION 6. Controls

SECTION 7. Ventilation Air Inlets & Ventilation Source

SECTION 8. Local Mechanical Exhaust

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

SECTION 9. Ventilation & exhaust fan ratings (exemptions for hvac and remote-mounted fans)

SECTION 10. Combustion appliances

SECTION 11. Filtration

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

SECTION 1. REVIEW OF HVAC SYSTEM QUALITY INSTALLATION CONTRACTOR CHECKLIST

1.1. HVAC System Quality Installation Contractor checklist completed in its entirety and collected for records, along with documentation on ventilation system (1.3), full load calculations (2.18), AHRI certificate (3.15), and balancing report (10.2)

1.2. Review the following parameters related to system cooling design, selection, and installation from the HVAC Contractor checklist (Contractor checklist item # indicated in parentheses):

1.2.1. Outdoor design temperatures (2.4) are equal to the 1% and 99% ACCA Manual J design temperatures for contractor-designated design location

1.2.2. Home orientation (2.5) matches orientation of rated home

1.2.3. Number of Occupants (2.6) equals number of occupants in rated home

1.2.4. Conditioned floor area (2.7) is within ±10% of conditioned floor area of rated home

1.2.5. Window area (2.8) is within ±10% of calculated window area of rated home

1.2.6. Predominant window SHGC (2.9) is within 0.1 of predominant value in rated home

1.2.7. Listed latent cooling capacity (3.10) exceeds design latent heat gain (2.12)

1.2.8. Listed sensible cooling capacity (3.11) exceeds design sensible heat gain (2.13)

1.2.9. Listed total cooling capacity (3.12) is 95-115% (or 95-125% for Heat Pumps in Climate Zones 4-8) of design total heat gain (2.14), or next nominal size

1.2.10. HVAC manufacturer and model numbers on installed equipment, contractor checklist (3.1, 3.3, 5.1), and AHRI certificate or OEM catalog data all match

1.2.11. Using reported liquid line (6.3) or suction line (6.5) pressure, corresponding temp. (as determined using pressure/temperature chart for refrigerant type) matches reported condenser (7.1) or evaporator (7.5) saturation temperature (+/- 3 degrees)

1.2.12. Calculated subcooling (7.1 minus 6.4) or superheat (6.6 minus 7.5) value equals reported target subcooling (7.3) or superheat (7.7) temperature

1.3. Rater-verified supply & return duct static pressure <110% of contractor values (9.3, 9.4)*

* For additional information and specific duct testing protocols please refer to RESNET Chapter 8 (Standard for Performance Testing and Work Scope: Enclosure and Air Distribution Leakage Testing).

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DETAIL 1.1 [2]

HVAC System Quality Installation Contractor checklist completed in its entirety and collected for records, along with documentation on ventilation system (1.3), full load calculations (2.18), AHRI certificate (3.15), and balancing report (10.2)

A. Check the Contractor checklist to ensure it is completed. It is not required to assess the accuracy of the load calculations or field verifications.

B. It is the Contractor's exclusive responsibility to ensure the system design and installation comply with the Contractor checklist specifications.

FOOTNOTES

2. The Rater is only responsible for ensuring that the Contractor has completed the Contractor checklist in its entirety and verifying the discrete objective parameters referenced in Section 1 of this checklist, not for assessing the accuracy of the load calculations or field verifications included or to verify the accuracy of every input on the Contractor checklist.

REQUIRED DOCUMENTS

HVAC System Quality Installation Contractor Checklist

This document is necessary to verify that the HVAC contractor has documented all pertinent information related to ENERGY STAR requirements for the house's HVAC system.

Ventilation System Documentation

The system shall have at least one supply or exhaust fan with associated ducts and controls. Local exhaust fans are allowed to be part of an exhaust ventilation system. Outdoor air ducts connected to the return side of an air handler are allowed to be part of a supply ventilation system if manufacturers' requirements for return air temperature are met.

The ventilation system documentation will provide information on which type of ventilation is installed. In addition, it indicates the ventilation rate necessary for Rater-verification purposes.

Full Load Calculations

HVAC Contractors shall perform a load calculation for the specific house plan and orientation of the home to be qualified or, for plans with multiple options or that may be built in more than one orientation, for every option and orientation.

AHRI Certificate

All evaporators and condensing units shall be properly matched as demonstrated by an attached AHRI certificate. If an AHRI certificate is not available, a copy of OEM-provided catalog data indicating acceptable combination selection and performance data shall be attached.

Balancing Report

The balancing report will provide the quantity of supply and return terminals in each room.

ENERGY STAR Qualified Homes, Version 3 (Rev. 04)
HVAC System Quality Installation Contractor Checklist [1]

Home Address: _____ City: _____ State: _____

System Description [2] _____ Cooling system for temporary occupant load? [3] Yes ☐ No ☐

1. Whole-Building Mechanical Ventilation Design [4]	Cont./Tech. Verified [5]	Rater Verified	N/A
1.1 Ventilation system installed that has been designed to meet ASHRAE 62.2-2010 requirements including, but not limited to, requirements in Items 1.2-1.5.[6]	☐	☐	-
1.2 Ventilation system does not utilize an intake duct to the return side of the HVAC system unless the system is designed to operate intermittently and automatically based on a timer and to restrict outdoor air intake when not in use (e.g., motorized damper).	☐	☐	-
1.3 Documentation is attached with ventilation system type, location, design rate, and frequency and duration of each ventilation cycle.	☐	☐	-
1.4 If present, continuously-operating vent. & exhaust fans designed to operate during all occupiable hours.	☐	☐	☐
1.5 If present, intermittently-operating whole-house ventilation system designed to automatically operate at least once per day and at least 10% of every 24 hours.	☐	☐	☐
2. Heating & Cooling System Design [4,7] – *Parameters used in the design calculations shall reflect home to be built, specifically, outdoor design temperatures, home orientation, number of bedrooms, conditioned floor area, window area, predominant window performance and insulation levels, infiltration rate, mechanical ventilation rate, presence of MERV6 or better filter, and indoor temperature setpoints = 70°F for heating; 75°F for cooling*			
2.1 Heat Loss / Gain Method: ☐ Manual J v8 ☐ ASHRAE 2009 ☐ Other: _____	☐	☐	-
2.2 Duct Design Method: ☐ Manual D ☐ Other: _____	☐	☐	☐
2.3 Equipment Selection Method: ☐ Manual S ☐ OEM Rec. ☐ Other: _____	☐	☐	-
2.4 Outdoor Design Temperatures:[8] Location: _____ 1%: _____ °F 99%: _____ °F	☐	☐	-
2.5 Orientation of Rated Home (e.g., North, South): _____	☐	☐	-
2.6 Number of Occupants Served by System:[9] _____	☐	☐	-
2.7 Conditioned Floor Area in Rated Home: _____ Sq. Ft.	☐	☐	-
2.8 Window Area in Rated Home: _____ Sq. Ft.	☐	☐	-
2.9 Predominant Window SHGC in Rated Home:[10] _____	☐	☐	-
2.10 Infiltration Rate in Rated Home:[11] Summer: _____ Winter: _____	☐	☐	-
2.11 Mechanical Ventilation Rate in Rated Home: _____ CFM	☐	☐	-
2.12 Design Latent Heat Gain: _____ BTUh	☐	☐	-
2.13 Design Sensible Heat Gain: _____ BTUh	☐	☐	-
2.14 Design Total Heat Gain: _____ BTUh	☐	☐	-
2.15 Design Total Heat Loss: _____ BTUh	☐	☐	-
2.16 Design Airflow:[12] _____ CFM	☐	☐	-
2.17 Design Duct Static Pressure:[13] _____ Inches Water Column (IWC)	☐	☐	☐
2.18 Full Load Calculations Report Attached	☐	☐	-
3. Selected Cooling Equipment, If Cooling Equipment to be Installed			
3.1 Condenser Manufacturer & Model: _____	☐	☐	☐
3.2 Condenser Serial #: _____	☐	☐	☐
3.3 Evaporator / Fan Coil Manufacturer & Model: _____	☐	☐	☐
3.4 Evaporator / Fan Coil Serial #: _____	☐	☐	☐
3.5 AHRI Reference #:[14] _____	☐	☐	☐
3.6 Listed Efficiency: _____ EER _____ SEER	☐	☐	☐
3.7 Metering Device Type: ☐ TXV ☐ Fixed orifice ☐ Other: _____	☐	☐	☐
3.8 Refrigerant Type: ☐ R-410a ☐ Other: _____	☐	☐	☐
3.9 Fan Speed Type:[15] ☐ Fixed ☐ Variable (ECM / ICM) ☐ Other: _____	☐	☐	☐
3.10 Listed Sys. Latent Capacity at Design Cond.[16]: _____ BTUh	☐	☐	☐
3.11 Listed Sys. Sensible Capacity at Design Cond.[16]: _____ BTUh	☐	☐	☐
3.12 Listed Sys. Total Capacity at Design Cond.[16]: _____ BTUh	☐	☐	☐
3.13 If Listed Sys. Latent Capacity (Value 3.10) ≤ Design Latent Heat Gain (Value 2.12), ENERGY STAR qualified dehumidifier installed	☐	☐	☐
3.14 Listed Total Cap. (Value 3.12) is 95-115% of Design Total Heat Gain (Value 2.14) or next nom. Size [7,17]	☐	☐	☐
3.15 AHRI Certificate Attached [14]	☐	☐	☐
4. Selected Heat Pump Equipment, If Heatpump to be Installed			
4.1 AHRI Listed Efficiency: _____ HSPF	☐	☐	☐
4.2 Performance at 17°F: Capacity _____ BTUh Efficiency: _____ COP	☐	☐	☐
4.3 Performance at 47°F: Capacity _____ BTUh Efficiency: _____ COP	☐	☐	☐

ENERGY STAR Qualified Homes, Version 3 (Rev. 04)
HVAC System Quality Installation Contractor Checklist [1]

5. Selected Furnace, If Furnace to be Installed	Cont./Tech. Verified [5]	Rater Verified	N/A
5.1 Furnace Manufacturer & Model: _____	☐	☐	☐
5.2 Furnace Serial #: _____	☐	☐	☐
5.3 Listed Efficiency: _____ AFUE	☐	☐	☐
5.4 Listed Output Heating Capacity: _____ BTUh	☐	☐	☐
5.5 Listed Output Heat. Cap. (Value 5.4) is 100-140% of Design Total Heat Loss (Value 2.15) or next nom. size [7,18]	☐	☐	☐
6. Refrigerant Tests - *Run system for 15 minutes before testing* Note: If outdoor ambient temperature at the condenser is < 55°F or, if known, below the manufacturer-recommended minimum operating temperature for the cooling cycle, then the system shall include a TXV, and the contractor shall mark "N/A" on the Checklist for Section 6 & 7. [19]			
6.1 Outdoor ambient temperature at condenser: _____ °F DB	☐	☐	☐
6.2 Return-side air temperature inside duct near evaporator, during cooling mode: _____ °F WB	☐	☐	☐
6.3 Liquid line pressure: _____ psig	☐	☐	☐
6.4 Liquid line temperature: _____ °F DB	☐	☐	☐
6.5 Suction line pressure: _____ psig	☐	☐	☐
6.6 Suction line temperature: _____ °F DB	☐	☐	☐
7. Refrigerant Calculations			
For System with Thermal Expansion Valve (TXV):			
7.1 Condenser saturation temperature: _____ °F DB (Using Value 6.3)	☐	☐	☐
7.2 Subcooling value: _____ °F DB (Value 7.1 - Value 6.4)	☐	☐	☐
7.3 OEM subcooling goal: _____ °F DB	☐	☐	☐
7.4 Subcooling deviation: _____ °F DB (Value 7.2 – Value 7.3)	☐	☐	☐
For System with Fixed Orifice:			
7.5 Evaporator saturation temperature: _____ °F DB (Using Value 6.5)	☐	☐	☐
7.6 Superheat value: _____ °F DB (Value 6.6 – Value 7.5)	☐	☐	☐
7.7 OEM superheat goal: _____ °F DB (Using superheat tables and Values 6.1 & 6.2)	☐	☐	☐
7.8 Superheat deviation: _____ °F DB (Value 7.6 – Value 7.7)	☐	☐	☐
7.9 Value 7.4 is ± 3°F or Value 7.8 is ± 5°F	☐	☐	☐
7.10 An OEM test procedure has been used in place of sub-cooling or super-heat process and documentation has been attached that defines this procedure	☐	☐	☐
8. Electrical Measurements – *Taken at electrical disconnect while component is in operation*			
8.1 Evaporator / air handler fan: _____ amperage _____ line voltage	☐	☐	☐
8.2 Condenser unit: _____ amperage _____ line voltage	☐	☐	☐
8.3 Electrical measurements within OEM-specified tolerance of nameplate value	☐	☐	☐
9. Air Flow Tests			
9.1 Air volume at evaporator: _____ CFM	☐	☐	☐
9.2 Test performed in which mode? ☐ Heating ☐ Cooing	☐	☐	☐
9.3 Return duct static pressure: _____ IWC Test Hole Location [20]: _____	☐	☐	☐
9.4 Supply duct static pressure: _____ IWC Test Hole Location [20]: _____	☐	☐	☐
9.5 Test hole locations are well-marked and accessible [20]	☐	☐	☐
9.6 Measurement method used: ☐ Anemometer ☐ Pressure matching [21] ☐ Flow grid ☐ Fan curve ☐ Other: _____	☐	☐	☐
9.7 Airflow volume at evaporator (Value 9.1), at fan design speed and full operating load, ± 15% of the airflow required per system design (Value 2.16) or within range recommended by OEM	☐	☐	☐
10. Air Balance			
10.1 Individual room airflows within the greater of ± 20% or 25 CFM of the design / application requirements for the supply and return ducts [22]	☐	☐	☐
10.2 Balancing report indicating, for each supply and return register: room name, design airflow, and final measured airflow	☐	☐	☐
11. System Controls			
11.1 Operating and safety controls meet OEM requirements	☐	☐	☐
12. Drain pan			
12.1 Corrosion-resistant drain pan, properly sloped to drainage system, included with each HVAC component that produces condensate [23]	☐	☐	☐

Technician Name [24] _____ Equipment Installation Date: _____
Technician Signature [24] _____ Company: _____
Designer Name [24] _____ System Design Date: _____
Designer Signature [24] _____ Company: _____

DETAIL 1.2

Review the following parameters related to system cooling design, selection, and installation from the HVAC Contractor checklist (Contractor checklist item # indicated in parenthesis) (DETAILS 1.2.1 - 1.2.10): [3, †]

1.2.1. Outdoor design temperatures (2.4) are equal to the 1% and 99% ACCA Manual J design temperatures for contractor-designated location or alternate temps supported with documentation [4]

1.2.2. Home orientation (2.5) matches orientation of rated home

1.2.3. Number of Occupants (2.6) equals number of occupants in rated home [5]

1.2.4. Conditioned floor area (2.7) is within ±10% of conditioned floor area of rated home

1.2.5. Window area (2.8) is within ±10% of calculated window area of rated home

1.2.6. Predominant window SHGC (2.9) is within 0.1 of predominant value in rated home [6]

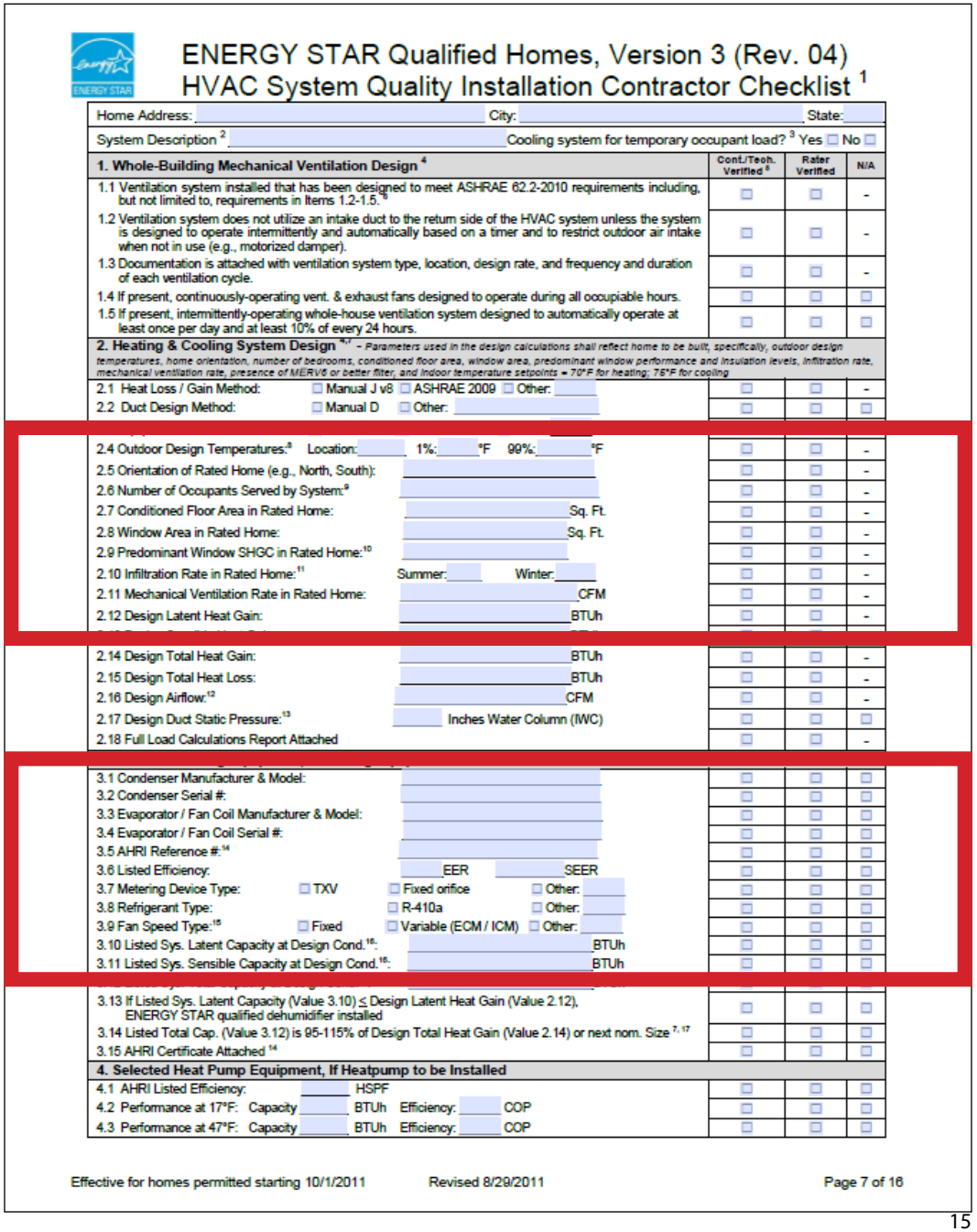
1.2.7. Listed latent cooling capacity (3.10) exceeds design latent heat gain (2.12)

1.2.8. Listed sensible cooling capacity (3.11) exceeds design sensible heat gain (2.13)

1.2.9. Listed total cooling capacity (3.12) is 95-115% (or 95-125% for Heat Pumps in Climate Zones 4-8) of design total heat gain (2.14), or next nominal size [7]

1.2.10. HVAC manufacturer and model numbers on installed equipment, contractor checklist (3.1, 3.3, 5.1), and AHRI certificate or OEM catalog data all match [8]

† Footnotes located on page 17



ENERGY STAR Qualified Homes, Version 3 (Rev. 04)
HVAC System Quality Installation Contractor Checklist [1]

Home Address: _____ City: _____ State: _____

System Description [2] _____ Cooling system for temporary occupant load? [3] Yes ☐ No ☐

1. Whole-Building Mechanical Ventilation Design [4]	Cont./Tech. Verified [5]	Rater Verified	N/A
1.1 Ventilation system installed that has been designed to meet ASHRAE 62.2-2010 requirements including, but not limited to, requirements in Items 1.2-1.5. [6]	☐	☐	-
1.2 Ventilation system does not utilize an intake duct to the return side of the HVAC system unless the system is designed to operate intermittently and automatically based on a timer and to restrict outdoor air intake when not in use (e.g., motorized damper).	☐	☐	-
1.3 Documentation is attached with ventilation system type, location, design rate, and frequency and duration of each ventilation cycle.	☐	☐	-
1.4 If present, continuously-operating vent. & exhaust fans designed to operate during all occupiable hours.	☐	☐	☐
1.5 If present, intermittently-operating whole-house ventilation system designed to automatically operate at least once per day and at least 10% of every 24 hours.	☐	☐	☐
2. Heating & Cooling System Design [4,7] – *Parameters used in the design calculations shall reflect home to be built, specifically, outdoor design temperatures, home orientation, number of bedrooms, conditioned floor area, window area, predominant window performance and insulation levels, infiltration rate, mechanical ventilation rate, presence of MERV6 or better filter, and indoor temperature setpoints = 70°F for heating; 75°F for cooling*			
2.1 Heat Loss / Gain Method: ☐ Manual J v8 ☐ ASHRAE 2009 ☐ Other: _____	☐	☐	-
2.2 Duct Design Method: ☐ Manual D ☐ Other: _____	☐	☐	☐
2.4 Outdoor Design Temperatures: [8] Location: _____ 1%: _____ °F 99%: _____ °F	☐	☐	-
2.5 Orientation of Rated Home (e.g., North, South): _____	☐	☐	-
2.6 Number of Occupants Served by System: [9] _____	☐	☐	-
2.7 Conditioned Floor Area in Rated Home: _____ Sq. Ft.	☐	☐	-
2.8 Window Area in Rated Home: _____ Sq. Ft.	☐	☐	-
2.9 Predominant Window SHGC in Rated Home: [10] _____	☐	☐	-
2.10 Infiltration Rate in Rated Home: [11] Summer: _____ Winter: _____	☐	☐	-
2.11 Mechanical Ventilation Rate in Rated Home: _____ CFM	☐	☐	-
2.12 Design Latent Heat Gain: _____ BTUh	☐	☐	-
2.14 Design Total Heat Gain: _____ BTUh	☐	☐	-
2.15 Design Total Heat Loss: _____ BTUh	☐	☐	-
2.16 Design Airflow: [12] _____ CFM	☐	☐	-
2.17 Design Duct Static Pressure: [13] _____ Inches Water Column (IWC)	☐	☐	☐
2.18 Full Load Calculations Report Attached	☐	☐	-
3.1 Condenser Manufacturer & Model: _____	☐	☐	☐
3.2 Condenser Serial #: _____	☐	☐	☐
3.3 Evaporator / Fan Coil Manufacturer & Model: _____	☐	☐	☐
3.4 Evaporator / Fan Coil Serial #: _____	☐	☐	☐
3.5 AHRI Reference #: [14] _____	☐	☐	☐
3.6 Listed Efficiency: _____ EER _____ SEER	☐	☐	☐
3.7 Metering Device Type: ☐ TXV ☐ Fixed orifice ☐ Other: _____	☐	☐	☐
3.8 Refrigerant Type: ☐ R-410a ☐ Other: _____	☐	☐	☐
3.9 Fan Speed Type: [15] ☐ Fixed ☐ Variable (ECM / ICM) ☐ Other: _____	☐	☐	☐
3.10 Listed Sys. Latent Capacity at Design Cond. [16]: _____ BTUh	☐	☐	☐
3.11 Listed Sys. Sensible Capacity at Design Cond. [16]: _____ BTUh	☐	☐	☐
3.13 If Listed Sys. Latent Capacity (Value 3.10) ≤ Design Latent Heat Gain (Value 2.12), ENERGY STAR qualified dehumidifier installed	☐	☐	☐
3.14 Listed Total Cap. (Value 3.12) is 95-115% of Design Total Heat Gain (Value 2.14) or next nom. Size [7, 17]	☐	☐	☐
3.15 AHRI Certificate Attached [14]	☐	☐	☐
4. Selected Heat Pump Equipment, If Heatpump to be Installed			
4.1 AHRI Listed Efficiency: _____ HSPF	☐	☐	☐
4.2 Performance at 17°F: Capacity _____ BTUh Efficiency: _____ COP	☐	☐	☐
4.3 Performance at 47°F: Capacity _____ BTUh Efficiency: _____ COP	☐	☐	☐

Effective for homes permitted starting 10/1/2011 Revised 8/29/2011 Page 7 of 16

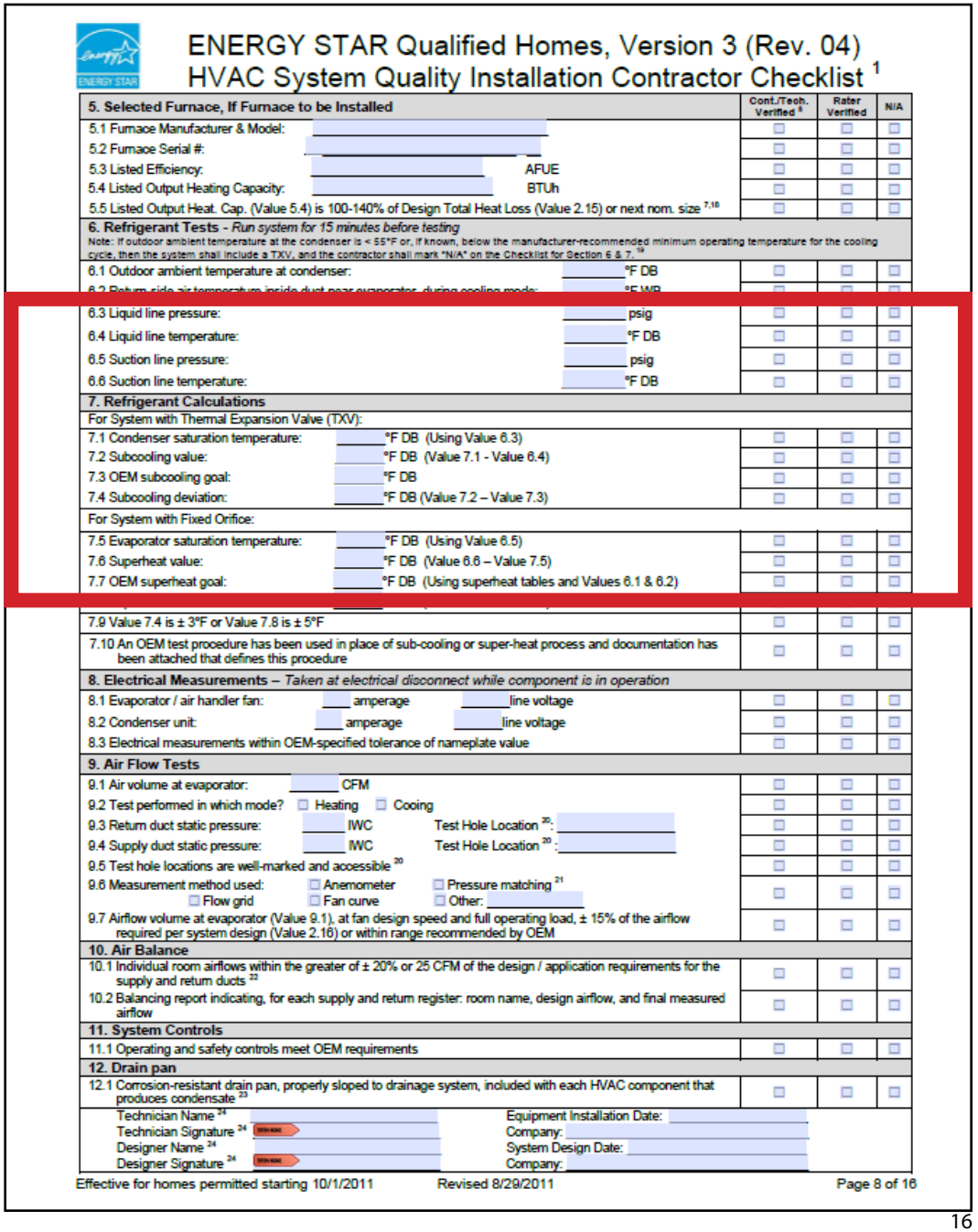
DETAIL 1.2 (Continued)

Review the following parameters related to system cooling design, selection, and installation from the HVAC Contractor checklist (Contractor checklist item # indicated in parenthesis) (DETAILS 1.2.11 - 1.2.12): [3, †]

1.2.11. Using reported liquid line (6.3) or suction line (6.5) pressure, corresponding temp. (as determined using pressure/ temperature chart for refrigerant type) matches reported condenser (7.1) or evaporator (7.5) saturation temperature (+/- 3 degrees) [9]

1.2.12. Calculated subcooling (7.1 minus 6.4) or superheat (6.6 minus 7.5) value equals reported target subcooling (7.3) or superheat (7.7) temperature [9]

† Footnotes located on page 17



ENERGY STAR Qualified Homes, Version 3 (Rev. 04)
HVAC System Quality Installation Contractor Checklist [1]

5. Selected Furnace, If Furnace to be Installed	Cont./Tech. Verified [8]	Rater Verified	N/A
5.1 Furnace Manufacturer & Model:	☐	☐	☐
5.2 Furnace Serial #:	☐	☐	☐
5.3 Listed Efficiency: AFUE	☐	☐	☐
5.4 Listed Output Heating Capacity: BTUh	☐	☐	☐
5.5 Listed Output Heat. Cap. (Value 5.4) is 100-140% of Design Total Heat Loss (Value 2.15) or next nom. size [7,10]	☐	☐	☐
6. Refrigerant Tests - *Run system for 15 minutes before testing* Note: If outdoor ambient temperature at the condenser is < 55°F or, if known, below the manufacturer-recommended minimum operating temperature for the cooling cycle, then the system shall include a TXV, and the contractor shall mark "N/A" on the Checklist for Section 6 & 7. [19]			
6.1 Outdoor ambient temperature at condenser: °F DB	☐	☐	☐
6.2 Return side air temperature inside duct near evaporator, during cooling mode: °F WB	☐	☐	☐
6.3 Liquid line pressure: psig	☐	☐	☐
6.4 Liquid line temperature: °F DB	☐	☐	☐
6.5 Suction line pressure: psig	☐	☐	☐
6.6 Suction line temperature: °F DB	☐	☐	☐
7. Refrigerant Calculations			
For System with Thermal Expansion Valve (TXV):			
7.1 Condenser saturation temperature: °F DB (Using Value 6.3)	☐	☐	☐
7.2 Subcooling value: °F DB (Value 7.1 - Value 6.4)	☐	☐	☐
7.3 OEM subcooling goal: °F DB	☐	☐	☐
7.4 Subcooling deviation: °F DB (Value 7.2 – Value 7.3)	☐	☐	☐
For System with Fixed Orifice:			
7.5 Evaporator saturation temperature: °F DB (Using Value 6.5)	☐	☐	☐
7.6 Superheat value: °F DB (Value 6.6 – Value 7.5)	☐	☐	☐
7.7 OEM superheat goal: °F DB (Using superheat tables and Values 6.1 & 6.2)	☐	☐	☐
7.9 Value 7.4 is ± 3°F or Value 7.8 is ± 5°F	☐	☐	☐
7.10 An OEM test procedure has been used in place of sub-cooling or super-heat process and documentation has been attached that defines this procedure	☐	☐	☐
8. Electrical Measurements – *Taken at electrical disconnect while component is in operation*			
8.1 Evaporator / air handler fan: amperage line voltage	☐	☐	☐
8.2 Condenser unit: amperage line voltage	☐	☐	☐
8.3 Electrical measurements within OEM-specified tolerance of nameplate value	☐	☐	☐
9. Air Flow Tests			
9.1 Air volume at evaporator: CFM	☐	☐	☐
9.2 Test performed in which mode? ☐ Heating ☐ Cooing	☐	☐	☐
9.3 Return duct static pressure: IWC Test Hole Location [20]:	☐	☐	☐
9.4 Supply duct static pressure: IWC Test Hole Location [20]:	☐	☐	☐
9.5 Test hole locations are well-marked and accessible [20]	☐	☐	☐
9.6 Measurement method used: ☐ Anemometer ☐ Pressure matching [21] ☐ Flow grid ☐ Fan curve ☐ Other:	☐	☐	☐
9.7 Airflow volume at evaporator (Value 9.1), at fan design speed and full operating load, ± 15% of the airflow required per system design (Value 2.16) or within range recommended by OEM	☐	☐	☐
10. Air Balance			
10.1 Individual room airflows within the greater of ± 20% or 25 CFM of the design / application requirements for the supply and return ducts [22]	☐	☐	☐
10.2 Balancing report indicating, for each supply and return register: room name, design airflow, and final measured airflow	☐	☐	☐
11. System Controls			
11.1 Operating and safety controls meet OEM requirements	☐	☐	☐
12. Drain pan			
12.1 Corrosion-resistant drain pan, properly sloped to drainage system, included with each HVAC component that produces condensate [23]	☐	☐	☐

Technician Name [24] — Equipment Installation Date:
Technician Signature [24] — Company:
Designer Name [24] — System Design Date:
Designer Signature [24] — Company:

Effective for homes permitted starting 10/1/2011 Revised 8/29/2011 Page 8 of 16

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

FOOTNOTES

3. *For homes with a date of final inspection through 12/31/2012*: Item 1.2.1 is permitted to be within +/- 5 degrees of the 1% and 99% ACCA Manual J design temperatures for the contractor-designated design location. In addition, for each house plan with multiple configurations (e.g., orientations, elevations, options), the Rater shall confirm that the parameters listed in Items 1.2.2 to 1.2.6 are aligned with either: the rated home or with the plans for the configuration used to calculate the loads, as provided by the contractor.

For homes with a date of final inspection on or after 01/01/2013: Item 1.2.1 shall match the 1% and 99% ACCA Manual J design temperatures for the contractor-designated design location. In addition, for each house plan with multiple configurations (e.g., orientations, elevations, options), the Rater shall confirm that the parameters listed in Items 1.2.2 to 1.2.6 are aligned with the rated home.

4. The Rater shall either confirm that the contractor selected the geographically closest available location or collect from the contractor a justification for the selected location. The Rater need not evaluate the legitimacy of the justification to qualify the home.

5. The number of occupants among all HVAC systems in the home shall be equal to the number of RESNET-defined bedrooms plus one. Occupants listed for systems for which the header of the Contractor Checklist indicates that it is designed to handle temporary occupant loads, as defined in Footnote 3 of the Contractor Checklist, shall be permitted to exceed this limit.

6. "Predominant" is defined as the SHGC value used in the greatest amount of window area in the home.

7. For cooling systems, the next largest nominal piece of equipment may be used that is available to satisfy the latent and sensible requirements. Single-speed systems generally have OEM nominal size increments of ½ ton. Multi-speed or multi-stage equipment may have OEM nominal size increments of one ton. Therefore, the use of these advanced system types can provide extra flexibility to meet the equipment sizing requirements.

8. In cases where the condenser unit is installed after the time of inspection by the Rater, the HVAC manufacturer and model numbers on installed equipment can be documented through the use of photographs provided by the HVAC Contractor after installation is complete.

9. If contractor has indicated that an OEM test procedure has been used in place of a sub-cooling or super-heat process and documentation has been attached that defines this procedure, then the box for "N/A" shall be checked for this item.

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DETAIL 1.3

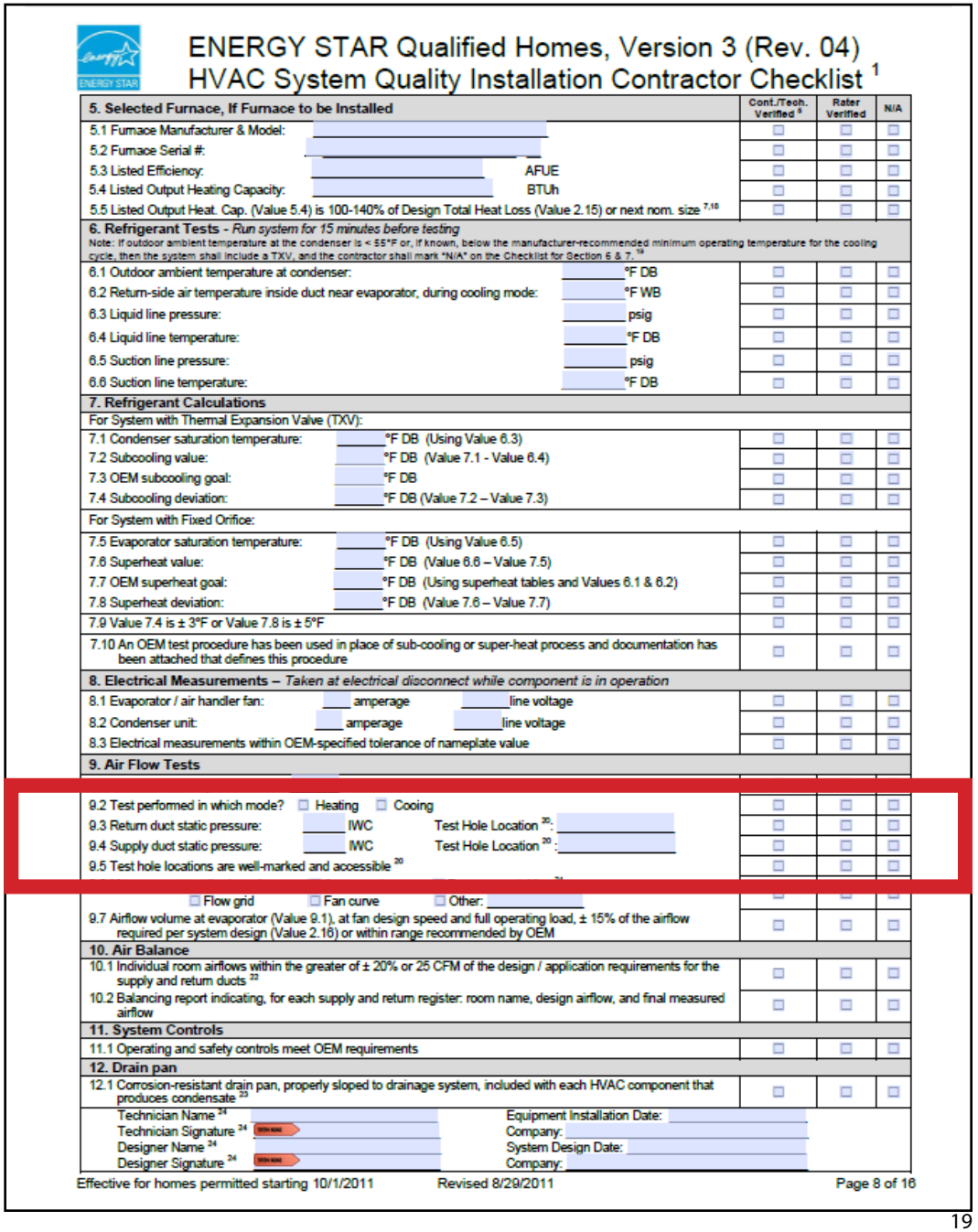
Rater-verified supply & return duct static pressure < 110% of contractor values (9.3, 9.4)

A. Locate the return static pressure and the supply static pressure on the HVAC System Quality Installation Contractor checklist.

B. Verify the return static pressure and the supply static pressure are less than 110% of the values listed on the checklist.

STATIC PRESSURE TESTING LOCATIONS

Examples of return or supply duct static pressure measurement locations are: plenum, cabinet, trunk duct, as well as front, back, left or right side. Test hole locations shall be well marked and accessible.



ENERGY STAR Qualified Homes, Version 3 (Rev. 04)
HVAC System Quality Installation Contractor Checklist [1]

5. Selected Furnace, If Furnace to be Installed	Cont./Tech. Verified [5]	Rater Verified	N/A
5.1 Furnace Manufacturer & Model:	☐	☐	☐
5.2 Furnace Serial #:	☐	☐	☐
5.3 Listed Efficiency: AFUE	☐	☐	☐
5.4 Listed Output Heating Capacity: BTUh	☐	☐	☐
5.5 Listed Output Heat. Cap. (Value 5.4) is 100-140% of Design Total Heat Loss (Value 2.15) or next nom. size [7,18]	☐	☐	☐
6. Refrigerant Tests - *Run system for 15 minutes before testing* Note: If outdoor ambient temperature at the condenser is < 55°F or, if known, below the manufacturer-recommended minimum operating temperature for the cooling cycle, then the system shall include a TXV, and the contractor shall mark "N/A" on the Checklist for Section 6 & 7. [19]			
6.1 Outdoor ambient temperature at condenser: °F DB	☐	☐	☐
6.2 Return-side air temperature inside duct near evaporator, during cooling mode: °F WB	☐	☐	☐
6.3 Liquid line pressure: psig	☐	☐	☐
6.4 Liquid line temperature: °F DB	☐	☐	☐
6.5 Suction line pressure: psig	☐	☐	☐
6.6 Suction line temperature: °F DB	☐	☐	☐
7. Refrigerant Calculations			
For System with Thermal Expansion Valve (TXV):			
7.1 Condenser saturation temperature: °F DB (Using Value 6.3)	☐	☐	☐
7.2 Subcooling value: °F DB (Value 7.1 - Value 6.4)	☐	☐	☐
7.3 OEM subcooling goal: °F DB	☐	☐	☐
7.4 Subcooling deviation: °F DB (Value 7.2 – Value 7.3)	☐	☐	☐
For System with Fixed Orifice:			
7.5 Evaporator saturation temperature: °F DB (Using Value 6.5)	☐	☐	☐
7.6 Superheat value: °F DB (Value 6.6 – Value 7.5)	☐	☐	☐
7.7 OEM superheat goal: °F DB (Using superheat tables and Values 6.1 & 6.2)	☐	☐	☐
7.8 Superheat deviation: °F DB (Value 7.6 – Value 7.7)	☐	☐	☐
7.9 Value 7.4 is ± 3°F or Value 7.8 is ± 5°F	☐	☐	☐
7.10 An OEM test procedure has been used in place of sub-cooling or super-heat process and documentation has been attached that defines this procedure	☐	☐	☐
8. Electrical Measurements – *Taken at electrical disconnect while component is in operation*			
8.1 Evaporator / air handler fan: amperage line voltage	☐	☐	☐
8.2 Condenser unit: amperage line voltage	☐	☐	☐
8.3 Electrical measurements within OEM-specified tolerance of nameplate value	☐	☐	☐
9. Air Flow Tests			
9.2 Test performed in which mode? ☐ Heating ☐ Cooing	☐	☐	☐
9.3 Return duct static pressure: IWC Test Hole Location [20]:	☐	☐	☐
9.4 Supply duct static pressure: IWC Test Hole Location [20]:	☐	☐	☐
9.5 Test hole locations are well-marked and accessible [20]	☐	☐	☐
☐ Flow grid ☐ Fan curve ☐ Other:	☐	☐	☐
9.7 Airflow volume at evaporator (Value 9.1), at fan design speed and full operating load, ± 15% of the airflow required per system design (Value 2.16) or within range recommended by OEM	☐	☐	☐
10. Air Balance			
10.1 Individual room airflows within the greater of ± 20% or 25 CFM of the design / application requirements for the supply and return ducts [22]	☐	☐	☐
10.2 Balancing report indicating, for each supply and return register: room name, design airflow, and final measured airflow	☐	☐	☐
11. System Controls			
11.1 Operating and safety controls meet OEM requirements	☐	☐	☐
12. Drain pan			
12.1 Corrosion-resistant drain pan, properly sloped to drainage system, included with each HVAC component that produces condensate [23]	☐	☐	☐

Technician Name [24] Equipment Installation Date:
Technician Signature [24] Company:
Designer Name [24] System Design Date:
Designer Signature [24] Company:

Effective for homes permitted starting 10/1/2011 Revised 8/29/2011 Page 8 of 16

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

SECTION 2. DUCT QUALITY INSTALLATION

2.1. Connections and routing of duct work completed without kinks or sharp bends

2.2. No excessive coiled or looped flexible duct work

2.3. Flexible ducts in unconditioned space not installed in cavities smaller than outer duct diameter; in conditioned space not installed in cavities smaller than inner duct diameter

2.4. Flexible ducts supported at intervals as recommended by manufacturer but at a distance ≤ 5 ft.

2.5. Building cavities not used as supply or return ducts unless they meet items 3.2, 3.3, 4.1, and 4.2 of this checklist

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

2.6. HVAC ducts, cavities used as ducts, and combustion inlets and outlets may pass perpendicularly through exterior walls but shall not be run within exterior walls unless at least R-6 continuous insulation is provided on exterior side of the cavity, along with an interior and exterior air barrier where required by the Thermal Enclosure System Checklist

2.7. Quantity & location of supply and return duct terminals match contractor balancing report

2.8. Bedrooms pressure-balanced using any combination of transfer grills, jump ducts, dedicated return ducts, and/or undercut doors to either: a) provide 1 sq. in. of free area opening per 1 CFM of supply air, as reported on the contractor-provided balancing report; or b) achieve a Rater-measured pressure differential ≤ 3 Pa (0.012 in. w.c.) with respect to the main body of the house when bedroom doors are closed and the air handler is operating

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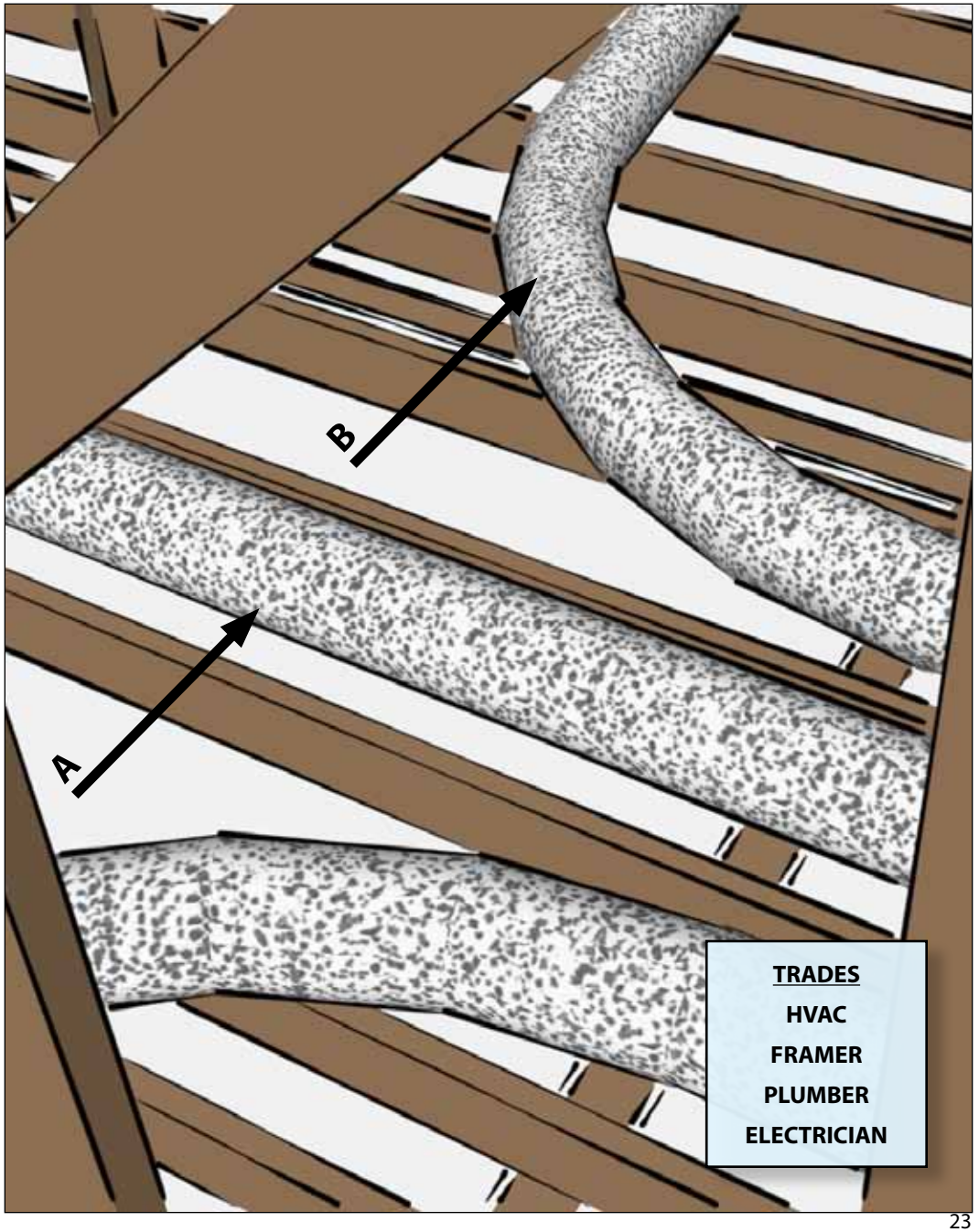
DETAIL 2.1 [10]

Connections and routing of duct work completed without kinks or sharp bends

A. Install ducts without kinks. Kinks are caused when ducts are bent across sharp corners such as framing members.

B. Install ducts without sharp bends. Sharp bends occur when the radius of the duct center line is less than one duct diameter.

C. Coordinate with the framer, plumber, and electrician for effective duct installation.



FOOTNOTES

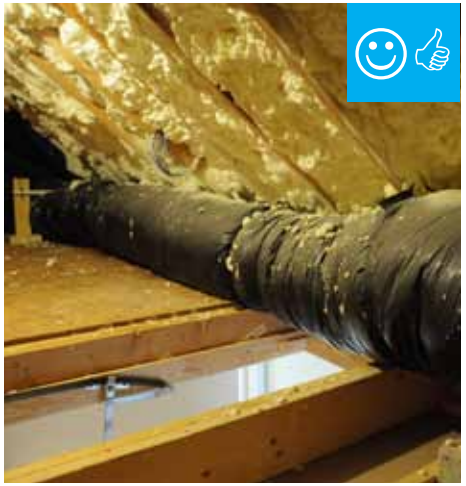
10. Kinks are to be avoided and are caused when ducts are bent across sharp corners such as framing members. Sharp bends are to be avoided and occur when the radius of the turn in the duct is less than one duct diameter.

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

2 DUCT QUALITY INSTALLATION

1 CONNECTIONS AND ROUTING OF DUCT WORK COMPLETED WITHOUT KINKS OR BENDS

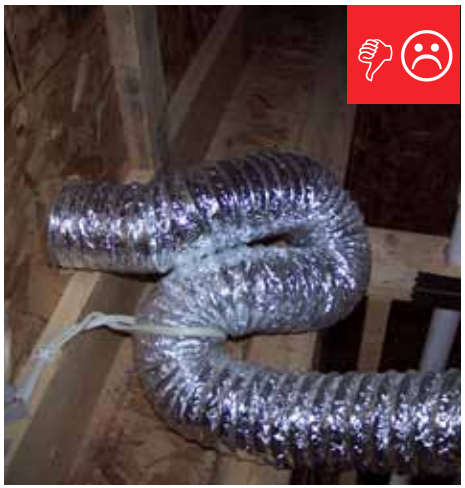
A. Duct is kinked in cavity.



Duct is run straight and supported properly.

B. Ducts crammed into cavity, kinked and sharply bent.

Ducts are run straight and supported properly.



C. Excessive length of duct installed causing sharp bends.

Fan housing was oriented in the correct direction to allow proper exhaust duct installation.

DUCT AIR FLOW BASICS

- Each turn, kink, or compression of duct work reduces air flow.
- If the recommended amount of air flow is not delivered to the room, it could lead to homeowner comfort complaints.

DUCT AIR FLOW TIPS

- To best understand the intent of the HVAC contractor, it is helpful to look at the ducts designed in compliance with Manual D.
- Use balancing dampers in flex ducts to control flow. For metal ducts, butterfly dampers may be used to control air flow.
- To prevent kinks at the duct and boot connection, EPA recommends using metal duct elbow instead of flex duct.
- Webbed trusses between floors allow for ducts to freely pass through the floor system without compromising the structure.

ENERGY STAR

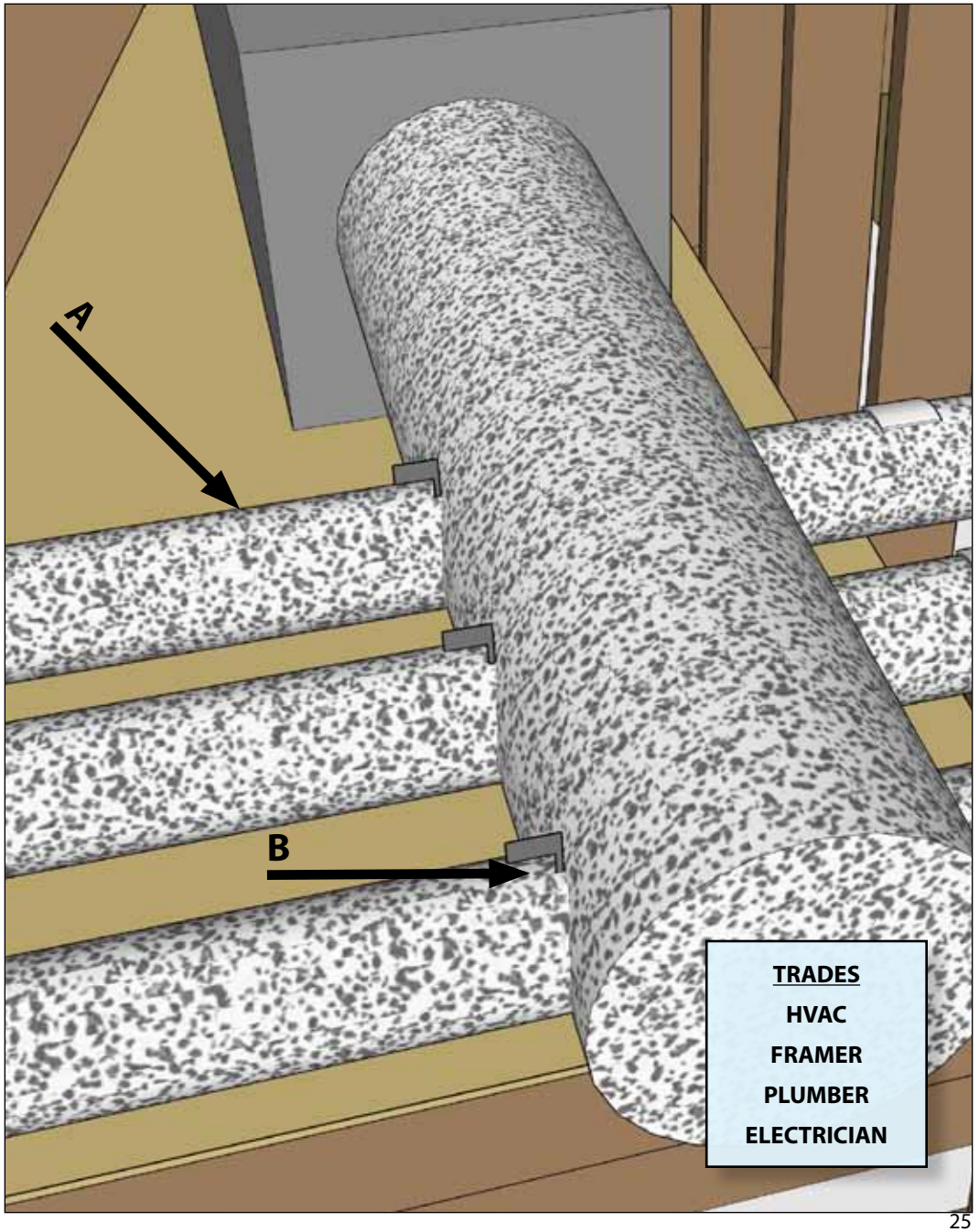
DETAIL 2.2 [11]

No excessive coiled or looped flexible duct work

A. Install ducts without excessive coiled or looped flexible duct work unless needed for acoustical control.

B. Install balancing dampers to limit flow to diffusers.

C. Coordinate with the framer, plumber, and electrician for effective duct installation.



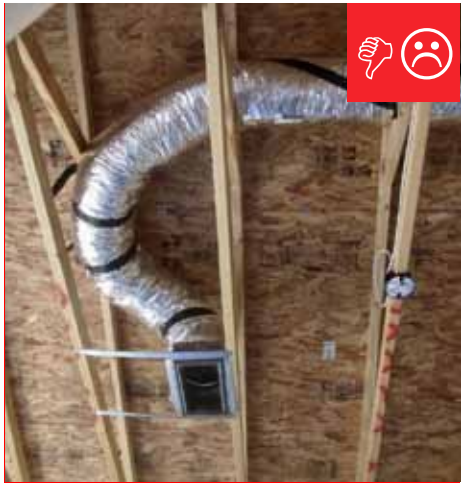
FOOTNOTES

11. Ducts shall not include coiled or looped duct work except to the extent needed for acoustical control. Balancing dampers or proper duct sizing shall be used instead of loops to limit flow to diffusers. When balancing dampers are used, they shall be located at the trunk to limit noise unless the trunk will not be accessible when the balancing process is conducted. In such cases, Opposable Blade Dampers (OBD) or dampers that are located in the duct boot are permitted.

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

2 DUCT QUALITY INSTALLATION

2 NO EXCESSIVE COILED OR LOOPED FLEXIBLE DUCT WORK

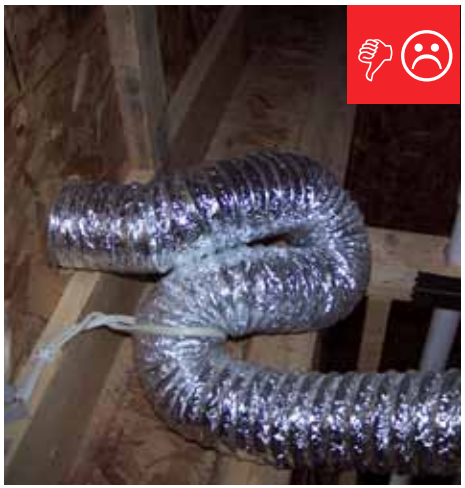


A. Excessive length of duct installed.

Duct is run straight and supported properly.

B. No mechanical damper installed.

Mechanical damper installed.



C. Excessive length of duct installed causing sharp bends.

Fan housing was oriented in the correct direction to allow proper exhaust duct installation.

DUCT AIR FLOW BASICS

- Each turn, kink, or compression of duct work reduces air flow.
- If the recommended amount of air flow is not delivered to the room, it could lead to homeowner comfort complaints.

DUCT AIR FLOW TIPS

- To best understand the intent of the HVAC contractor, it is helpful to look at the ducts designed in compliance with Manual D.
- Use balancing dampers in flex ducts to control flow. For metal ducts, butterfly dampers may be used to control air flow.
- To prevent kinks at the duct and boot connection, EPA recommends using metal duct elbow instead of flex duct.
- Webbed trusses between floors allow for ducts to freely pass through the floor system without compromising the structure.

ENERGY STAR

DETAIL 2.3

Flexible ducts in unconditioned space shall not be installed in cavities smaller than outer duct diameter; In conditioned space not installed in cavities smaller than inner duct diameter

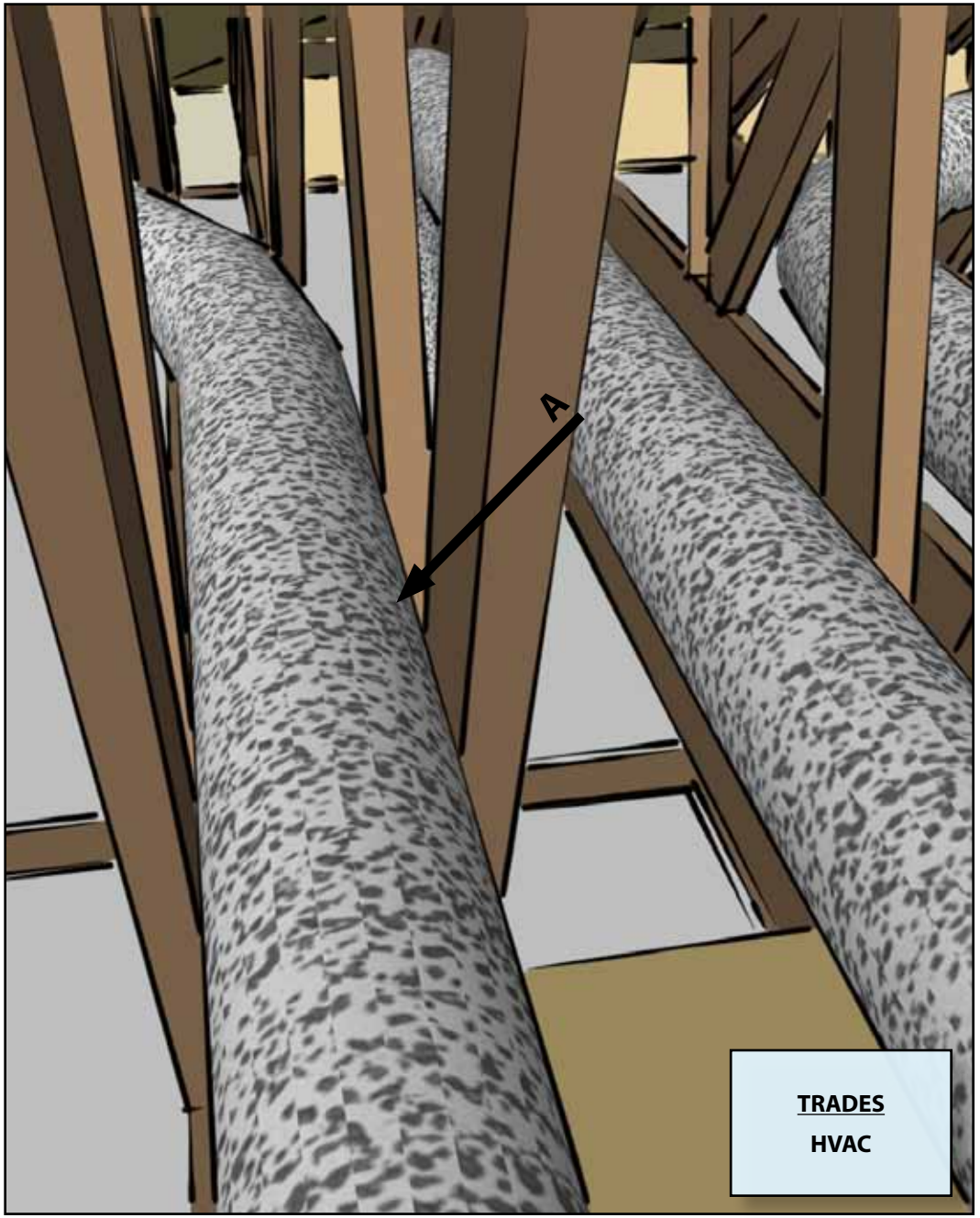
A. Install ducts to prevent compression of duct or duct insulation.

DUCT AIR FLOW BASICS

- Each turn, kink, or compression of duct work reduces air flow.
- If the recommended amount of air flow is not delivered to the room, it could lead to homeowner comfort complaints.

DUCT AIR FLOW TIPS

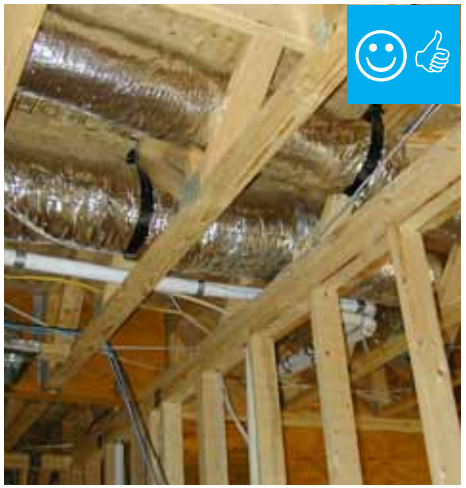
- To best understand the intent of the HVAC contractor, it is helpful to look at the ducts designed in compliance with Manual D.
- Use balancing dampers in flex ducts to control flow. For metal ducts, butterfly dampers may be used to control air flow.
- To prevent kinks at the duct and boot connection, EPA recommends using metal duct elbow instead of flex duct.
- Webbed trusses between floors allow for ducts to freely pass through the floor system without compromising the structure.



A. Duct is compressed.

Framing allowed duct work to be properly installed without compression.

A. Recessed can light is compressing duct work.



Ducts properly installed without compression and appropriately supported.

A. Duct is compressed.

Ducts properly installed without compression and appropriately supported.

ENERGY STAR

DETAIL 2.4

Flexible ducts supported at intervals as recommended by manufacturer but at a distance ≤ 5 ft.

A. Install supports at a minimum of every 5 ft. to prevent sagging.

B. Install supports at least 1 in. wide.

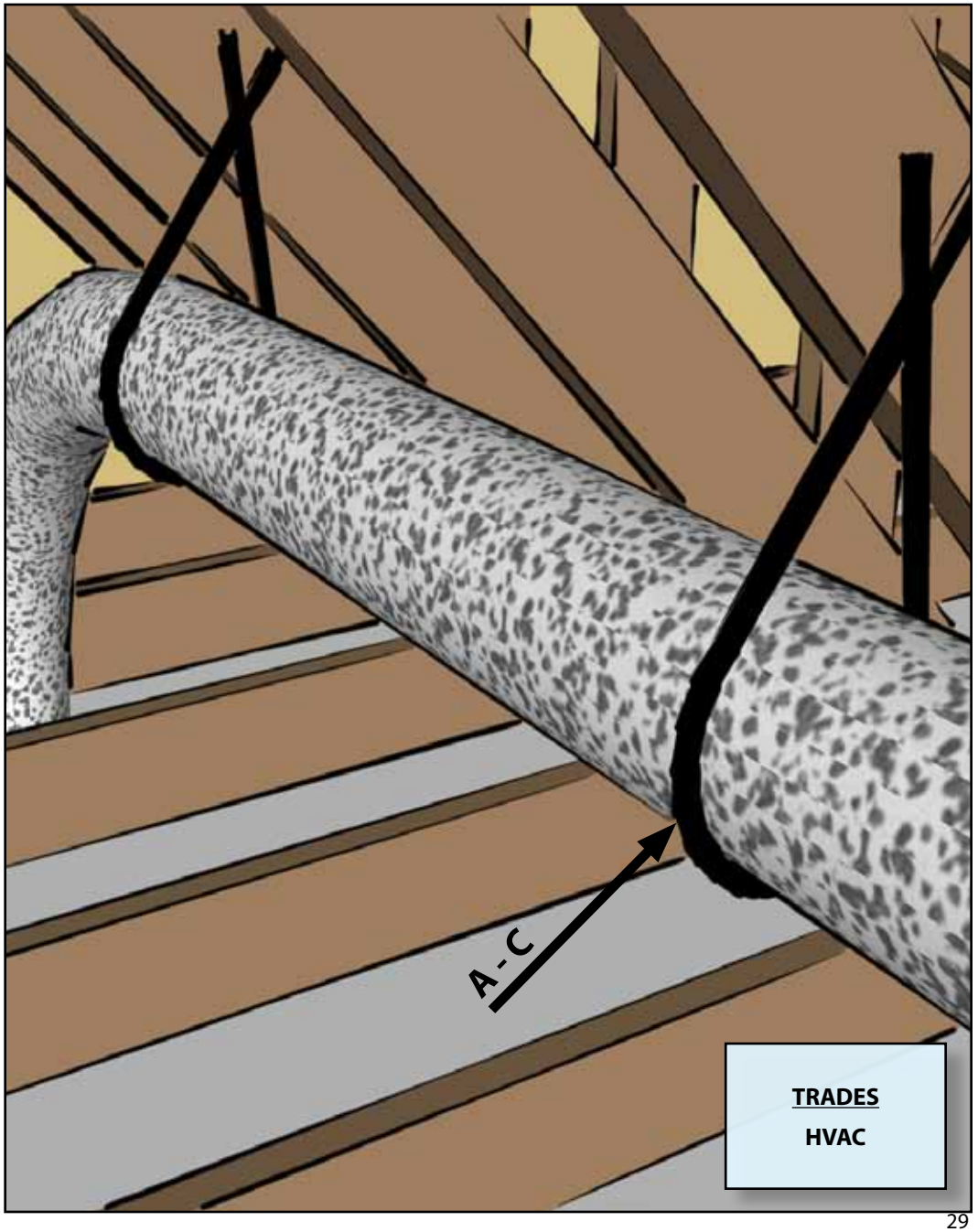
C. Install supports without compressing the duct and the duct insulation.

DUCT AIR FLOW BASICS

- Each turn, kink, or compression of duct work reduces air flow.
- If the recommended amount of air flow is not delivered to the room, it could lead to homeowner comfort complaints.

DUCT AIR FLOW TIPS

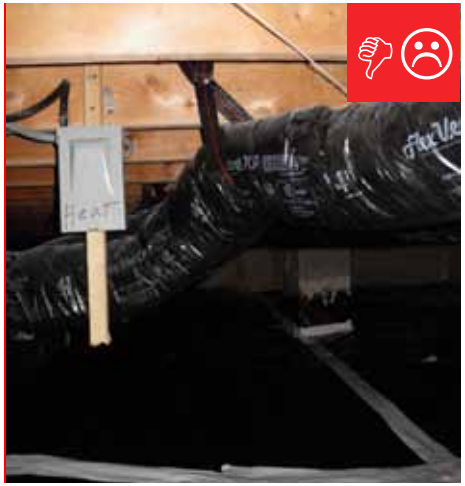
- To best understand the intent of the HVAC contractor, it is helpful to look at the ducts designed in compliance with Manual D.
- Use balancing dampers in flex ducts to control flow. For metal ducts, butterfly dampers may be used to control air flow.
- To prevent kinks at the duct and boot connection, EPA recommends using metal duct elbow instead of flex duct.
- Webbed trusses between floors allow for ducts to freely pass through the floor system without compromising the structure.



HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

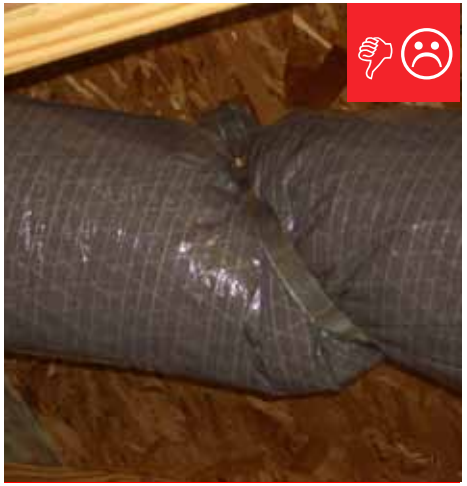
2 DUCT QUALITY INSTALLATION

4 FLEXIBLE DUCTS SUPPORTED AT INTERVALS AS RECOMMENDED BY MANUFACTURER

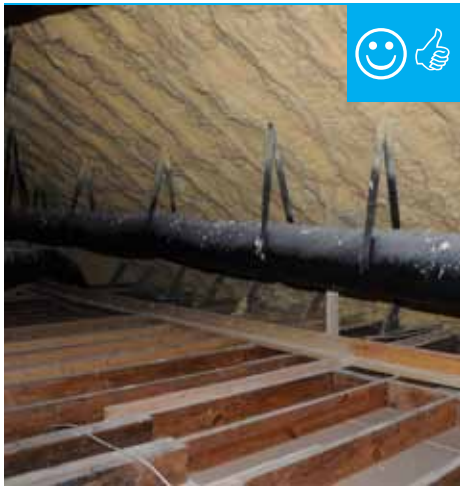


A. Duct sagging because supports not installed at regular intervals.

Ducts well supported.



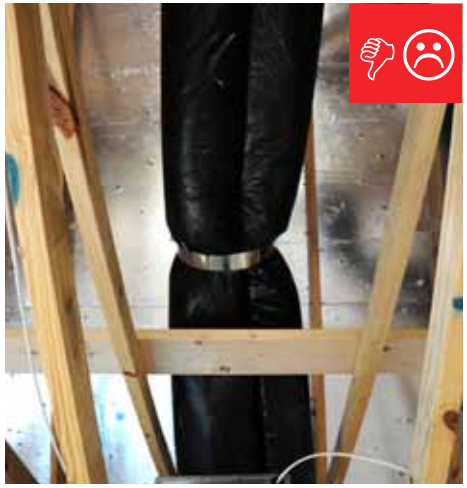
C. Metal strap is too small and is compressing duct.



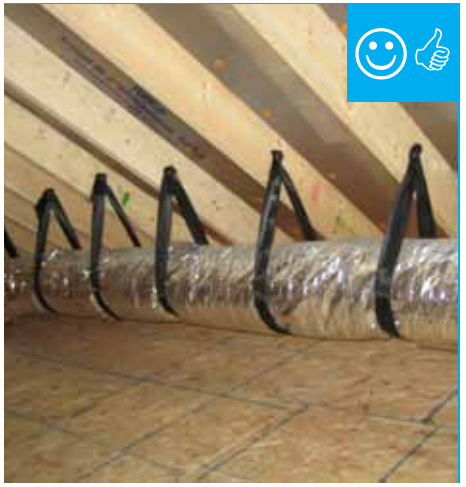
Ducts well supported.

C. Straps are spaced too far apart causing the straps to compress the duct under its own weight.

Ducts well supported by framing and straps as needed.



C. Metal strap is too small and is compressing duct.



Ducts well supported.

ENERGY STAR

DETAIL 2.5

Building cavities not used as supply or return ducts unless they meet items 3.2, 3.3, 4.1, and 4.2 of this checklist

A. Avoid using building cavities as ducts due to the difficulty of properly air sealing and insulating them.

If building cavities are used:

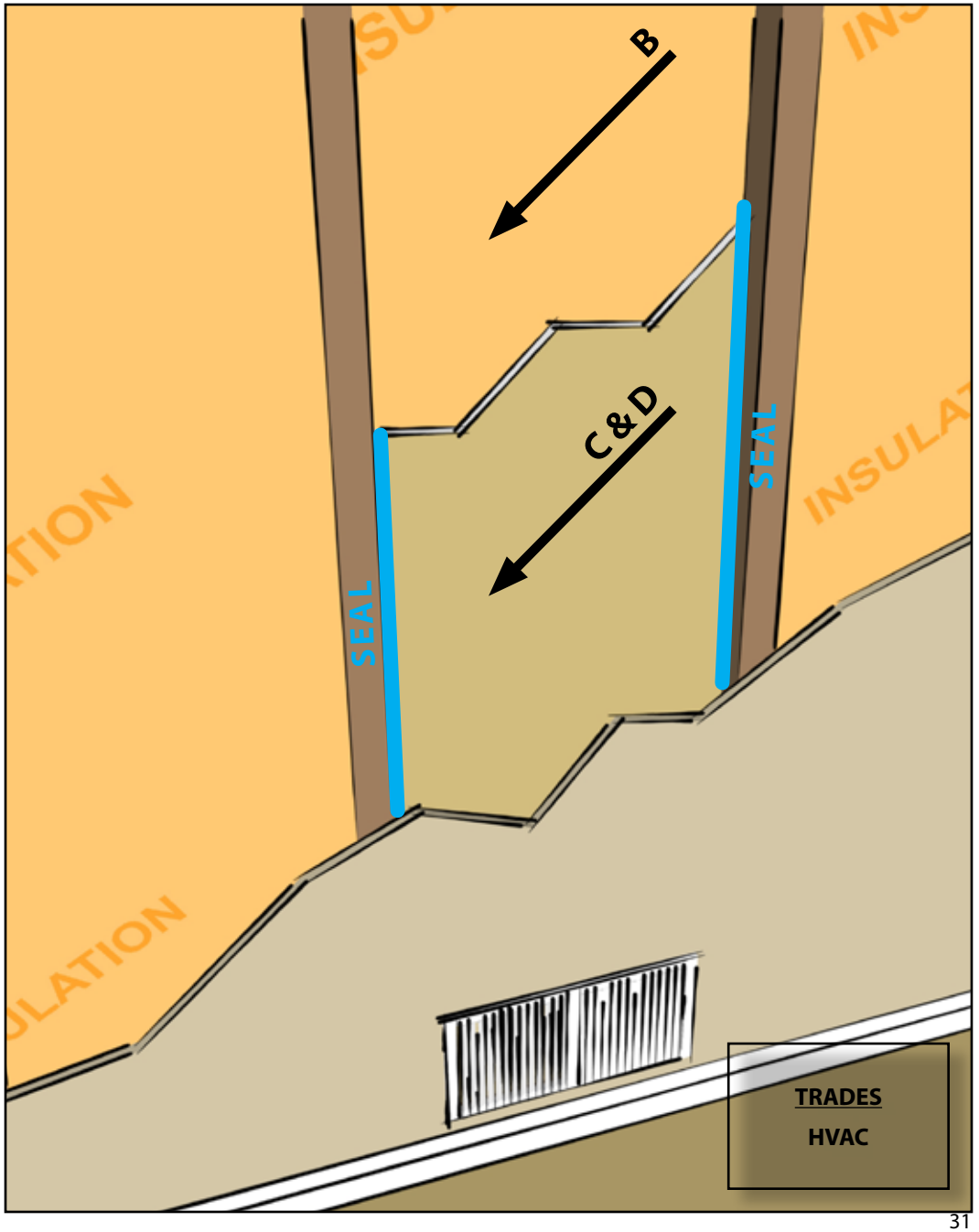
B. Install insulation without misalignments, compressions, gaps, or voids in all cavities used for ducts.

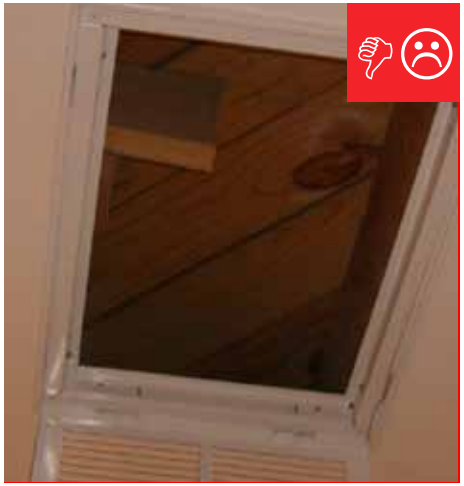
C. If non-rigid insulation is used, install a rigid air barrier or other supporting material to hold insulation in place.

D. Seal all seams, gaps, and holes of the air barrier with caulk or foam.

DUCT INSTALLATION TIPS

- EPA requires that all ducts in exterior walls must be within the air barrier as well as the thermal boundary.
- It is important for the framer and HVAC contractor to coordinate on the location of a return duct. This allows for proper spacing of the floor or roof structure for installation of the return.
- If installing supply ducts within the walls, verify that the duct is capable of outputting the necessary air flow. Typically, only double-wall assemblies will have enough depth to allow for proper insulation and duct size.
- If installing return ducts using the floor or ceiling structure, EPA recommends to seal both the exterior and the interior of all return boxes to prevent air leakage.





B. Cavity used for return is not insulated and is not air sealed, which will pull in air from outside.

Cavity used for duct has been lined with rigid insulation and is ready to be air sealed.

BAD PIC OF INSULATION INSTALLED WITHOUT AIR BARRIER IN BUILDING CAVITY USED AS A DUCT NEEDED

C.

GOOD PIC OF RIGID AIR BARRIER INSTALLED IN BUILDING CAVITY USED AS A DUCT NEEDED

D. Cavity was not air sealed.

Cavity has been air sealed with mastic.

ENERGY STAR

DETAIL 2.6

HVAC ducts, cavities used as ducts, and combustion inlets and outlets may pass perpendicularly through exterior walls but shall not be run within exterior walls unless at least R-6 continuous insulation is provided on exterior side of the cavity, along with an interior and exterior air barrier where required by the Thermal Enclosure System Rater Checklist

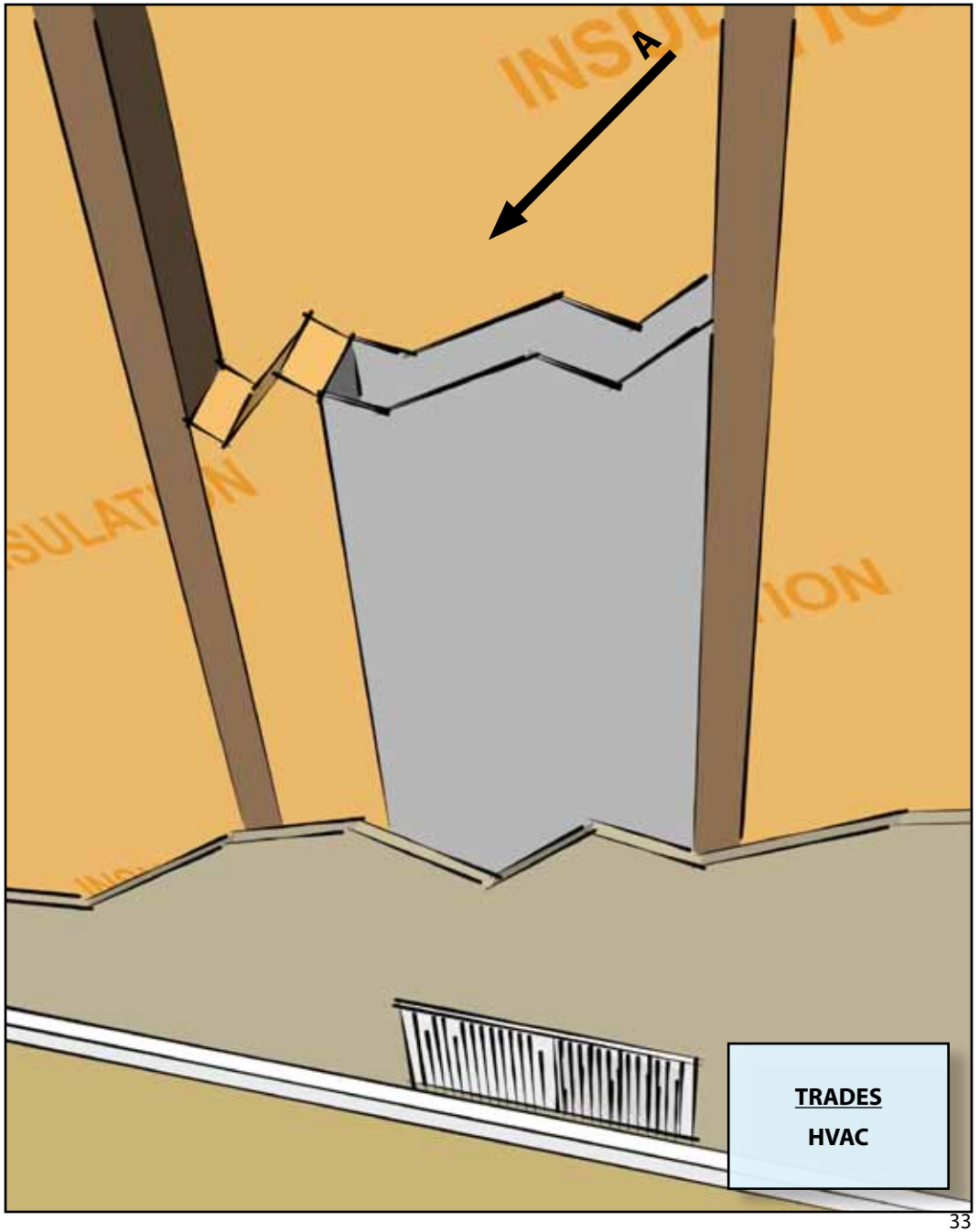
A. Install insulation without misalignments, compressions, gaps, or voids in all building cavities with ducts or cavities used as ducts.

B. If non-rigid insulation is used, install a rigid air barrier or other supporting material to hold insulation in place.

C. Seal all seams, gaps, and holes of the air barrier with caulk or foam.

DUCT INSTALLATION TIPS

- EPA requires that all ducts in exterior walls must be within the air barrier as well as the thermal boundary.
- It is important for the framer and HVAC contractor to coordinate on the location of a return duct. This allows for proper spacing of the floor or roof structure for installation of the return.
- If installing supply ducts within the walls, verify that the duct is capable of outputting the necessary air flow. Typically, only double-wall assemblies will have enough depth to allow for proper insulation and duct size.
- If installing return ducts using the floor or ceiling structure, EPA recommends to seal both the exterior and the interior of all return boxes to prevent air leakage.



A. Inadequate amount of insulation installed with compression, misalignment, and voids.

GOOD PIC OF PROPERLY INSTALLED INSULATION IN BUILDING CAVITY USED AS A DUCT NEEDED

BAD PIC OF INSULATION INSTALLED WITHOUT AIR BARRIER IN BUILDING CAVITY USED AS A DUCT NEEDED

B.

GOOD PIC OF RIGID AIR BARRIER INSTALLED IN BUILDING CAVITY USED AS A DUCT NEEDED

C. No insulation installed in cavity and not air sealed.

GOOD PIC OF PROPERLY SEALED BUILDING CAVITY USED AS A DUCT NEEDED

ENERGY STAR

DETAIL 2.7

Quantity and location of supply and return duct terminals match contractor-provided balancing report

A. Verify ducts are located where specified on the balancing report.

B. Verify the number of ducts match the balancing report.

N/A

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ENERGY STAR

DETAIL 2.8A [12, 13, †]

Bedrooms pressure-balanced using any combination of transfer grills, jump ducts, dedicated return ducts, and/or undercut doors to provide 1 sq. in. of free area opening per 1 CFM of supply air, as reported on the contractor-provided balancing report:

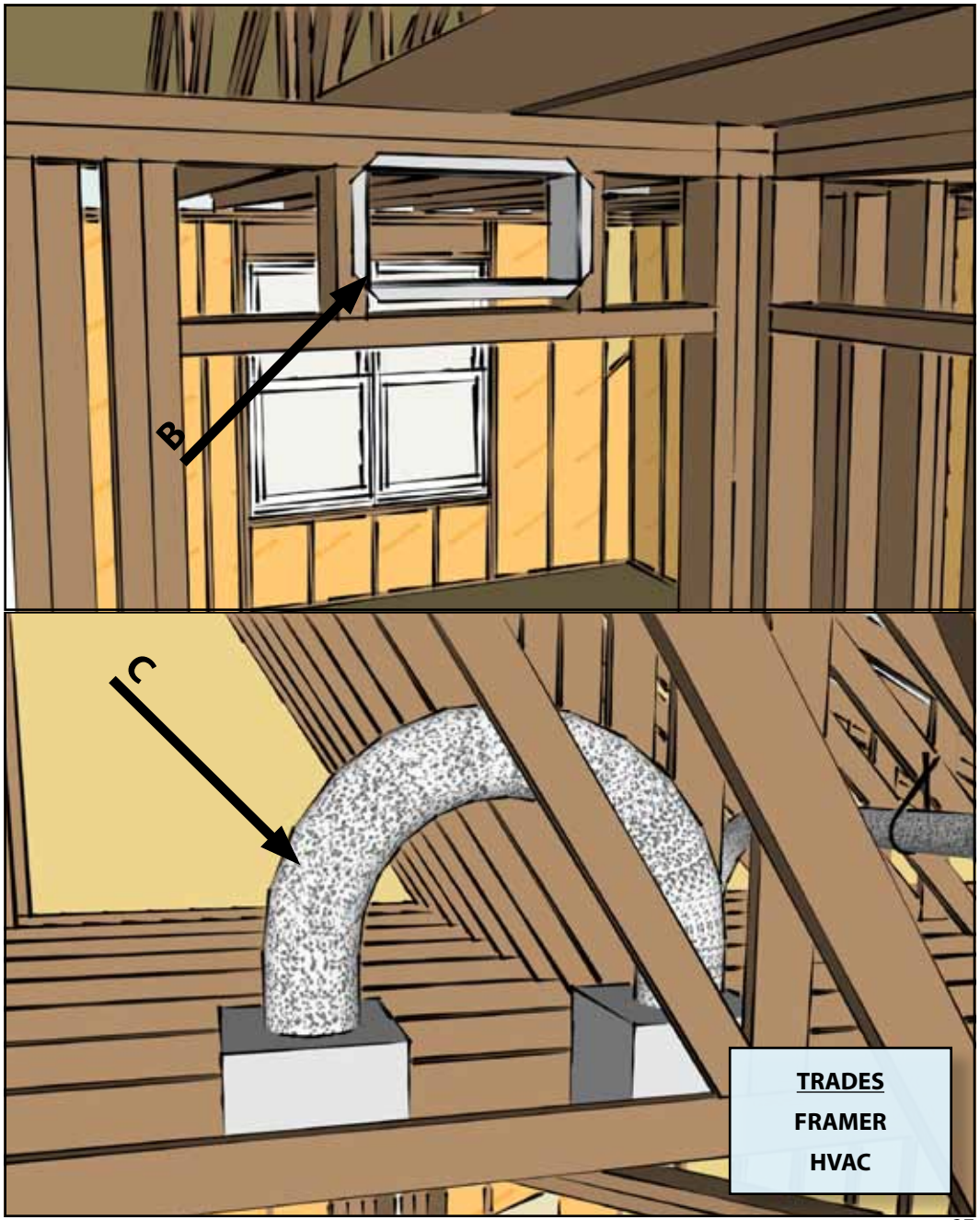
A. Refer to the balancing report provided by the HVAC contractor for the bedroom air flows to size the transfer grills and/or jumper ducts.

B. Install and seal properly sized transfer grills during framing. Both openings of the transfer grill must have the required free area.

C. If transfer grills are not used, install and seal jumper ducts during framing. Both openings and ducts must have the required free area.

D. EPA recommends that doors are undercut to approximately 3/4 in. above the finished floor.

† Footnotes located on page 41.



Room supply air flow (CFM)	Free area opening required	Height required for 10 in. wide transfer grill*	Height required for 12 in. wide transfer grill*	Height required for 14 in. wide transfer grill*	Jumper duct diameter
	in^2	in	in	in	in
50	50	6.7	5.6	4.8	8
75	75	10	8.3	7.1	10
100	100	13.3	11.1	9.5	12
125	125	-	13.8	11.9	14
150	150	-	-	14.3	14
175	175	-	-	-	16
200	200	-	-	-	16

* Assumes the net free area of the transfer grill as .75 in.

GOOD PIC OF NO/ UNDERSIZED GRILL OR DUCTS INSTALLED TO PRESSURE BALANCE ROOM NEEDED

A.

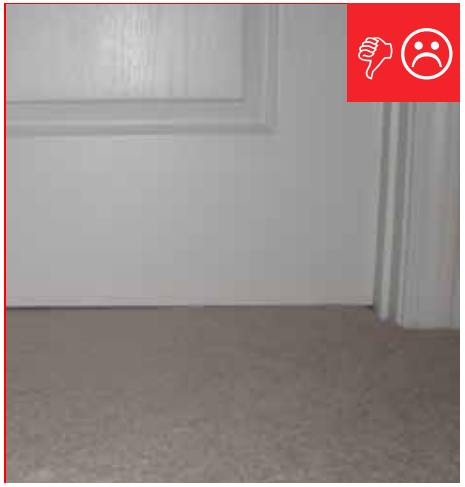
Grill and duct size based on calculated requirements for net free area.

B. Transfer grill not sealed.

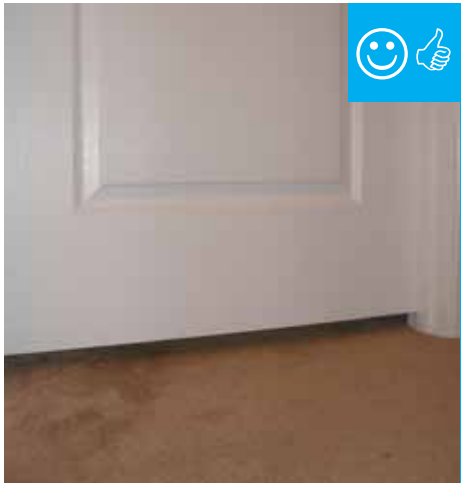
Transfer grill sealed with mastic.

C. Duct to boot connection of jump duct not fastened and sealed.

Duct to boot connection of jump duct is properly sealed with mastic.



D. Door is not undercut therefore not contributing to pressure balancing.



Door has been undercut to allow for specified amount of air flow therefore contributing to pressure balancing.

ENERGY STAR

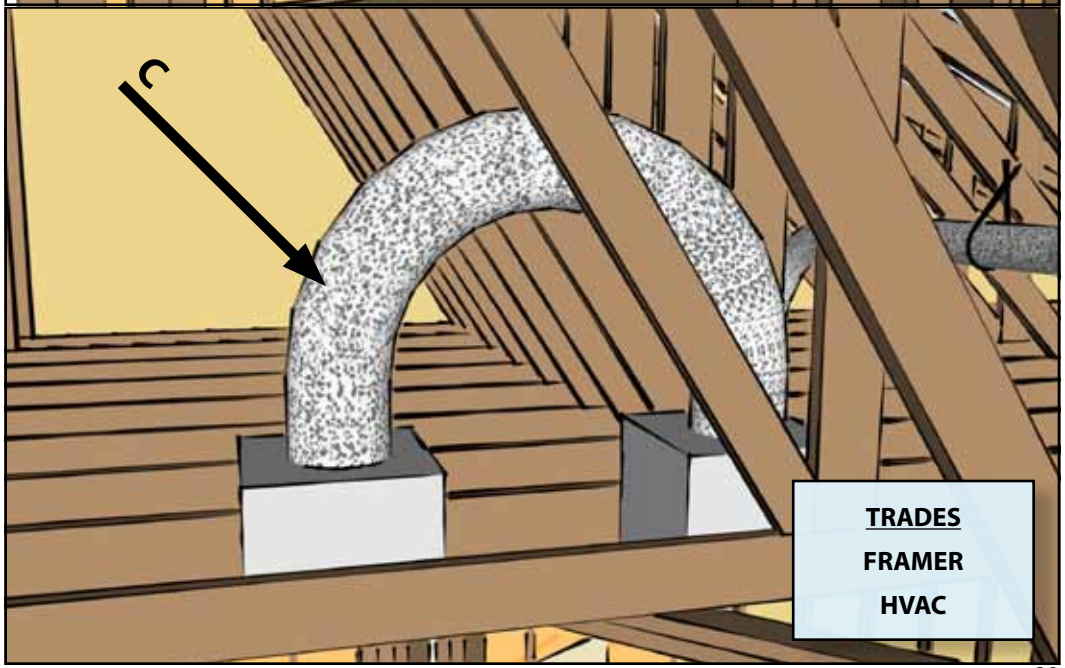
DETAIL 2.8B [12, 13]

Bedrooms pressure-balanced using any combination of transfer grills, jump ducts, dedicated return ducts, and/or undercut doors to achieve a Rater-measured pressure differential ≤ 3 Pa (0.012 in. w.c.) with respect to the main body of the house when bedroom doors are closed and the air handler is operating

A. EPA recommends that transfer grills, jumper ducts or dedicated returns be installed and doors undercut to approximately 3/4" above the finished floor.

B. Test the pressures of each bedroom.

† Footnotes located on page 41.



ROOM	PRESSURE (PA) WITH RESPECT TO MAIN BODY
Bedroom 1	
Bedroom 2	
Bedroom 3	
Bedroom 4	
Bedroom 5	
Bedroom 6	

A. Return has not been sealed.

Return duct has been properly sealed with mastic.

B. Return box has not been sealed.

Return box has been properly sealed with mastic.

PRESSURE RELIEF TIPS

- EPA recommends that HVAC Contractors install transfer grills, jumper ducts, or dedicated returns.
- EPA recommends that Framers undercut doors to approximately 3/4" above the finished floor.
- If transfer grills are used, Contractors must install and seal properly sized transfer grills according to the load calculation.
- If jumper ducts are installed, Contractors must seal all seams, gaps, and holes of the ducts and connections.
- If return ducts are installed, Contractors must seal all seams, gaps, and holes of the return duct system with mastic and seal the return box to the floor, wall, or ceiling with mastic, caulk, and/or foam.
- To see photos of proper and improper installation, see Detail 2.8A.

PRESSURE TESTING TIPS

- Prior to testing pressures:
  - Verify all supply and return terminations are unrestricted.
  - Turn the HVAC system on to cooling mode. If there is no cooling mode, set it to heating mode.
  - Verify air is blowing out of the supply terminations.
- Verify the reference pressure is measuring the outdoor pressure.
- Test all pressures by placing the pressure measuring device in each bedroom with the door shut.

ADDITIONAL INFORMATION

For additional information and specific duct testing protocols please refer to RESNET Chapter 8 (Standard for Performance Testing and Work Scope: Enclosure and Air Distribution Leakage Testing).

FOOTNOTES

12. *For homes with a date of final inspection through 12/31/2012*: Homes are permitted to be qualified without enforcement of this item to provide architects and designers with additional time to integrate these features into their homes.

For homes with a date of final inspection on or after 01/01/2013: Homes shall meet this item to be qualified.

13. For HVAC system with multi-speed fans, the highest design fan speed shall be used when verifying this requirement.

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

SECTION 3. DUCT INSULATION

3.1. All connections to trunk ducts in unconditioned space are insulated

3.2. *Prescriptive Path:* Supply ducts in unconditioned attic have insulation ≥ R-8

***Performance Path:* Supply ducts in unconditioned attic have insulation ≥ R-6**

3.3. All other supply ducts and all return ducts in unconditioned space have insulation ≥ R-6

ENERGY STAR

DETAIL 3.1

All connections to trunk ducts in unconditioned space are insulated

A. Seal all seams, gaps, and holes of all trunk duct connections before installing insulation, preferably with mastic.

B. Install insulation without misalignments, compressions, gaps, or voids around all connections and exposed duct work.

C. Seal duct insulation to boot to prevent accumulation of condensation, preferably with mastic.

CONNECTIONS TO SEAL AND INSPECT

Listed below are common places in a duct system, where HVAC Contractors must seal in unconditioned spaces and areas that Raters must inspect for properly sealed and insulated connections:

SUPPLY

- Boots
- Duct splicing (two ducts put together)
- Main supply trunk to duct work

RETURN

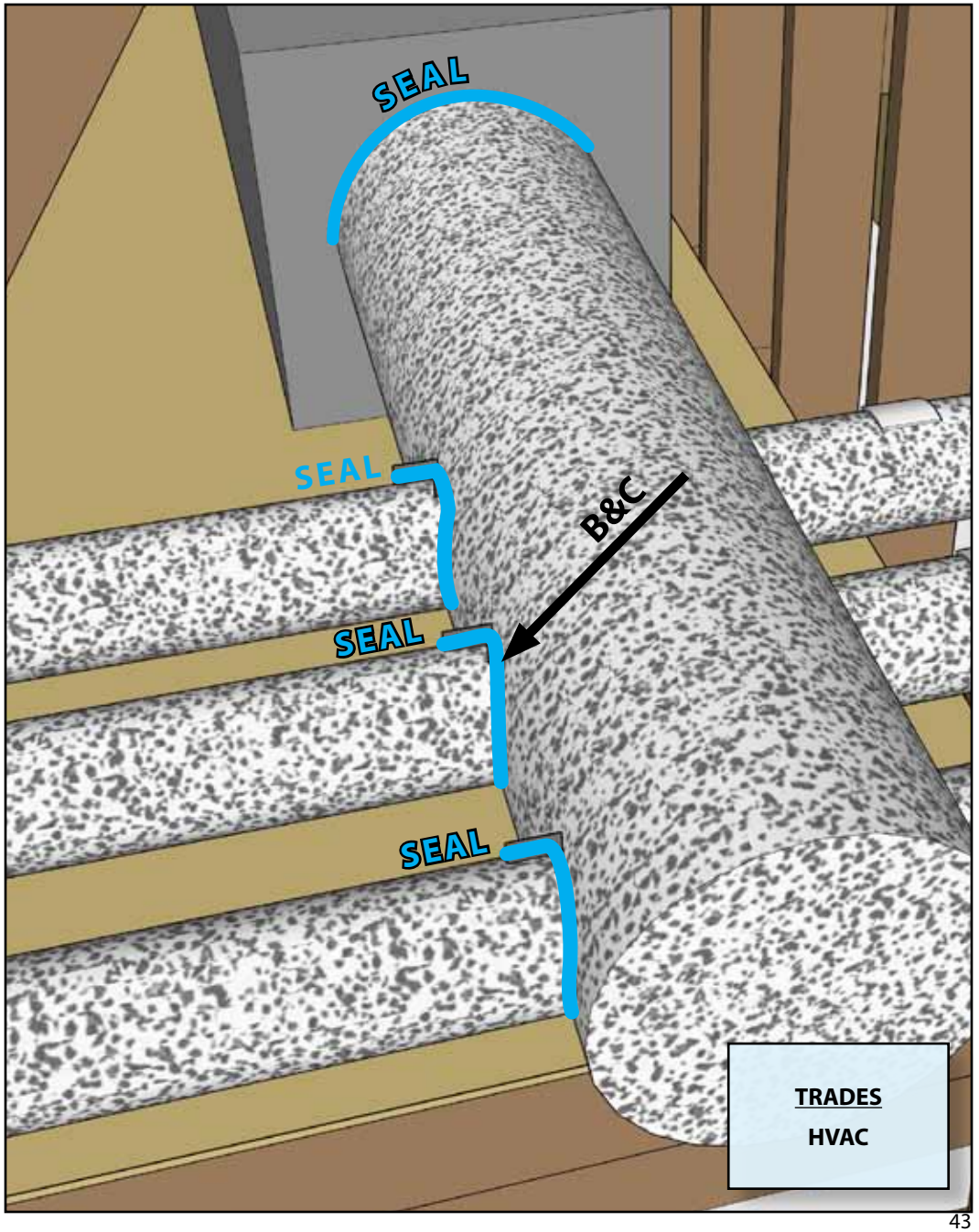
- Return box to duct work

PRESSURE BALANCING

- Jump duct boxes to duct work
- Dedicated return boxes to duct work

VENTILATION

- Return box to outside air duct work
- Exhaust fans to dedicated duct work
- ERV/HRV to dedicated duct work

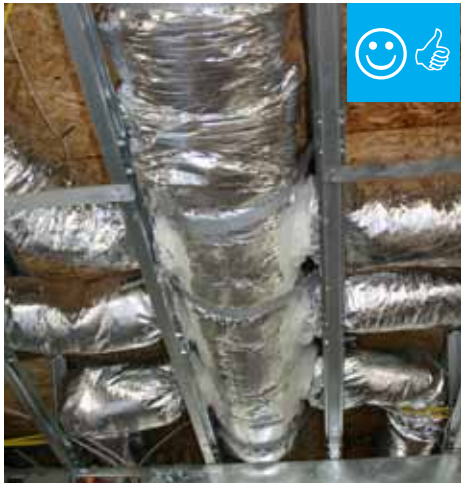


HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

3 DUCT INSULATION

1 ALL CONNECTIONS TO TRUNK DUCTS IN UNCONDITIONED SPACE ARE INSULATED

A. Trunk to duct connections are only mechanically fastened and not sealed.



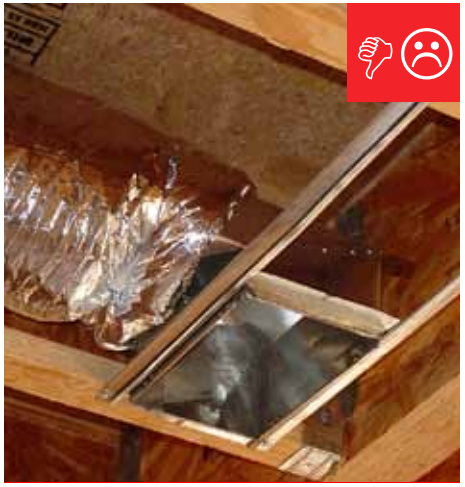
Trunk to duct connections are properly insulated and have been sealed with mastic.

A. Duct work is uninsulated and not sealed at seams.

Seams are being properly sealed with mastic and mesh tape.

B. Boot is uninsulated.

Duct insulation is installed over boot.



C. Insulation does not cover boot and is not sealed.

Boot has been covered with insulation and sealed with mastic.

ENERGY STAR

DETAIL 3.2

***Prescriptive Path*: Supply ducts in unconditioned attic have insulation ≥ R-8**

***Performance Path*: Supply ducts in unconditioned attic have insulation ≥ R-6**

A. Install insulated duct work, boxes, and boots in all unconditioned attic spaces to meet either the prescriptive or performance path.

B. Install all ducts in unconditioned spaces without compressing the insulation.

DETAIL 3.3

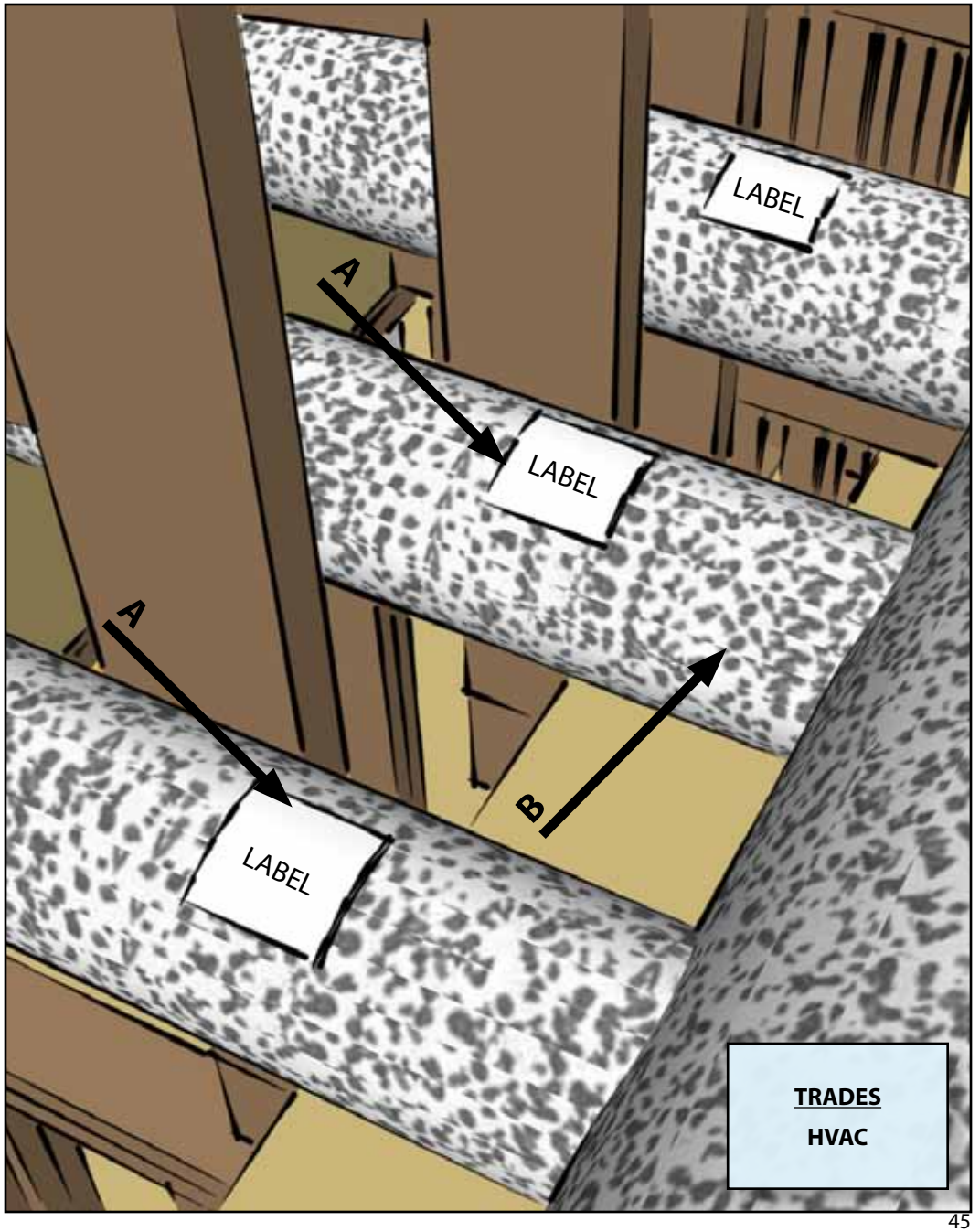
All other supply ducts and all return ducts in unconditioned space have insulation ≥ R-6

A. Install insulated duct work, boxes, and boots in all unconditioned spaces.

B. Install all ducts in unconditioned spaces without compressing the insulation.

Common unconditioned places include:

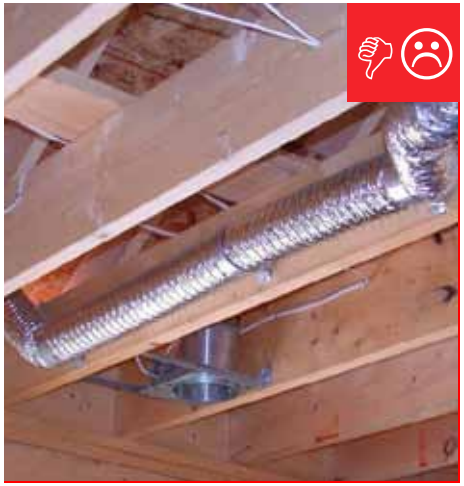
- Basements
- Vented Crawlspaces
- Closed Crawlspaces
- Bonus Room Attic Space



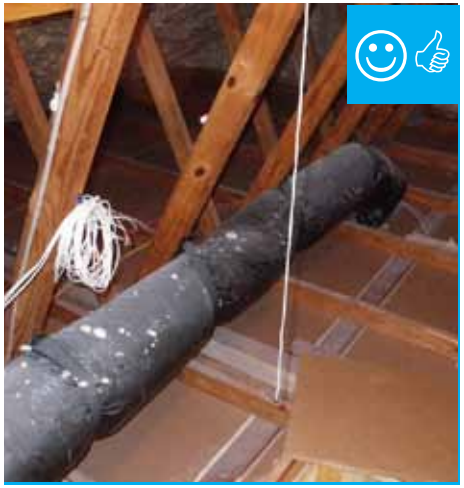
HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

3 DUCT INSULATION

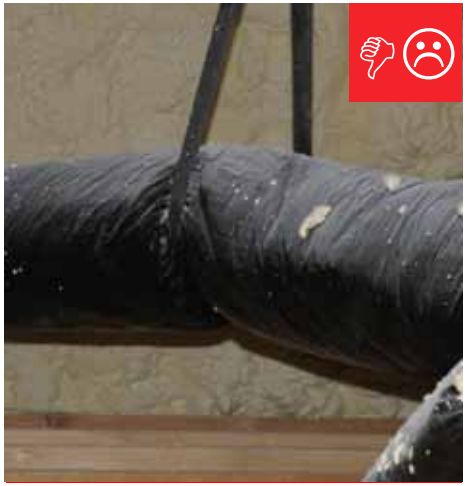
2-3 ALL DUCTS IN UNCONDITIONED SPACE INSULATED



A. Duct is located in unconditioned space and is not insulated.



Duct is located in unconditioned space and is properly insulated.



B. Duct is insulated but strapping is compressing the insulation therefore reducing the R-value.

Ducts are properly insulated and supported without compressing the insulation.

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

SECTION 4. DUCT LEAKAGE

4.1. Total Rater-measured duct leakage ≤ 6 CFM25 per 100 sq. ft. of conditioned floor area

4.2. Rater-measured duct leakage to outdoors ≤ 4 CFM25 per 100 sq. ft. of conditioned floor area

4.3. Duct boots sealed to floor, wall, or ceiling using caulk, foam, mastic tape, or mastic paste

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DETAIL 4.1 [15, 16, †]

Total Rater-measured duct leakage ≤ 6 CFM25 per 100 sq. ft. of conditioned floor area*

A. Seal all seams, gaps, and holes of all trunk duct connections before installing insulation, preferably with mastic.

B. Install insulation without misalignments, compressions, gaps, or voids around all connections and exposed duct work.

C. Seal duct insulation in place. Mastic is recommended for sealing.

D. EPA recommends testing ducts only after completing a visual inspection of proper duct sealing.

† Footnotes located on page 51.

DETAIL 4.2 [15, 16, 17, †]

Rater-measured duct leakage to outdoors ≤ 4 CFM25 per 100 sq. ft. of conditioned floor area

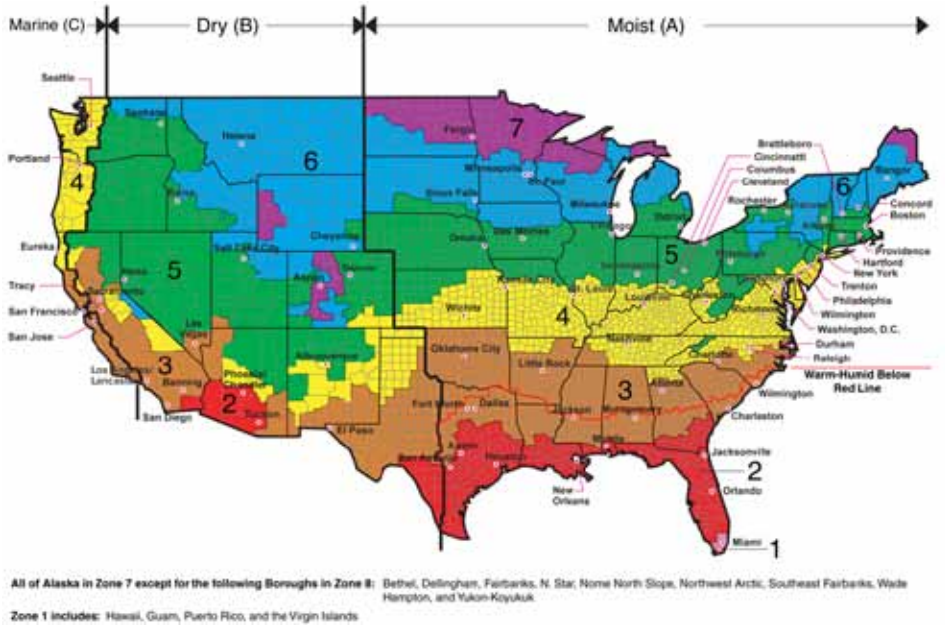
A. Seal all seams, gaps, and holes of all trunk duct connections before installing insulation. Mastic is recommended for sealing.

B. Install insulation without misalignment, compression, gaps, or voids around all connections and exposed duct work.

C. Seal duct insulation in place. Mastic is recommended for sealing.

D. EPA recommends testing ducts only after completing a visual inspection of proper duct sealing.

† Footnotes located on page 51.



INFILTRATION

Duct leakage testing can be waived if all ducts & air handling equipment are located within the home's air and thermal barriers AND envelope leakage has been tested to be less than or equal to half of the Reference Design infiltration limit for the Climate Zone where the home is to be built.

Climate Zone	Reference Design ACH50	Max Infiltration for Waived Duct Leakage ACH50
Zone 1	6	≤ 3.5
Zone 2	6	≤ 3.5
Zone 3	5	≤ 3.0
Zone 4	5	≤ 3.0
Zone 5	4	≤ 2.5
Zone 6	4	≤ 2.5
Zone 7	4	≤ 2.5

A. Connection in place but not sealed.

Mechanically fastened and sealed.

B. Insulation does not cover boot and is not sealed.

Duct insulation is installed over boot.

C. Insulation does not cover boot and is not sealed.

Boot has been covered with insulation and sealed with mastic.

DUCT TESTING TIPS

- Test duct system for leakage after all previous steps have been properly completed.
- Visually inspecting ducts prior to drywall installation allows for easier corrections.
- Recommend sealing the air handler unit with tape to reduce duct leakage. In addition, leaving a roll of tape behind allows the technician to reseal the unit after servicing it.
- If duct leakage is too high, use a theatrical smoke machine to illustrate duct leakage to the HVAC contractor.

FOOTNOTES

15. Duct leakage shall be determined and documented by a Rater using a RESNET-approved testing protocol only after all components of the system have been installed (e.g., air handler and register grills). Leakage limits shall be assessed on a per-system, rather than per-home, basis. Testing of duct leakage to the outside can be waived if all ducts & air handling equipment are located within the home's air and thermal barriers AND envelope leakage has been tested to be less than or equal to half of the Prescriptive Path infiltration limit for the Climate Zone where the home is to be built.

16. For all homes that have less than 1,200 sq. ft. of conditioned floor area (CFA), total measured duct leakage shall be ≤ 8 CFM25 per 100 sq. ft. of CFA and measured duct leakage to outdoors shall be ≤ 5 CFM25 per 100 sq. ft. of CFA.

17. If total duct leakage is ≤ 4 CFM25 per 100 sq. ft. of conditioned floor area, or ≤ 5 CFM25 per 100 sq. ft. of conditioned floor area for homes that have less than 1,200 sq. ft. of conditioned floor area, then leakage to outdoors need not be tested.

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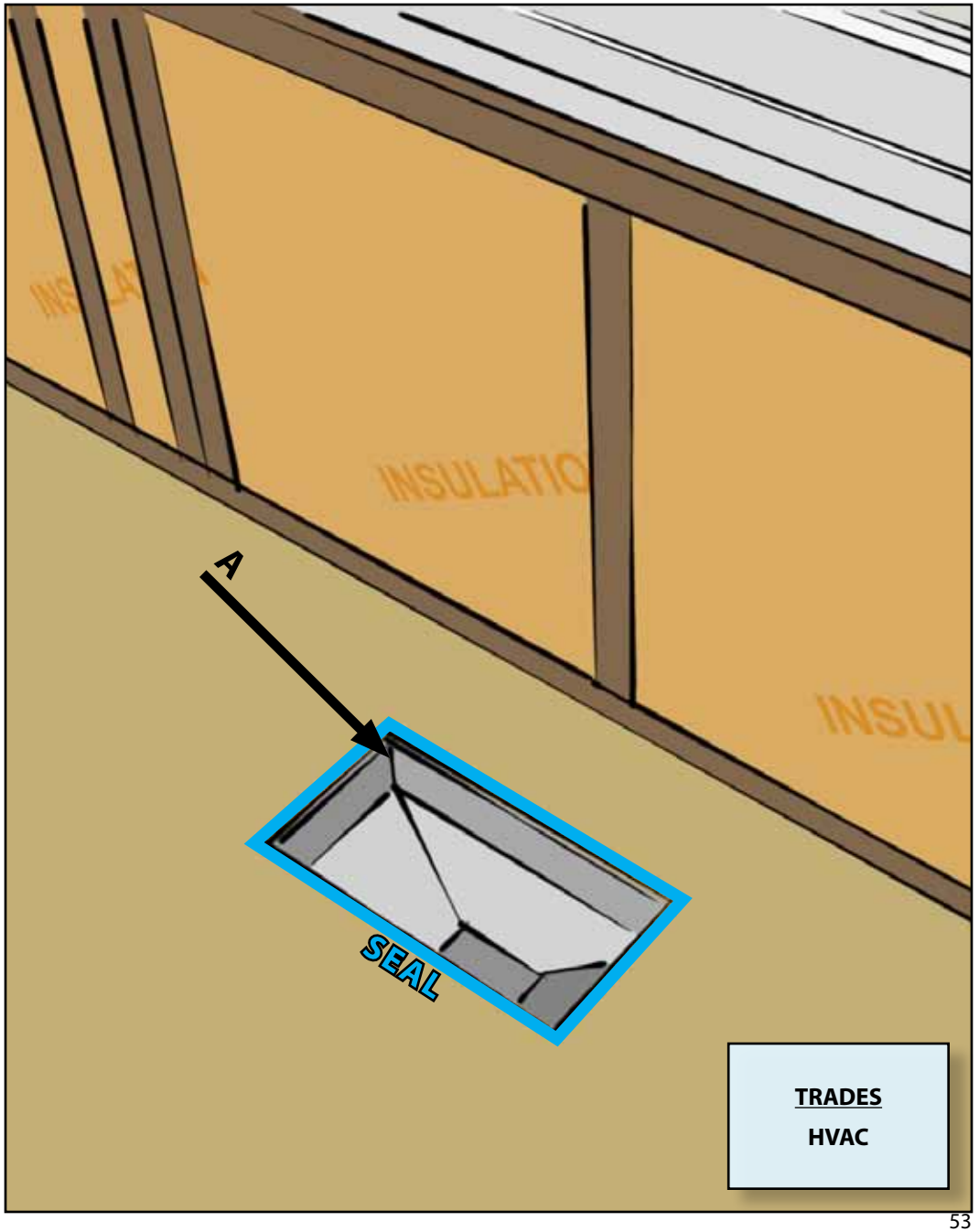
ENERGY STAR

DETAIL 4.3

Duct boots sealed to floor, wall, or ceiling using caulk, foam, mastic tape, or mastic paste

A. Seal all seams, gaps, and holes of all duct boots to the floor, wall, or ceiling, preferably with mastic.



4 DUCT LEAKAGE

3 DUCT BOOTS SEALED TO FLOOR, WALL, OR CEILING

A. Boot to floor connection not sealed.

Boot to floor connection sealed.

A. Boot to drywall connection not sealed.

Boot to drywall connection sealed.

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

SECTION 5. WHOLE-BUILDING DELIVERED VENTILATION

5.1. Rater-measured ventilation rate is within 100-120% of HVAC contractor design value (2.11)

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ENERGY STAR

DETAIL 5.1 [18]

Rater-measured ventilation rate is within 100-120% of HVAC contractor design value (2.11)

EPA requires a ventilation system that meets ASHRAE 62.2-2010 and sealing all holes, gaps, and seams of ducts and their connections including:

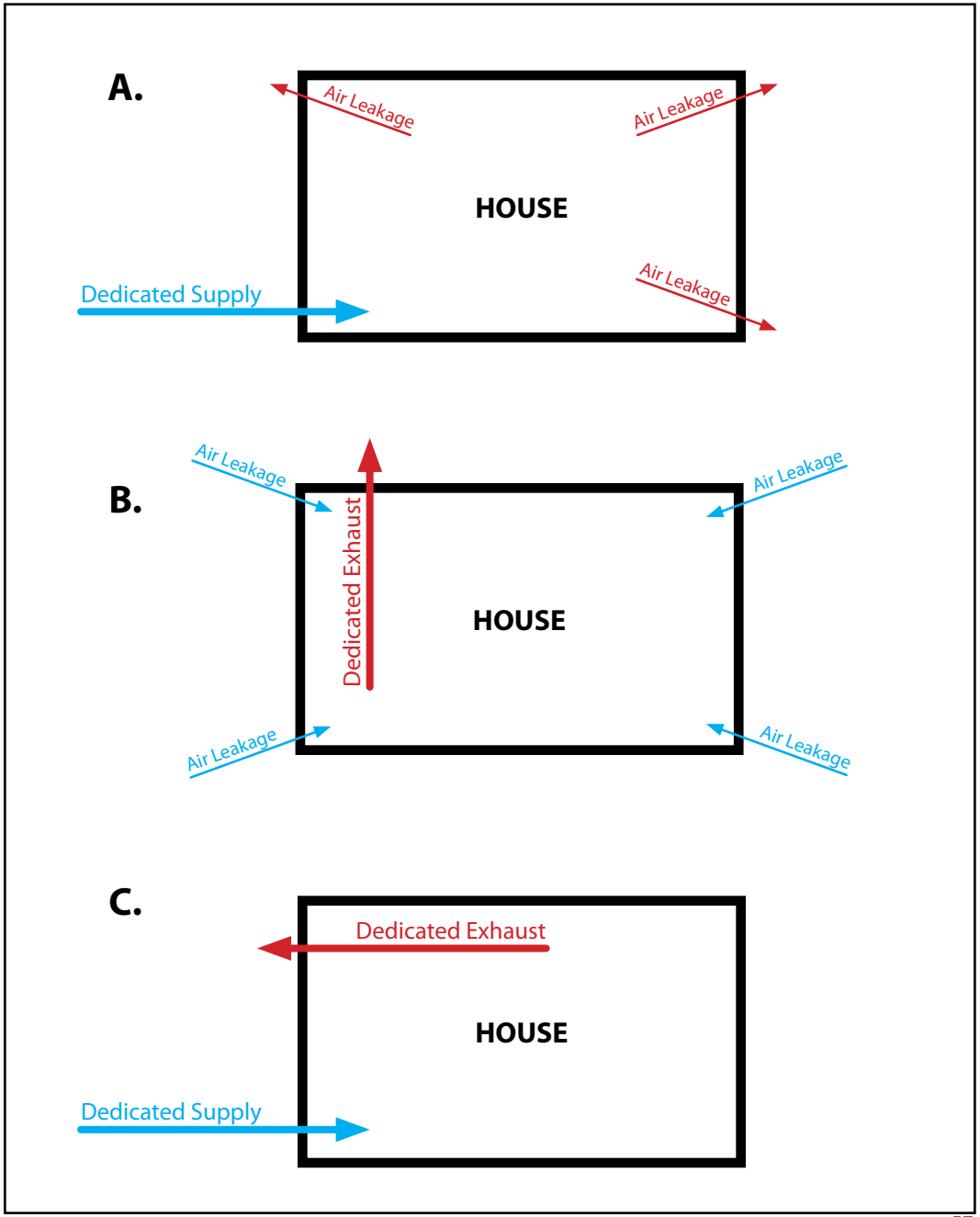
A. Supply (such as an intake duct to the **return** side of the HVAC system coupled with a motorized damper and control system).

B. Exhaust (such as a continuously operating exhaust fan).

C. Balanced (such as an ERV or HRV).

FOOTNOTES

18. The whole-house ventilation air flow and local exhaust air flows shall be measured by the Rater using a flow hood, flow grid, anemometer (in accordance with AABC, NEBB, or ASHRAE procedures), or substantially equivalent method.



HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

5 WHOLE-BUILDING DELIVERED VENTILATION

1 MEASURED VENTILATION RATE IS WITHIN 100-120% OF HVAC CONTRACTOR DESIGN VALUES

A. Ventilation tied into the return without a mechanical damper.

Ventilation tied into the return with a mechanical damper.

B. Exhaust fan installed but in wrong direction causing excessive bend and duct is uninsulated.

In line exhaust ventilation installed.

C. Properly installed ERV/HRV.

Properly installed ERV/HRV.

TESTING VENTILATION RATE

The HVAC Contractor and the Rater can calculate the ASHRAE 62.2-2010 ventilation rate using this formula:

(7.5 CFM)*(Number of Bedrooms + 1) + (0.01 CFM)*(Square Footage of the Conditioned Space) = Ventilation Rate in CFM

The HVAC contractor must attach documentation showing the ventilation system type, location, and design rate to the HVAC System Quality Installation Contractor Checklist.

The Rater must use a flow hood, flow grid, anemometer, or another substantially equivalent method to test the ventilation.

Testing must be in accordance with AABC, NEBB, or ASHRAE procedures.

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

SECTION 6. CONTROLS

6.1. Air flow is produced when central HVAC fan is energized (set thermostat to "fan")

6.2. Cool air flow is produced when the cooling cycle is energized (set thermostat to "cool")

6.3. Heated air flow is produced when the heating cycle is energized (set thermostat to "heat")

6.4. Continuously-operating ventilation and exhaust fans include readily accessible override controls

6.5. Function of ventilation controls is obvious (e.g., bathroom exhaust fan) or, if not, controls have been labeled

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DETAIL 6.1

Air flow is produced when central HVAC fan is energized (set thermostat to "fan")

A. Turn the fan on at the thermostat.

B. Reset the thermostat to the original settings before continuing.

DETAIL 6.2 [19, 20 †]

Cool air flow is produced when the cooling cycle is energized (set thermostat to "cool")

D. Turn the system on to cool and change the set point temperature to 3 degrees below the ambient temperature.

E. Reset the thermostat to the original settings before continuing.

F. If the system does not have air conditioning, this item does not need to be verified.

† Footnotes located on page 62.

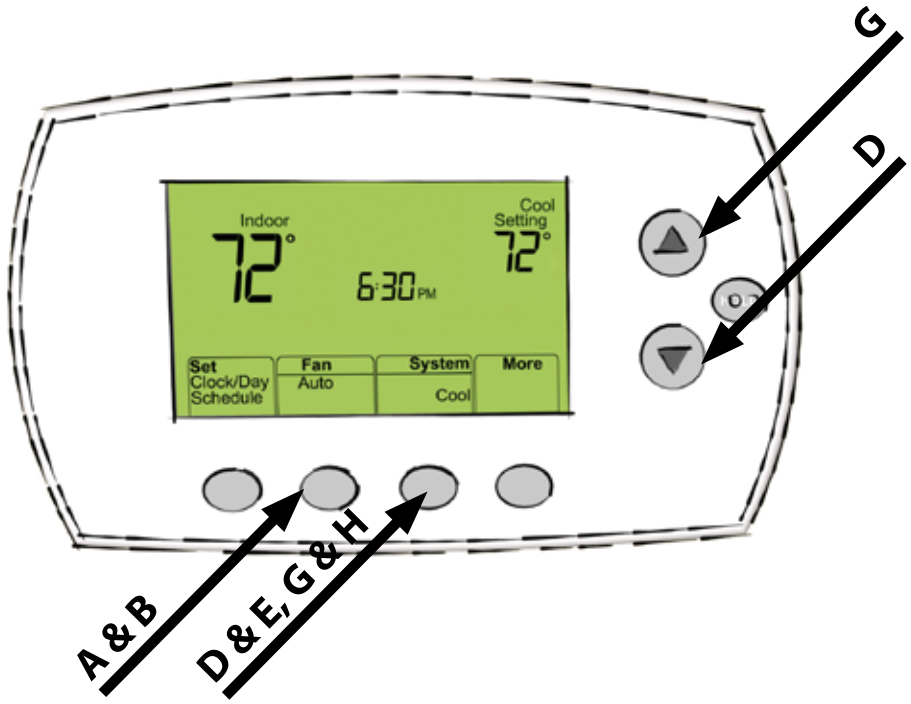
DETAIL 6.3 [19 †]

Heated air flow is produced when the heating cycle is energized (set thermostat to heat)

G. Turn the system on to heat and change the set point temperature to 3 degrees above the ambient temperature.

H. Reset the thermostat to the original settings before continuing.

† Footnotes located on page 62.



FOOTNOTES

19. In cases where the condenser unit is installed after the time of inspection by the Rater, the Rater is exempt from verifying item 6.2 when the condenser is for an AC unit and also item 6.3 when the condenser is for a heatpump unit.

20. To prevent potential equipment damage, the Rater shall not conduct this test if the outdoor temperature is < 55°F or, if known, below the manufacturer-recommended minimum operating temperature for the cooling cycle. When this occurs, the Rater shall mark 'N/A' on the checklist for this item.

ENERGY STAR

DETAIL 6.4

Continuously-operating ventilation and exhaust fans include readily accessible override controls

A. Install continuously operating ventilation and exhaust fans that have override control accessories.

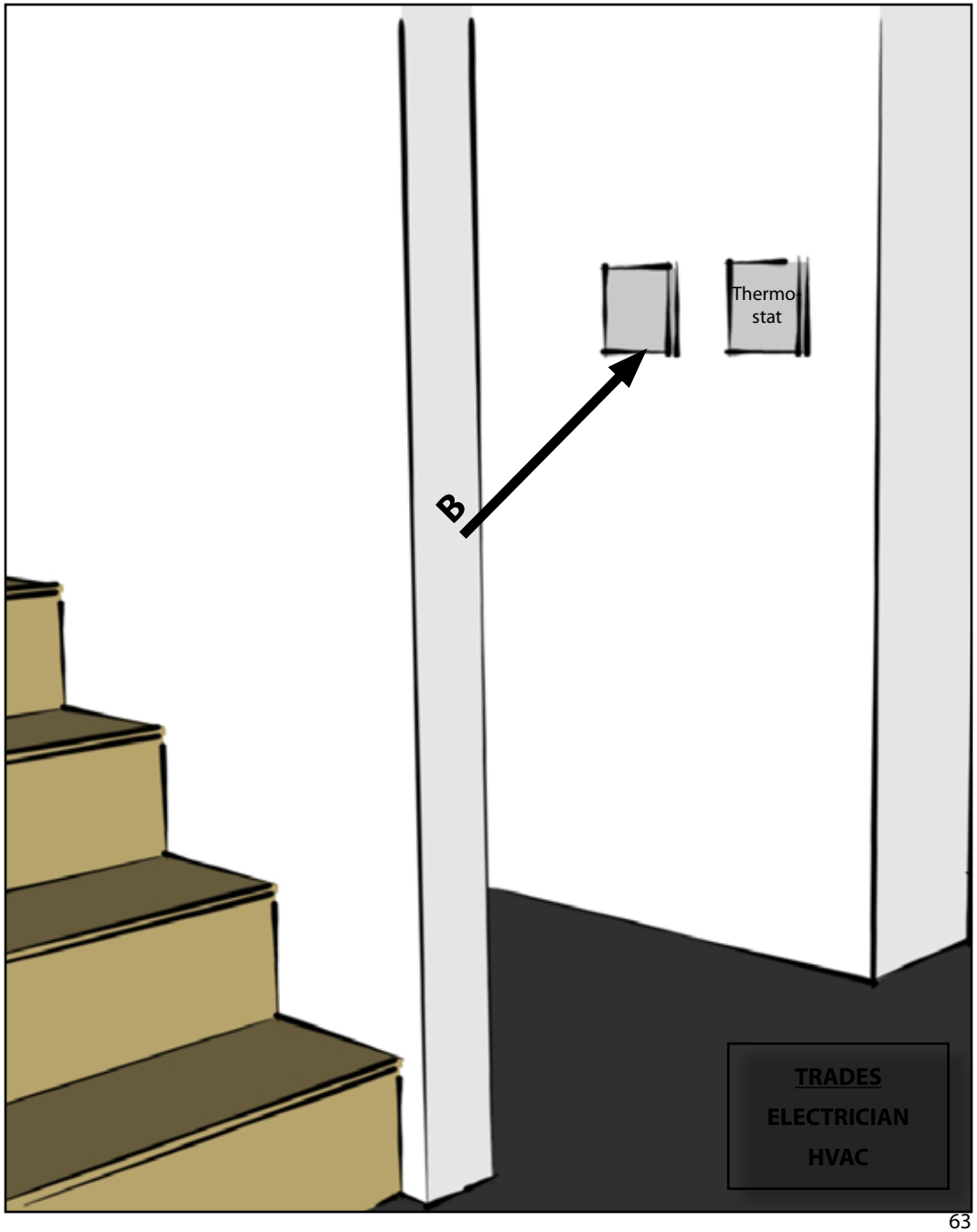
B. Install override controls for all fans in an easily accessible location.

OVERRIDE CONTROL LOCATION

It is important for HVAC Contractors and electricians to locate the override controls for continuously operating ventilation and exhaust fans in a location easily accessible to the homeowner. It is also important to properly label these controls. If controls are not properly labeled, fans may be mistakenly turned off.

Override Control Location Recommendations:

- Locate the labeled control near the thermostat, creating a control center for the homeowner. This allows the homeowner to access the majority of the HVAC system controls in one place. This setup is ideal for ventilation systems, such as ERVs and HRVs, that may be located in inaccessible places.
- Locate a switch on the electrical panel with a label. This prevents accidental turn off of fans and also provides one switch for all fans. This setup is ideal for a house that has multiple continuously running exhaust fans.
- Some bath exhaust fans have internal override systems, either on the electrical switch plate or defined in the manufacturer's manual. These exhaust fans meet the requirement as long as the override is accessible.



HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

6 CONTROLS

4 CONTINUOUSLY-OPERATING VENTILATION & EXHAUST FANS INCLUDE OVERRIDE CONTROLS

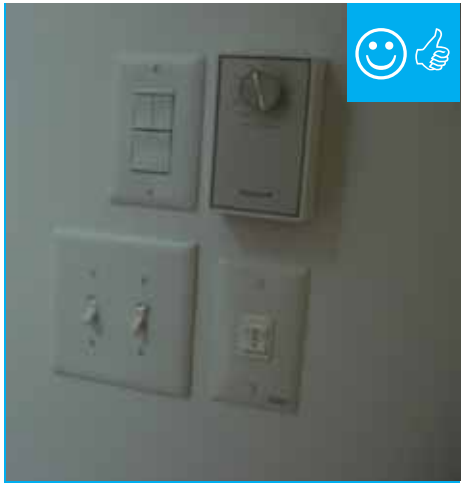
BAD PIC OF EQUIPMENT INSTALLED WITHOUT OVERRIDE CONTROL OPTIONS? OR PIC OF EQUIPMENT INSTALLED WITHOUT IT? NEEDED

A.

GOOD PIC OF EQUIPMENT INSTALLED WITH OVERRIDE CONTROL OPTIONS NEEDED

BAD PIC OF BAD LOCATION FOR OVERRIDE EQUIP. NEEDED

B.



Override control switches centrally located near thermostat for ease of access.

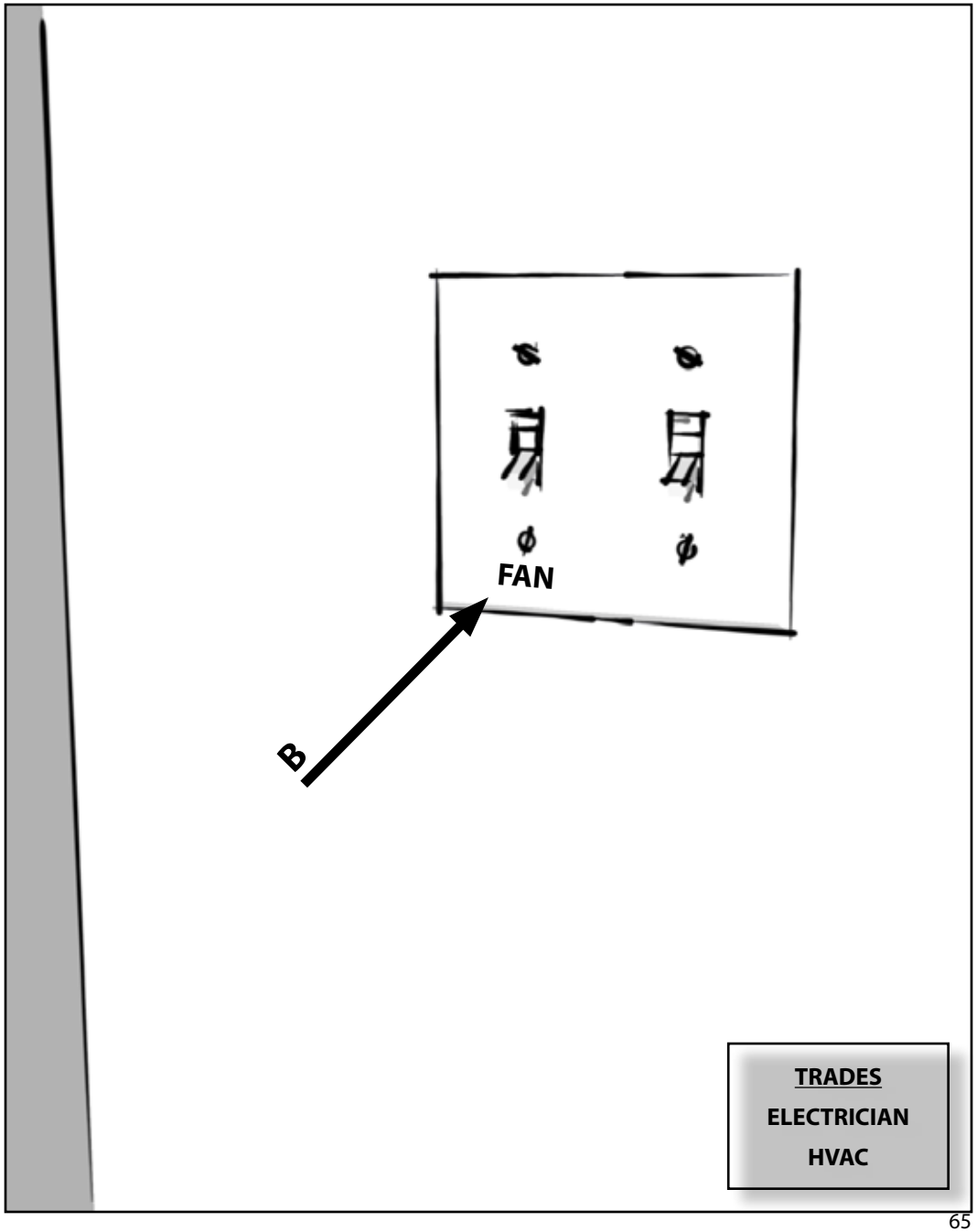
ENERGY STAR

DETAIL 6.5

Function of ventilation controls is obvious (e.g., bathroom exhaust fan) or, if not, controls have been labeled

A. Install controls that are differentiated or labeled by the manufacturer.

B. If function of ventilation controls is not obvious, install permanent labels to indicate the function of the control.



TRADES
ELECTRICIAN
HVAC

6 CONTROLS

5 CONTROLS LABELED, UNLESS FUNCTION IS OBVIOUS (E.G., BATHROOM EXHAUST FAN)

A. Ventilation control is not obvious.

Manufacturer labeled ventilation switch.

A. Function of controls is not obvious.

Manufacturer labeled controls.

B. Ventilation control is not obvious.

Installer permanently labeled ventilation switch.

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

SECTION 7. VENTILATION AIR INLETS & VENTILATION SOURCE

7.1. All ventilation air inlets located ≥10 ft. of stretched-string distance from known contamination sources such as stack, vent, exhaust hood, or vehicle exhaust. Exception: ventilation air inlets in the wall ≥ 3 ft. from dryer exhausts and contamination sources exiting through the roof

7.2. Ventilation air inlets ≥ 2 ft. above grade or roof deck in Climate Zones 1-3 or ≥ 4 ft. above grade or roof deck in Climate Zones 4-8 and not obstructed by snow, plantings, condensing units or other material at time of inspection

7.3. Ventilation air inlets provided with rodent / insect screen with ≤ 0.5 inch mesh

7.4. Ventilation air comes directly from outdoors and not from adjacent dwelling units, garages, crawlspaces, or attics

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ENERGY STAR

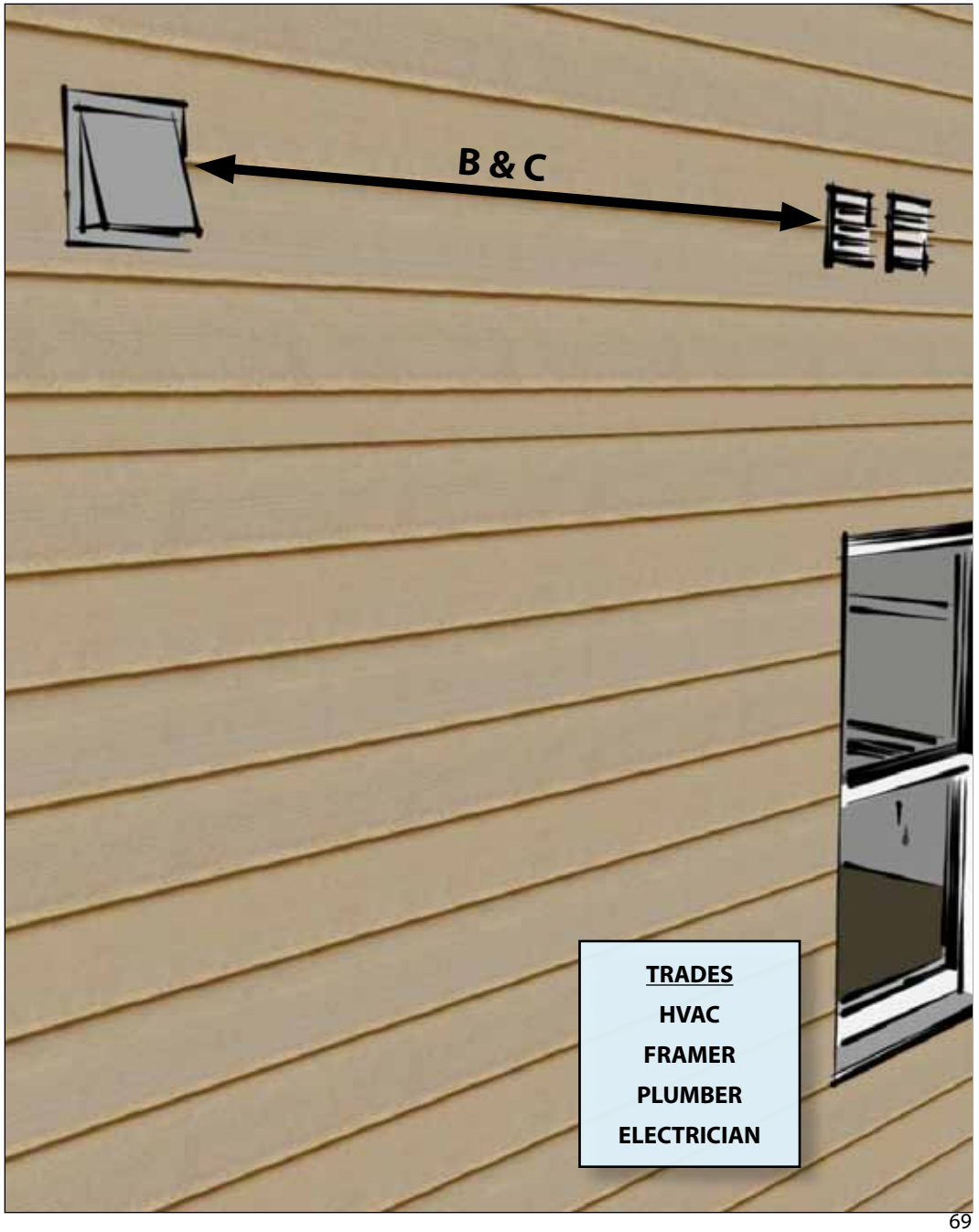
DETAIL 7.1 [21]

All ventilation air inlets located ≥ 10 ft. of stretched-string distance from known contamination sources such as stack, vent, exhaust hood, or vehicle exhaust. Exception: ventilation air inlets in the wall≥ 3 ft. from dryer exhausts and contamination sources exiting through the roof

A. Verify locations of all contamination source terminations.

B. Install air inlets at least 10 ft. away from all contamination source terminations.

C. Install air inlets at least 3 ft. away from dryer exhausts and contamination sources exiting through the roof.

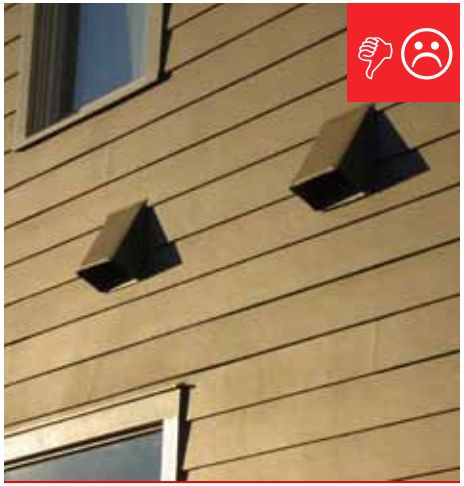


FOOTNOTES

21. The outlet and inlet of balanced ventilation systems shall meet these spacing requirements unless manufacturer instructions indicate that a smaller distance may be used. However, if this occurs the manufacturer's instructions shall be collected for documentation purposes.

7 VENTILATION AIR INLETS & VENTILATION SOURCE

1 VENTILATION AIR INLETS LOCATED AWAY FROM CONTAMINATION SOURCES



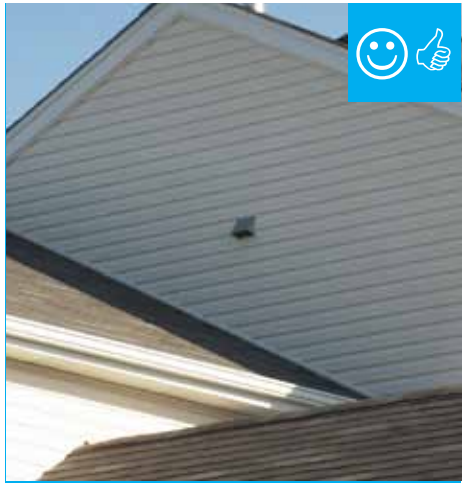
B. Ventilation air inlet is too close to exhaust outlet.

Ventilation inlet is greater than 10 ft. from known contamination source.

B. Ventilation air inlet is too close to exhaust outlet.

Ventilation inlet is greater than 10 ft. from known contamination source.

C. Ventilation inlet is too close to exhaust outlets and does not extend at least 2 ft. above the roof deck.



Ventilation inlet is not near any exhaust outlets/contamination sources and is at least 2 ft. above the roof deck.

CONTAMINATION SOURCES

It is important to locate contamination sources away from the air inlets. Contaminated air coming into the home could lead to moisture, odor, or health issues.

The HVAC Contractor should coordinate with other subcontractors, including, but not limited to, framers, plumbers, and electricians. This coordination at the beginning of construction will allow for proper placement of both air inlets and contamination source terminations.

Possible contamination source terminations:

- Bathroom exhaust fans
- Plumbing vent pipes
- Kitchen exhaust fans
- Dryer exhaust vents
- Furnace exhaust vents
- Water heater exhaust vents
- Fireplace flues
- Whole-house fans

ENERGY STAR

DETAIL 7.2 [22†]

Ventilation air inlets ≥ 2 ft. above grade or roof deck in Climate Zones 1-3 or ≥ 4 ft. above grade or roof deck in Climate Zones 4-8 and not obstructed by snow, plantings, condensing units or other material at time of inspection

A. Coordinate the location of all air inlets prior to installation.

B. Install air inlets at least 2 ft. above grade or roof deck in Climate Zones 1-3.

C. Install air inlets at least 4 ft. above grade or roof deck in Climate Zones 4-8.

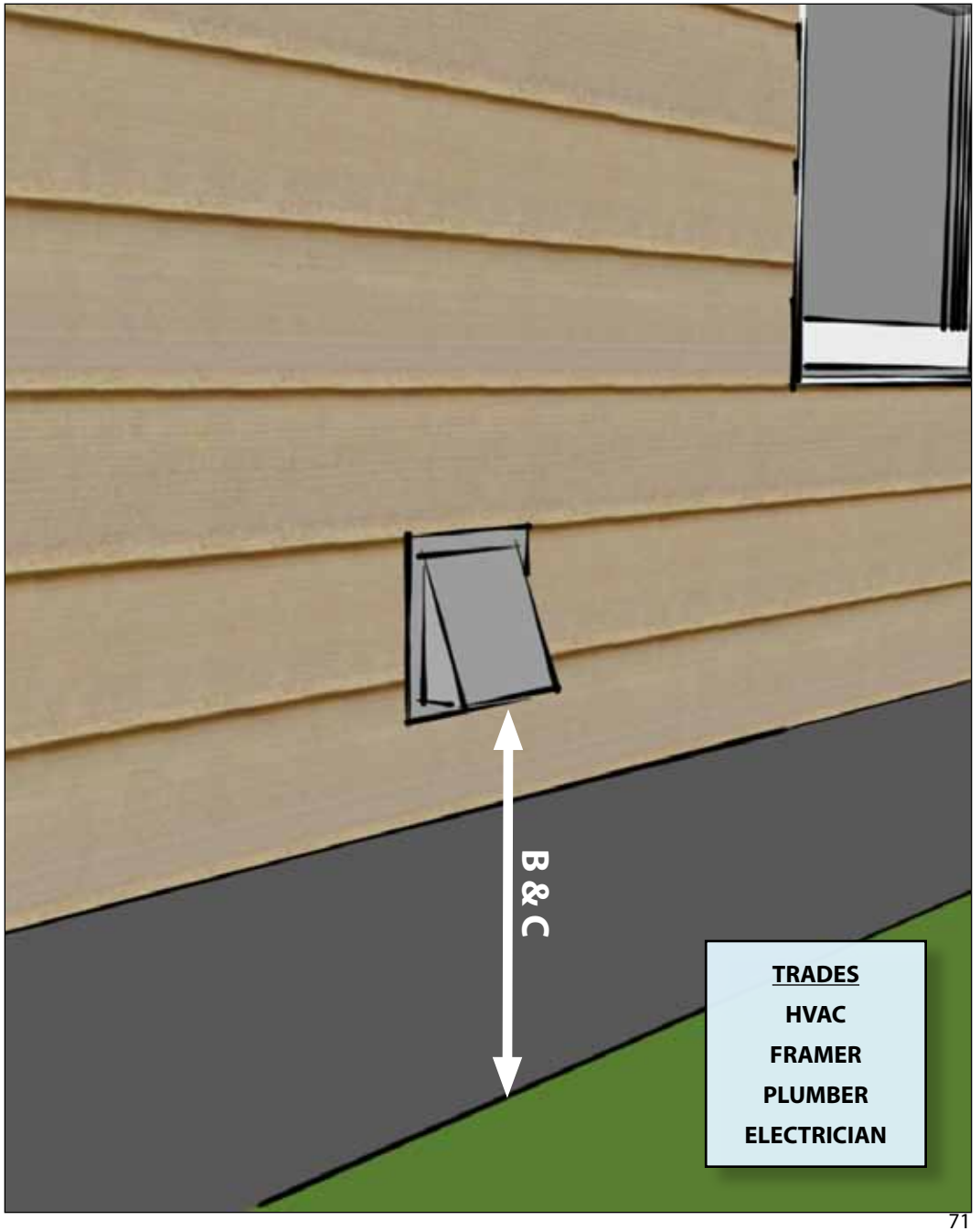
† Footnote located on page 73.

AIR INLET LOCATIONS

It is important for the HVAC Contractor to locate air inlets where they will not be blocked by external conditions. Blockage could lead to inadequate air flow in the system. Contaminated air coming into the home could lead to moisture, odor, or health issues.

EPA recommends that the HVAC Contractor coordinate with other subcontractors, including, but not limited to framers, plumbers, and electricians to understand all possible constraints on air inlet locations. Considering where the air inlet duct is connecting both to the exterior and to the system will prevent the use of ducts that are too long or ones with too many kinks and turns.

HVAC Contractors should consult the local code and speak with code officials to understand the constraints of air inlet locations.

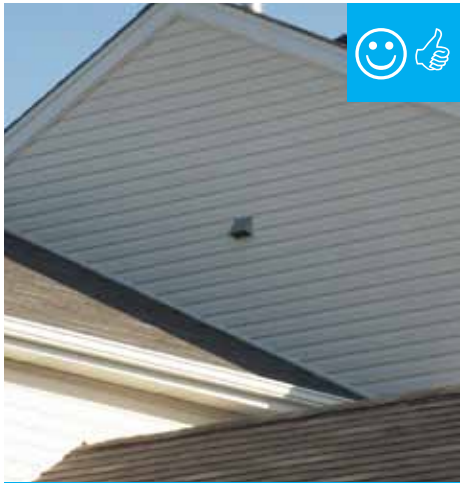


HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

7 VENTILATION AIR INLETS & VENTILATION SOURCE

2 VENTILATION AIR INLETS LOCATED ABOVE GRADE OR ROOF DECK

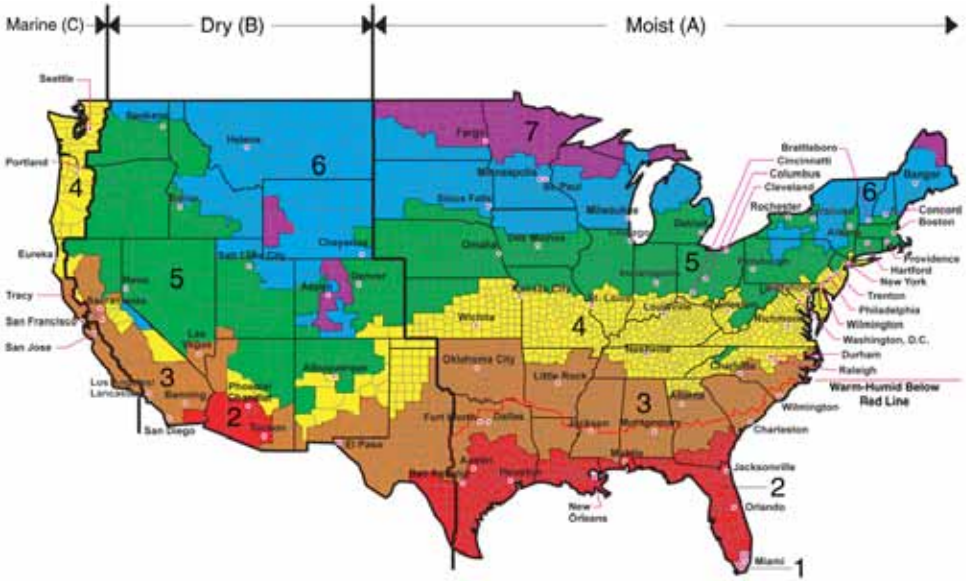
B. Ventilation inlet does not terminate high enough above the roof deck.



Ventilation inlet is not near any exhaust outlets/contamination sources and is at least 2 ft. above the roof deck.

C. Ventilation inlet is too close to the ground and is being blocked by the grass.

Ventilation inlet is appropriately located above grade.



All of Alaska in Zone 7 except for the following Boroughs in Zone 8: Bethel, Dellingham, Fairbanks, N. Star, Nome North Slope, Northwest Arctic, Southeast Fairbanks, Wade Hampton, and Yukon-Koyukuk

Zone 1 includes: Hawaii, Guam, Puerto Rico, and the Virgin Islands

AIR INLET INSTALLATION TIPS

It is easier to install an air inlet at the gable end of the house than to try to lift it off the roof 2-4 feet.

Interactive Map: http://energycode.pnl.gov/EnergyCodeReqs/

FOOTNOTES

22. EPA will permit the use of reduced ventilation air inlet heights in North Carolina. The minimum required height in North Carolina for Climate Zone 4 will be reduced from 4 feet to 2 feet and in Climate Zone 5 from 4 feet to 2.5 feet based on historical snowfall data for this state. Note that EPA is evaluating the potential to reduce inlet heights in other regions based upon historical snowfall data.

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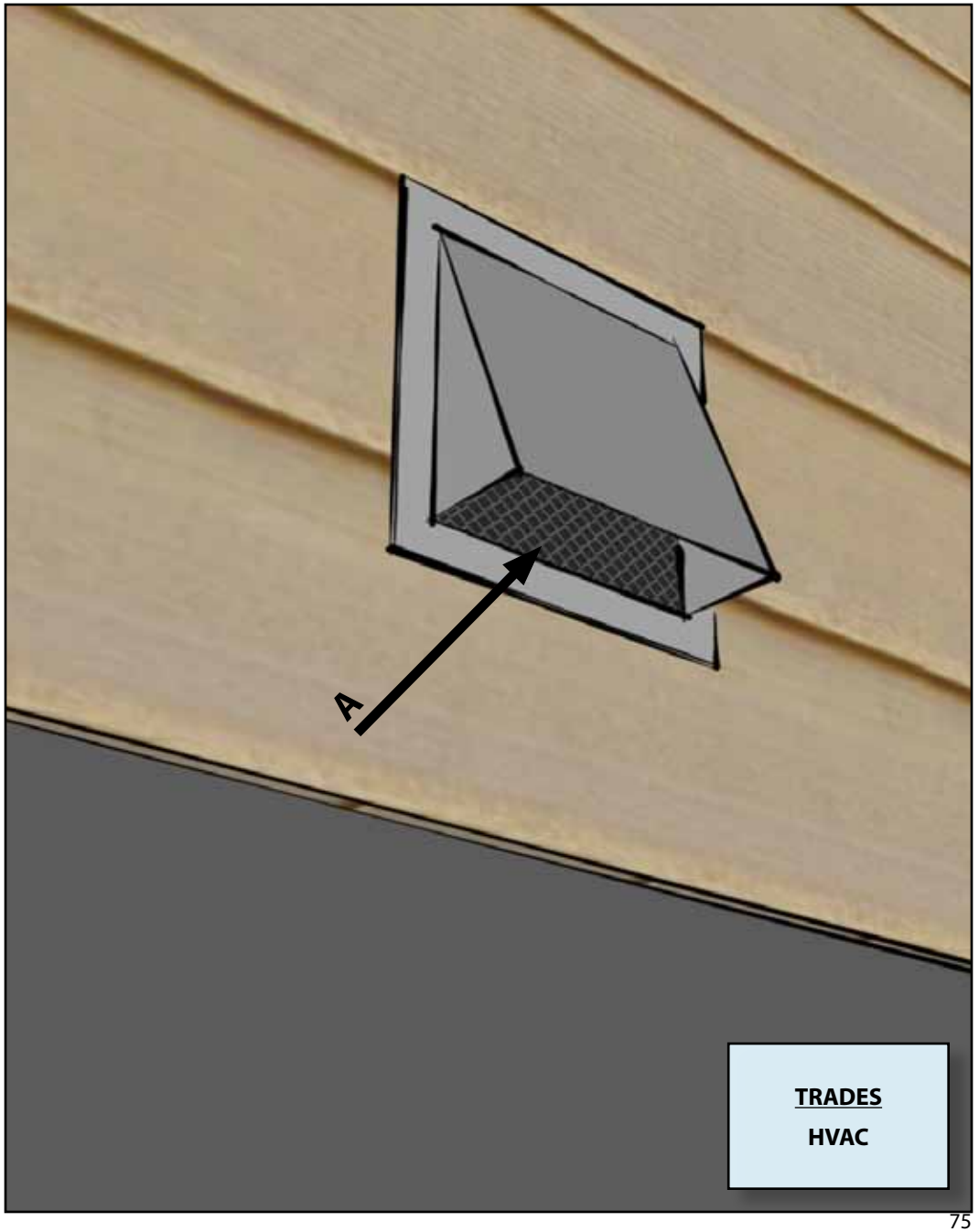
DETAIL 7.3 [23]

Ventilation air inlets provided with rodent / insect screen with ≤ 0.5 inch mesh

A. Install rodent/insect screen on all air inlets.

B. EPA recommends installing the air inlet in an accessible location that allows for cleaning the screen.



FOOTNOTES

23. Without proper maintenance, ventilation air inlet screens often become filled with debris. Therefore, EPA recommends, but does not require, that these ventilation air inlets be located so as to facilitate access and regular service by the owner.

7 VENTILATION AIR INLETS & VENTILATION SOURCE

3 VENTILATION AIR INLETS PROVIDED WITH MESH RODENT/INSECT SCREEN

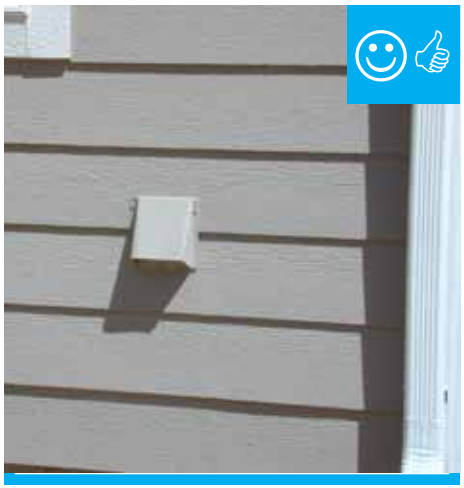
A. Mesh screen is spaced wider than 0.5" allowing insects to enter.

Mesh screen is correctly installed and gaps are less than 0.5".

A. Mesh screen is spaced wider than 0.5" allowing insects to enter.

Mesh screen is correctly installed and gaps are smaller less than 0.5".

B. Air inlet is not convenient for cleaning and located next to exhaust outlets.



Air inlet is located in a convenient place for homeowner to clean.

DETAIL 7.4

Ventilation air comes directly from outdoors and not from adjacent dwelling units, garages, crawlspaces, or attics

A. Install ventilation ducts to terminate at the exterior.

B. Seal all seams, gaps, holes, and connections to exterior of all ventilation ducts, preferably with mastic.

C. Install duct supports at a minimum of every 5 ft. to prevent sagging.

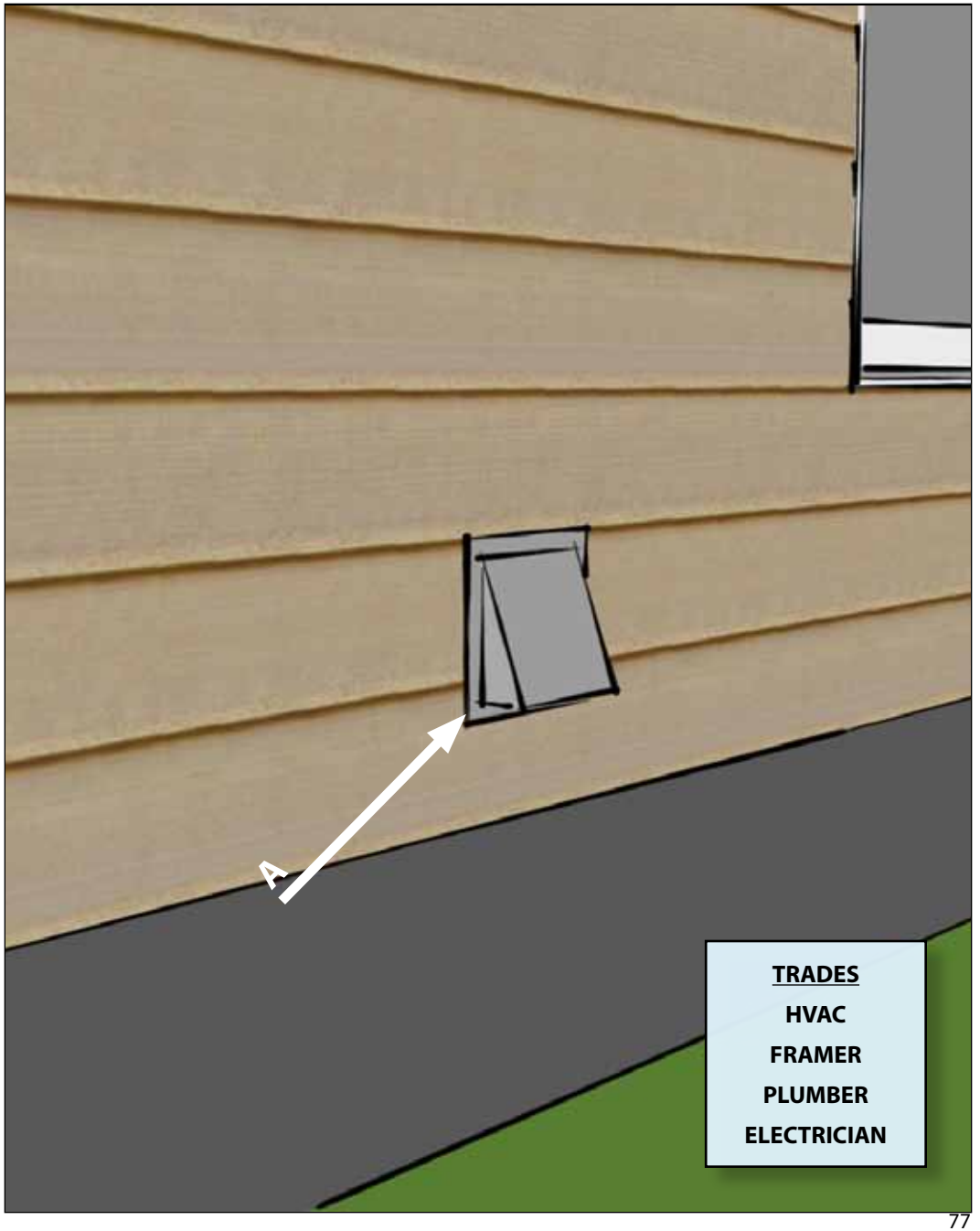
D. Install duct supports without compressing the duct insulation.

AIR INLET LOCATIONS

It is important for the HVAC Contractor to locate air inlets where they will not be blocked by external conditions. Blockage could lead to inadequate air flow in the system. Contaminated air coming into the home could lead to moisture, odor, or health issues.

EPA recommends that the HVAC Contractor coordinate with other subcontractors, including, but not limited to framers, plumbers, and electricians to understand all possible constraints on air inlet locations. Considering where the air inlet duct is connecting both to the exterior and to the system will prevent the use of ducts that are too long or ones with too many kinks and turns.

HVAC Contractors should consult the local code and speak with code officials to understand the constraints of air inlet locations.



7 VENTILATION AIR INLETS & VENTILATION SOURCE

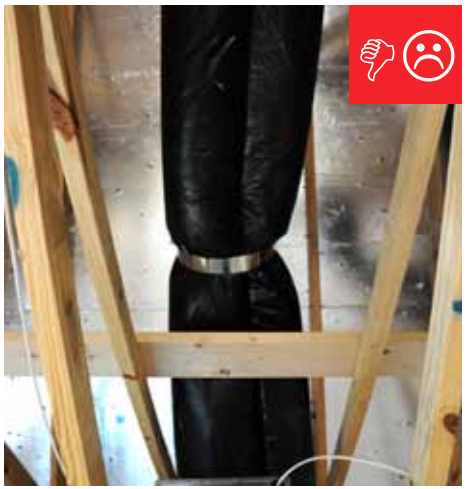
4 VENTILATION AIR COMES DIRECTLY FROM OUTDOORS

A. Exhaust terminates inside of soffit and was just covered.

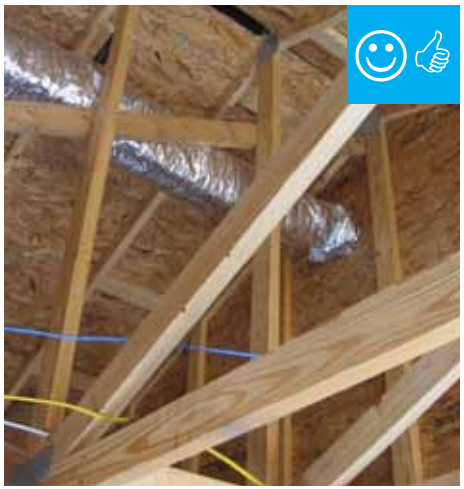
Exhaust terminates to the outside away from air inlets.

B. Exhaust duct only mechanically fastened and not sealed.

Kitchen exhaust properly installed and sealed with mastic.



C./D. Ventilation duct is compressed because supporting strap is too small.



Exhaust duct is well supported by framing and support straps.

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

SECTION 8. LOCAL MECHANICAL EXHAUST

In each kitchen and bathroom, a system shall be installed that exhausts directly to the outdoors and meets one of the following Rater-measured airflow standards:

8.1. Kitchen Continuous Rate: ≥ 5 ACH, based on kitchen volume * †

Kitchen Intermittent Rate: ≥ 100 CFM

8.2. Bathroom Continuous Rate: ≥ 20 CFM * †

Bathroom Intermittent Rate: ≥ 50 CFM

8.3. If fans share common exhaust duct, back-draft dampers installed

8.4. Common exhaust duct not shared by fans in separate dwellings

8.5. Clothes dryers vented directly to outdoors, except for ventless dryers equipped with a condensate drain

* Fans used at continuous rate must be rated for continuous use.

† For additional information and specific duct testing protocols please refer to RESNET Chapter 8 (Standard for Performance Testing and Work Scope: Enclosure and Air Distribution Leakage Testing).

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DETAIL 8.1 [18, 24, 25 †]

In each kitchen, a system shall be installed that exhausts directly to the outdoors and meets one of the following Rater-measured airflow standards: *

Continuous rate is ≥ 5 ACH, based on kitchen volume [27]

A. EPA recommends selecting a fan that provides more than 5 air changes per hour (ACH) in order to pull the required amount.

Intermittent rate is ≥ 100 CFM [26, 28]

B. EPA recommends selecting a fan with a rating of 150-200 CFM to pull at least 100 CFM when measured.

Continuous and Intermittent

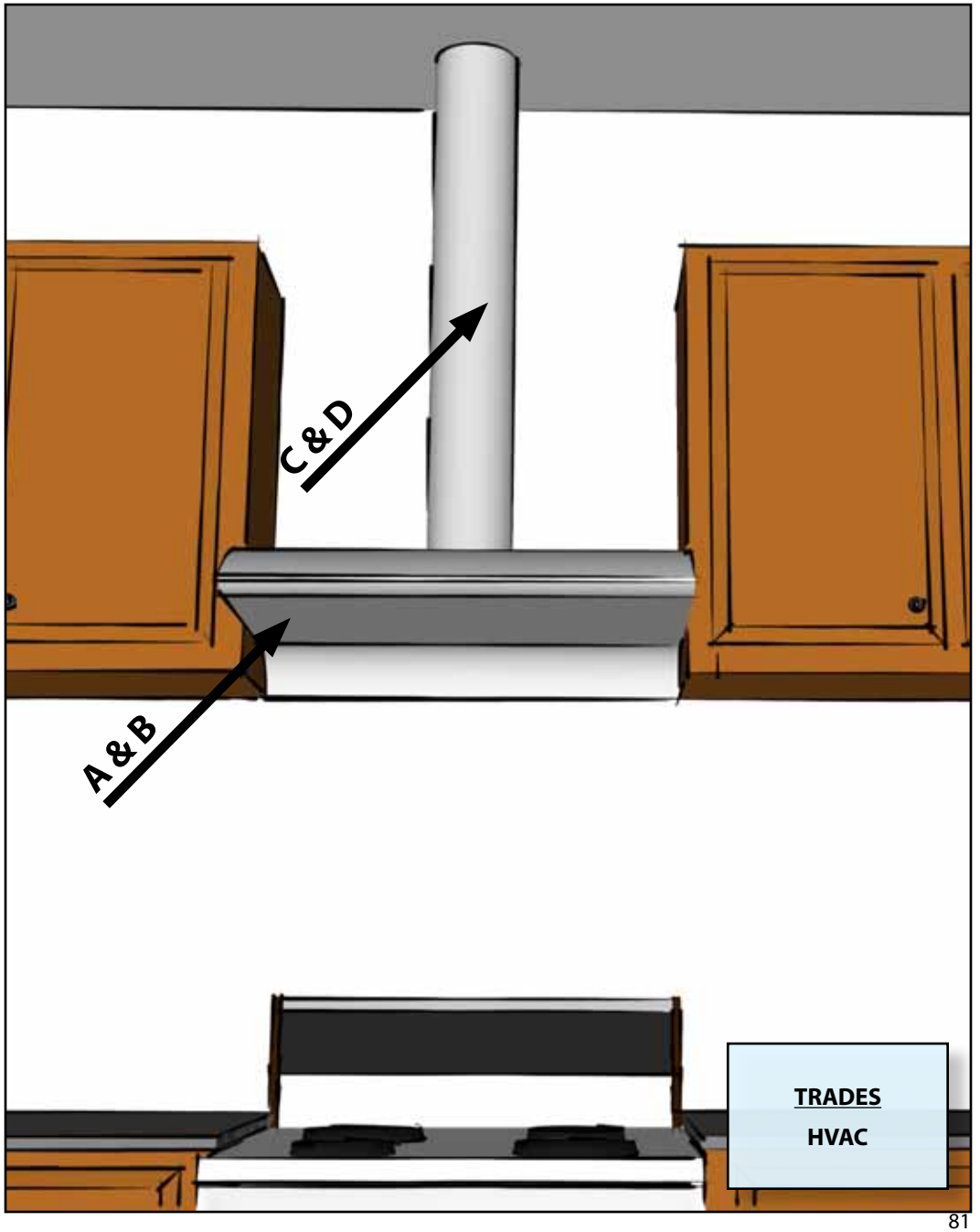
C. Install the fan to directly exhaust to the outdoors through a termination with little or no restriction.

D. Seal all seams, gaps, holes, and connections to the exterior of all ventilation ducts, preferably with mastic.

E. EPA recommends testing the kitchen fan after completing a visual inspection of proper duct sealing.

* All kitchen fans must comply with either the continuous or intermittent rate.

† Footnotes located on page 83.



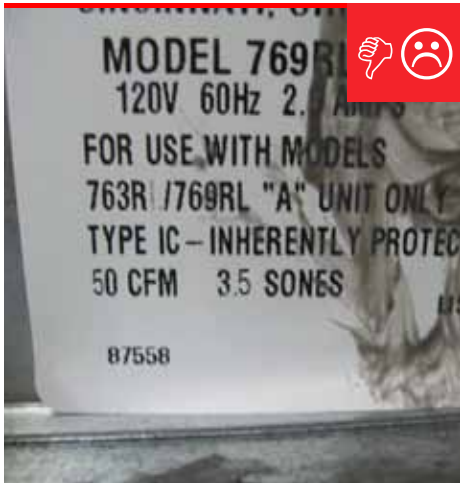
KITCHEN FAN RATING

Kitchen fans are typically rated by how many cubic feet per minute (CFM) the fan will exhaust in a factory setting. Duct work, termination choices and installation may decrease the measured CFM below the factory-rated CFM.

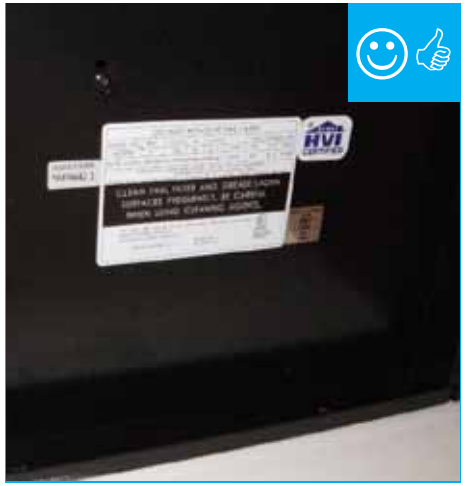
To ensure the installed fan exhausts the correct amount of CFM, EPA recommends the HVAC Contractor to install a fan with a rating higher than the required measured amount.

ADDITIONAL INFORMATION

For additional information and specific duct testing protocols please refer to RESNET Chapter 8 (Standard for Performance Testing and Work Scope: Enclosure and Air Distribution Leakage Testing).



A./B. CFM rating may not meet the performance specification once installed.

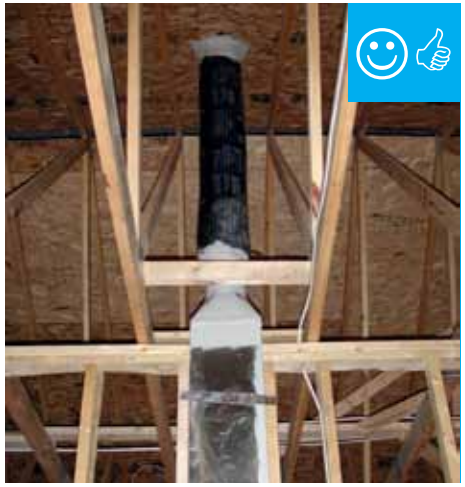


Fan CFM rating is higher than the requirement increasing the likelihood that it will meet the performance level once installed.

C. Recirculating fan installed that does not exhaust to outside.

Exhaust fan has terminates to the outside.

D. Exhaust duct work and penetration to the exterior have not been sealed.



Exhaust duct work and penetration to the exterior have been sealed with mastic.

KITCHEN FAN SELECTION

To calculate the CFM requirement of the kitchen fan for continuous rate, use the equation below:

Required CFM = (5 ACH) * (Kitchen Volume) / (60 minutes)

If intermittent fan flow rate of at least 100 CFM is less than 5 ACH, based on kitchen volume, then a vented range hood is required.

KITCHEN FAN TESTING TIPS

- Test the kitchen fan after completing a visual inspection of proper fan installation.
- Verify the kitchen fan is set to "exhaust" instead of "recirculate."
- Use a flow hood, flow grid, anemometer (in accordance with AABC, NEBB, or ASHRAE procedures), or other equivalent method to test the fan.

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

FOOTNOTES

18. The whole-house ventilation air flow and local exhaust air flows shall be measured by the Rater using a flow hood, flow grid, anemometer (in accordance with AABC, NEBB, or ASHRAE procedures), or substantially equivalent method.

24. Per ASHRAE 62.2-2010, an exhaust system is one or more fans that remove air from the building, causing outdoor air to enter by ventilation inlets or normal leakage paths through the building envelope. Examples include bath exhaust fans, range hoods, and clothes dryers.

25. Per ASHRAE 62.2-2010, a bathroom is any room containing a bathtub, shower, spa, or similar source of moisture.

26. An intermittent mechanical exhaust system, where provided, shall be designed to operate as needed by the occupant. Control devices shall not impede occupant control in intermittent systems.

27. Kitchen volume shall be determined by drawing the smallest possible rectangle on the floor plan that encompasses all cabinets, pantries, islands, and peninsulas and multiplying by the average ceiling height for this area. Cabinet volume shall be included in the kitchen volume calculation.

28. If the flow rate of the selected exhaust fan is less than 5 ACH, based on kitchen volume, then a vented range hood or appliance-range hood combination is required rather than a remote fan that is not integral to the range. Also, for intermittent kitchen exhaust fans that are integrated with microwaves, a rated air flow rate that is ≥ 200 CFM may be used in lieu of measuring the actual air flow rate.

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DETAIL 8.2 [18, 24, 25 †]

In each bathroom, a system shall be installed that exhausts directly to the outdoors and meets one of the following Rater-measured airflow standards: *

Continuous rate is ≥ 20 CFM

A. EPA recommends selecting a fan with a rating of 50 CFM to pull at least 20 CFM when measured.

Intermittent rate is ≥ 50 CFM [26]

B. EPA recommends selecting a fan with a rating of 70 CFM to pull at least 50 CFM when measured.

Continuous and Intermittent

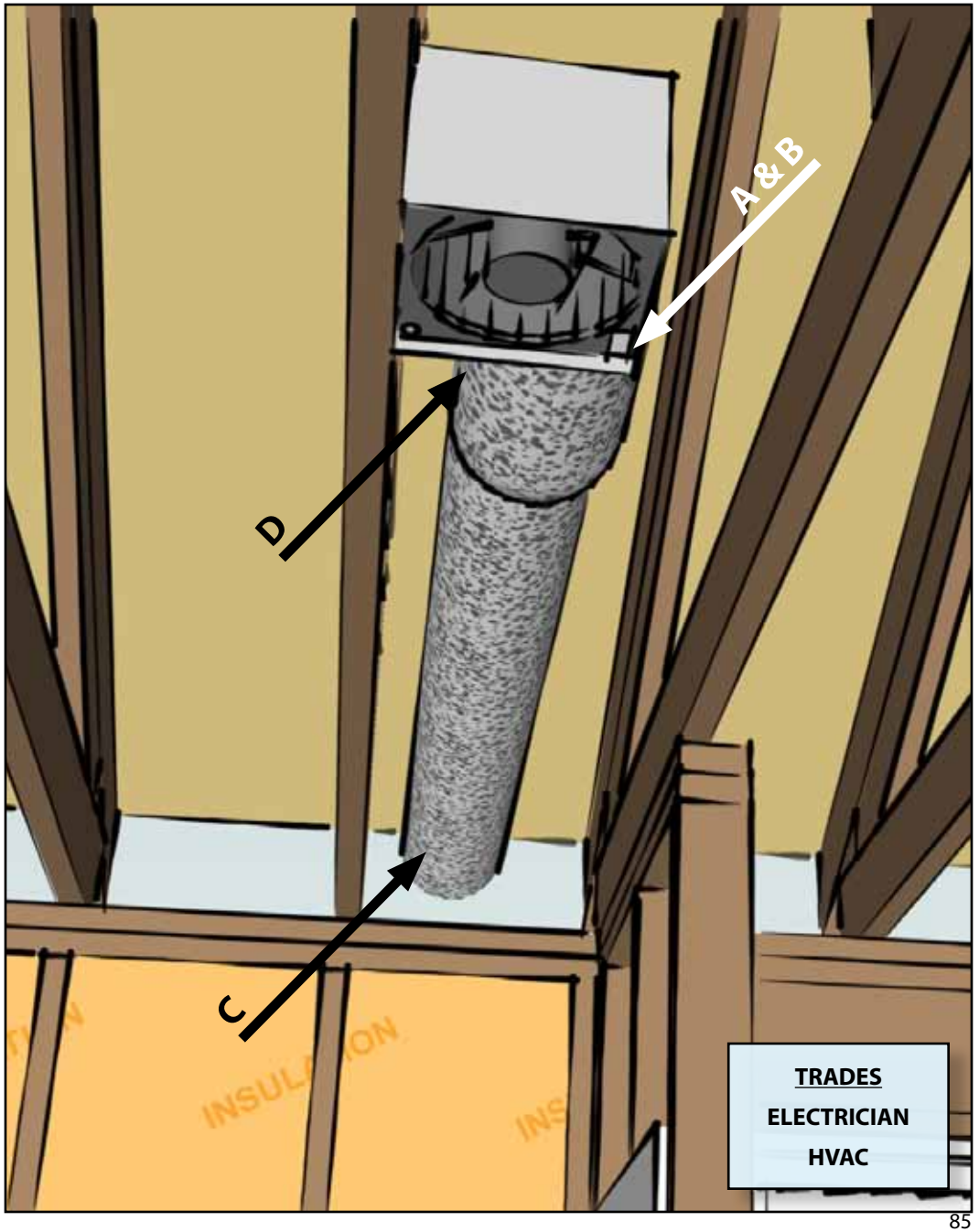
C. Install the fan to directly exhaust to the outdoors through a termination with little or no restriction.

D. Seal all seams, gaps, holes, and connections to exterior of all ventilation ducts, preferably with mastic.

E. EPA recommends completing a visual inspection of proper fan installation, prior to testing the fan.

* All bathroom fans must comply with the continuous or intermittent rate.

†Footnotes located on page 87.



BATHROOM FAN RATING

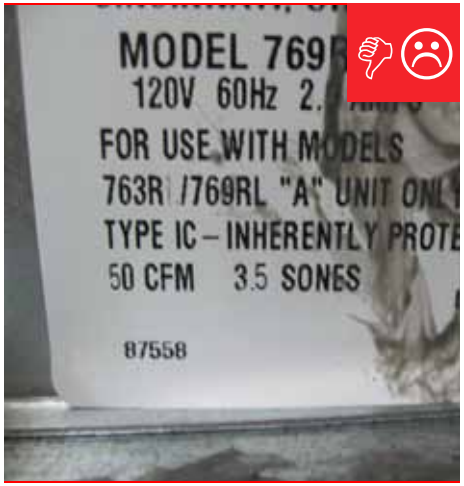
A bathroom is any room containing a bathtub, shower, spa, or similar source of moisture.

Bathroom fans are typically rated by how many cubic feet per minute (CFM) the fan will exhaust in a factory setting. Duct work, termination choices and installation may decrease the measured CFM below the factory-rated CFM.

To ensure the installed fan exhausts the correct amount of CFM, EPA recommends installing a fan with a rating higher than the required measured amount.

ADDITIONAL INFORMATION

For additional information and specific duct testing protocols please refer to RESNET Chapter 8 (Standard for Performance Testing and Work Scope: Enclosure and Air Distribution Leakage Testing).



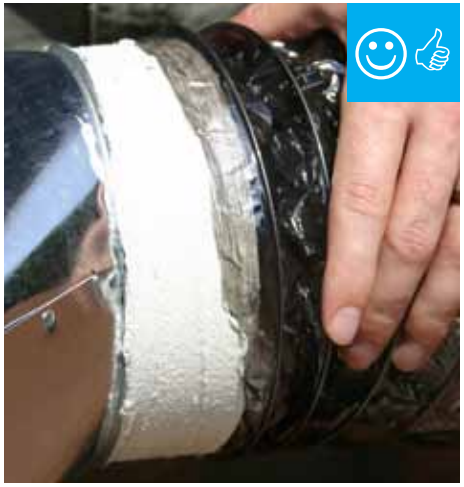
A/B. CFM rating may not meet the performance specification once installed.

Fan CFM rating is higher than the requirement increasing the likelihood that it will meet the performance level once installed.

C. Two exhaust terminations, joined in a roughly cut hole restrictive hole and not air sealed.

Exhaust has been properly installed, sealed, and terminates to outdoors.

D. Exhaust duct only mechanically fastened and not sealed.



Exhaust duct has been mechanically fastened and sealed with mastic.

BATHROOM FAN TESTING TIPS

- Test the bathroom fan after completing a visual inspection of proper fan installation.
- Seal bath fans to the drywall, including conditioned areas. This will ensure air is exhausted from the bathroom and not the plenum.
- Use a flow hood, flow grid, anemometer (in accordance with AABC, NEBB, or ASHRAE procedures) or other equivalent method to test the fan.
- Verify that the control devices of the bathroom fan do not impede occupant control.

If the fan is not pulling enough:

- Verify the exterior termination is operating properly.
- Verify the fan damper swings freely and packing tape is removed.

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

FOOTNOTES

18. The whole-house ventilation air flow and local exhaust air flows shall be measured by the Rater using a flow hood, flow grid, anemometer (in accordance with AABC, NEBB, or ASHRAE procedures), or substantially equivalent method.

24. Per ASHRAE 62.2-2010, an exhaust system is one or more fans that remove air from the building, causing outdoor air to enter by ventilation inlets or normal leakage paths through the building envelope. Examples include bath exhaust fans, range hoods, and clothes dryers.

25. Per ASHRAE 62.2-2010, a bathroom is any room containing a bathtub, shower, spa, or similar source of moisture.

26. An intermittent mechanical exhaust system, where provided, shall be designed to operate as needed by the occupant. Control devices shall not impede occupant control in intermittent systems.

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ENERGY STAR

DETAIL 8.3

If fans share common exhaust duct, back-draft dampers installed

A. Install back-draft dampers on all fans sharing a common exhaust duct.

B. Remove all packing tape from back-draft dampers.

DETAIL 8.4 [29]

Common exhaust duct not shared by fans in separate dwellings

C. Install separate exhaust ducts for separate units.

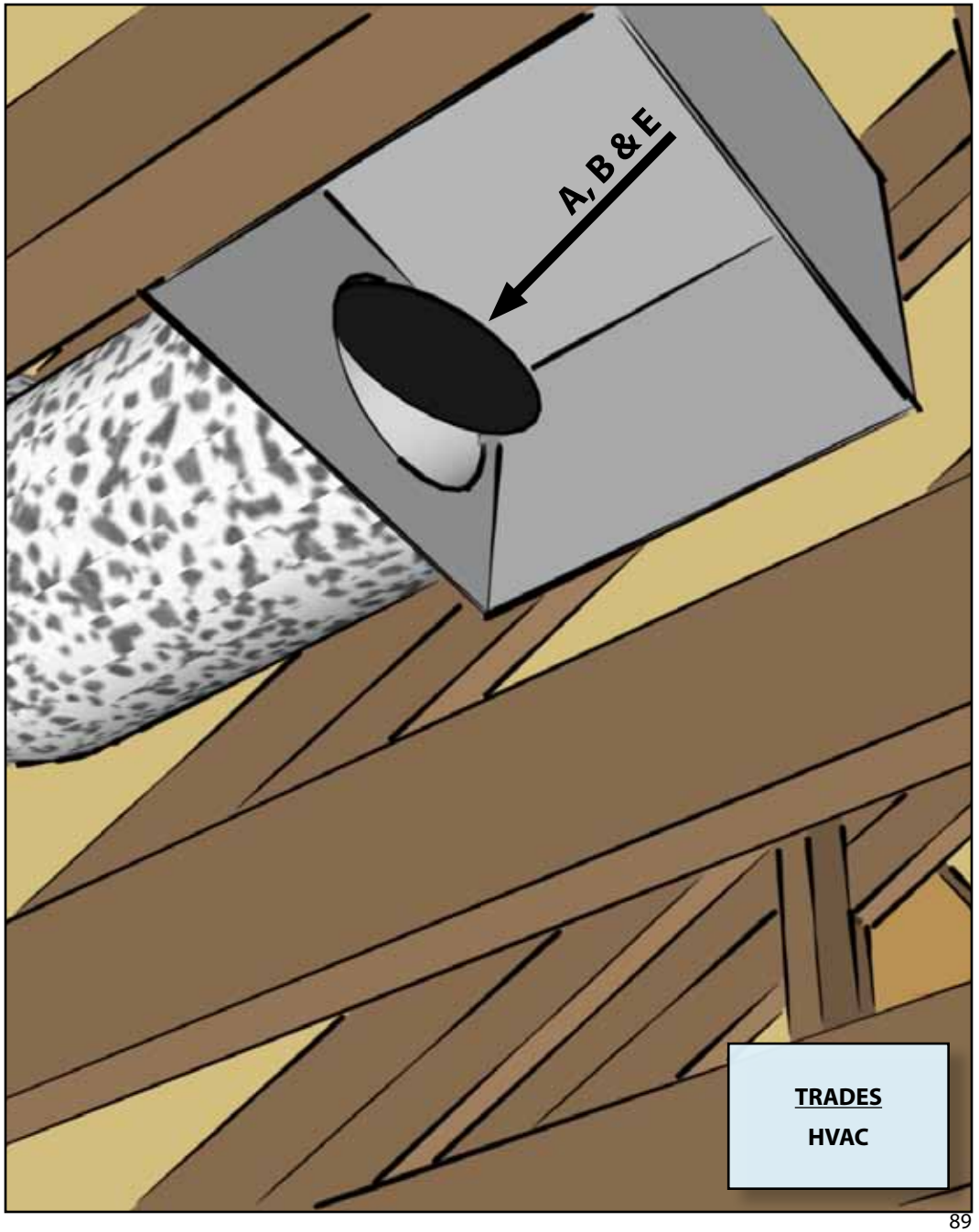
If fans from separate dwellings do share a common exhaust duct, one of the following must apply:

D. The fans must run continuously **OR**

E. Each outlet must have a back-draft damper to prevent cross-contamination when the fan is not running.

FOOTNOTES

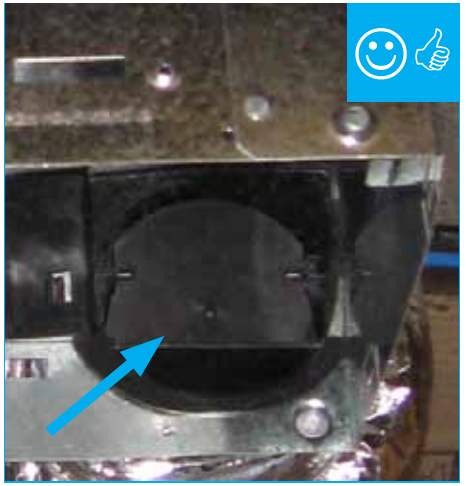
29. Exhaust outlets from more than one dwelling unit may be served by a single exhaust fan if the fan runs continuously or if each outlet has a back-draft damper to prevent cross-contamination when the fan is not running.



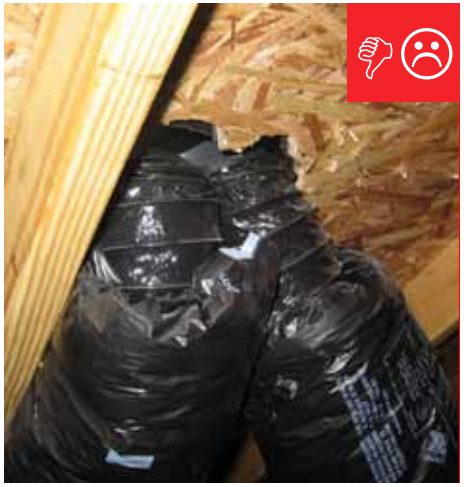
A. Fan shares exhaust and does not have a back-draft damper installed.

Fan shares exhaust and has a back-draft damper installed.

B. Back-draft damper still has a piece of tape that prevented it from rattling during shipping.



Packing tape has been removed and damper will be able to function properly once fan is installed.



C. Fans from separate dwellings exhausted together without back-draft dampers and not sealed.

Separate dwellings with their own separate exhaust terminations.

ENERGY STAR

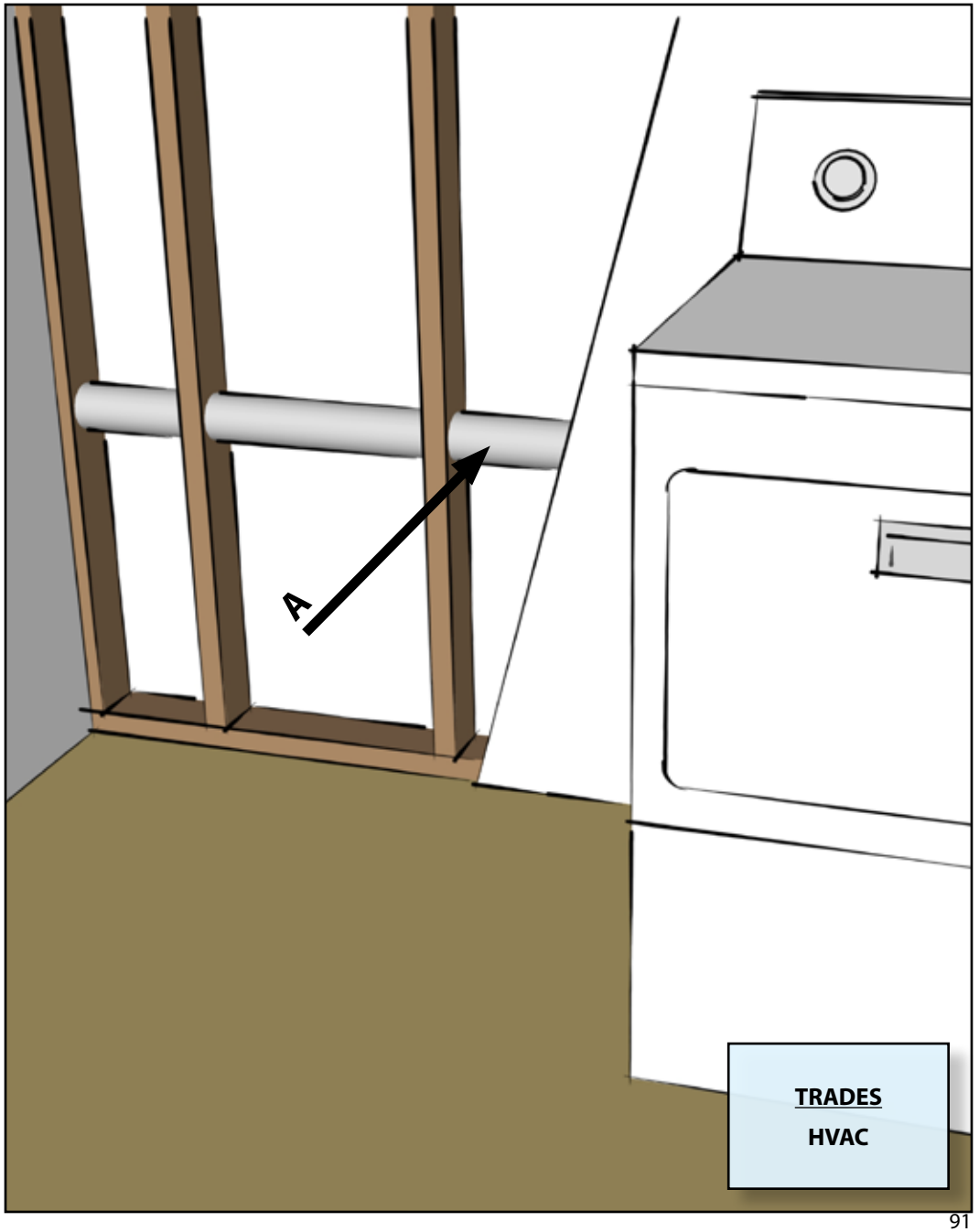
DETAIL 8.5

Clothes dryers vented directly to outdoors, except for ventless dryers equipped with a condensate drain

A. Install dryer ducts to vent directly to the exterior.

CLOTHES DRYER VENTING TIPS

- Do not use devices that remove lint and bring the heat back into the home. This adds unwanted moisture to the house.
- Do not exhaust dryers within 10 ft. of the AC condenser to prevent poor HVAC operations.



8 LOCAL MECHANICAL EXHAUST

5 CLOTHES DRYERS VENTED DIRECTLY TO OUTDOORS

A. Dryer vent is run vertical with a 90 degree bend and does not vent to the outside.

Dryer vents directly to the outdoors.

A. Dryer exhaust line terminates in the crawlspace.

Dryer vents directly to the outdoors.

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

SECTION 9. VENTILATION & EXHAUST FAN RATINGS (EXEMPTIONS FOR HVAC AND REMOTE-MOUNTED FANS)

9.1. Intermittent supply & exhaust fans rated at ≤ 3 sones by manufacturer, unless rated flow ≥ 400 CFM

9.2. Continuous supply & exhaust fans rated at ≤ 1 sone by manufacturer

9.3. Bathroom fans used as part of a whole-house mechanical ventilation system shall be ENERGY STAR qualified; unless rated flow rate ≥ 500 CFM

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ENERGY STAR

DETAIL 9.1 [30, †]

Intermittent supply & exhaust fans rated at ≤ 3 sones by manufacturer, unless rated flow ≥ 400 CFM

A. Install fans rated by the manufacturer at 3 sones or less.

B. If the fan has a rated flow equal to or above 400 CFM, the requirement described in "A" does not apply.

DETAIL 9.2 [30, †]

Continuous supply & exhaust fans rated at ≤ 1 sone by manufacturer

C. Install fans rated by the manufacturer at 1 sones or less.

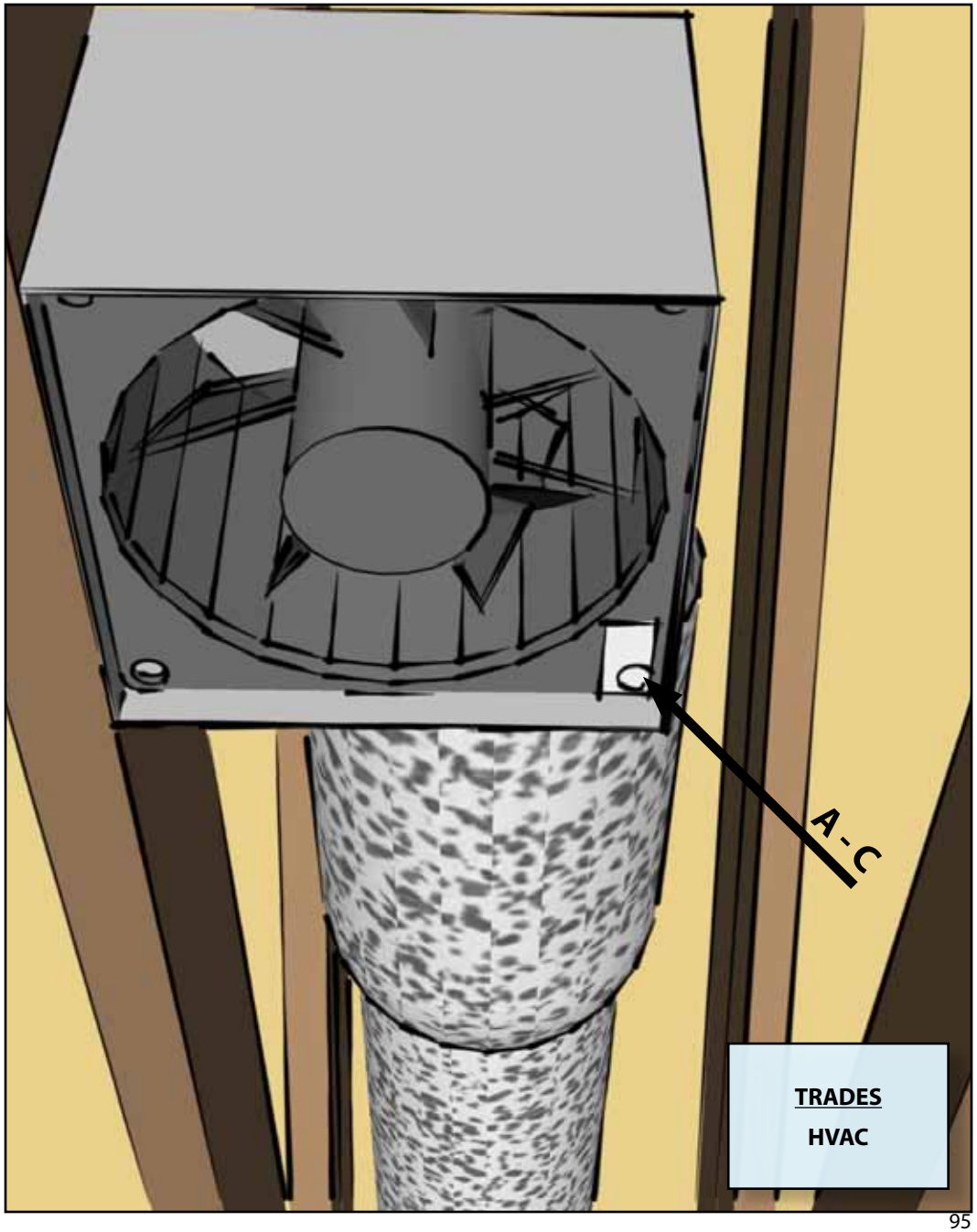
DETAIL 9.3 [30, †]

Bathroom fans used as part of a whole-house mechanical ventilation system shall be ENERGY STAR qualified; unless rated flow rate ≥ 500 CFM

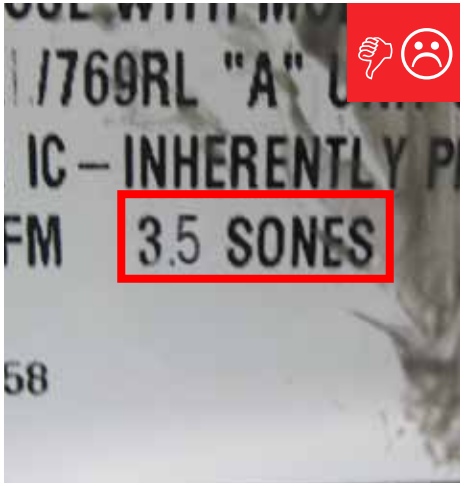
Install ENERGY STAR qualified fans if the fans:

D. Are part of a whole-house mechanical ventilation system

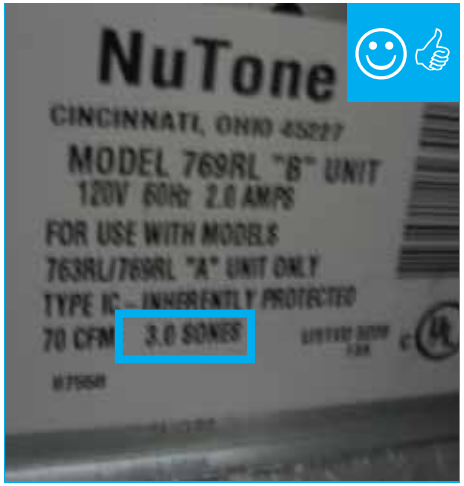
E. Have a flow rate less than 500 CFM



† Footnote located on page 97.

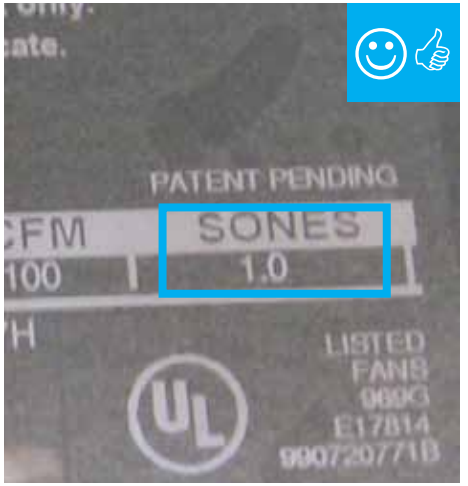


A. Sone rating is greater than 3.0.



Sone rating is 3.0 for this intermittent exhaust fan.

C. Sone rating is greater than 1 on a continuous exhaust fan.



Sone rating is less than or equal to 1 on a continuous exhaust fan.

D./E. The fan does not have an ENERGY STAR label.

The fan has an ENERGY STAR label.

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

FOOTNOTES

30. Fans exempted from this requirement include HVAC air handlers and remote-mounted fans. To be considered for this exemption, a remote-mounted fan must be mounted outside the habitable spaces, bathrooms, toilets, and hallways and there shall be > 4 ft. ductwork between the fan and intake grill. Per ASHRAE 62.2-2010, habitable spaces are intended for continual human occupancy; such space generally includes areas used for living, sleeping, dining, and cooking but does not generally include bathrooms, toilets, hallways, storage areas, closets, or utility rooms.

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HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

SECTION 10. COMBUSTION APPLIANCES

10.1. Furnaces, boilers, and water heaters located within the home's pressure boundary are mechanically drafted or direct-vented to outdoors. As an exception, atmospherically vented equipment is allowed in Climate Zone 1-3. For atmospherically vented furnaces, boilers, and water heaters, the Rater has conducted BPI's or RESNET's combustion safety test procedure and determined that the CO test results are less than 25 ppm and the combustion appliance zone depressurization limit is not exceeded.

10.2. For fireplaces that are not mechanically drafted or direct-vented to outdoors, total net rated exhaust flow of the two largest exhaust fans (excluding summer cooling fans) is ≤15 CFM per 100 sq. ft. of occupiable space when at full capacity or the Rater has verified that the pressure differential is ≤ 5 Pa using BPI's or RESNET's combustion safety test procedure.

10.3. If unvented combustion appliances other than cooking ranges are located inside the home's pressure boundary, the Rater has conducted RESNET's or BPI's combustion safety test procedure and determined that the ambient CO test results are less than 35 ppm.

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ENERGY STAR

DETAIL 10.1 [31, 32, 33 †]

Furnaces, boilers, and water heaters located within the home's pressure boundary are mechanically drafted or direct-vented. As an exception, naturally drafted equipment is allowed in Climate Zone 1-3. For naturally drafted furnaces, boilers, and water heaters, the Rater has followed RESNET or BPI combustion safety test procedures and met the selected standard's limits for depressurization, spillage, draft pressure, and CO concentration in ambient air, as well as a CO concentration in the flue of < 25 ppm.

A. Install mechanically-drafted or direct-vented appliances.

Naturally drafted appliances are acceptable if ALL of the following are true:

B. The house is located in Climate Zones 1-3.

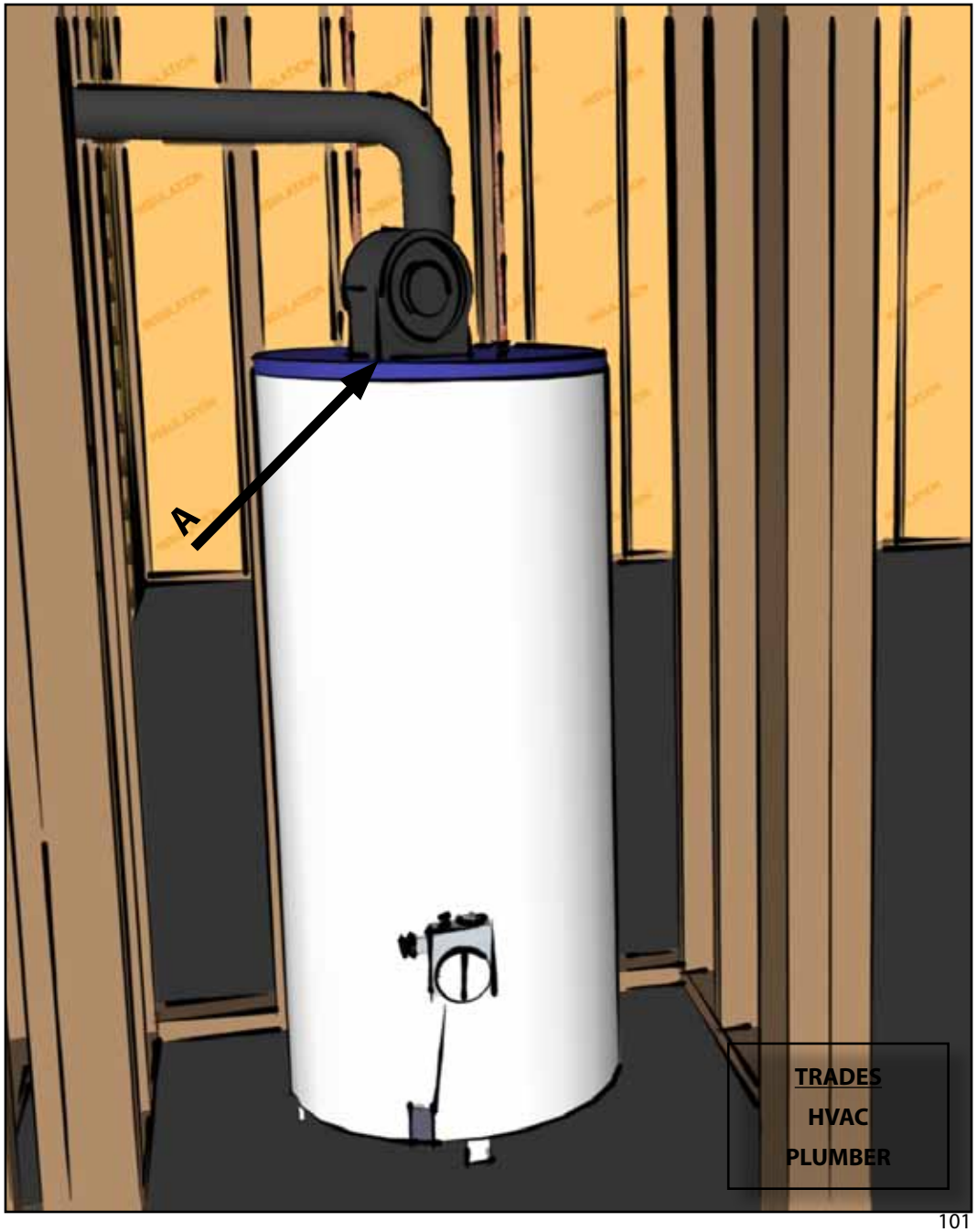
C. The Building Performance Institute (BPI) or RESNET combustion safety test has been performed

D. The CO concentration in the flue is less than 25 ppm and the selected standard's limits for depressurization, spillage, draft pressure and CO concentration in ambient air are met.

† Footnotes located on page 103.

MECHANICALLY DRAFTED / DIRECT VENT APPLIANCES

Per the 2009 International Mechanical Code, a direct-vent appliance is one that is constructed and installed so that all air for combustion is derived from the outdoor atmosphere and all flue gases are discharged to the outside atmosphere; and a mechanical draft system is a venting system designed to remove flue or vent gases by mechanical means consisting of an induced draft portion under non-positive static pressure or a forced draft portion under positive static pressure.



HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

10 COMBUSTION APPLIANCES

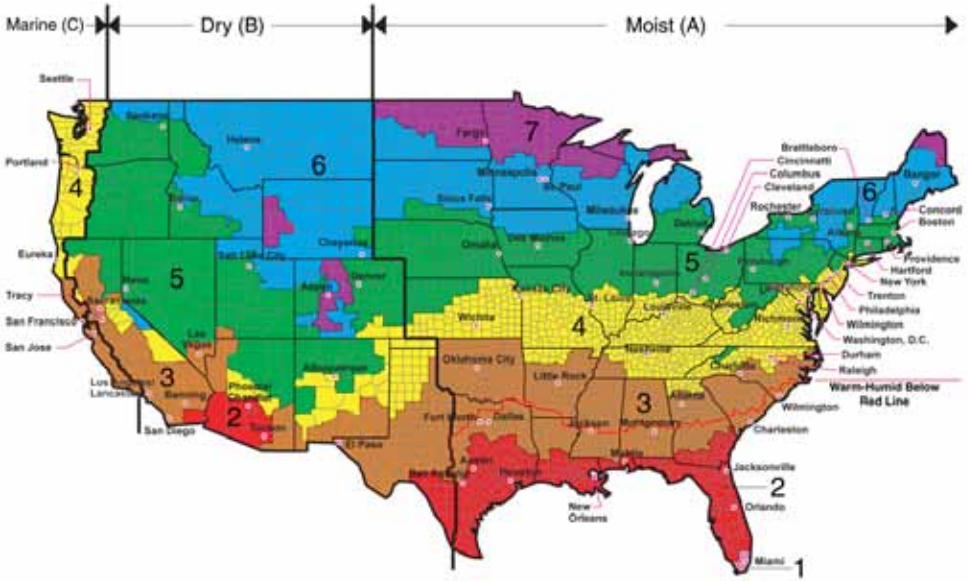
1 APPLIANCES LOCATED WITHIN THE HOME'S PRESSURE BOUNDARY DRAFTED OUTDOORS

A. Naturally drafted heater installed. Requires combustion safety testing.

Direct vent appliance installed.

A. Naturally drafted water heater installed. Requires combustion safety testing.

Power vented water heater installed.



All of Alaska in Zone 7 except for the following Boroughs in Zone 8: Bethel, Dellingham, Fairbanks, N. Star, Nome North Slope, Northwest Arctic, Southeast Fairbanks, Wade Hampton, and Yukon-Koyukuk

Zone 1 includes: Hawaii, Guam, Puerto Rico, and the Virgin Islands

NATURALLY DRAFTED APPLIANCES

All naturally drafted combustion appliances other than fireplaces shall comply with the Building Performance Institute's (BPI's) or RESNET's Combustion Safety Test Procedures.

The pressure boundary is the primary air enclosure boundary separating indoor and outdoor air. For example, a volume that has more leakage to outside than to conditioned space would be outside the pressure boundary.

In alignment with ASHRAE 62.2-2010, these ENERGY STAR guidelines do not address unvented combustion space heaters.

Interactive Map: http://energycode.pnl.gov/EnergyCodeReqs/

ADDITIONAL INFORMATION

For additional information and specific duct testing protocols please refer to RESNET Chapter 8 (Standard for Performance Testing and Work Scope: Enclosure and Air Distribution Leakage Testing).

FOOTNOTES

31. Per the 2009 International Mechanical Code, a direct-vent appliance is one that is constructed and installed so that all air for combustion is derived from the outdoor atmosphere and all flue gases are discharged to the outside atmosphere; a mechanical draft system is a venting system designed to remove flue or vent gases by mechanical means consisting of an induced draft portion under non-positive static pressure or a forced draft portion under positive static pressure; and a natural draft system is a venting system designed to remove flue or vent gases under nonpositive static vent pressure entirely by natural draft.

32. The pressure boundary is the primary air enclosure boundary separating indoor and outdoor air. For example, a volume that has more leakage to outside than to conditioned space would be outside the pressure boundary.

33. Raters shall use either the Building Performance Institute's (BPI's) Combustion Safety Test Procedure for Vented Appliances or RESNET's Interim Guidelines for Combustion Appliance Testing and Writing Work Scope and be BPI-certified or RESNET-accredited to follow the protocol. If using RESNET's protocol to evaluate fireplaces, per Item 10.2, the blower door will not be set to exhaust 300 CFM to simulate the fireplace in operation. The remainder of the protocol for determining worst-case depressurization shall be followed.

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ENERGY STAR

DETAIL 10.2 [24, 32, 33, 34, 35, †]

For fireplaces that are not mechanically drafted or direct-vented to outdoors, total net rated exhaust flow of the two largest exhaust fans (excluding summer cooling fans) is ≤ 15 CFM per 100 sq. ft. of occupiable space when at full capacity or the Rater has verified that the pressure differential is ≤ -5 Pa using BPI's or RESNET's worst-case depressurization test procedure

A. Calculate the total occupiable space of the house.

B. Calculate the net rated exhaust flow of the two largest exhaust fans.

C. Verify the total net rated exhaust flow is less than or equal to 15 CFM per 100 sq. ft. of occupiable space.

† Footnotes located on page 106.

NET FLOW PER SQ. FT. OF OCCUPIABLE SPACE

15 CFM per 100 sq. ft. ≥ ((Largest Fan Rated Flow) CFM + (Second Largest Fan Rated Flow) CFM - (Supply Outdoor Air Intake) CFM) / (Occupiable Space) sq. ft.

The term "net-exhaust flow" is referenced from ASHRAE 62.2-2010 and is defined as the flow through an exhaust system minus the compensating outdoor airflow through any supply system that is interlocked to the exhaust system. If net exhaust flow exceeds the allowable limit, net exhaust flow shall be reduced or compensating outdoor airflow provided.

According to ASHRAE 62.2-2010, occupiable space is any enclosed space inside the pressure boundary and intended for human activities, including, but not limited to, all habitable spaces, toilets, closets, halls, storage and utility areas, and laundry areas.

TRADES

HVAC

FOOTNOTES

24. Per ASHRAE 62.2-2010, an exhaust system is one or more fans that remove air from the building, causing outdoor air to enter by ventilation inlets or normal leakage paths through the building envelope. Examples include bath exhaust fans, range hoods, and clothes dryers.

32. The pressure boundary is the primary air enclosure boundary separating indoor and outdoor air. For example, a volume that has more leakage to outside than to conditioned space would be outside the pressure boundary.

33. Raters shall use either the Building Performance Institute's (BPI's) Combustion Safety Test Procedure for Vented Appliances or RESNET's Interim Guidelines for Combustion Appliance Testing and Writing Work Scope and be BPI-certified or RESNET-accredited to follow the protocol. If using RESNET's protocol to evaluate fireplaces, per Item 10.2, the blower door will not be set to exhaust 300 CFM to simulate the fireplace in operation. The remainder of the protocol for determining worst-case depressurization shall be followed.

34. Per ASHRAE 62.2-2010 and pub. addenda, the term "net-exhaust flow" is defined as flow through an exhaust system minus the compensating outdoor airflow through any supply system that is interlocked to the exhaust system. "Net supply flow" is intended to represent the inverse. If net exhaust flow exceeds allowable limit, it shall be reduced or compensating outdoor airflow provided.

35. Per ASHRAE 62.2-2010, occupiable space is any enclosed space inside the pressure boundary and intended for human activities, including, but not limited to, all habitable spaces, toilets, closets, halls, storage and utility areas, and laundry areas. See footnote 30 for definition of "habitable spaces".

ENERGY STAR

DETAIL 10.3 [36]

If unvented combustion appliances other than cooking ranges are located inside the home's pressure boundary, the Rater has operated the appliance for at least 10 minutes and verified that the ambient CO level does not exceed 35 ppm

FOOTNOTES

36. The minimum volume of combustion air required for safe operation by the manufacturer and/or code shall be met or exceeded. Also, in accordance with the National Fuel Gas Code, ANSI Z223.l/ NFPA54, unvented room heaters shall not be installed in bathrooms or bedrooms.

ADDITIONAL INFORMATION

For additional information and specific duct testing protocols please refer to RESNET Chapter 8 (Standard for Performance Testing and Work Scope: Enclosure and Air Distribution Leakage Testing).

N/A

TRADES

HVAC

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HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

SECTION 11. FILTRATION

11.1. At least one MERV 6 or higher filter installed in each ducted mechanical system

11.2. All return air and mechanically supplied outdoor air pass through filter prior to conditioning

11.3. Filter located and installed so as to facilitate access and regular service by the owner

11.4. Filter access panel includes gasket or comparable sealing mechanism and fits snugly against the exposed edge of filter when closed to prevent bypass

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ENERGY STAR

DETAIL 11.1 [37, †]

At least one MERV 6 or higher filter installed in each ducted mechanical system

Install filters that are:

A. MERV 6 or better.

B. Compatible with the HVAC equipment.

DETAIL 11.2

All return air and mechanically supplied outdoor air pass through filter prior to conditioning

C. Install filters in the proper locations of the HVAC system.

D. Install filters at all outdoor air intakes.

DETAIL 11.3 [38, †]

Filter located and installed so as to facilitate access and regular service by the owner

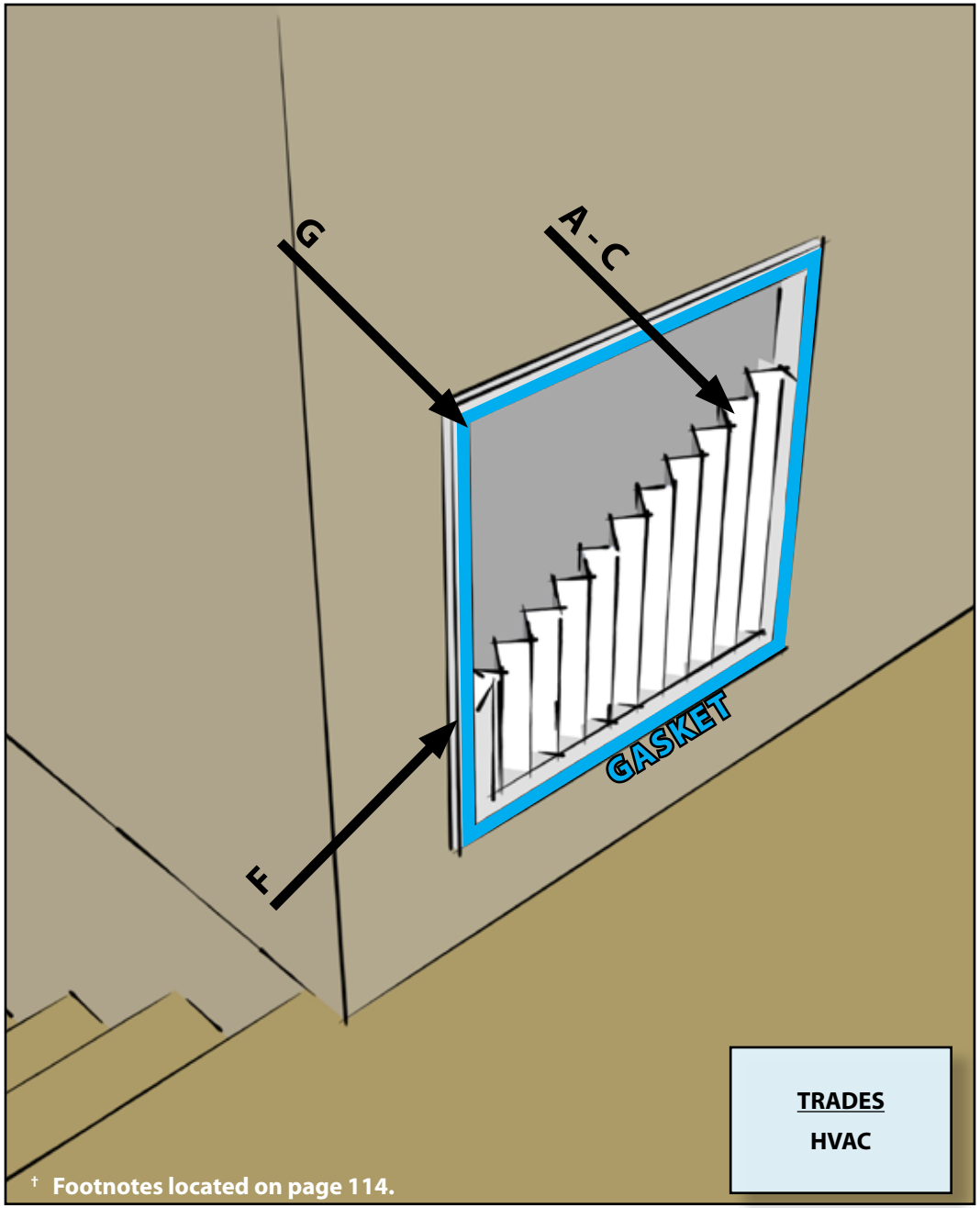
E. If the HVAC equipment is placed in an accessible location, such as a basement, filters should be installed adjacent to the equipment.

F. If the HVAC equipment is placed in an inaccessible location, such as a crawlspace, install filters in an accessible location, such as a return box.

DETAIL 11.4 [39, †]

Filter access panel includes gasket or comparable sealing mechanism and fits snugly against the exposed edge of filter when closed to prevent bypass.

G. Install gaskets or frame to prevent air bypass



TRADES

HVAC

† Footnotes located on page 114.

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

11 FILTRATION

1-2 FILTER SELECTION, LOCATION, ACCESSIBILITY, & GASKET

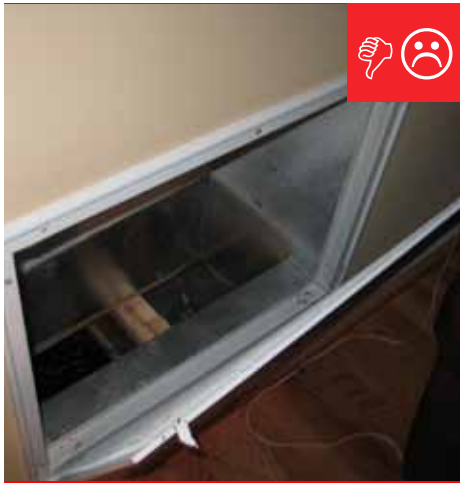
A. The installed filter is not a MERV 6 filter.

The installed filter is at least a MERV 6 filter.

BAD PIC OF INCORRECT FILTER FOR SYSTEM INSTALLED NEEDED

B.

HVAC HOMEOWNER MANUAL SHOWING WHICH FILTER SHOULD BE INSTALLED OR PROPER FILTER INSTALLED NEEDED



C. There is no filter installed in the HVAC system.

GOOD PIC OF MERV 6 OR HIGHER FILTER INSTALLED NEEDED

D. There is no filter installed to filter the outdoor air.

There is a filter installed to filter outdoor air.

BAD PIC OF FILTER LOCATION NEEDED

GOOD PIC OF ACCESSIBLE FILTER LOCATION WITH MERV 6 INSTALLED NEEDED

E.

GOOD PIC OF ACCESSIBLE FILTER LOCATION NEEDED

F. The filter is installed in the crawlspace and is not easily accessible.

GOOD PIC OF GASKET AT FILTER LOCATION NEEDED

G. No gasket at filter location.

MERV DEFINITION

The acronym MERV stands for "Minimum Efficiency Reporting Value". The MERV rating is the standard method for comparing the efficiency of an air filter. The higher the MERV rating, the better the filter is at removing particles from the air.

The MERV scale ranges from 1 (least efficient) to 16 (most efficient), and measures a filter's ability to remove particles from 3 to 10 microns in size. Filters with higher ratings not only remove more particles from the air, they also remove smaller particles. A typical fiberglass furnace filter might be rated from 1 to 4 on the MERV scale.

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

FOOTNOTES

37. Per ASHRAE 62.2-2010, ducted mechanical systems are those that supply air to an occupiable space through duct work exceeding 10 ft. in length and through a thermal conditioning component, except for evaporative coolers. Systems that do not meet this definition are exempt from this requirement. Also, mini-split systems typically do not have MERV-rated filters available for use and are, therefore, also exempted under this version of the guidelines.

38. HVAC filters located in the attic shall be considered accessible to the owner if drop-down stairs provide access to attic and a permanently installed walkway has been provided between the attic access location and the filter.

39. The filter media box (i.e., the component in the HVAC system that houses the filter) may be either site-fabricated by the installer or pre-fabricated by the manufacturer to meet this requirement. These requirements only apply when the filter is installed in a filter media box located in the HVAC system, not when the filter is installed flush with the return grill.

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

ALL FOOTNOTES

1. The HVAC System Quality Installation Rater Checklist is designed to align with the requirements of ASHRAE 62.2-2010 and published addenda and ANSI / ACCA's 5 QI-2010 protocol, thereby improving the performance of HVAC equipment in new homes when compared to homes built to minimum code. However, these features alone cannot prevent all ventilation, indoor air quality, and HVAC problems, for instance those caused by a lack of occupant maintenance. Therefore, this checklist is not a guarantee of proper ventilation, indoor air quality, or HVAC performance. This checklist with supporting documents may also be used to demonstrate compliance with Indoor airPLUS specifications 4.1, 4.2, 4.5, 4.6, and 7.1.

2. The Rater is only responsible for ensuring that the Contractor has completed the Contractor checklist in its entirety and verifying the discrete objective parameters referenced in Section 1 of this checklist, not for assessing the accuracy of the load calculations or field verifications included or to verify the accuracy of every input on the Contractor checklist.

3. *For homes with a date of final inspection through 12/31/2012*: Item 1.2.1 is permitted to be within +/- 5 degrees of the 1% and 99% ACCA Manual J design temperatures for the contractor-designated design location. In addition, for each house plan with multiple configurations (e.g., orientations, elevations, options), the Rater shall confirm that the parameters listed in Items 1.2.2 to 1.2.6 are aligned with either: the rated home or with the plans for the configuration used to calculate the loads, as provided by the contractor.

   For homes with a date of final inspection on or after 01/01/2013: Item 1.2.1 shall match the 1% and 99% ACCA Manual J design temperatures for the contractor-designated design location. In addition, for each house plan with multiple configurations (e.g., orientations, elevations, options), the Rater shall confirm that the parameters listed in Items 1.2.2 to 1.2.6 are aligned with the rated home.

4. The Rater shall either confirm that the contractor selected the geographically closest available location or collect from the contractor a justification for the selected location. The Rater need not evaluate the legitimacy of the justification to qualify the home.

5. The number of occupants among all HVAC systems in the home shall be equal to the number of RESNET-defined bedrooms plus one. Occupants listed for systems for which the header of the contractor checklist indicates that it is designed to handle temporary occupant loads, as defined in Footnote 3 of the HVAC System Quality Installation Contractor Checklist, shall be permitted to exceed this limit.

6. "Predominant" is defined as the SHGC value used in the greatest amount of window area in the home.

7. For cooling systems, the next largest nominal piece of equipment may be used that is available to satisfy the latent and sensible requirements. Single-speed systems generally have OEM nominal size increments of ½ ton. Multi-speed or multi-stage equipment may have OEM nominal size increments of one ton. Therefore, the use of these advanced system types can provide extra flexibility to meet the equipment sizing requirements.

8. In cases where the condenser unit is installed after the time of inspection by the Rater, the HVAC manufacturer and model numbers on installed equipment can be documented through the use of photographs provided by the HVAC Contractor after installation is complete.

9. If contractor has indicated that an OEM test procedure has been used in place of a sub-cooling or super-heat process and documentation has been attached that defines this procedure, then the box for "n/a" shall be checked for this item.

10. Kinks are to be avoided and are caused when ducts are bent across sharp corners such as framing members. Sharp bends are to be avoided and occur when the radius of the turn in the duct is less than one duct diameter.

11. Ducts shall not include coiled or looped duct work except to the extent needed for acoustical control. Balancing dampers or proper duct sizing shall be used instead of loops to limit flow to diffusers. When balancing dampers are used, they shall be located at the trunk to limit noise unless the trunk will not be accessible when the balancing process is conducted. In such cases, Opposable Blade Dampers (OBD) or dampers that are located in the duct boot are permitted.

12. *For homes with a date of final inspection through 12/31/2012*: Homes are permitted to be qualified without enforcement of this item to provide architects and designers with additional time to integrate these features into their homes.

    For homes with a date of final inspection on or after 01/01/2013: Homes shall meet this item to be qualified.

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

13. For HVAC system with multi-speed fans, the highest design fan speed shall be used when verifying this requirement.

14. EPA recommends, but does not require, that all metal ductwork not encompassed by Section 3 (e.g., exhaust ducts, duct boots, ducts in conditioned space) also be insulated and that insulation be sealed to duct boots to prevent condensation.

15. Duct leakage shall be determined and documented by a Rater using a RESNET-approved testing protocol only after all components of the system have been installed (e.g., air handler and register grilles). Leakage limits shall be assessed on a per-system, rather than per-home, basis. Testing of duct leakage to the outside can be waived if all ducts & air handling equipment are located within the home's air and thermal barriers AND envelope leakage has been tested to be less than or equal to half of the Prescriptive Path infiltration limit for the Climate Zone where the home is to be built.

16. For all homes that have less than 1,200 sq. ft. of conditioned floor area (CFA), total measured duct leakage shall be ≤ 8 CFM25 per 100 sq. ft. of CFA and measured duct leakage to outdoors shall be ≤ 5 CFM25 per 100 sq. ft. of CFA.

17. If total duct leakage is ≤ 4 CFM25 per 100 sq. ft. of conditioned floor area, or ≤ 5 CFM25 per 100 sq. ft. of conditioned floor area for homes that have less than 1,200 sq. ft. of conditioned floor area, then leakage to outdoors need not be tested.

18. The whole-house ventilation air flow and local exhaust air flows shall be measured by the Rater using a flow hood, flow grid, anemometer (in accordance with AABC, NEBB, or ASHRAE procedures), or substantially equivalent method.

19. In cases where the condenser unit is installed after the time of inspection by the Rater, the Rater is exempt from verifying Item 6.2 when the condenser is for an AC unit and also Item 6.3 when the condenser is for a heat pump unit.

20. To prevent potential equipment damage, the Rater shall not conduct this test if the outdoor temperature is < 55°F or, if known, below the manufacturer-recommended minimum operating temperature for the cooling cycle. When this occurs, the Rater shall mark 'N/A' on the checklist for this item.

21. The outlet and inlet of balanced ventilation systems shall meet these spacing requirements unless manufacturer instructions indicate that a smaller distance may be used. However, if this occurs the manufacturer's instructions shall be collected for documentation purposes.

22. EPA will permit the use of reduced ventilation air inlet heights in North Carolina. The minimum required height in North Carolina for Climate Zone 4 will be reduced from 4 feet to 2 feet and in Climate Zone 5 from 4 feet to 2.5 feet based on historical snowfall data for this state. Note that EPA is evaluating the potential to reduce inlet heights in other regions based upon historical snowfall data.

23. Without proper maintenance, ventilation air inlet screens often become filled with debris. Therefore, EPA recommends, but does not require, that these ventilation air inlets be located so as to facilitate access and regular service by the owner.

24. Per ASHRAE 62.2-2010, an exhaust system is one or more fans that remove air from the building, causing outdoor air to enter by ventilation inlets or normal leakage paths through the building envelope. Examples include bath exhaust fans, range hoods, and clothes dryers.

25. Per ASHRAE 62.2-2010, a bathroom is any room containing a bathtub, shower, spa, or similar source of moisture.

26. An intermittent mechanical exhaust system, where provided, shall be designed to operate as needed by the occupant. Control devices shall not impede occupant control in intermittent systems.

27. Kitchen volume shall be determined by drawing the smallest possible rectangle on the floor plan that encompasses all cabinets, pantries, islands, and peninsulas and multiplying by the average ceiling height for this area. Cabinet volume shall be included in the kitchen volume calculation.

28. If the flow rate of the selected exhaust fan is less than 5 ACH, based on kitchen volume, then a vented range hood or appliance-range hood combination is required rather than a remote fan that is not integral to the range. Also, for intermittent kitchen exhaust fans that are integrated with microwaves, a rated air flow rate that is ≥ 200 CFM may be used in lieu of measuring the actual air flow rate.

29. Exhaust outlets from more than one dwelling unit may be served by a single exhaust fan if the fan runs continuously or if each outlet has a back-draft damper to prevent cross-contamination when the fan is not running.

HVAC SYSTEM QUALITY INSTALLATION RATER CHECKLIST

30. Fans exempted from this requirement include HVAC air handlers and remote-mounted fans. To be considered for this exemption, a remote-mounted fan must be mounted outside the habitable spaces, bathrooms, toilets, and hallways and there shall be > 4 ft. ductwork between the fan and intake grill. Per ASHRAE 62.2-2010, habitable spaces are intended for continual human occupancy; such space generally includes areas used for living, sleeping, dining, and cooking but does not generally include bathrooms, toilets, hallways, storage areas, closets, or utility rooms).

31. Per the 2009 International Mechanical Code, a direct-vent appliance is one that is constructed and installed so that all air for combustion is derived from the outdoor atmosphere and all flue gases are discharged to the outside atmosphere; a mechanical draft system is a venting system designed to remove flue or vent gases by mechanical means consisting of an induced draft portion under non-positive static pressure or a forced draft portion under positive static pressure; and a natural draft system is a venting system designed to remove flue or vent gases under nonpositive static vent pressure entirely by natural draft.

32. The pressure boundary is the primary air enclosure boundary separating indoor and outdoor air. For example, a volume that has more leakage to outside than to conditioned space would be outside the pressure boundary.

33. Raters shall use either the Building Performance Institute's (BPI's) Combustion Safety Test Procedure for Vented Appliances or RESNET's Interim Guidelines for Combustion Appliance Testing and Writing Work Scope and be BPI-certified or RESNET-accredited to follow the protocol. If using RESNET's protocol to evaluate fireplaces, per Item 10.2, the blower door will not be set to exhaust 300 CFM to simulate the fireplace in operation. The remainder of the protocol for determining worst-case depressurization shall be followed.

34. Per ASHRAE 62.2-2010 and pub. addenda, the term "net-exhaust flow" is defined as flow through an exhaust system minus the compensating outdoor airflow through any supply system that is interlocked to the exhaust system. "Net supply flow" is intended to represent the inverse. If net exhaust flow exceeds allowable limit, it shall be reduced or compensating outdoor airflow provided.

35. Per ASHRAE 62.2-2010, occupiable space is any enclosed space inside the pressure boundary and intended for human activities, including, but not limited to, all habitable spaces, toilets, closets, halls, storage and utility areas, and laundry areas. See footnote 30 for definition of "habitable spaces".

36. The minimum volume of combustion air required for safe operation by the manufacturer and/or code shall be met or exceeded. Also, in accordance with the National Fuel Gas Code, ANSI Z223.l/NFPA54, unvented room heaters shall not be installed in bathrooms or bedrooms.

37. Per ASHRAE 62.2-2010, ducted mechanical systems are those that supply air to an occupiable space through duct work exceeding 10 ft. in length and through a thermal conditioning component, except for evaporative coolers. Systems that do not meet this definition are exempt from this requirement. Also, mini-split systems typically do not have MERV-rated filters available for use and are, therefore, also exempted under this version of the guidelines.

38. HVAC filters located in the attic shall be considered accessible to the owner if drop-down stairs provide access to attic and a permanently installed walkway has been provided between the attic access location and the filter.

39. The filter media box (i.e., the component in the HVAC system that houses the filter) may be either site-fabricated by the installer or pre-fabricated by the manufacturer to meet this requirement. These requirements only apply when the filter is installed in a filter media box located in the HVAC system, not when the filter is installed flush with the return grill.

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