

IECC Residential IECC:

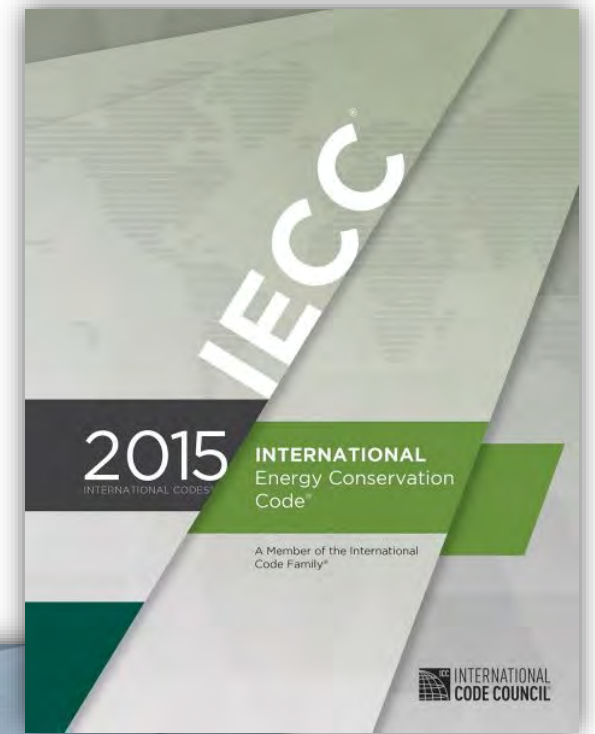
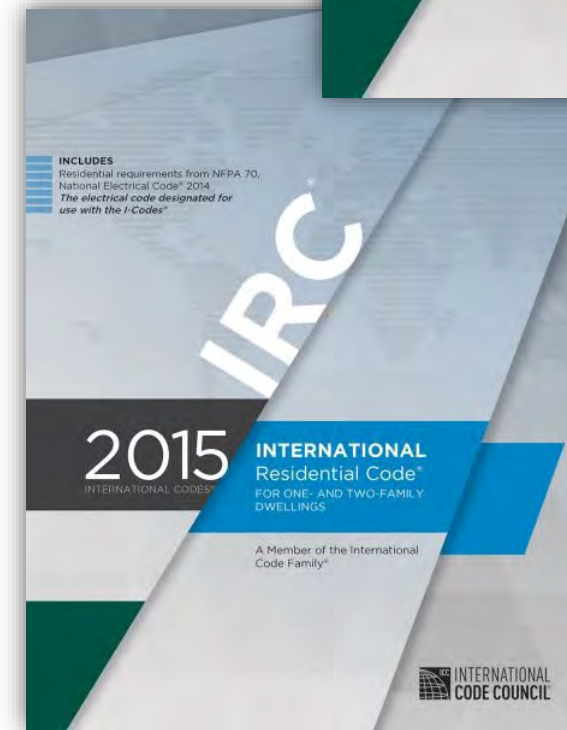
Virtual Field Trip

Energy Inspections



ENERGY INSTITUTE

INVESTING IN THE ENERGY WORKFORCE



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Energy/Mechanical Specialist



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Funding & Support for Energy Code Training




Big Thank You to James Jonsson at Ivory for allowing me to walk through several homes taking pictures for this field trip
Serious violations in this presentation are not from Ivory Projects.

Residential IECC Field Inspections

- Code sections referenced are from the 2015 IECC Residential Provisions. Identical requirements are found in the 2015 IRC Chapter 11
- Example **IECC R403.3 Ducts** aligns with **IRC N1103.3**
- See the Energy Code Guide for Residential Projects in Utah with amendments

[https://utahenergycode.com/wp-content/uploads/Residential Energy Code QR Guide-Updated-4-11-19.pdf](https://utahenergycode.com/wp-content/uploads/Residential_Energy_Code_QR_Guide-Updated-4-11-19.pdf)

Energy Code Guide for Residential Projects in Utah



2015 International Energy Conservation Code (IECC)

Utah Amended Sections in Red text

R401.2 Compliance Options

1. 2015 Prescriptive Table R402.1.2
2. Total UA Alternative – 2015 REScheck – R402.1.5
3. Simulated Performance Alternative – R405
4. ERI (Energy Rating Index) – HERs Score – R406
5. **2012 Utah REScheck – pass rate of 3% better than code, increasing to 4% on Jan. 1, 2019 and 5% on Jan. 1, 2021**

R103.2 Construction Documents
U-factors, R-value and other pertinent data must be **shown and identical** on plans, energy compliance reports, and HVAC design documents. **Construction documents include all documentation required to be submitted in order to issue a building permit.**


R202 Definitions
CONTINUOUS AIR BARRIER. A combination of materials and assemblies that resist or prevent the passage of air through the building thermal envelope.

CONTINUOUS INSULATION (ci). Insulating material that is continuous across all structural members penetrated only with fasteners and service openings. – Attic insulation in trusses is cavity, not ci.

CAVITY INSULATION. Insulation installed between wood studs, metal framing, channels, or z-clips.

RESIDENTIAL BUILDING. One and two family dwellings, townhouses, and Group R-2, R-3 and R-4 buildings, 3 stories or less in height above grade plane.

R301.1 Utah Climate Zones by County



R401.3 Certificate
Permanent certificate listing performance values, factors, and ratings for all building thermal envelope components, shall be posted in approved location.

Prescriptive Table R402.1.2

Climate Zone and Subtype	3 - B	5 - B	6 - B
Crawl Space Wall R-value*	5/13	15/19*	15/19*
Fenestration U-factor*	0.35	0.32	0.32
Skylight U-factor*	0.55	0.55	0.55
Glazed SHGC Fenestration*	0.25	NR	NR
Ceiling R-value	38	49	49
Wood Frame Wall R-value*	20 or 13+5	20 or 13+5	20+5 or 13+10

Mass Wall R-value*	8/13	13/17	15/20
Floor R-value	19	30	30
Basement Wall R-value*	5/13	15/19	15/19
Slab R-value* and depth (Add R-5 if heated slab)	0	10-2'	10-4'

*See footnotes in 2015 IECC.

R402.2.4 Access Hatches and Doors

- Must be weather stripped.
- Attic hatch must have insulation of required R-value attached to the panel.
- Insulation dam required around access opening.
- Vertical access doors must meet fenestration requirements - Table R402.1.2.

R402.4 Air Leakage
The components of the Building Thermal Envelope as listed in Table R402.1.1 shall be installed in accordance with the manufacturer's instructions.

R402.4.1 Building Thermal Envelope
Comply with all items in Table 402.4.1.1 OR Blower Door Test per R402.4.1.2.

1st Option

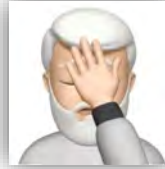
R402.4.1.1 Air Barrier and Insulation Installation and Inspection per Table R402.4.1.1.

Table R402.4.1.1 Summary

- Insulation and air barriers installed in accordance with manufacturer's instructions.
- Continuous air barrier installed at the building thermal envelope.

Inspection Step One – Identify Compliance Option Selected

- Too often hear someone say: “We don’t review energy in the office, we leave it up to the inspector.”
- This simply doesn’t work!
- Inspection verifies compliance with a completed plan review
- Five options
- REScheck is not mandatory
- REScheck and Prescriptive do NOT address air barriers, blower door testing, duct insulation or testing & several other mandatory requirements
- Mandatory requirements apply to all 5 options



Utah Amended Sections in Red text

R401.2 Compliance Options

1. 2015 Prescriptive Table R402.1.2
2. Total UA Alternative – 2015 REScheck - R402.1.5
3. Simulated Performance Alternative – R405
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5. 2012 Utah REScheck – pass rate of 3% better than code, increasing to 4% on Jan. 1, 2019 and 5% on Jan. 1, 2021

With each path, plans should include proposed R-values, U-factors, SHGCs, HVAC design, and mandatory requirements identified

Insulation and Fenestration - Requirements by Climate Zone

2015 Prescriptive Table - no amendments- enclosed values are all improvements

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^{b, e}	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE ⁱ	FLOOR R-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWL SPACE ^c WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.35	0.55	0.25	38	20 or 13+5 ^h	8/13	19	5/13 ^f	0	5/13
4 except Marine	0.35	0.55	0.40	49	20 or 13+5 ^h	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5 ^h	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.32	0.55	NR	49	20+5 or 13+10 ^h	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.32	0.55	NR	49	20+5 or 13+10 ^h	19/21	38 ^g	15/19	10, 4 ft	15/19

For SI: 1 foot = 304.8 mm.

a. R-values are minimums. U-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed R-value of the insulation shall not be less than the R-value specified in the table.

b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in climate zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.

c. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

d. R-5 shall be added to the required slab edge R-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Climate Zones 1 through 3 for heated slabs.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. The first value is cavity insulation, the second value is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. The second R-value applies when more than half the insulation is on the interior of the mass wall.

j. Log walls complying with ICC400 and with a minimum average wall thickness of 5" or greater shall be permitted in Zones 5-6 when overall window glazing is 0.31 U-factor or lower, minimum heating equipment efficiency is 90 AFUE (gas) or 84 AFUE (oil), and all other requirements met.



Prescriptive Option in Guide Includes Only Utah CZs

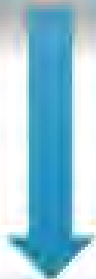
Prescriptive Table **R402.1.2**

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Glazed SHGC Fenestration*	0.25	NR	NR
Ceiling R-value	38	49	49
Wood Frame Wall R-value*	20 or 13+5	20 or 13+5	20+5 or 13+10

Mass Wall R-value*	8/13	13/17	15/20
Floor R-value	19	30	30
Basement Wall R-value*	5/13	15/19	15/19
Slab R-value* and depth (Add R-5 if heated slab)	0	10-2'	10-4'

*See footnotes in 2015 IECC

PRESCRIPTIVE
UA- Trade-off
2015
REScheck



- U-factor (tradeoffs within individual components)
- UA (tradeoffs between components)



REScheck Software Version 4.6.5

Compliance Certificate

Project

Energy Code: **2015 IECC**
 Location: **South Salt Lake, Utah**
 Construction Type: **Single-family**
 Project Type: **New Construction**
 Orientation: **Bldg. faces 0 deg. from North**
 Conditioned Floor Area: **2,000 ft²**
 Glazing Area: **18%**
 Climate Zone: **5 (5765 HDD)**
 Permit Date:
 Permit Number:

2018 IECC?

Construction Site:

Owner/Agent:

Designer/Contractor:

Compliance: Passes using UA trade-off


Compliance: **6.5% Better Than Code** Maximum UA: **201** Your UA: **188**

The % Better or Worse Than Code Index reflects how close to compliance the house is based on code trade-off rules. It DOES NOT provide an estimate of energy use or cost relative to a minimum-code home.

Envelope Assemblies

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	1,000	49.0	0.0	0.026	26
Wall 1: Wood Frame, 16" o.c. Orientation: Front	300	19.0	0.0	0.060	14
Window 1: Vinyl Frame:Double Pane Orientation: Front	40			0.320	13
Door 1: Solid Orientation: Front	21			0.200	4
Wall 2: Wood Frame, 16" o.c. Orientation: Right side	300	19.0	0.0	0.060	18



**RESNET**
RESIDENTIAL ENERGY SERVICES NETWORK

Procedures for Verification of International Energy Conservation Code (IECC) Performance Path Calculation Tools

RESNET Publication No. 003-14


March, 2014

Published by:

Residential Energy Services Network, Inc.
P.O. Box 4561
Oceanside, CA 92052-4561
<http://resnet.us/>

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Compliance Forms | International Energy Conservation Code | VE 2018.1.0.0

**INTEGRATED ENVIRONMENTAL SOLUTIONS**

International Energy Conservation Code (IECC)

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Project Name: Warehouse
Contact Person: Liam Buckley | Email: Liam.Buckley@iesve.com | Telephone: 6178406101

Energy Results

End Use	Energy Type	Proposed Building		Standard Reference Building		Proposed/Standard Ref Energy (%)
		Energy (kBtu/yr)	Peak (kBtu/h)	Energy (kBtu/yr)	Peak (kBtu/h)	
Lighting - conditioned	Electricity	270,197.2	95.3	367,406.1	135.9	30.3%
Lighting - unconditioned	Electricity	8,281.6	1.7	12,008.0	2.0	31.0%
Space Heating	Gas	624,366.5	480.5	1,278,388.5	827.6	51.2%
Space Heating	Electricity	197,193.8	125.0	393,220.6	201.5	49.9%
Space Cooling	Electricity	49,506.7	130.8	78,782.1	217.9	36.4%
Heat Rejection	Electricity	405.5	5.4	536.5	2.3	24.7%
Pumps	Electricity	2,720.4	10.9	4,753.8	18.2	42.8%
Fans Interior	Electricity	74,900.7	28.9	47,458.4	15.6	-57.8%
Receptacle Equipment	Electricity	85,939.3	30.4	85,939.3	30.4	0.0%
Office Equipment	Electricity	38,127.6	11.7	38,127.6	11.7	0.0%
Elevators Escalators	Electricity	296,903.8	34.1	296,903.8	34.1	0.0%
Total building consumption		1,649,543.1		2,625,527.0		37.2%

Energy and Cost Summary by Fuel Type

	Proposed Building		Standard Reference Building		Proposed/Standard Reference	
	Energy (kBtu/yr)	Cost (\$/yr)	Energy (kBtu/yr)	Cost (\$/yr)	Energy (%)	Cost (%)
Electricity	1,026,176.8	153,776.5	1,347,138.5	202,070.8	23.9%	23.9%
Gas	624,366.5	31,219.3	1,278,388.5	83,919.4	51.2%	51.2%
Total ex Onsite Generation	1,649,543.1	184,994.8	2,625,527.0	286,000.2	37.2%	30.5%
Elec Gen PV	-146,050.7	-21,907.6	0	0	0%	0%
Total inc Onsite Generation	1,503,492.4	163,087.2	2,625,527.0	286,000.2	42.7%	38.7%

* These results use assumptions for showing compliance during a typical year; actual energy costs may be substantially different.

Notes

The results are based on 8760 simulated hours
1 Rooms included in the unmet load hours check


Integrated Environmental Solutions

Virtual Environment 2018.1.0.0



Allows An Equipment Trade-off

This method does NOT provide efficiencies equal to other methods – the pass rate should be closer to 10% to be equal



REScheck Software Version 4.6.5
Compliance Certificate

Project

Energy Code: Utah Energy Conservation Code
Location: South Salt Lake, Utah
Construction Type: Single-family
Project Type: New Construction
Orientation: Bldg. faces 0 deg. from North
Conditioned Floor Area: 2,000 ft2
Glazing Area: 18%
Climate Zone: 5 (5765 HDD)
Permit Date:
Permit Number:

Construction Site: Owner/Agent: Designer/Contractor:

Compliance: Passes using UA trade-off

Compliance: **14.9% Better Than Code** Maximum UA: **221** Your UA: **188**

The % Better or Worse Than Code Index reflects how close to compliance the house is based on code trade-off rules. It DOES NOT provide an estimate of energy use or cost relative to a minimum-code home.

Envelope Assemblies

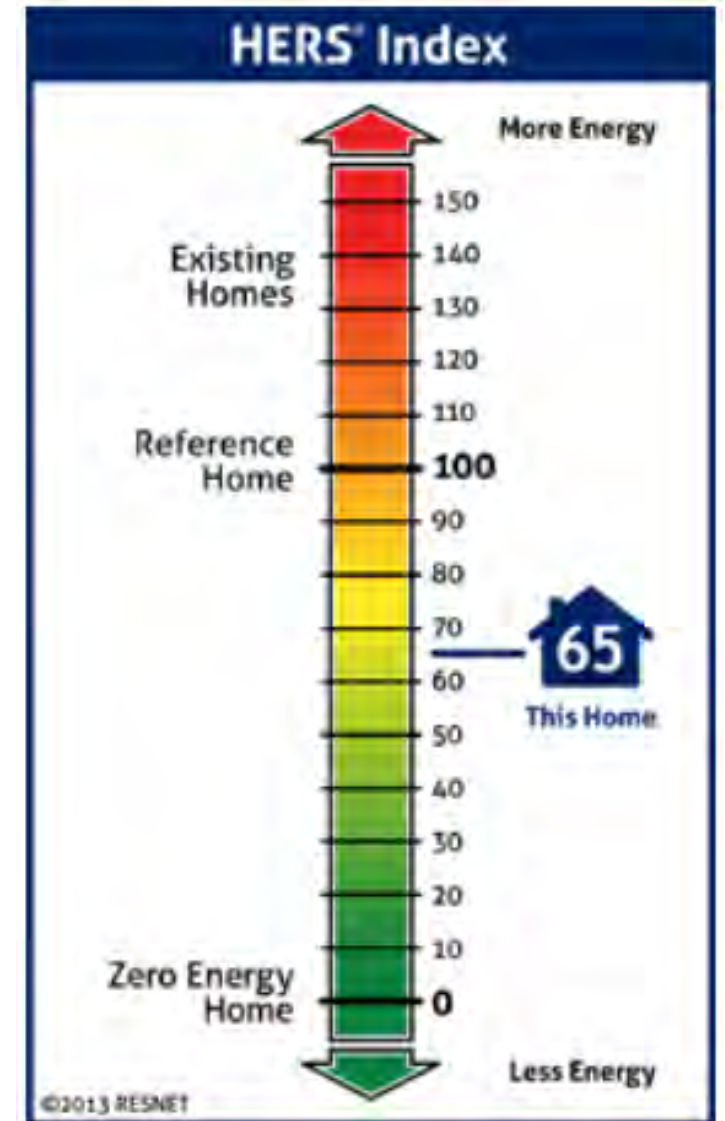
Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	1,000	49.0	0.0	0.026	26
Wall 1: Wood Frame, 16" o.c. Orientation: Front	300	19.0	0.0	0.060	14
Window 1: Vinyl Frame:Double Pane Orientation: Front	40			0.320	13
Door 1: Solid Orientation: Front	21			0.200	4
Wall 2: Wood Frame, 16" o.c. Orientation: Right side	300	19.0	0.0	0.060	18
Wall 3: Wood Frame, 16" o.c. Orientation: Left side	300	19.0	0.0	0.060	17
Window 4: Vinyl Frame:Double Pane Orientation: Left side	20			0.320	6
Wall 4: Wood Frame, 16" o.c. Orientation: Back	208	19.0	0.0	0.060	8

**NEW 2015
ENERGY
RATING INDEX
(ERI)**

ERI (HERS)
Compliance
Alternative
R406

**TABLE R406.4
MAXIMUM ENERGY RATING INDEX**

CLIMATE ZONE	ENERGY RATING INDEX
1	52
2	52
3	65
4	54
5	69
6	68
7	53
8	53



IECC R103.2 – Construction Documents

R103.2 Construction Documents

U-factors, R-value and other pertinent data must be shown and identical on plans, energy compliance reports, and HVAC design documents. **Construction documents include all documentation required to be submitted in order to issue a building permit.**

Documents Included:


- REScheck Option
- REScheck Checklist
- Certificate
- Manual J, D, & S



REScheck or Other Option

Use as Basis of Inspection

- Prescriptive Option requires table values
- Other Options may have weaker & stronger values in some areas
 - Less attic insulation
 - Less or no slab edge
 - Better windows
 - Better attic insulation

 **REScheck Software Version 4.6.5**
Compliance Certificate

Project Clairemont (Traditional)

Energy Code: **Utah Energy Conservation Code**
Location: **West Jordan, Utah**
Construction Type: **Single-family**
Project Type: **New Construction**
Orientation: **Bldg. faces 180 deg. from North**
Conditioned Floor Area: **3,546 ft²**
Glazing Area: **12%**
Climate Zone: **5 (5799 HDD)**
Permit Date:
Permit Number:

Construction Site: Lot 60 Hyde Point
7112 W Lexi Loop Lane
West Jordan, UT

Owner/Agent: Ivory Homes
978 East Woodoak Lane
Salt Lake City, UT 84117
(801) 747-7000

Designer/Contractor:

Compliance: Passes using UA trade-off

Compliance: **10.0% Better Than Code** Maximum UA: **450** Your UA: **405**
The % Better or Worse Than Code Index reflects how close to compliance the house is based on code trade-off rules.
It DOES NOT provide an estimate of energy use or cost relative to a minimum-code home.


Envelope Assemblies

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	1,638	38.0	0.0	0.030	49
Wall 1: Wood Frame, 16" o.c. Orientation: Front	721	23.0	0.0	0.055	33
Window 1: Vinyl Frame:Double Pane Orientation: Front	85			0.300	26
Door 1: Solid Orientation: Front	38			0.160	6
Wall 2: Wood Frame, 16" o.c. Orientation: Left side	768	23.0	0.0	0.055	41
Window 2: Vinyl Frame:Double Pane Orientation: Left side	20			0.300	6
Wall 3: Wood Frame, 16" o.c. Orientation: Back	721	23.0	0.0	0.055	31
Window 3: Vinyl Frame:Double Pane Orientation: Back	162			0.300	49
Wall 4: Wood Frame, 16" o.c. Orientation: Right side	768	23.0	0.0	0.055	42
Window 4: Vinyl Frame:Double Pane Orientation: Right side	8			0.300	2

Report date: 01/14/20
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Project Title: Clairemont (Traditional)
Project Path: Clairemont (Utah 2012).rck

Ok to use REScheck Inspection checklist as a general guide for any Compliance Option – 5+ pages

 **REScheck Software Version 4.6.5**
Inspection Checklist
Energy Code: Utah Energy Conservation Code

Requirements: 0.0% were addressed directly in the REScheck software
Text in the "Comments/Assumptions" column is provided by the user in the REScheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req.ID	Pre-Inspection/Plan Review	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
103.1, 103.2 [PR1] ¹	Construction drawings and documentation demonstrate energy code compliance for the building envelope.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
302.1, 403.6 [PR2] ²	Heating and cooling equipment is sized per ACCA Manual S based on loads calculated per ACCA Manual J or other methods approved by the code official.	Heating: Btu/hr _____ Cooling: Btu/hr _____	Heating: Btu/hr _____ Cooling: Btu/hr _____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Additional Comments/Assumptions:

Section # & Req.ID	Foundation Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
402.1.1 [FO4] ¹	Conditioned basement wall insulation R-value. Where interior insulation is used, verification may need to occur during Insulation Inspection. Not required in warm-humid locations in Climate Zone 3.	R- _____ R- _____	R- _____ R- _____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
303.2 [FO5] ¹	Conditioned basement wall insulation installed per manufacturer's instructions.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
402.2.8 [FO6] ¹	Conditioned basement wall insulation depth of burial or distance from top of wall.	_____ ft	_____ ft	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
303.2.1 [FO11] ¹	A protective covering is installed to protect exposed exterior insulation and extends a minimum of 6 in. below grade.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.8 [FO12] ¹	Snow- and ice-melting system controls installed.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Additional Comments/Assumptions:

Section # & Req.ID	Framing / Rough-In Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
402.1.1, 402.3.4 [FR1] ¹	Door U-factor.	U- _____	U- _____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
402.1.1, 402.3.1, 402.3.3, 402.3.6, 402.5 [FR2] ¹	Glazing U-factor (area-weighted average).	U- _____	U- _____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
303.1.3 [FR4] ¹	U-factors of fenestration products are determined in accordance with the NFRC test procedure or taken from the default table.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
402.4.3 [FR20] ¹	Fenestration that is not site built is listed and labeled as meeting AAMA /WDMA/CSA 1014.5.2/A440 or has infiltration rates per NFRC 400 that do not exceed code limits.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
402.4.4 [FR16] ²	IC-rated recessed lighting fixtures sealed at housing/interior finish and labeled to indicate ≤2.0 cfm leakage at 75 Pa.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.2.1 [FR12] ¹	Supply ducts in attics are insulated to ≥R-8. All other ducts in unconditioned spaces or outside the building envelope are insulated to ≥R-6.	R- _____ R- _____	R- _____ R- _____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.2.2 [FR13] ¹	All joints and seams of air ducts, air handlers, and filter boxes are sealed.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.3 [FR17] ²	HVAC piping conveying fluids above 105 °F or chilled fluids below 55 °F are insulated to ≥R-3.	R- _____ R- _____	R- _____ R- _____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.3.1 [FR24] ²	Protection of insulation on HVAC piping.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.4.2 [FR18] ²	Hot water pipes are insulated to ≥R-3.	R- _____ R- _____	R- _____ R- _____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.5 [FR19] ²	Automatic or gravity dampers are installed on all outdoor air intakes and exhausts.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Additional Comments/Assumptions:

1 High Impact (Tier 1) 2 Medium Impact (Tier 2) 3 Low Impact (Tier 3)

Report date: 01/14/20
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Load Calculations in Documents Attached

- Equipment Model Numbers & Capacities
- Airflow to each room
- Construction Components
 - Do R-values & U-factors match the installed
- Worksheets
 - Verify Orientation

Load Short Form Entire House Ivory Homes

JOB: 001248-0000
DATE: Jan 05
BY: J. Hines
PLOT: Clearmont

Project Information

For: Ivory Homes
1112 SP Lee Loop Lane West Jordan, Utah

Design Information

	Min	Cig	Method	Information	Supplied
Outside db (°F)	10	95	Method		Supplied
Inside db (°F)	70	72	Construction quality		Supplied
Design TD (°F)	60	23	Temperature		
Daily range	30	84			
Inside humidity (%)	50	85			
Moisture difference (grains)	30	33			

HEATING EQUIPMENT

Make Lennox
Trade ELITE
Model L1290U4950V48C-1
A/R# 101-688913

Efficiency 96 AFUE
Heating input 85000 Btu/h
Heating output 55000 Btu/h
Temperature rise 64 °F
Actual air flow 1432 cfm
Air flow factor 0.051 cfm/ft²
Static pressure 0.80 in H₂O
Space thermostat

COOLING EQUIPMENT

Make Lennox
Trade L1290C
Model L1290U4950V48C-1
C/R# 48C-11290U4950V48C-1-TOR
A/R# 101-688906

Efficiency 11.5 EER, 14 SEER
Sensible cooling 20713 Btu/h
Latent cooling 8233 Btu/h
Total cooling 41056 Btu/h
Actual air flow 1383 cfm
Air flow factor 0.048 cfm/ft²
Static pressure 0.80 in H₂O
Load sensible heat ratio 1.00

ROOM NAME	Area (ft ²)	cig load (Btu/h)	Cig load (Btu/h)	Wg AWT (lbm)	Cig AWT (lbm)
Kitchen	295	3405	2544	211	343
Family	337	3944	2426	254	350
Study	139	1798	1798	106	166
Living	352	3945	1373	143	122
Entry	74	0	0	0	0
Stairs	36	0	0	0	0
Hall	39	0	0	0	0
CHL	33	337	143	27	54
IG Bath	44	429	215	36	55
Mud	969	1409	238	130	71
IG 3	75	929	233	37	68
Bath-2	865	441	238	130	71
Bed-7	52	619	274	31	58
Laundry					

Calculations approved by ACCA to meet all requirements of Manual J 9.9.6.1

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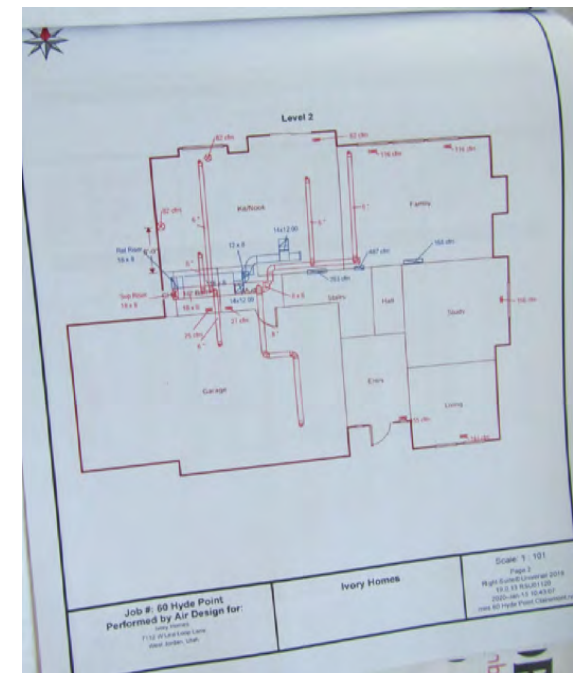
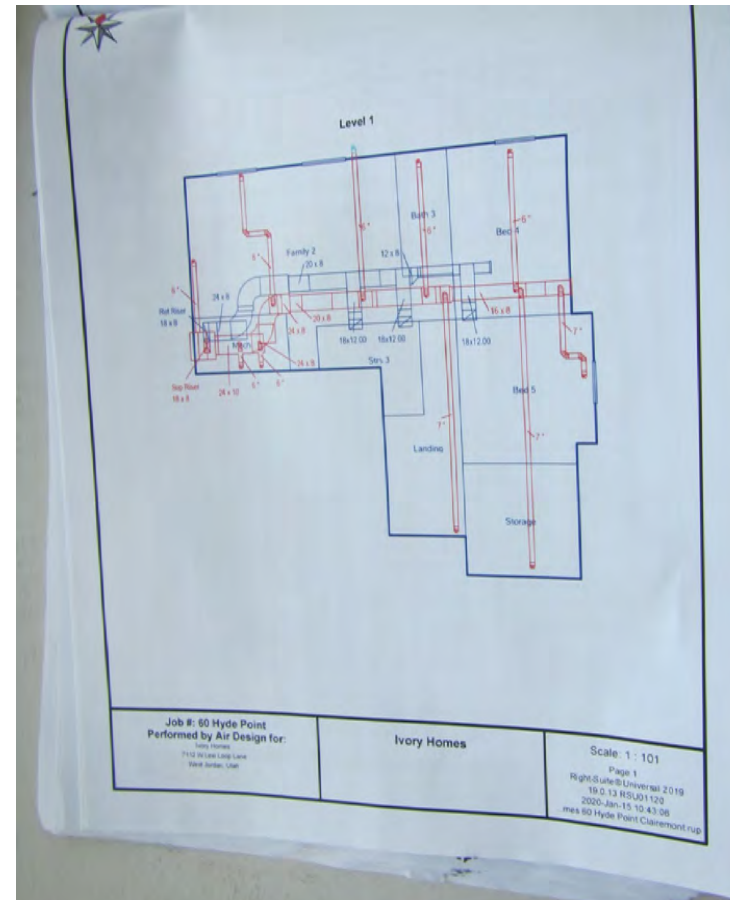
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Duct Design also Attached

- Duct layout similar to drawing?
- Fittings
- Trunk and branch sizes
- Devices: Coils & Filter
- Leakage
- Testing
- Insulation
- DO NOT get hung up on minor changes



Project Information

For: Ivory Homes
7112 W Loop Lane, West Jordan, Utah

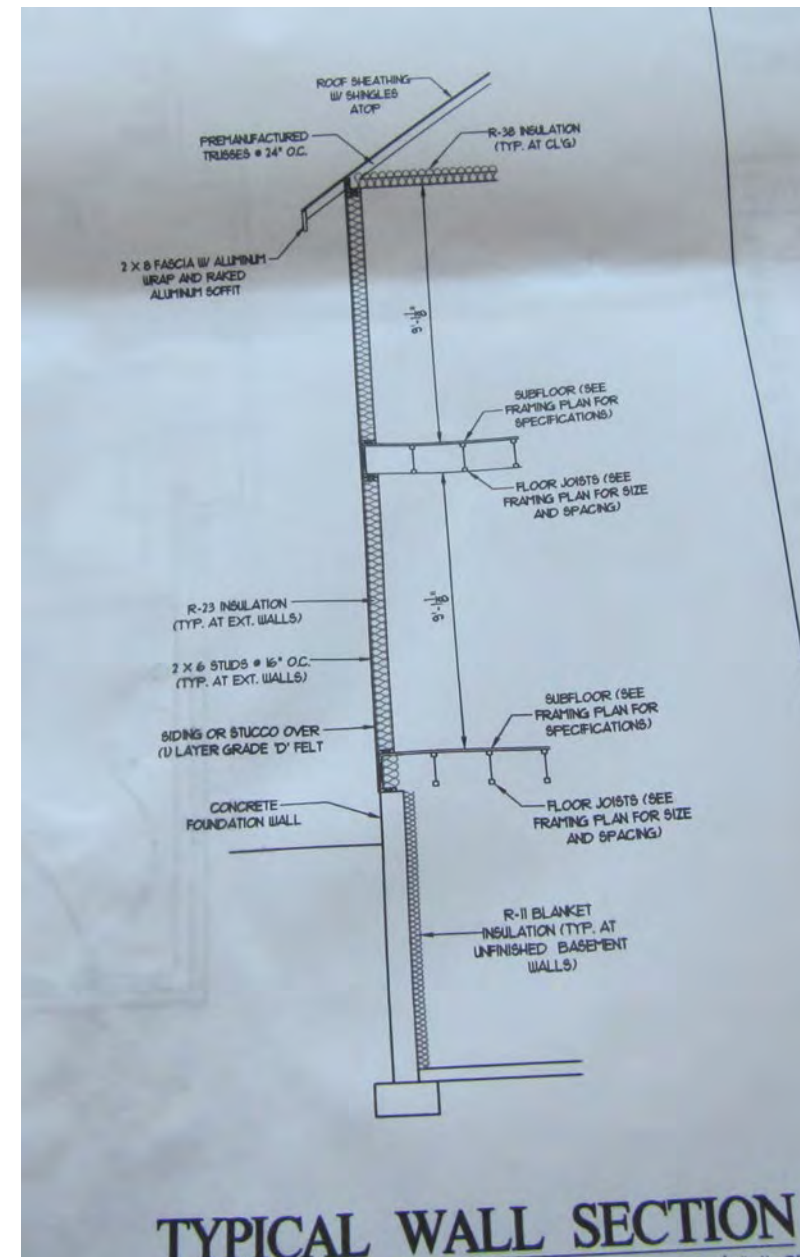
	Heating	Cooling
External static pressure	0.80 in H ₂ O	0.80 in H ₂ O
Pressure losses	0.38 in H ₂ O	0.38 in H ₂ O
Available static pressure	0.42 in H ₂ O	0.42 in H ₂ O
Supply / return available pressure	0.218 / 0.202 in H ₂ O	0.218 / 0.202 in H ₂ O
Lowest friction rate	0.071 in/100'	0.071 in/100'
Actual air flow	1400 cfm	593 cfm
Total effective length (TEL)		1383 ft

Supply Branch Detail Table

Name	Design (ft/min)	HFg (ft/min)	CFg (ft/min)	Design FPA	Diam (in)	H x W (in)	Duct Matd.	Actual Lp (ft)	Fg (ft/min)	Trunk
1st Main	R 409	25	10	0.121	6.0	24 x 8	SMAN	5.5	178.0	#1
2nd Main	R 441	27	23	0.085	6.0	24 x 8	SMAN	31.5	225.0	#2A
3rd Main	R 1829	100	71	0.077	6.0	24 x 8	SMAN	40.0	345.0	#2B
4th Main	R 1847	90	68	0.080	6.0	24 x 8	SMAN	21.6	220.0	#2
5th Main	R 2138	155	122	0.084	7.0	24 x 8	SMAN	38.0	255.0	#3A
6th Main	R 1228	102	116	0.081	6.0	24 x 8	SMAN	42.0	215.0	#3B
7th Main	R 1228	102	116	0.076	6.0	24 x 8	SMAN	51.5	225.0	#3
8th Main	R 1228	102	116	0.083	6.0	24 x 8	SMAN	35.1	225.0	#3
9th Main	R 651	70	82	0.221	6.0	24 x 8	SMAN	3.1	40.0	#3B
10th Main	R 651	70	82	0.083	6.0	24 x 8	SMAN	6.6	230.0	#3
11th Main	R 174	37	68	0.082	6.0	24 x 8	SMAN	66.5	225.0	#3C
12th Main	R 2345	143	130	0.075	7.0	24 x 8	SMAN	34.0	240.0	#2
13th Main	R 170	164	144	0.080	6.0	24 x 8	SMAN	12.5	185.0	#2
14th Main	R 2792	99	79	0.111	6.0	24 x 8	SMAN	6.0	165.0	#1
15th Main	R 1024	74	62	0.126	6.0	24 x 8	SMAN	53.5	225.0	#3C
16th Main	R 430	27	108	0.079	7.0	24 x 8	SMAN			
17th Main	R 1790	108	108	0.079	7.0	24 x 8	SMAN			

Insulation Noted on Plans

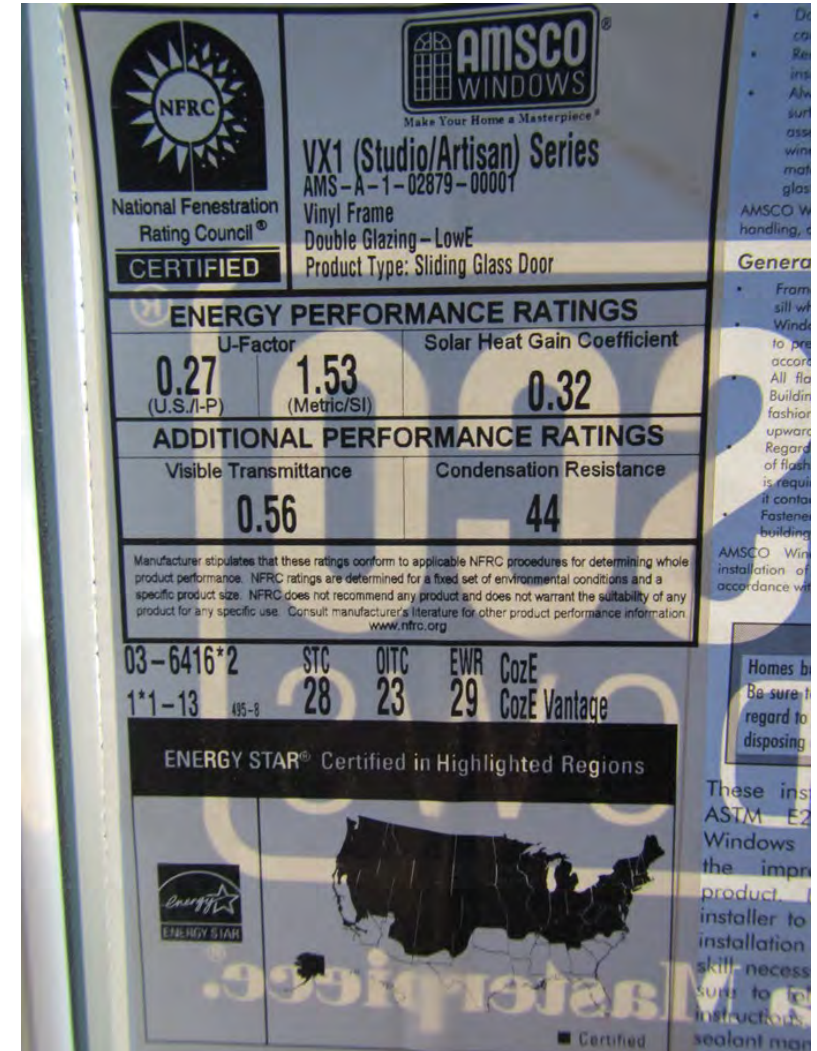
- R-values noted on plans increases odds correct R-values are installed
- R-23 wall insulation – expect net and blow
- Blankets on walls
- Verify Continuous Insulation is only penetrated by fasteners



Fenestration Performance

Verify meets selected compliance option:

- Prescriptive Table
- REScheck 2015 or 2018
- Performance
- ERI/HERS
- REScheck 2012 Utah



Triple Glazed Window



before they dry by washing with clean water. HOLES. could scratch glass or vinyl. cleaning fluids containing petroleum products, corrosive materials. Insulating glass seals can be damaged. is required by law in some locations. Safety

complete support to interior sill. Windows over 4' in width require minimum 1" of support to exterior.

5. Adjust frame to provide a uniform margin around the sash.

6. Nail with 6d or larger galvanized fasteners 8 to 16 inches apart using the holes provided in the nailing fin. Do not nail within 6 inches of frame corners. Drilling holes through the frame of the window could cause a leakage problem which would not be covered by the warranty.

7. Use of expanding foam insulation may cause binding of windows that will not be covered under warranty. Loosely pack fiberglass insulation

4. Adjust rollers for smooth operation.

MAINTENANCE

1. Sills, roller tracks, and weep holes: Clean sash and periodically thereafter. Use only warm water and mild detergent. Rinse with clean water and squeeze dry. Do not use abrasive tools, or dirty cloth, which may scratch the glass. Maintenance and replacement of rollers and sash cords should be done by a qualified professional.
2. Use only warm water and mild detergent. Rinse with clean water and squeeze dry. Do not use abrasive tools, or dirty cloth, which may scratch the glass. Maintenance and replacement of rollers and sash cords should be done by a qualified professional.
3. Maintenance and replacement of rollers and sash cords should be done by a qualified professional.

Tested in accordance with AAMA 501.1


Class LC - PG40 1219 x 2134 (Design Pressure + 1920/- 192 (+ 40/- 40 psf))

Tested in accordance with AAMA 501.1

STC Rating: **UNRAT**

7039175.3

AR[®] Qualified in All 50 States

 Qualified

NFRC
National Fenestration Rating Council[®]
CERTIFIED

CPD#: PWG-M-122-05786-00001

PWG
Vinyl Frame
Triple Glazing
Low-E
GBG 5/8" Argon Fill
Single Hung

ENERGY PERFORMANCE RATINGS

U-Factor (U.S./I-P)	0.21	Solar Heat Gain Coefficient	0.20
	1.19 (Metric/SI)		

ADDITIONAL PERFORMANCE RATINGS

Visible Transmittance	0.37	Air Infiltration	≤ 0.3
-----------------------	------	------------------	-------

Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining window product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information. www.nfrc.org

NOV-02-2018 0000 12:07:47

- NFRC Labels must remain on windows and doors until inspected
- Receipts may be acceptable if approved
- Labels may be used in rebate applications



NFRC Labels?



Insulation Thoughts



- The pieces of insulation on the floor.....extra, or fell out and not put back in place before drywall?
- Will someone put his piece of insulation back in place?
- Duct in drop ceiling – discussion on another slide



Insulation Issues?

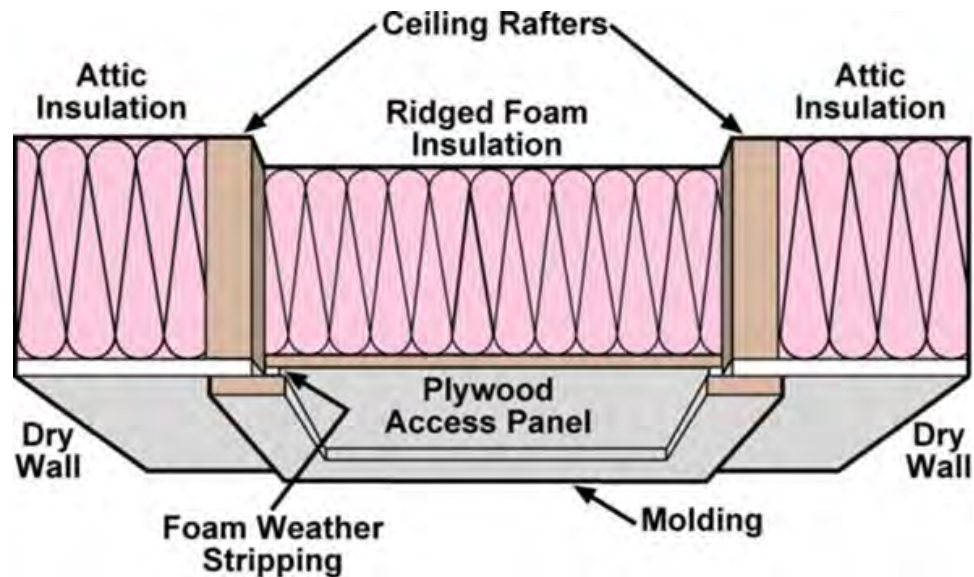
- Two older homes with insulation voids
- My neighbor's home – two supply air boots without insulation



Attic Access

R402.2.4 Access Hatches and Doors

- Must be weather stripped.
- Attic hatch must have insulation of required R-value attached to the panel.
- Insulation dam required around access opening.
- Vertical access doors must meet fenestration requirements - Table R402.1.2.



Insulation Installed Per Manufacturer's Installation Instructions

- Cut and fit around boxes, pipes and wires
- Don't compress – reduces R-value
- Fill all voids and gaps
- Friction fit – add $\frac{1}{2}$ to width
- Small gaps and spaces
- Fiberglass not an air barrier



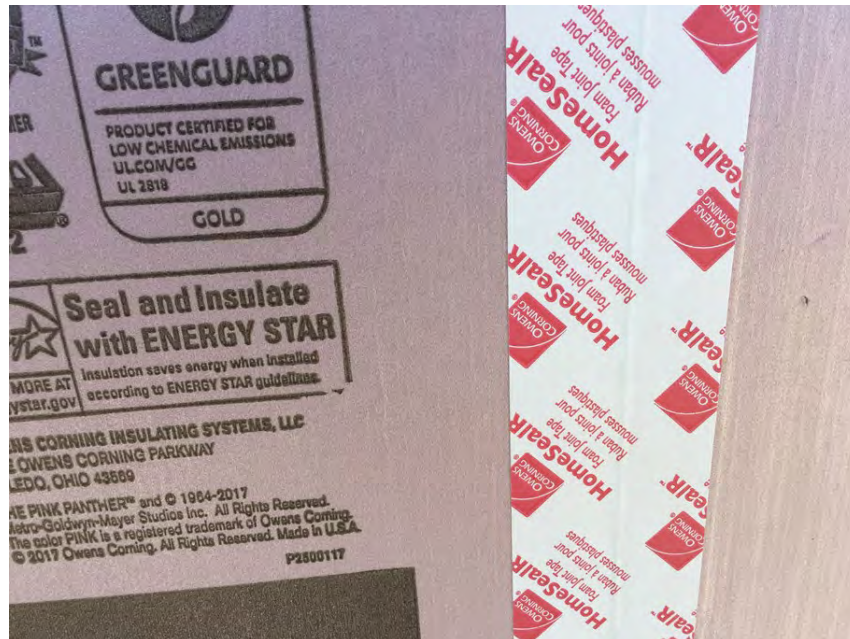
Interior Walls Intersecting Exterior Walls

- Framing prevent insulating space
- This occurred 13 times in this home
- 10' Ceiling
- 4" wide cavity not insulated
- 43 sq. ft. of uninsulated wall



Exterior CI

- Penetrated by fastener only
- Approved tape all seam
- Tyvek tape is not approved – expansion rate different
- Also serves as air barrier and weather barrier



High Heal Truss

- Is the baffle/dam higher than the insulation depth?



R402.4.1.1 - Walls Framed to Allow Insulation in Corners and Headers

- Ladder Blocking/Backing – Allows insulation Behind



- Foam in header
- Insulation dam needs to wrap around above left wall
- Insulate left corner?



- Rim insulation compressed – poor fit
- Air on face of rim insulation? No
- Blown insulation fills in behind intersecting wall



- Blown insulation behind intersecting wall
- Small gap between studs not insulated



Basement Blankets Per REScheck/Compliance Option



Ensure All Insulation Is Secure At Insulation Inspection

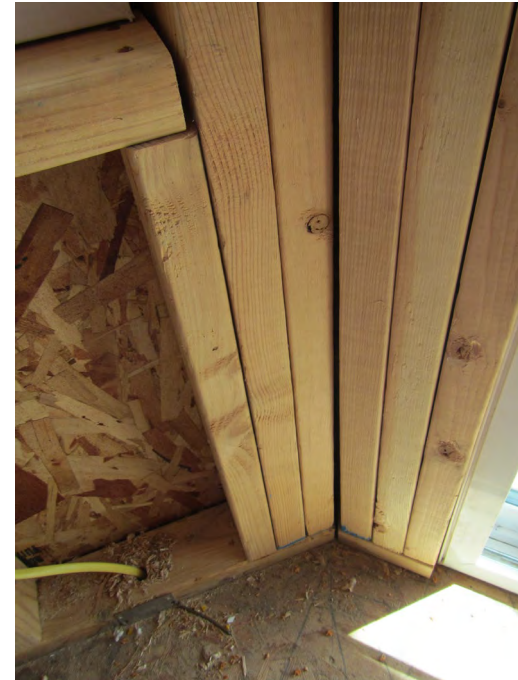


- Small Spaces
- 45-degree corners
- Too many studs?



45-degree corners

- Drill and Spray foam
- Considerable air leak as OSB seam does not land on a stud



Framing Allowing Insulation in the Corners



- Duct in garage, prior to insulation
- Blown insulation is about R-4 per inch
- Minimum 2" space



Ducts in Garage Ceilings – Insulate Duct with Floor Insulation

- Completely encapsulate the duct with minimum R-8
- Eliminate all air spaces
- Maintain required level of floor insulation
- Blown will generally work
- Batts will not



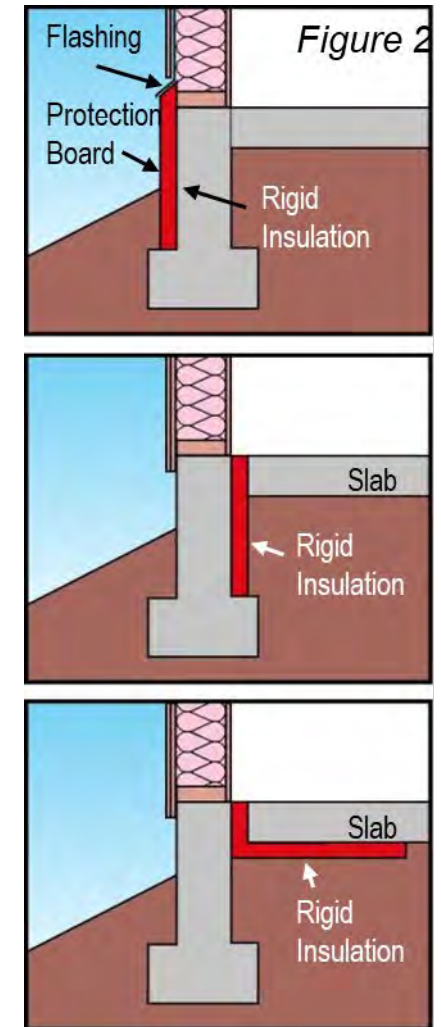
Unconditioned room in Basement?

- Room may be indirectly conditioned
- Insulate concrete wall or insulate to isolate from the conditioned portions of the house



Slab Edge Insulation

- R-10 Prescriptive – may be traded off
- + R-5 for heated slab
- May be just a portion of a basement
- Discuss at foundation and sub-rough plumbing
- Must provide a thermal break to top of slab



Under porch storage

- Isolate from conditioned space with:
 - Threshold
 - Gasket
 - Sealing
 - Interior door OK



- Is there an air barrier behind the soffit material?



Cantilevers

Proper insulation installation?

Gaps, air movement, duct above, rim joist, air barrier



- Cantilevers
- Extremely critical to address this with air barriers/sealing and insulating to eliminate air spaces



Supply Branch Out into Cantilever

- Is there a minimum R-8 under and around duct?
- Is the rim properly insulated?
- True R-30 or traded-off value in this cavity?
- Net and blow probably only compliant method
- Sealed air barrier underside



- Knee wall, ceiling height shifts, require an air barrier on the back side
- 6-side enclosure of all vertical insulation
- Air Barrier type house wraps comply



R402.4.1 Building Thermal Envelope

Comply with all items in Table 402.4.1.1
OR Blower Door Test per R402.4.1.2.

2nd Option

R402.4.1.2 Blower Door Testing and Third-Party Verification

- ≤ 5 ACH50
- ≤ 3.5 ACH50 beginning Jan. 1, 2019
- ≤ 3.0 ACH50 beginning Jan. 1, 2021
- Testing by BPI or RESNET certified parties or licensed contractors with approved training.

***Townhouses, other multi-family remain 5 ACH50 effective March 2019.



TABLE R402.4.1.1
AIR BARRIER AND INSULATION INSTALLATION

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance of R-3 per inch minimum. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between window/door jambs and framing, and skylights and framing shall be sealed.	
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors (including above garage and cantilevered floors)	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking, or floor framing cavity insulation shall be permitted to be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing and extends from the bottom to the top of all perimeter floor framing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.	Where provided instead of floor insulation, insulation shall be permanently attached to the crawlspace walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	
Narrow cavities		Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the drywall.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring		Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls, or insulation that on installation readily conforms to available space shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate them from the showers and tubs.	Exterior walls adjacent to showers and tubs shall be insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical or communication boxes or air-sealed boxes shall be installed.	
HVAC register boots	HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall.	
Concealed sprinklers	When required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	

a. In addition, inspection of log walls shall be in accordance with the provisions of ICC-400.

Blower Door Testing vs Table 402.4.1.1

- Original Amendment required a maximum 5 ACH @ 50Pa
- Current Utah SFD requirement is 3.5 ACH @ 50pa – significantly harder to attain
- IECC without amendment is 3 ACH @ 50Pa
- The table is a guide, which if followed will result in a passing score
- IF a contractor doesn't want to BD test, compliance to the entire Table is required – including closed cell foam at the rim joist, which prevents condensation on the rim joist
- If BD Testing is selected, compliance with most of the Table is needed to pass the test
- If BD Testing results in less than 3 ACH, mechanical ventilation is required

1st Option
**R402.4.1.1 Air Barrier and
Insulation Installation and
Inspection per Table R402.4.1.1.**

Table R402.4.1.1 Summary

- Insulation and air barriers installed in accordance with manufacturer's instructions.
- Continuous air barrier installed at the building thermal envelope.
- All gaps and voids sealed between conditioned and un-conditioned spaces.
- Air-permeable insulation (fiberglass, rock-wool, cellulose) is not used for air sealing.
- Closed-cell foam is the only insulation that also serves as an air barrier.
- Dropped ceilings/soffits, shafts and chases shall be capped with an air barrier lid and sealed-(attic insulation does not drop down into soffits).
- Walls shall be framed to allow insulation in corners and in headers.

- Wall insulation shall be enclosed on 6 sides. Includes an air barrier, backside of knee-walls.
- Wall batt insulation shall be cut neatly to fit wall cavities and around all pipes, wiring and boxes in cavity (recommend blown insulation).
- Rim joist insulation shall include a sealed air barrier on the inside face of insulation, or closed cell spray foam.
- Recessed can lights, boxes and HVAC boots penetrating the thermal envelope shall be sealed.
- Exterior walls adjacent to fireplaces, tubs, showers shall include an inside surface air barrier.
- Air sealing shall be provided between the garage and conditioned spaces.
- Floor insulation in contact with underside of floor or topside of sheathing/lid below.
- Air barrier underside of cantilevers.



IF Blower Door Tested – Mechanical Ventilation May Be Required

Section R403.6 - Mechanical Ventilation

Required (IRC) if tested tighter than 3 ACH@50pa (State amended from 5 ACH@50pa)

✓ Ventilation

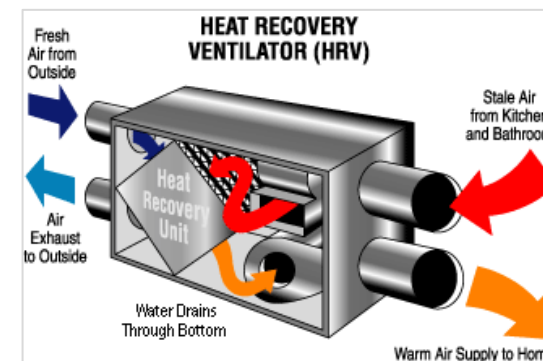
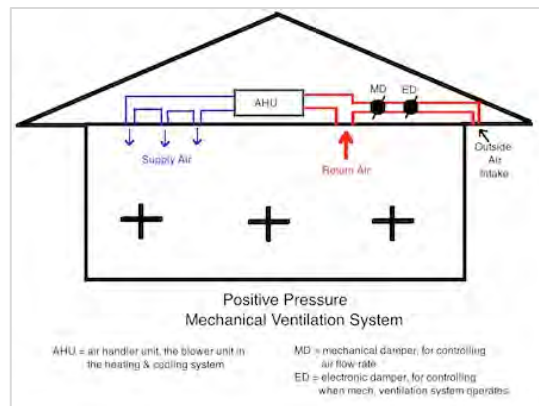
- Building to have ventilation meeting IRC or IMC or with other approved means (previously deleted by the 2012 amendments)
- Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating

✓ Whole-house mechanical ventilation system fans to meet efficacy in Table R403.6.1

✓ Exception

- ✓ When fans are integral to tested and listed HVAC equipment, they shall be powered by an electronically commutated motor

IF testing under 5 ACH@50pa, understand risk of moisture in cavities increases



Blower Door and Duct Air Tightness Test

- Performed by certified raters or contractors completing approved training
- Call if you have questions

The image shows two inspection forms taped to a metal surface. The top form is titled 'SPECIAL INSPECTION: UTAHS IECC 2012: DUCT AIR TIGHTNESS'. It contains handwritten information: Date Tested: 12/14/16, Tested By: Troy S. Percini Jr., Project: Daybrook Garden Park, Street Address: 1108 S Percini Dr, Unit (Lot): 350, Unit Finished SqFt: 2835, and Observed Leakage in CFM: 79. The bottom form is titled 'SPECIAL INSPECTION: Utah's IECC 2015: BUILDING AIR TIGHTNESS'. It contains handwritten information: Date Tested: 5/14/17, Tested By: Troy S. Percini Jr., Project: Garden Park, Street Address: 108 S Percini Dr, Unit (Lot): 350, Unit Conditioned SqFt: 2835, and Observed Leakage in CFM: 851. Both forms include checkboxes for 'Pass' or 'Fail' and contact information for Survey & Testing Services Inc.

SPECIAL INSPECTION: UTAHS IECC 2012: DUCT AIR TIGHTNESS

Date Tested: 12/14/16 Tested By: Troy S. Percini Jr.
Project: Daybrook Garden Park Street Address: 1108 S Percini Dr
Unit (Lot): 350 Unit Finished SqFt: 2835
Observed Leakage in CFM: 79 Leakage as % of SqFt: 2.0

For Utah's IECC 2012 Compliance this unit must pass one of the following standards.

Rough in Test (Test @ Away, NO Air Handler): Max Leakage 7.5 CFM/100SF (7.5% Total Leakage) ☒ Pass ☐ Fail
Rough in Test (Test @ Away, w/Air Handler): Max Leakage 10 CFM/100SF (10% Total Leakage) ☒ Pass ☐ Fail
Post Construction Test (Finished Unit Test): Max Leakage 15 CFM/100SF (10% Leakage to Outside) ☒ Pass ☐ Fail

For Further Verification Contact: Mitch Richardson (801) 738-9933, SurveyTestingServices@gmail.com

Survey & Testing Services Inc., 1021 W. Union Park, Midvale, UT 84047

SPECIAL INSPECTION: Utah's IECC 2015: BUILDING AIR TIGHTNESS

Date Tested: 5/14/17 Tested By: Troy S. Percini Jr.
Project: Garden Park Street Address: 108 S Percini Dr
Unit (Lot): 350 Unit Conditioned SqFt: 2835
Observed Leakage in CFM: 851 Leakage as % of SqFt: 3.0

For Utah 2015 Compliance this unit must be less than 2 air changes per hour at 40 percent of blower door pressure.

Calculate the leak level of this house as follows: Max CFM
Step 1: (Volume of House) x 0.02 = 2,766
Step 2: If the leakage test CFM number is less than the Max CFM then the house passes.

For Further Verification Contact: Mitch Richardson (801) 738-9933, SurveyTestingServices@gmail.com

Survey & Testing Services Inc., 1021 W. Union Park, Midvale, UT 84047

- An efficient exhaust fan provide effective ventilation
- Option for time on, minimum CFM low speed occupancy and humidity sensors
- Cheap fans make noise, waste energy and are not designed for continuous operation



Combustion Air Openings Through Air Barrier

R402.4.4 Rooms Containing Fuel Burning Appliances

- Where open combustion air ducts serve open combustion, fuel burning appliances:
 - The open duct and appliance shall be enclosed in a sealed and insulated room, isolated from inside the thermal envelope.
 - Combustion air duct passing through conditioned space shall be insulated to a minimum R-8.
 - Exceptions: Direct vent appliance, Fireplaces and stoves installed per code.

IF WATER HEATER AND/OR
FURNACE IS OPEN COMBUSTION
WITH AN OUTSIDE COMBUSTION
AIR OPENING, IT MUST BE
ENCLOSED IN A SEALED ROOM



Air Barrier Where Drywall Will Not Be In Contact With Insulation



Air Handlers and Ducts in Attics – Insulation & Duct Pressure Testing

R403.3.1 Duct Insulation

Outside thermal envelope, both return and supply.

- Ducts in attic- R-8
- Ducts in other areas- R-6

R403.3.2 Duct Sealing and Testing

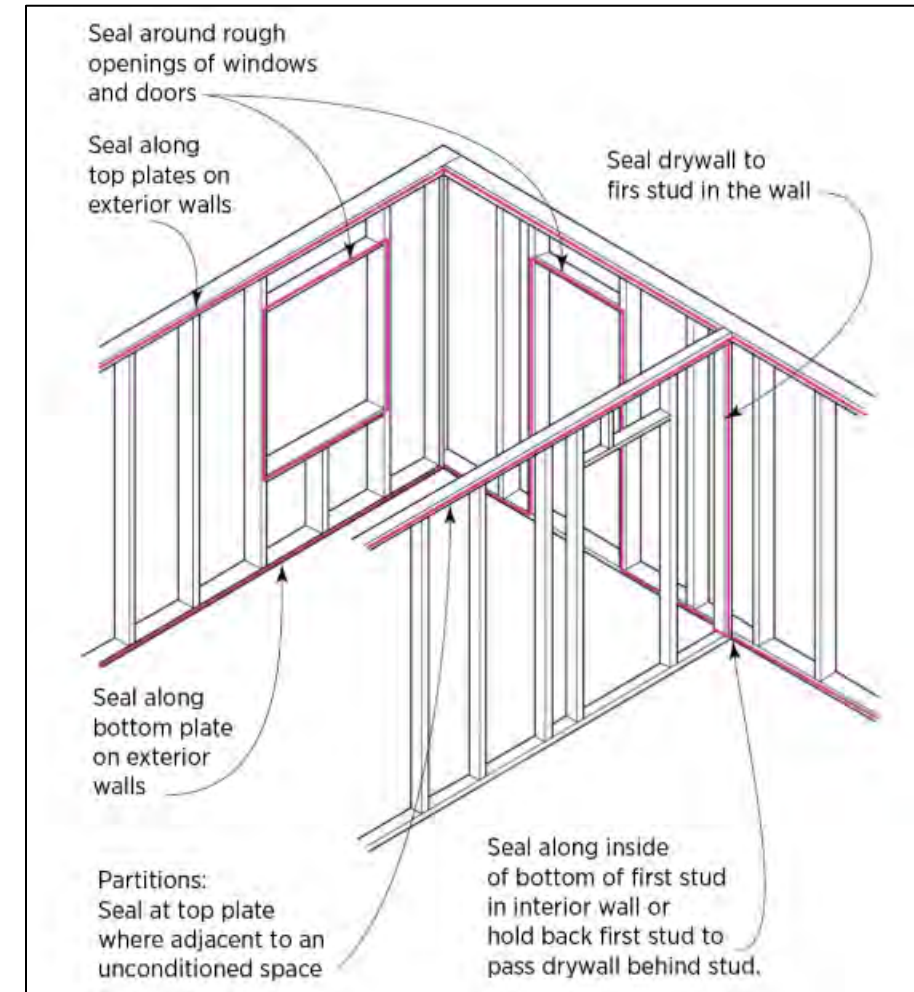
Ducts, air handlers and filter boxes sealed per IRC/IMC AND tested if air handler is outside the thermal envelope, or at least 35% of duct is outside thermal envelope.

- 25% outside the envelope- Jan. 1, 2019
- 20% outside the envelope- Jan. 1, 2021
- Testing by BPI or RESNET certified parties or licensed contractors, approved training.

- Duct insulation on all sheet metal
- Platform per mechanical code
- Air handler alone in attic requires test
- 25% of duct in attic requires test



- Significant source of air leakage is top plate, including interior
- Foam strip stapled to plates provides a gasket



Ceiling/Attic Air Barriers – The Ceiling Lid

- Where ceilings are dropped with an attic above, maintaining an air barrier is near impossible
- Table 402.4.1.1 requires a ceiling lid in these drops, sealed around the edges
- The attic insulation flows continuously across the entire attic



Will Building Paper or Tyvek Seal this Hole?

Sheathing is often used as the air barrier



Integrate/Seal Air Barrier Wraps and Flashing



Seal Air Barrier at Penetration

- Over-cut hole
- Space for termination
- If not provided at rough, air barrier and exterior wall coverings will be cut for termination installation



Air Barrier Penetrations

- Building paper behind
- No backdraft damper in fan termination
- If fan does not operate 24/7, must have a backdraft damper at penetration - R403.6



Positive Items:

- Full depth attic insulation
- Insulation dam at exterior wall
- Intersecting wall frame to allow insulation behind
- Space in one header to insulate
- Continuous foam on exterior



- Garage wall area indicated
- Insulation dam, unless garage is insulated to the level of the home
- Insulation rulers at rough



- Ceiling box and can light with flange and gasket
- Verify air-tite can light



AeroBarrier – Whole House Sealing



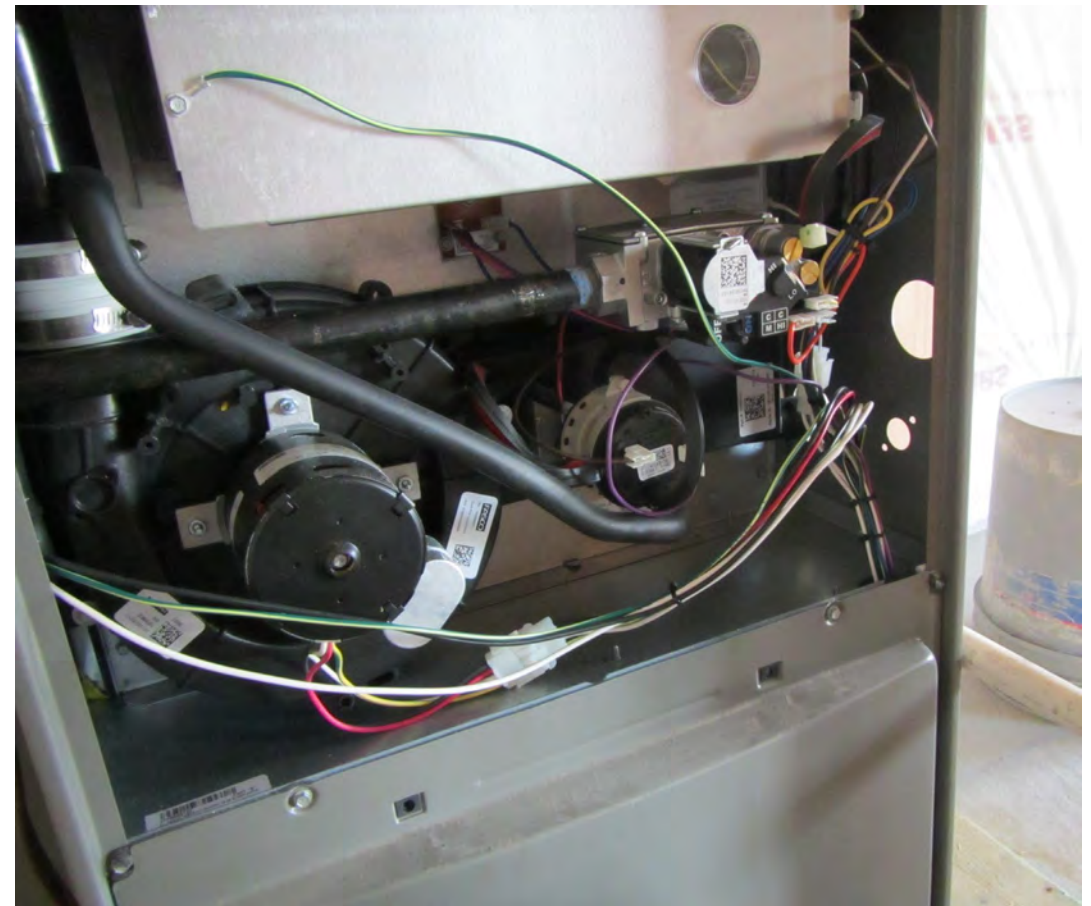


- Filter cabinet allows wider, lower resistance filter – less air leakage
- Ensure furnace has a sealed burner
- If not, seal all penetrations into upper burner compartment



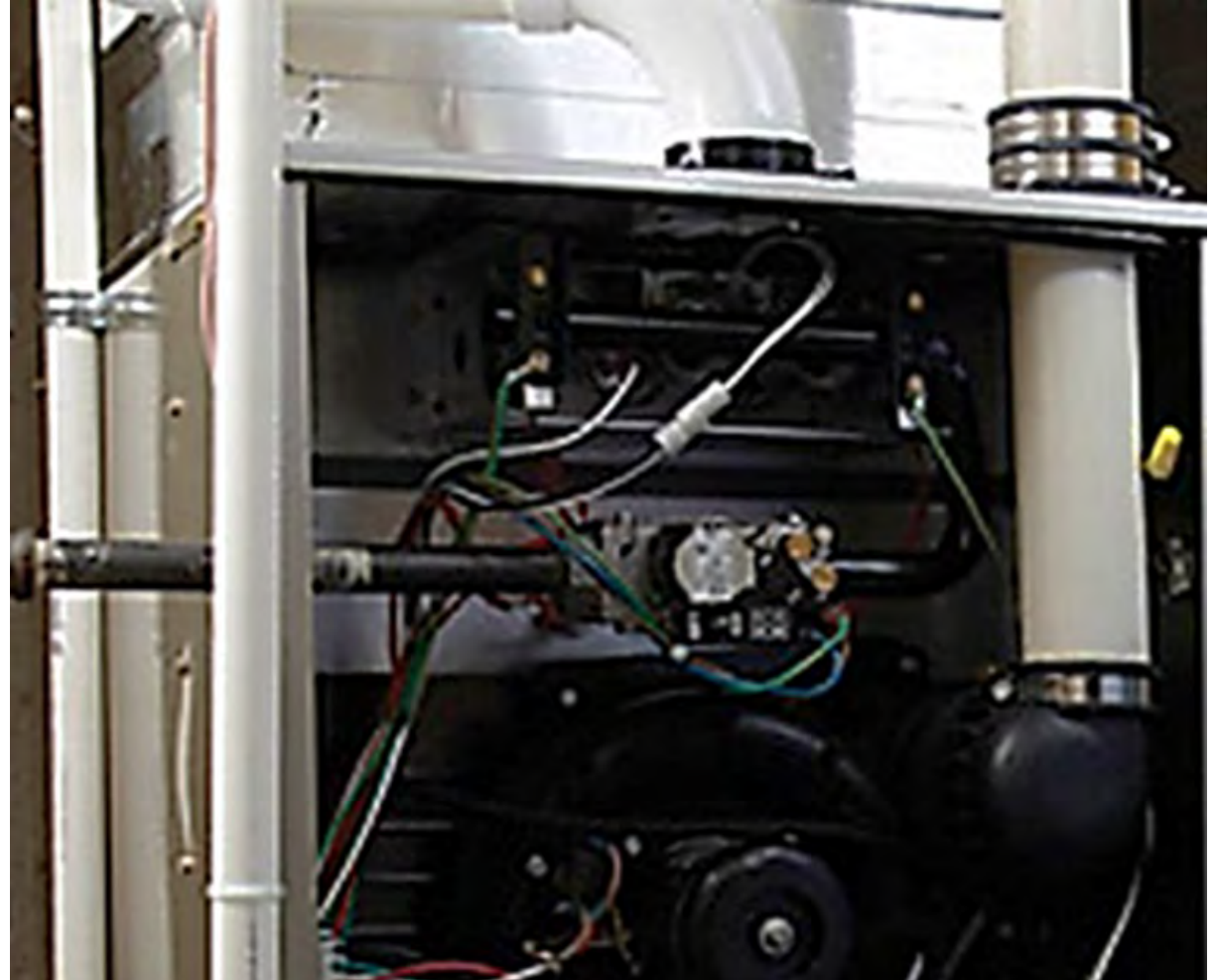
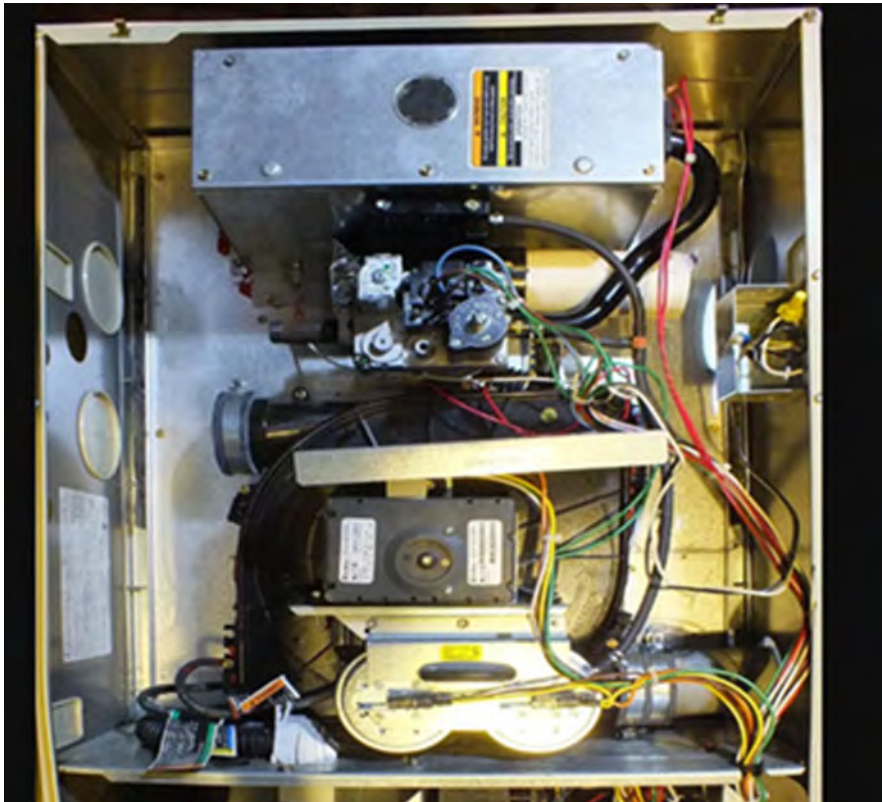


- Verify DV Two Pipe furnace is truly sealed
- This furnace has a sealed burner
- Most do not



Direct Furnace Installed Direct Vent

- Two pipe venting
- Upper compartment sealed



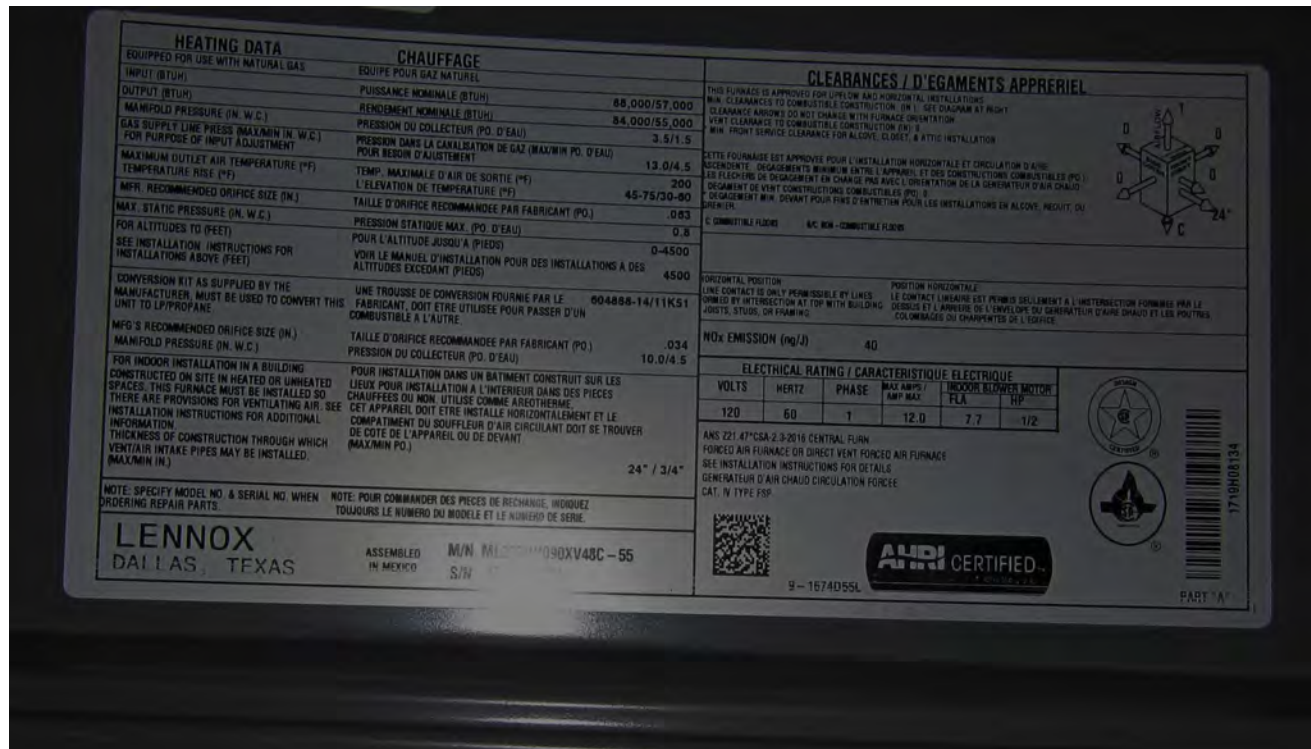
HVAC per ACCA Standards – R403.7

- Return path from each supply back to a return
- Return in each bedroom rather than a single return in the hall – or return path
- Duct sealed up to include wall inlet
- Nice job – controls noise, low leakage



HVAC Equipment Model Numbers

- Verify against load calculations
- Condenser at Final
- May require a nut driver to access blower compartment



Manufacturer's Installation and Maintenance Instruction are required to be left with the equipment



Air Handlers and Ducts in Attics – Insulation & Duct Pressure Testing

R403.3.4 Duct Leakage

Rough-in or post-construction testing

- ≤ 8 cfm/100 sf, with air handler
- ≤ 7 cfm/100 sf, Jan. 1, 2019
- ≤ 6 cfm/100 sf, Jan. 1, 2021*
- ≤ 6 cfm/100 sf, w/o air handler*



- The amended leakage allowed is double the IECC allowed
- $2000 \text{ ft}^2 = 160 \text{ CFM}$
- Conditioned air wasted
- Price of a new home?
- Is it unreasonable to expect a tight duct system?
- Do you want to throw away heated or cooled air?



Duct Sealing, Air Barrier

Energy Items

- Water line through return – sealing
- Daylight through holes in rim-board
- Compounded with cantilevers

Mechanical Items

- Pipe supported in part by water and wires
- Cellular core – manufacturer's installation instructions



Typical at Furnace Air Leakage Locations

- Poor air filter access or cabinet
- Leakage at air filter or return connection to furnace
- Coil cabinet to furnace
- Plenum to coil cabinet
- Line-set and drain openings- after completed
- How is the furnace burner sealed?
- Bottom of furnace on uneven floor



Duct Sealing



Selective Duct Sealing

- Verify if interior duct sealing (Aero-seal) occurred
- Longitudinal snap-lock and button-lock seams require sealing in 2015 IECC but not in the 2018 IECC



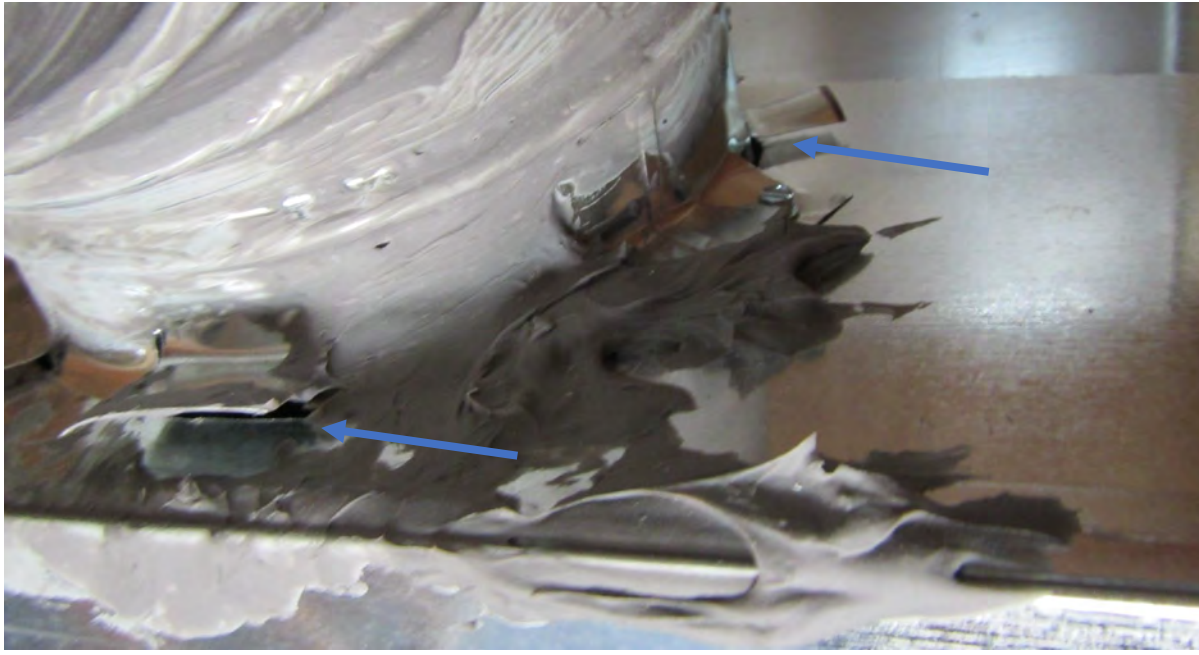
Ducted Return – Not Panned



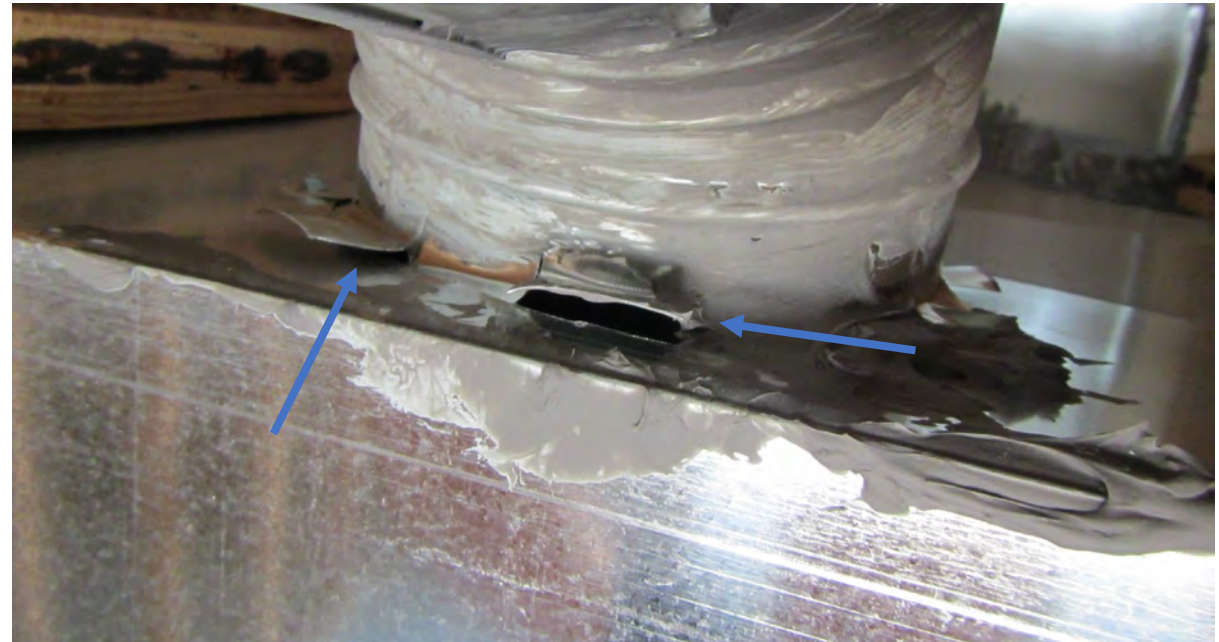
Complete Sealing





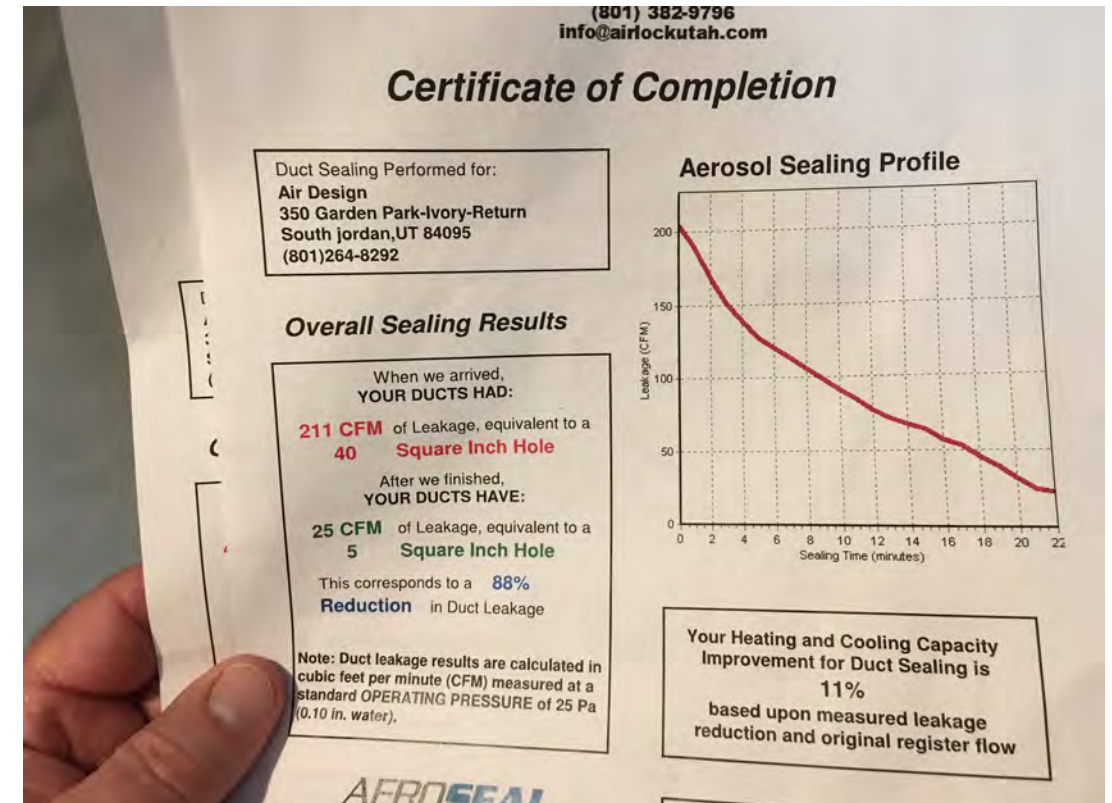


- Top of ducts in basements
- Ducts in attics
- Meet the contractor – have him/her take pictures while you observe
- Why does the code require testing?

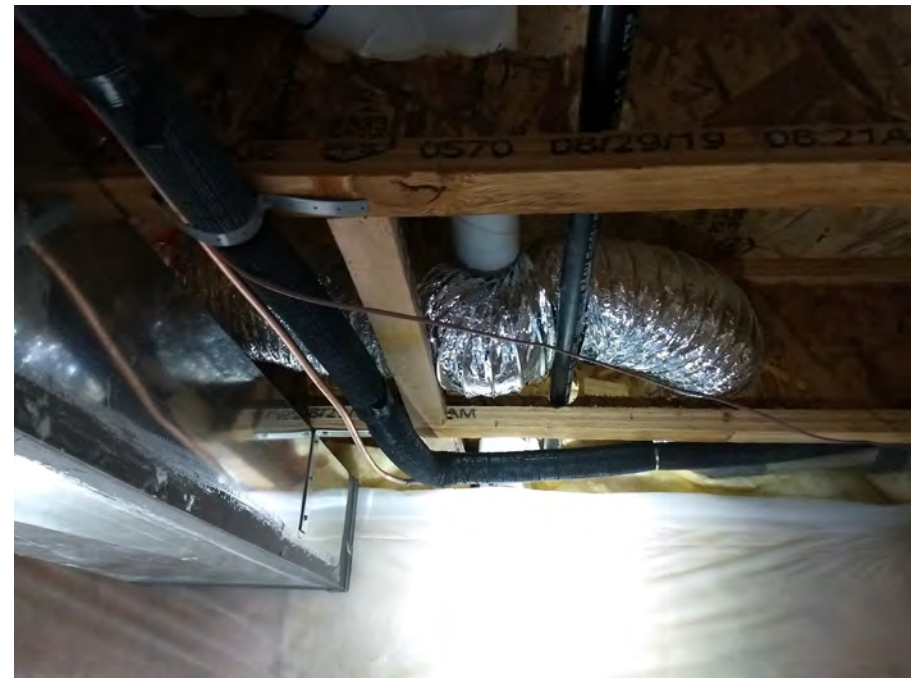




Air Duct Sealing from Inside – Similar to Aerobarrier



For Your Entertainment?



Every Code Hearing Proposals Submitted To Eliminate Or Limit Flex Duct In The Code



- Return path for every bedroom and in living space
- Temporary screen to keep garbage out
- Great!



DUCTS In ATTICS – Good or Bad?

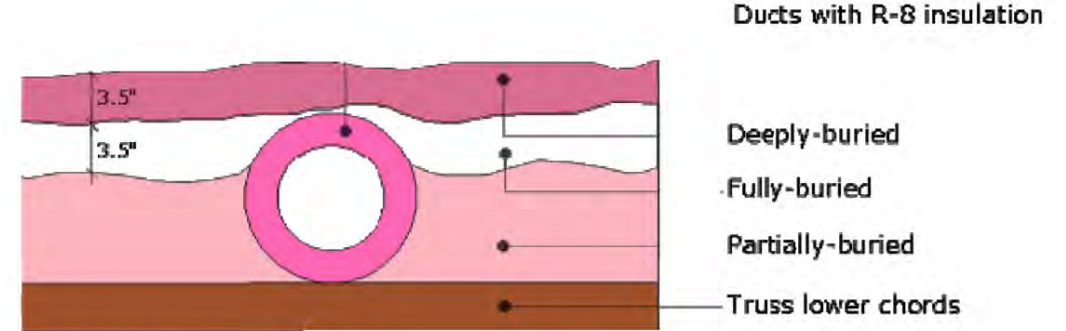
- Ductwork in vented attics traditionally have had thermal losses from 10-45%
- Interior ducts may be impractical, expensive, or increase envelope loads based on house design



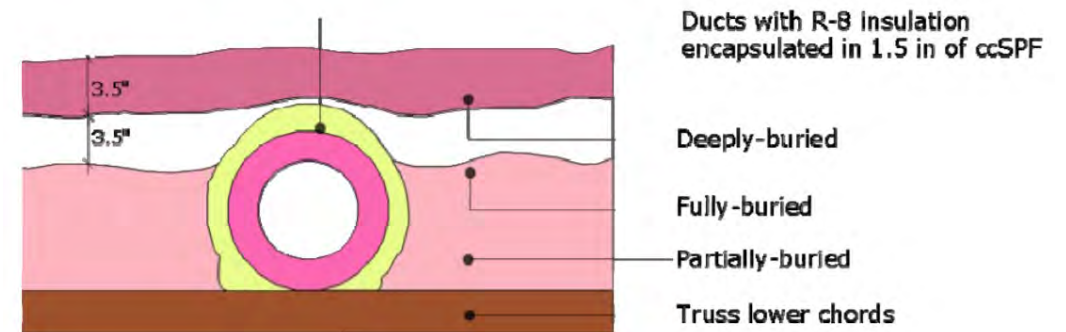
Image courtesy of Home Innovation Research Labs¹

Advantages of Buried Ducts

- Saves energy vs. ducts exposed in attics
- Typically a lower cost solution to bringing ducts fully into conditioned space
- Can easily be implemented
- Does not require high-tech solutions



Buried Duct Schematic (Dry Climate Only)



Buried & Encapsulated Duct Schematic (All Climates)

Ducts Buried within Ceiling Insulation

Prior to 2018, the IECC did not prohibit buried ducts, but neither did it define the practice or make specific allowance for it. The new provisions:

1. Define buried-duct practices that are explicitly allowed
2. Provide a means to characterize the performance of a buried duct system as an equivalent duct insulation R-value
3. Allow simplified credit for buried ducts in the performance path
 - Buried duct system may be considered inside conditioned space if certain requirements are met

Service Water Heating

R403.5 Circulating and Demand Hot Water Systems

- Automatic controls- time or demand sensing
- Demand recirculation systems- maximum return temperature- 104°F.

Look for:

- Insulate entire recirc loop
- Pump includes timer
- Pump installed inline with hot water flow, not on the return line? *Manufacturer's Installation Instructions*



R403.5.3 Hot Water Pipe Insulation R-3 (some exceptions)

Insulate HW pipe:

1. $\geq \frac{3}{4}$ " nominal
2. Serving more than one dwelling
3. Locate outside conditioned space
4. From WH to manifold
5. ~~Located under floor slab~~
6. Buried piping
7. Supply and return recirculation system (exception for demand recirculation)

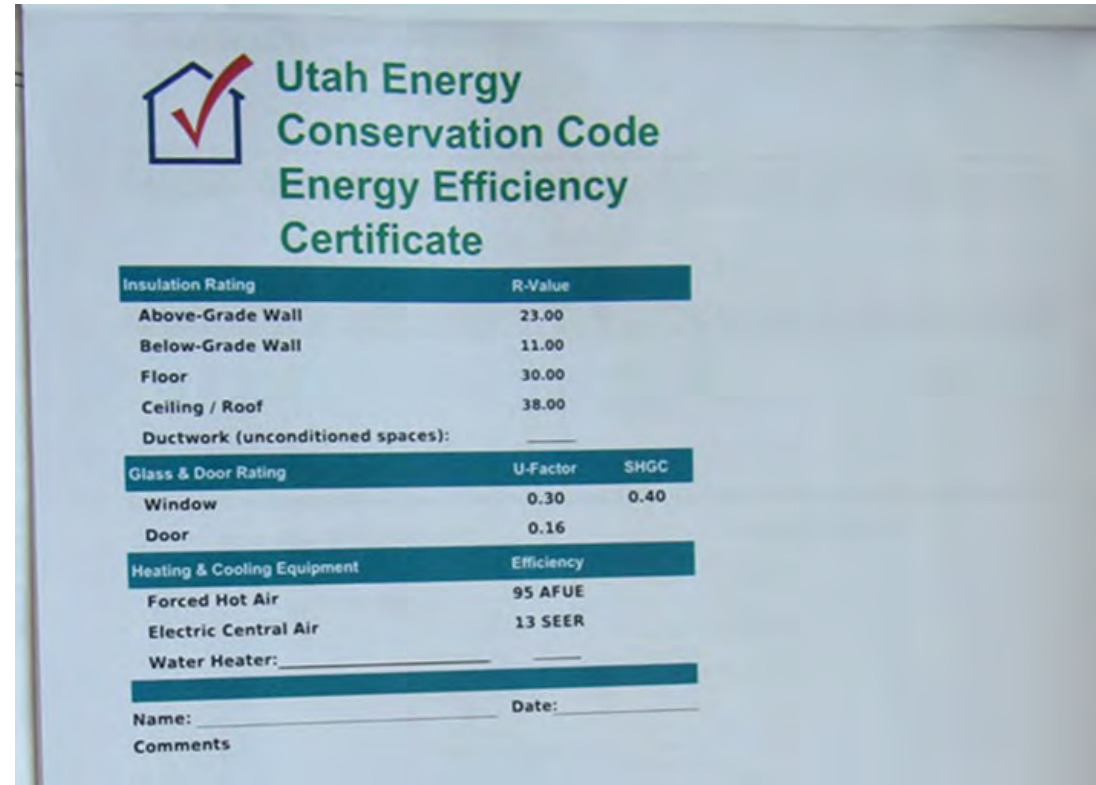
Final Inspection Item – REScheck prints this

R401.3 Certificate

Permanent certificate listing performance values, factors, and ratings for all building thermal envelope components, shall be posted in approved location.

Useful information for future use by:

- Future Home Sales and Owners
- Raters
- HVAC Designers
- Utility Incentive Programs
- Alternative Energy Source Companies



The image shows a printed form titled "Utah Energy Conservation Code Energy Efficiency Certificate". It features a logo of a house with a checkmark inside. The form is divided into several sections with blue headers. The "Insulation Rating" section lists R-values for Above-Grade Wall (23.00), Below-Grade Wall (11.00), Floor (30.00), Ceiling / Roof (38.00), and Ductwork (unconditioned spaces). The "Glass & Door Rating" section lists U-Factor and SHGC for Window (0.30, 0.40) and Door (0.16). The "Heating & Cooling Equipment" section lists Efficiency for Forced Hot Air (95 AFUE), Electric Central Air (13 SEER), and Water Heater. At the bottom, there are fields for Name, Date, and Comments.

Insulation Rating	R-Value
Above-Grade Wall	23.00
Below-Grade Wall	11.00
Floor	30.00
Ceiling / Roof	38.00
Ductwork (unconditioned spaces):	

Glass & Door Rating	U-Factor	SHGC
Window	0.30	0.40
Door	0.16	

Heating & Cooling Equipment	Efficiency
Forced Hot Air	95 AFUE
Electric Central Air	13 SEER
Water Heater:	

Name: _____ Date: _____
Comments

AT ROUGH and/or FINAL – verify the following:

- ✓ Programmable Thermostat
- ✓ Heat pump supplementary heat – outdoor 'stat
- ✓ Hot water boiler outdoor temperature setback
- ✓ Snow melt controls
 - ✓ Roughed in before driveway pour
- ✓ Pools and in-ground permanently installed spas
 - ✓ Timer, Switch with Access, vapor-retarder cover if heated
- ✓ 75% High efficacy lighting



QUESTIONS OR COMMENTS?

Thank you for your participation!

Be Safe - Stay Healthy

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