Achieving Compliance with New Residential Energy Code

- Tim Manz

  Senior Building Inspector

  City of Blaine

  tmanz@ci.blaine.mn.us

  763-785-6175

Effective dates:

- 2015 MN Mechanical Code:
  - January 24, 2015
- 2015 MN Residential Energy Code:
  - February 14, 2015
- 2015 MN Commercial Energy Code:
  - June 2, 2015

R303.1.1 Building thermal envelope insulation

- An R-value identification mark shall be applied by the manufacturer to each piece of building thermal envelope insulation 12 inches or greater in width

R303.1.1 Building thermal envelope insulation

- For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled R-value, installed density, coverage area and number of bags installed shall be listed on the certification

The following products comply with Minnesota Rules Chapter 1322 ("Residential Energy Code") effective 2015:

Blanket Insulation

Blanket and batt insulation when Installed according to the manufacturer's recommendation **will provide the state R-Value listed below.**

R-Value To Obtain an Insulation Resistance R of:	Nominal Thickness Installed Insulation should be
R-38	12" Thick
R-38C	10 ¼" Thick
R-30	9 ½" Thick
R-30C	8 ¼" Thick
R-25	8" Thick
R-22	6 ¾" Thick
R-21	5 ½" Thick
R-19	6 ¼" Thick
R-15	3 ½" Thick
R-13	3 ½" Thick
R-11	3 ½" Thick

†R-18 in a 5 ½" Cavity

PROPINK™

Unbonded Loosefill Insulation (L77 PINK Fiberglas™)

Stated R-Value is provided by installing the required number of bags per 1,000 sq. ft. at a thickness not less than the label minimum thickness. Installation of the required number of bags may yield more than specified minimum thickness and a minimum sq. ft. weight. Failure by the installer to provide both the required bags and at least the minimum thickness will result in lower insulation R-Value.

Nominal Bag Weight 33 lbs.

Attics

R-Value	Bags Per 1000 Sq.Ft.	Maximum Net Coverage	Minimum Weight/Sq.Ft.	Minimum Thickness (in)	Minimum Settled Thickness†
R-13	5.5	182.9	0.180	4.75	4.75
R-19	8.1	124.2	0.266	6.75	6.75
R-22	9.4	106.3	0.311	7.75	7.75
R-26	11.2	89.6	0.368	9.00	9.00
R-30	13.0	77.0	0.428	10.25	10.25
R-38	16.8	59.5	0.555	12.75	12.75
R-44	20.1	49.8	0.662	14.75	14.75
R-50	23.1	43.4	0.761	16.50	16.50
R-60	28.5	35.1	0.940	19.50	19.50

*The higher the R-Value, the greater the insulating power. Ask your seller for the fact sheet on R-Values.

Loosefill insulations vary in thermal performance due to factors such as aging, mean temperature, settlement, convection, moisture absorption and installation variation. Convection in glass loosefill insulation installed in open attics can reduce its thermal performance in extreme winter temperatures during the heating season.

The following products have been installed as specified above

12290 KISKA CIRCLE NE – JOB #12245 – BLAINE, MN

	Type (Fill in appropriate box)			R-Value	Thickness	No. Pkgs.	Coverage Area
	Unfaced	Foam	Loosefill				
Ceilings	☐	☐	■	**R-50**	**16 ½"**	**39**	**1706 SF**
Floors	☐	☐	■	**R-38**	**12 ¾"**	**1**	**53 SF**
Walls	■	☐	☐	**R-21**	**5 ½"**		

R303.1.1 Building thermal envelope insulation

- For sprayed polyurethane foam (SPF) insulation, the installed thickness of the areas covered and R-value of installed thickness shall be listed on the certification. The insulation installer shall sign, date and post the certification in a conspicuous location on the job site

Insulation Certificate

DO NOT REMOVE. PLEASE POST NEAR ELECTRICAL PANEL.

This form must be filled out and posted to comply with building code requirements.
Meets IRC requirements: **2006 IRC - N1101.2, N1101.4, N1101.8**
2009 IRC - N1101.2, N1101.4, N1101.8
2012 IRC - N1101.3, N1101.7, N1101.12

The following spray polyurethane foam product(s) has/have been installed.

☐ Classic ☐ Classic Plus ■ ProSeal ☐ ProSeal Eco ☐ MD-C-200 ☐ Other

Please consult International Building Code (IBC), Chapter 26 - Plastic and International Residential Code (IRC) 2006 IRC R314, 2009 IRC R316, 2012 IRC R316 - Foam Plastics for specific requirements. The aforementioned Icynene spray polyurethane foam insulation system(s) has/have been installed in accordance with manufacturer's processing guidelines to provide a thermal resistance of:

Area Insulated		Aged R-Value		Thickness*	
Attic Area		R-	at		inches
Sloped Ceilings		R-	at		inches
Walls (location):		R-	at		inches
Walls (location):		R-	at		inches
Floors (over an unheated crawl space)		R-	at		inches
Crawl Space Perimeter		R-	at		inches
Basement Walls		R-	at		inches
Other (location):	Exterior Rim Joist	R-	21 at	3.00	inches

*Nominal thicknesses are representative of field, spray-applied foam material.

Jobsite Address	12290 Kiska Circle NE
Date of Insulation Installation	7-14-15
Building Contractor	Hans Hagen Homes
Insulation Contractor	Quality Insulation
Insulation Contractor Phone	952-929-6889
Installed By	QI

R303.2.1 Protection of exposed foundation insulation

- Insulation applied to the exterior of basement walls, crawlspace walls and the perimeter of slab-on-grade floors shall have a rigid, opaque and weather-resistant protective covering to prevent the degradation of the insulation’s thermal performance

R303.2.1 Protection of exposed foundation insulation (cont'd)

- The protective covering shall cover the exposed exterior insulation and extend a minimum of 6 inches (153 mm) below grade.

R401.3 Certificate

R401.3 Certificate. Include the following on or in the electrical distribution panel:

A. Date the certificate is installed
B. Dwelling address
C. Residential contractor name and contractor license number
D. Homeowner name, if acting as the general contractor
E. Predominant installed R-values and location
F. Type of insulation installed in or on ceiling/roof, walls, rim/band joist, foundation, slab, basement wall, crawl space wall or floor, and ducts outside conditioned spaces
G. U-factors for fenestration and the solar heat gain coefficient (SHGC) of fenestration
H. Results of any required duct system and building envelope air leakage testing
I. Types, input ratings, manufacturers, model numbers and efficiencies of heating, cooling and service water heating equipment
J. Structure's calculated heat loss, cooling load and heat gain
K. Mechanical ventilation type, location and capacity
L. Buildings designated continuous and total ventilation rates
M. Type, size and location of any make-up air system
N. Location or future location of radon fan

R402.1.1 Insulation, waterproofing, & fenestrations

- The building thermal envelope shall meet the requirements of Table R402.1.1 based on the climate zone specified in chapter 3, and the requirements contained in section R402.2. Cast-in-place concrete and masonry block foundation walls shall be waterproofed according to IRC section R406 and the following requirements:

R402.1.1 Insulation, waterproofing, & fenestrations

1. The waterproofing shall extend from the top interior wall edge, across the top of the wall, and down the exterior wall face to the top of the footing. If a full width, closed-cell material is installed to create a seal between the sill plate and the top of the foundation wall, the installation is deemed to meet the requirements for the top of the wall waterproofing.

R402.1.1 Insulation, waterproofing, & fenestrations

2. If the walls are exposed to the exterior environment, the waterproofing system shall have a rigid, opaque, and weather-resistant protective covering to prevent degradation of the waterproofing system. The protective covering shall cover the exposed waterproofing and extend a minimum of 6 inches below grade. The protective covering system shall be flashed in accordance with IRC section R703.8.


CertiFoam 25

R402.1.1.2 Exterior draining foundation insulation

Any insulation assembly installed on the exterior of the foundation walls and on the perimeter of slabs-on-grade that permits water drainage shall:

1. be made of water-resistant materials manufactured for that intended use;

2. be installed according to the manufacturer's installation instructions;

R402.1.1.2 Exterior draining foundation insulation

4. have a rigid, opaque, and weather-resistant protective covering to prevent the degradation of the insulation's thermal performance. The protective covering shall cover the exposed exterior insulation and extend a minimum of 6 inches (152 mm) below grade. The insulation and protective covering system shall be flashed in accordance with IRC section R703.8.


CAT
DiversiFoam

R402.1.1.3 Exterior non-draining foundation insulation

Any insulation assembly installed on the exterior of the foundation walls or on the perimeter of slabs-on-grade that does not permit bulk water drainage shall:

1. be made of water-resistant materials manufactured for that intended use;

2. be installed according to the manufacturer's installation instructions

R402.1.1.3 Exterior non-draining foundation insulation

4. be covered with a 6-mil polyethylene slip sheet over the entire exterior surface; and

R402.1.1.3 Exterior non-draining foundation insulation

5. have a rigid, opaque, and weather-resistant protective covering to prevent degradation of the insulation's thermal performance. The protective covering shall cover the exposed exterior insulation and extend a minimum of 6 inches (152 mm) below grade. The insulation and protective covering system shall be flashed in accordance with IRC section R703.8.

R402.1.1.4 Interior foundation insulation requirements

Any insulation assembly installed on the interior of foundation walls shall meet the following requirements:

1. Masonry foundation walls shall be drained through each masonry block core to an approved interior drainage system.

R402.1.1.8 Foundation wall insulation performance option

- Insulated foundation systems designed and installed under the performance option shall meet the requirements of this section and the foundation, basement, or crawl space wall equivalent U-factor from Table 402.1.3.
- Many other requirements as well

(don’t even think about this option)

R402.2.8 Basement walls

- Walls associated with conditioned basements shall be insulated from the top of the basement wall down to 10 feet (3048 mm) below grade or to the top of the footing, whichever is less. Foundation insulation shall be installed according to the manufacturer's installation instructions.

R402.2.8 Basement walls

- Walls associated with unconditioned basements shall meet the requirements of this section unless the floor overhead is insulated in accordance with sections R402.1.1 and R402.2.7 and the following requirements:

R402.2.8 Basement walls

a. R-15 insulation for concrete and masonry foundations shall be installed according to R402.1.1.1 to R402.1.1.8 and a minimum of a R-10 shall be installed on the exterior of the wall. Interior insulation, other than closed cell spray foam, shall not exceed R-11.

R402.2.8 Basement walls

Exception: R-10 continuous insulation on the exterior of each foundation wall shall be permitted to comply with this code if the tested air leakage rate required in section R402.4.1.2 does not exceed 2.6 air changes per hour and the total square feet between the finished grade and the top of each foundation wall does not exceed 1.5 multiplied by the total lineal feet of each foundation wall that encloses conditioned space

R402.2.9 Slab-on-grade floors

- Slab-on-grade floors with a floor surface less than 12 inches (305 mm) below grade shall be insulated in accordance with Table R402.1.1. The insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall.

Table R402.1.1 Insulation Values

TABLE R402.1.1
)FENESTRATION REQUIREMENTS BY COMPONENT[a]

) TION[e]	CEILING[j] *R*-VALUE	WOOD FRAME WALL *R*-VALUE[f]	MASS WALL *R*-VALUE[i,g,h]	FLOOR *R*-VALUE	BASEMENT[c, i] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c, i] WALL *R*-VALUE
	49	20, 13+5	15/20	30[e]	15	10, 3.5 ft	15
	49	21	19/21	38[e]	15	10, 5 ft	15


CertiFoam 15
EXTRUDED POLYSTYRENE INSULATION

Table R402.1.1 Insulation Values

Window maximum U factor: 0.32
Attic ceiling: R-49
Attic vaulted ceiling: R-38 (if R-49 not possible)
Floor insulation: R-30 **(R-38 in Climate Zone 7)**
Slab insulation (on foundation wall): R-10

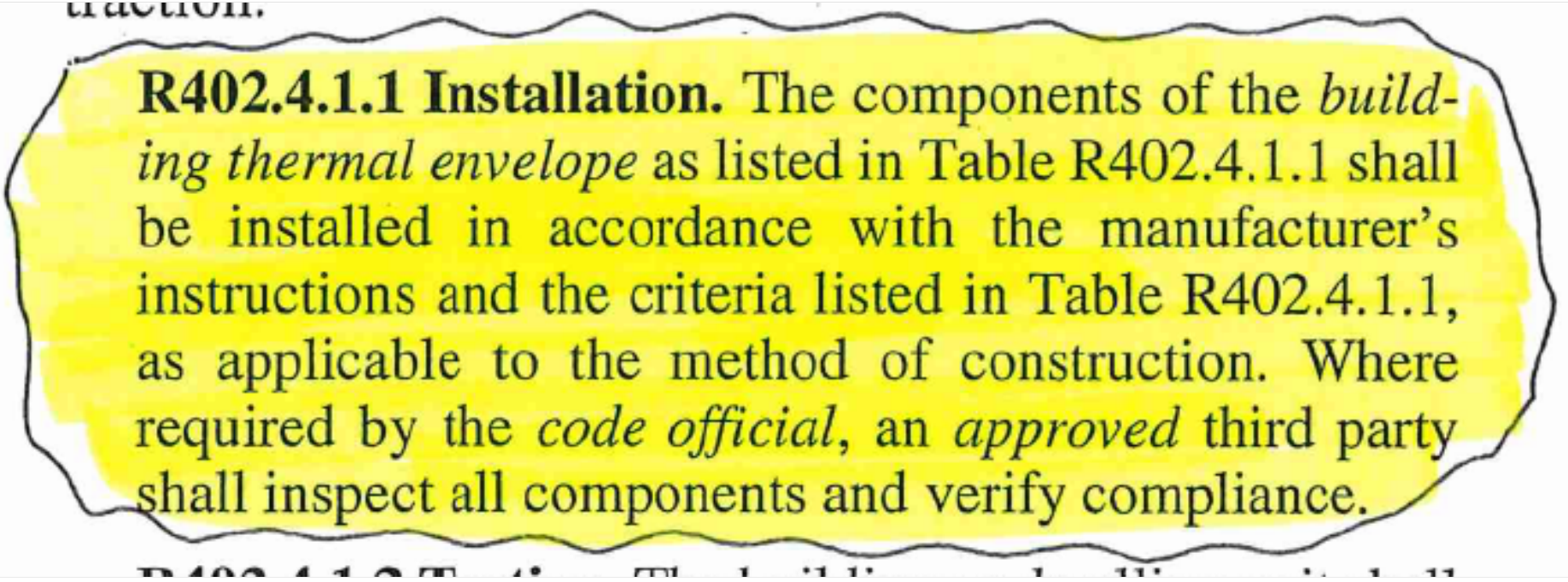
Table R402.1.1 Insulation Values

Wood frame wall insulation: R-20
Wood frame wall option: R-13 with R-5 continuous
Basement wall insulation: R-15
Crawl space insulation: R-15
Rim joist insulation: R-20

R402.4.1 Building thermal envelope

- The building thermal envelope shall comply with Sections R402.4.1.1 and R402.4.1.2. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

R402.4.1.1 Installation



R402.4.1.1 Installation. The components of the *building thermal envelope* as listed in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table R402.4.1.1, as applicable to the method of construction. Where required by the *code official*, an *approved* third party shall inspect all components and verify compliance.

TABLE R402.4.1.1
AIR BARRIER AND INSULATION INSTALLATION

COMPONENT	CRITERIA[a]
Air barrier and thermal barrier	A continuous air barrier shall be installed in the building envelope. 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 sealed. Access openings, drop down stair or knee wall doors to unconditioned attic spaces shall be sealed.
Walls	Corners and headers shall be insulated and the junction of the foundation and sill plate shall be sealed. The junction of the top plate and top of exterior walls shall be sealed. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier. Knee walls shall be sealed.
Windows, skylights and doors	The space between window/door jambs and framing and skylights and framing shall be sealed.
Rim joists	Rim joists shall be insulated and include the air barrier.
Floors (including above-garage and cantilevered floors)	Insulation shall be installed to maintain permanent contact with underside of subfloor decking. The air barrier shall be installed at any exposed edge of insulation.
Crawl space walls	Where provided in lieu of floor insulation, insulation shall be permanently attached to the crawlspace walls. Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.
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 air tight, IC rated, and sealed to the drywall.
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	Exterior walls adjacent to showers and tubs shall be insulated and the air barrier installed separating them from the showers and tubs.
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.
Fireplace	An air barrier shall be installed on fireplace walls. Fireplaces shall have gasketed doors.

R402.4.1.2 Building thermal envelope testing

- The building or dwelling unit shall be tested and verified as having an air leakage rate of not exceeding 3 air changes per hour. Testing shall be conducted with a blower door at a pressure of 50 Pascals (0.2 inches w.g.) When required by the code official, testing shall be conducted by an approved third party.

R402.4.1.2 Building thermal envelope testing

- (continued) A written report of the results of the test shall be signed by the party conducting the test and provided to the code official. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope.

R402.4.1.2 Building thermal envelope testing

- (continued) During testing:

  1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.

  2. Dampers shall be closed, but not sealed beyond intended infiltration control measures.

R402.4.1.2 Building thermal envelope testing

- (continued) During testing:

  3. Interior doors, if installed at the time of the test, shall be open.

  4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed.

R402.4.1.2 Building thermal envelope testing

- (continued) During testing:

  5. Heating and cooling systems, if installed at the time of the test, shall be turned off.

  6. Supply and return registers, if installed at the time of the test, shall be fully open.

BUILDING LEAKAGE TEST

3105 123rd COURT NE

B15-0995

Date of Test: 6/20/2015

Customer: Hedberg Homes, Inc.
4247 - 117th Ave. NE
Blaine, MN 55449
Phone: 612-309-6487
Email: hedberghomesinc@aol.com

Test File: hedberg
Technician: Frank Wagamon
Project Number: 3105

Building Address: Rambler S/on grade
3105 - 123rd Ct. NE
Blaine, MN 55449

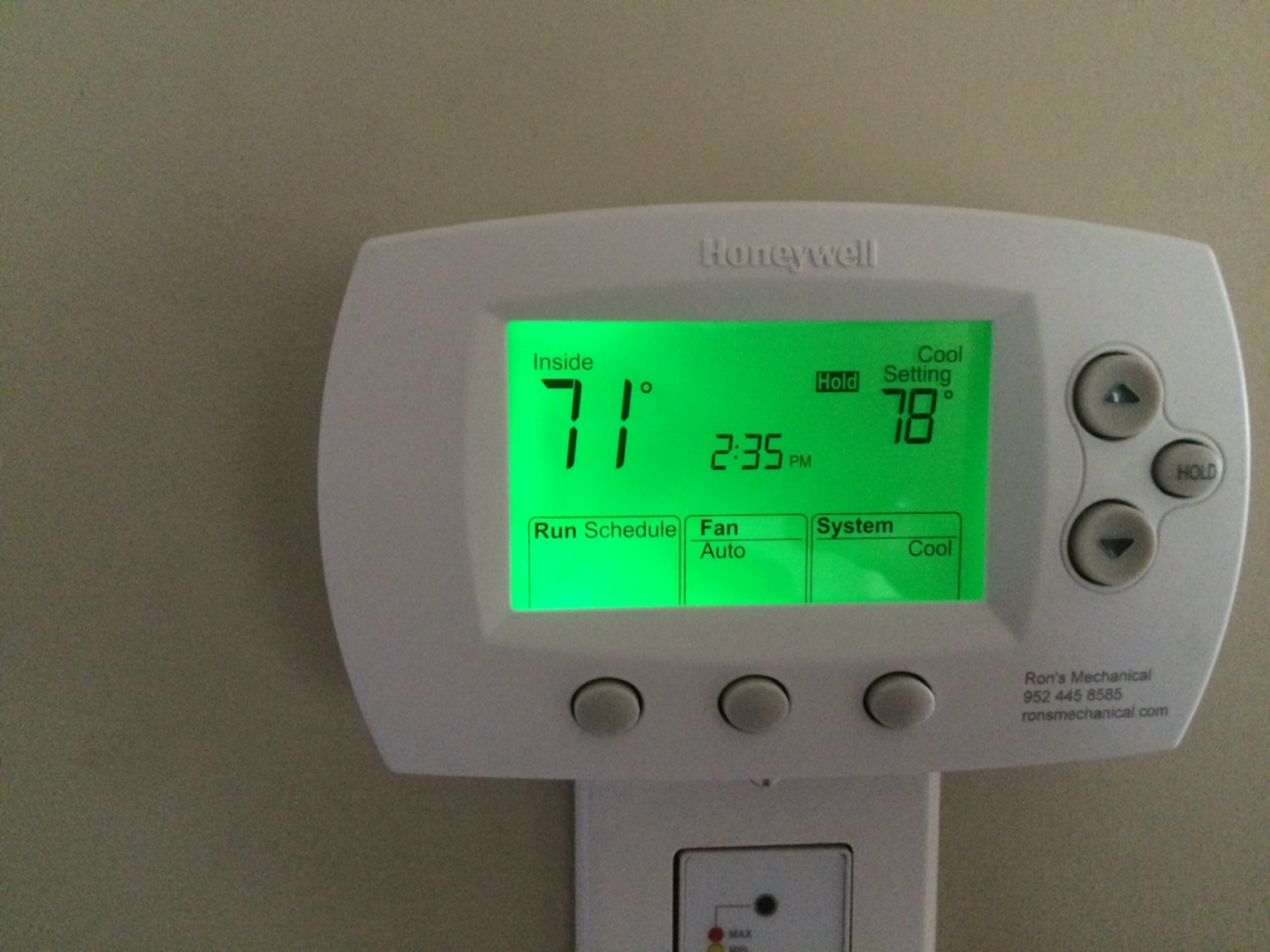
Test Results

1. Airflow at 50 Pascals: (50 Pa = 0.2 w.c.) — 608 CFM50 / 2.11 ACH50
2. Leakage Area: — 33.4 in2 LBL ELA @ 4 Pa
3. Building Leakage Curve: — Flow Coefficient (C) = 47.8; Exponent (n) = 0.650 (Assumed)
4. Test Settings: — Test Standard: RESNET One-Point Test; Test Mode: Depressurization
5. Accuracy Level — Standard Level of Accuracy Test

R403.1.1 Programmable thermostat

- Where the primary heating system is a forced air furnace, at least one thermostat per dwelling unit shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day.


Honeywell
73
Fan
Auto
System
Off
Ron's Mechanical
952 445 8585
ronsmechanical.com
MAX
MIN
INTERMITTENT
PUSH
VENMAR
AVS


Honeywell
Inside
71°
2:35 PM
Hold
Cool
Setting
78°
HOLD
Run Schedule
Fan
Auto
System
Cool
Ron's Mechanical
952 445 8585
ronsmechanical.com
MAX

(MN Amendment)
R403.2.1 Duct insulation

- All exhaust, supply, and return air ducts and plenums shall be insulated according to Table R403.2.1.

(MN Amendment)
R403.2.1 Duct insulation

TABLE R403.2.1
MINIMUM REQUIRED DUCT AND PLENUM INSULATION FOR DWELLING UNITS

DUCT TYPE/LOCATION	REQUIREMENTS
Exterior of building	R-8, V and W
Attics, garages, and ventilated crawl spaces	R-8 and V
Outdoor air intakes within conditioned spaces	R3.3 and V
Exhaust ducts within conditioned spaces	R3.3 and V
Within concrete slab or within ground	R3-5 and V
Within conditioned spaces and in basements with insulated walls	None Required

(MN Amendment)
R403.2.1 Duct insulation

For the purposes of Table R403.2.1, the following applies:

a. Insulation is only required in the conditioned space for a distance of 3 feet (914 mm) from the exterior or unconditioned space.

b. V means the vapor retarder in accordance with IMC Section 604.11. When a vapor retarder is required, duct insulation required by this section shall be installed without respect to other building envelope insulation.

c. W means an approved weatherproof barrier.

R403.2.2 Duct sealing

- Ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with the IMC.

  Exception:

  Air-impermeable spray foam products shall be permitted to be applied without additional joint seals.

IMC 603.9 Duct sealing

- ***Possible Interpretation:***

Ducts shall be sealed per IMC 603.9 to ensure that dissimilar materials allow for differential expansion and contraction. In addition, a thermal barrier per Section R316.4 of the MN Residential Code and Section 2603.4 of the MN Building Code is required so that an ignition barrier is provided between the foam plastic and the interior of the building.

IMC 603.9 Duct sealing

- All longitudinal and transverse joints, seams and connections in metallic and nonmetallic ducts shall be constructed as specified in SMACNA *HVAC Duct Construction Standards—Metal and Flexible* and NAIMA *Fibrous Glass Duct Construction Standards*.

IMC 603.9 Duct sealing

- (continued) All joints, longitudinal and transverse seams and connections in ductwork shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, liquid sealants or tapes.

IMC 603.9 Duct sealing

- (continued) Closure systems used to seal ductwork listed and labeled in accordance with UL 181A and shall be marked “181A-P” for pressure-sensitive tape or “181A-M” for mastic.

IMC 603.9 Duct sealing

- (continued) Closure systems used to seal flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked “181B-FX” for pressure-sensitive tape or “181B-M” for mastic.

IMC 603.9 Duct sealing

- (continued) Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with UL181B and shall be marked UL181B-C.

(MN Amendment)
IMC 603.9 Duct sealing

- (continued) Closure systems used to seal metal ductwork shall be installed in accordance with the manufacturer's installation instructions. Pressure-sensitive tape shall not be used as the primary sealant on ducts, unless it has been certified to comply with UL 181A or UL 181B by a nationally recognized testing laboratory.

IMC 603.9 Duct sealing

- (continued) Unlisted duct tape is not permitted as a sealant on any duct.

IMC 603.9 Duct sealing

- ***How can metal duct joints, seams and connections be sealed?***
  - *Mastics?*
  - *Tapes?*
  - *Liquid sealants (e.g. caulks)?*
  - *Aerosol sealants?*
  - *Closure systems?*


STRENGTH AXIS
EJE DE
RESISTENCIA
THIS SIDE DOWN
ESTE LADO ABAJO
SPACE ENDS 1/8"
SEPARE LOS
EXTREMOS A 1/8"
CONSTRUCTION SHEATHING
1F24
18.0 mm
CSA O325-07
EXTERIOR TYPE
ADHESIVE
PREPARE SURFACE AS
REQUIRED BY FLOOR
COVERING MANUFACTURER
PREPARE LA
SUPERFICIE SEGUN EL
www.norbord.com
507
2015 B
MAY 13
APA


POLYKEN 367-17

1.50" IPS SCH 40 SERIES COEXTRUDED

GREEN BUILDING
COUNCIL MEMBER

Venture Tape
1581A


HUBER
SFI
2014
NOV
1
A

IMC 603.9 Duct sealing

- ***Possible Interpretation:***

Although a listed duct tape may comply with the sealing requirements of this section, in order to comply with the tightness tests specified in Section R403.2.2, typically duct mastic listed to UL181A-M or UL181B-M will be required on all joints, seams and connections, and it shall be installed liberally with a minimum thickness of approximately 1/16 inch

IMC 603.9 Duct sealing

- ***Possible Interpretation (cont'd):***

For metal ducts that are not required to comply with the tightness test, pressure-sensitive tape listed to UL181A-P or UL181B-FX for ***cold weather*** *applications will typically be allowed if it is installed according to commonly-accepted industry practices.*

R403.2.2 Duct tightness

- Duct tightness shall be verified by either of the following:

  1. **Postconstruction test:** Total leakage shall be less than or equal to 4 cfm per 100 square feet of conditioned floor area when tested at a pressure differential of 25 Pascals (0.1 inches w.g.) across the entire system, including the air handler enclosure. All register boots shall be taped or sealed.

R403.2.2 Duct tightness

- Duct tightness shall be verified by either of the following:

  2. **Rough-in test:** Total leakage shall be less than or equal to 4 cfm per 100 square feet of conditioned floor area when tested at a pressure differential of 25 Pascals (0.1 inches w.g.) across the entire system, including the air handler enclosure. All register boots shall be taped or sealed.

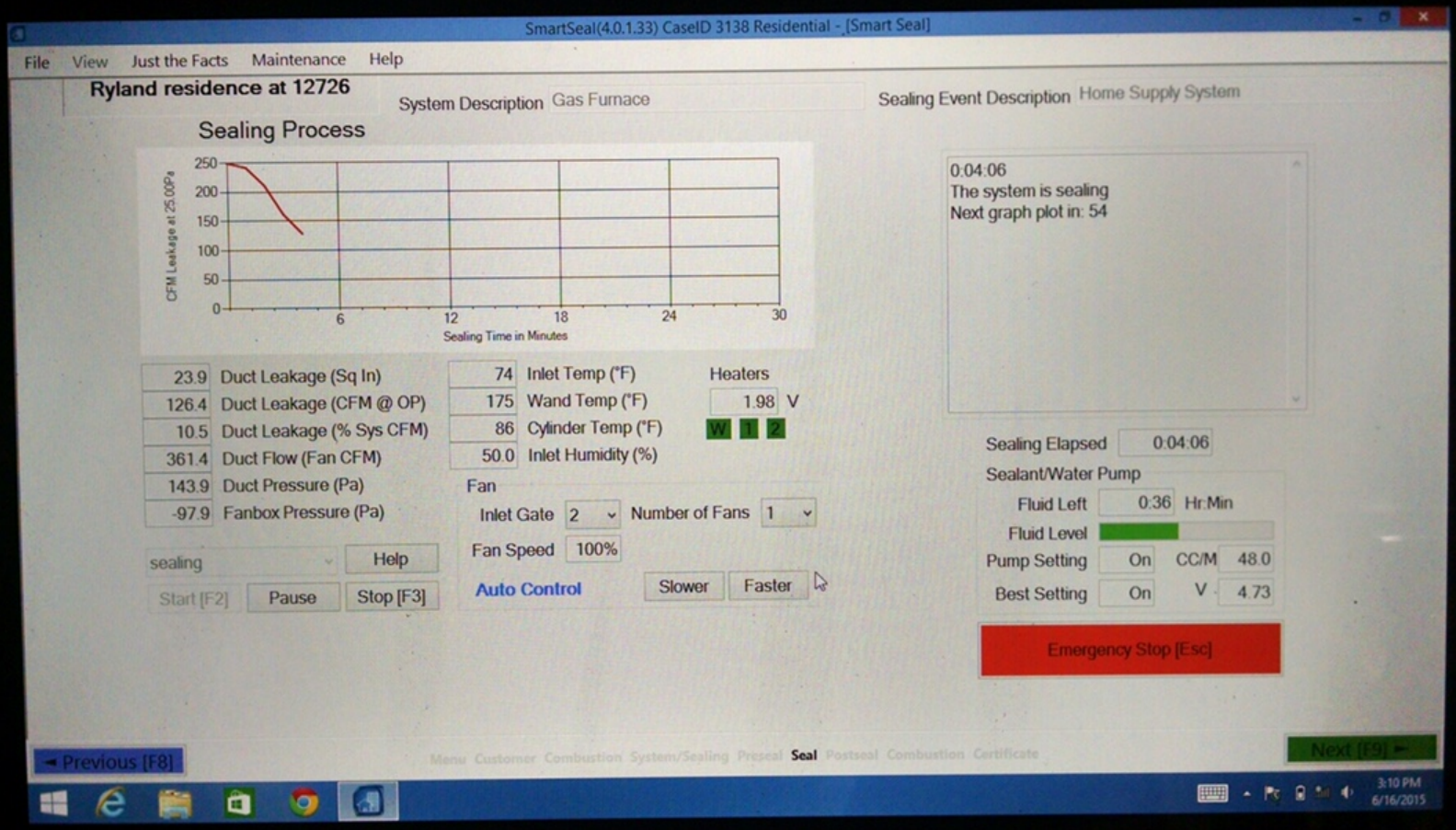
R403.2.2 Duct tightness

- Duct tightness shall be verified by either of the following:

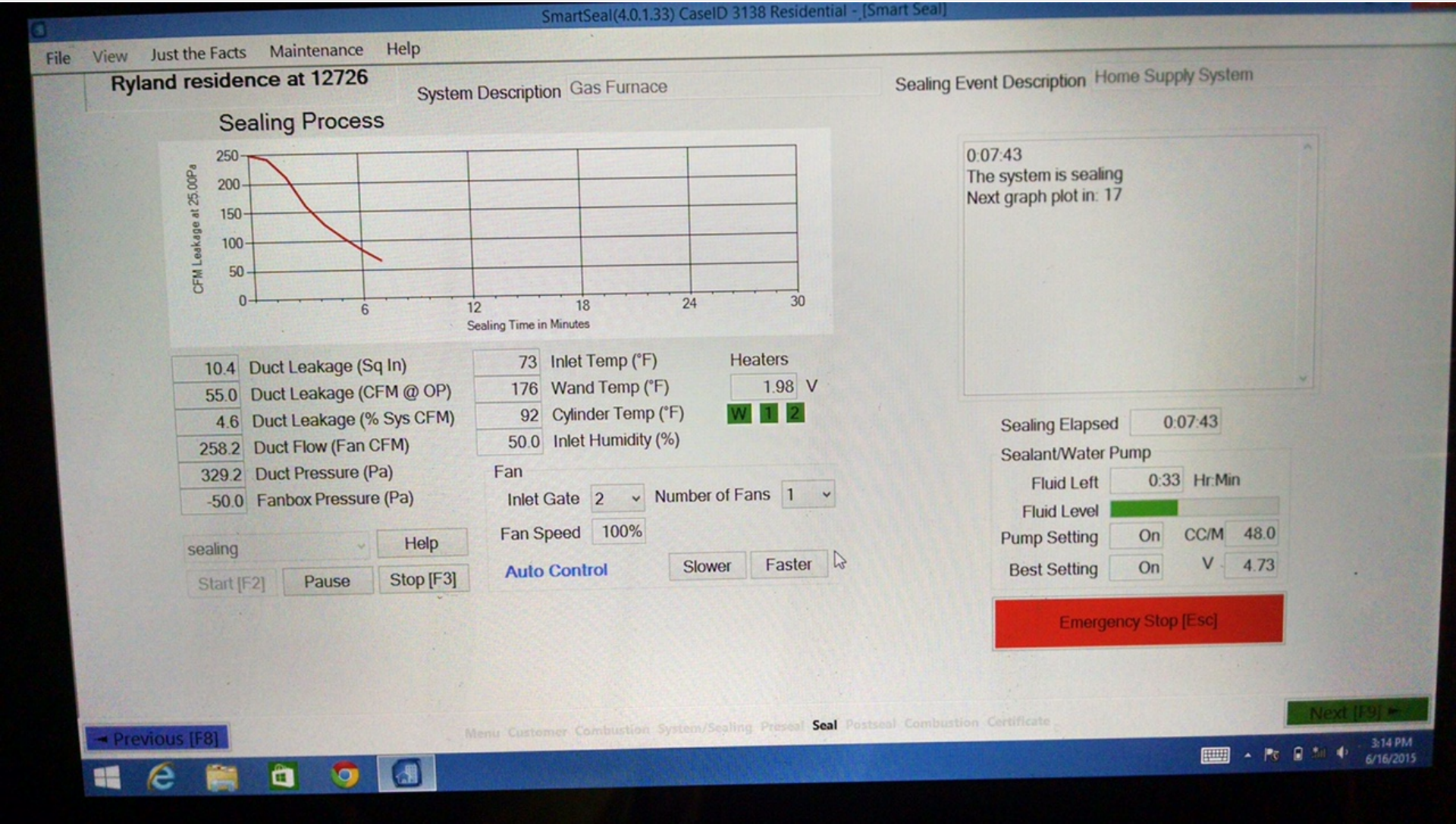
  2. **Rough-in test (continued):**

  If the air handler is not installed at the time of test, total leakage shall be less than or equal to 3 cfm per 100 square feet of conditioned floor area.

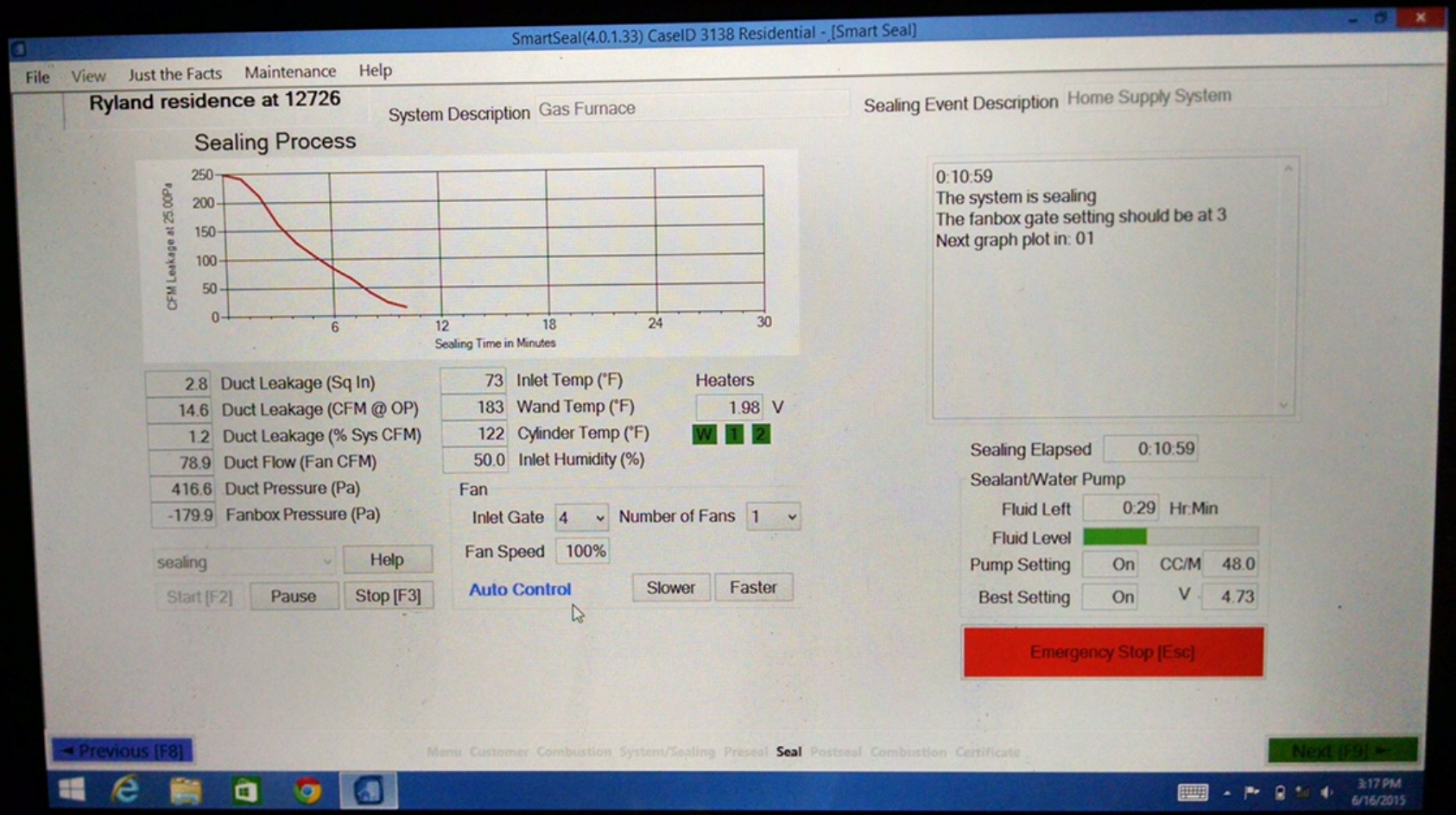
Aeroseal


SmartSeal(4.0.1.33) CaseID 3138 Residential - [Smart Seal]
File View Just the Facts Maintenance Help
Ryland residence at 12726
System Description Gas Furnace
Sealing Event Description Home Supply System
Sealing Process
CFM Leakage at 25.00Pa
250 200 150 100 50 0
6 12 18 24 30
Sealing Time in Minutes
0:04:06
The system is sealing
Next graph plot in: 54
23.9 Duct Leakage (Sq In)
126.4 Duct Leakage (CFM @ OP)
10.5 Duct Leakage (% Sys CFM)
361.4 Duct Flow (Fan CFM)
143.9 Duct Pressure (Pa)
-97.9 Fanbox Pressure (Pa)
74 Inlet Temp (°F)
175 Wand Temp (°F)
86 Cylinder Temp (°F)
50.0 Inlet Humidity (%)
Heaters
1.98 V
W 1 2
Fan
Inlet Gate 2
Number of Fans 1
Fan Speed 100%
Auto Control
Slower
Faster
sealing
Help
Start [F2]
Pause
Stop [F3]
Sealing Elapsed 0:04:06
Sealant/Water Pump
Fluid Left 0:36 Hr:Min
Fluid Level
Pump Setting On CC/M 48.0
Best Setting On V 4.73
Emergency Stop [Esc]
Previous [F8]
Menu Customer Combustion System/Sealing Preseal Seal Postseal Combustion Certificate
Next [F9]
3:10 PM
6/16/2015

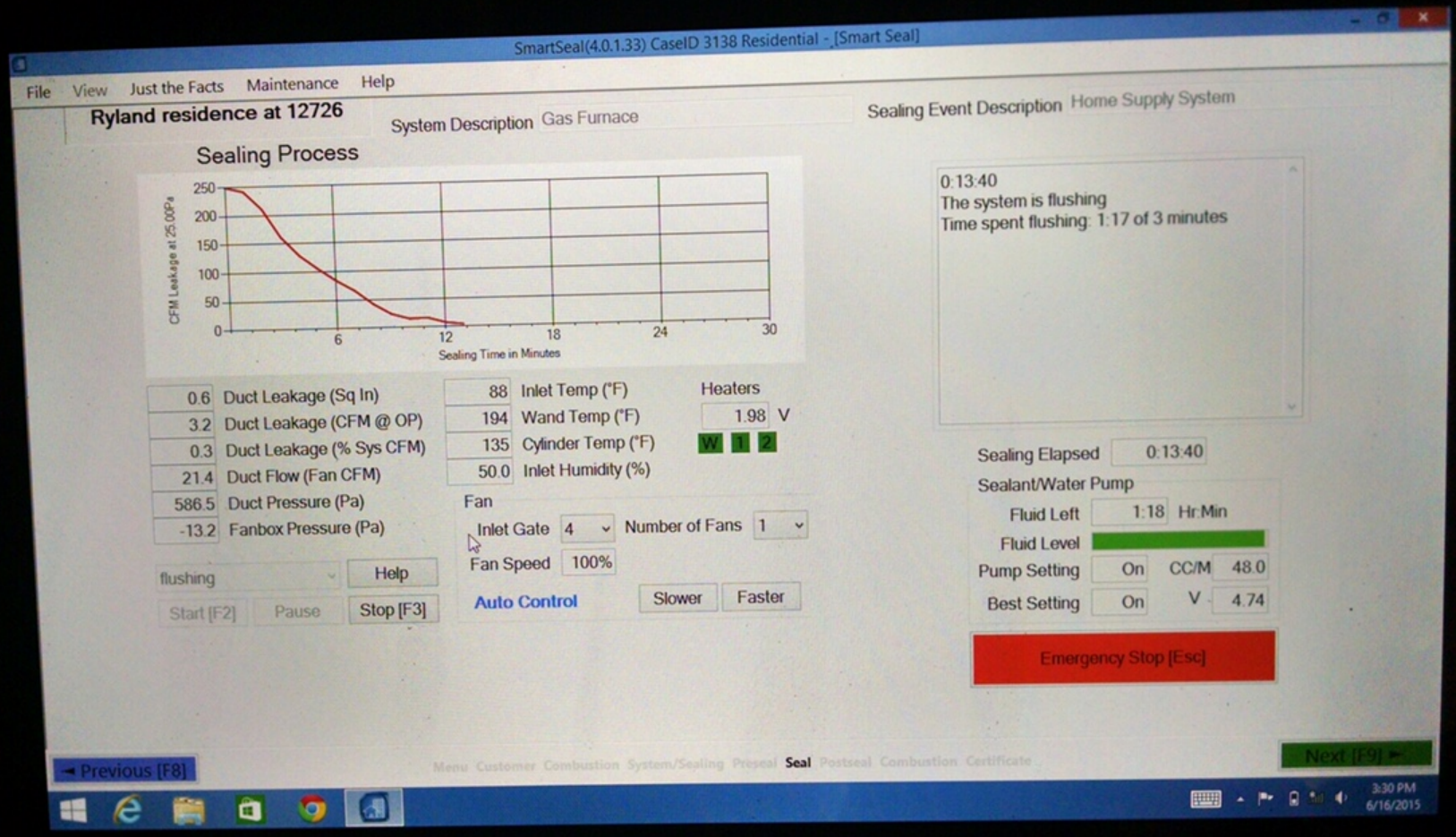
Aeroseal


SmartSeal(4.0.1.33) CaseID 3138 Residential - [Smart Seal]
File View Just the Facts Maintenance Help
Ryland residence at 12726
System Description Gas Furnace
Sealing Event Description Home Supply System
Sealing Process
CFM Leakage at 25.00Pa
250
200
150
100
50
0
6
12
18
24
30
Sealing Time in Minutes
0:07:43
The system is sealing
Next graph plot in: 17
10.4 Duct Leakage (Sq In)
55.0 Duct Leakage (CFM @ OP)
4.6 Duct Leakage (% Sys CFM)
258.2 Duct Flow (Fan CFM)
329.2 Duct Pressure (Pa)
-50.0 Fanbox Pressure (Pa)
73 Inlet Temp (°F)
176 Wand Temp (°F)
92 Cylinder Temp (°F)
50.0 Inlet Humidity (%)
Heaters
1.98 V
W 1 2
Fan
Inlet Gate 2
Number of Fans 1
Fan Speed 100%
Auto Control
Slower
Faster
sealing
Help
Start [F2]
Pause
Stop [F3]
Sealing Elapsed 0:07:43
Sealant/Water Pump
Fluid Left 0:33 Hr:Min
Fluid Level
Pump Setting On CC/M 48.0
Best Setting On V 4.73
Emergency Stop [Esc]
Previous [F8]
Menu Customer Combustion System/Sealing Preseal Seal Postseal Combustion Certificate
Next [F9]
3:14 PM
6/16/2015

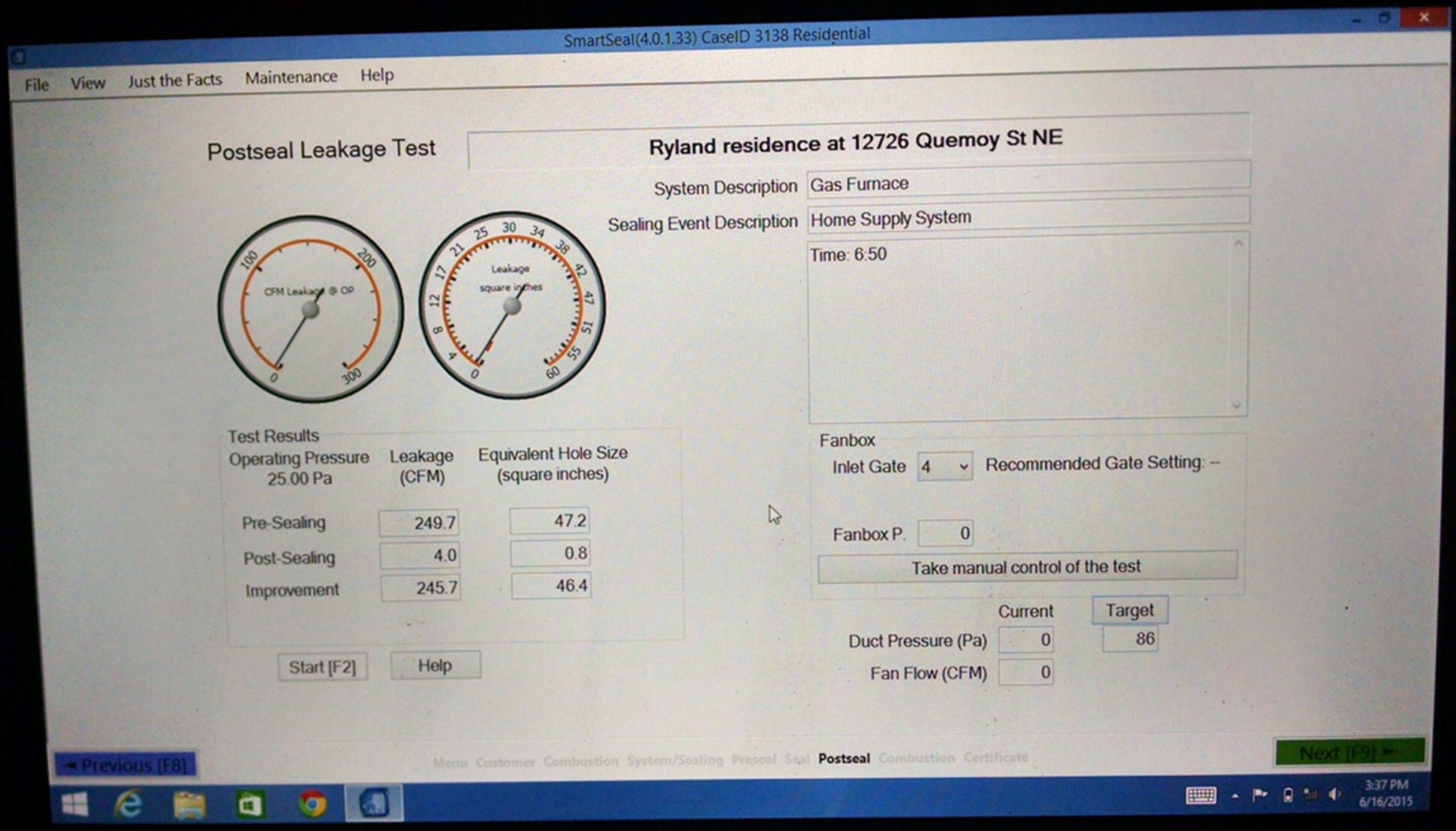
Aeroseal


SmartSeal(4.0.1.33) CaseID 3138 Residential - [Smart Seal]
File View Just the Facts Maintenance Help
Ryland residence at 12726
System Description Gas Furnace
Sealing Event Description Home Supply System
Sealing Process
CFM Leakage at 25.00Pa
250 200 150 100 50 0
6 12 18 24 30
Sealing Time in Minutes
0:10:59
The system is sealing
The fanbox gate setting should be at 3
Next graph plot in: 01
2.8 Duct Leakage (Sq In)
14.6 Duct Leakage (CFM @ OP)
1.2 Duct Leakage (% Sys CFM)
78.9 Duct Flow (Fan CFM)
416.6 Duct Pressure (Pa)
-179.9 Fanbox Pressure (Pa)
73 Inlet Temp (°F)
183 Wand Temp (°F)
122 Cylinder Temp (°F)
50.0 Inlet Humidity (%)
Heaters
1.98 V
W 1 2
Fan
Inlet Gate 4
Number of Fans 1
Fan Speed 100%
Auto Control
Slower
Faster
sealing
Help
Start [F2]
Pause
Stop [F3]
Sealing Elapsed 0:10:59
Sealant/Water Pump
Fluid Left 0:29 Hr:Min
Fluid Level
Pump Setting On CC/M 48.0
Best Setting On V 4.73
Emergency Stop [Esc]
◄ Previous [F8]
Menu Customer Combustion System/Sealing Preseal Seal Postseal Combustion Certificate
Next [F9] ►
3:17 PM
6/16/2015

Aeroseal


SmartSeal(4.0.1.33) CaseID 3138 Residential - [Smart Seal]
File View Just the Facts Maintenance Help
Ryland residence at 12726
System Description Gas Furnace
Sealing Event Description Home Supply System
Sealing Process
CFM Leakage at 25.00Pa
250
200
150
100
50
0
6
12
18
24
30
Sealing Time in Minutes
0:13:40
The system is flushing
Time spent flushing: 1:17 of 3 minutes
0.6 Duct Leakage (Sq In)
3.2 Duct Leakage (CFM @ OP)
0.3 Duct Leakage (% Sys CFM)
21.4 Duct Flow (Fan CFM)
586.5 Duct Pressure (Pa)
-13.2 Fanbox Pressure (Pa)
88 Inlet Temp (°F)
194 Wand Temp (°F)
135 Cylinder Temp (°F)
50.0 Inlet Humidity (%)
Heaters
1.98 V
W 1 2
Fan
Inlet Gate 4
Number of Fans 1
Fan Speed 100%
Auto Control
Slower
Faster
flushing
Help
Start [F2]
Pause
Stop [F3]
Sealing Elapsed 0:13:40
Sealant/Water Pump
Fluid Left 1:18 Hr:Min
Fluid Level
Pump Setting On CC/M 48.0
Best Setting On V 4.74
Emergency Stop [Esc]
Previous [F8]
Menu Customer Combustion System/Sealing Preseal Seal Postseal Combustion Certificate
Next [F9]
3:30 PM
6/16/2015

Aeroseal


SmartSeal(4.0.1.33) CaseID 3138 Residential
File View Just the Facts Maintenance Help
Postseal Leakage Test
Ryland residence at 12726 Quemoy St NE
System Description Gas Furnace
Sealing Event Description Home Supply System
Time: 6:50
CFM Leakage @ OP
Leakage square inches
Test Results
Operating Pressure 25.00 Pa
Leakage (CFM)
Equivalent Hole Size (square inches)
Pre-Sealing 249.7 47.2
Post-Sealing 4.0 0.8
Improvement 245.7 46.4
Start [F2]
Help
Fanbox
Inlet Gate 4
Recommended Gate Setting: --
Fanbox P. 0
Take manual control of the test
Current
Target
Duct Pressure (Pa) 0 86
Fan Flow (CFM) 0
Previous [F8]
Menu Customer Combustion System/Sealing Preseal Seal Postseal Combustion Certificate
Next [F9]
3:37 PM
6/16/2015

R403.2.2 Duct tightness

- ***What about ducts located in the following areas?***
  - *Above garage for bonus room?*
  - *Cantilever?*
  - *Oval duct in exterior wall?*
  - *Underground duct (transite)?*
  - *Attics?*

R403.2.2 Duct tightness

- **Exception:**

  The total leakage test is not required for ducts and air handlers located entirely within the building thermal envelope.


FOAMULAR
R-7.5
1½ inch Thickness
OWENS CORNING
FOAMULAR
SFI-00008
1¾" TJ® Rim Board


FOAMULAR
R-7.5
1½ inch Thickness
1½ pulg. de espesor
FI CERTIFIED SOURCING SF
IRCING SFI-00008
056

R403.2.2 Duct tightness

- ***Possible Interpretation:***

Typically a supply duct serving a conditioned room above an attached garage would be considered to be located entirely within the building thermal envelope if it complies with the following:

R403.2.2 Duct tightness

- ***Possible Interpretation (cont'd):***

1. Duct joints, seams and connections shall be sealed per IMC 603.9.

2. Duct shall be insulated with minimum R-8 duct insulation and have a vapor retarder (per IMC 604.11) installed without respect to other building envelope insulation.

3. Duct shall be completely located above the floor insulation of minimum R-30.

R403.2.2 Duct tightness

- ***Possible Interpretation (cont'd):***

4. HVAC register boots shall be sealed to the subfloor or drywall.

5. If the space above the garage ceiling freely communicates with the floor/ceiling cavity of the house, an air and vapor impermeable R-30 building thermal envelope insulation shall be used.

☐ SHEATHING ☐ SEPTIC INSTALL ☐ _____
☐ FRAMING/HOUSEWRAP

METER NUMBER: _____ WIRED? ☐

COMMENTS: _____

Plbg rough-in:
5 psi air test above ground
Approved

Mech / HVAC rough-in:
* Correction item:
Ensure that supply ducts above garage have min R-30 building thermal envelope under them. Rigid foam board or spray foam is required to obtain R-30.

☐ WORK COMPLETED SATISFACTORILY - CLOSE PERMIT
☒ WORK SATISFACTORY: PROCEED Plbg
☒ CORRECT WORK & PROCEED mech
☐ INSPECTION FAILED: CORRECT WORK: CALL FOR REINSPECTION
☐ STOP WORK ORDER POSTED, CALL INSPECTOR

R403.2.2 Duct tightness

TABLE R402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b,e]	CEILING[j] *R*-VALUE	WOOD FRAME WALL *R*-VALUE[f]	MASS WALL *R*-VALUE[i,g,h]	FLOOR *R*-VALUE	BA
6	0.32	0.55	NR	49	20, 13+5	15/20	30[e]	
7	0.32	0.55	NR	49	21	19/21	38[e]	

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 that is less than 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.

c. See Section R402.2.8.

d. Insulation R-values for heated slabs shall be installed to the depth indicated or to the top of the footing, whichever is less.

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

f. First value is cavity insulation, second is continuous insulation or insulated siding, so "13+5" means R-13 cavity insulati
insulated siding. If

R403.2.2 Duct tightness

443 Lafayette Road N.
St. Paul, Minnesota 55155
www.dli.mn.gov

MINNESOTA DEPARTMENT OF
LABOR & INDUSTRY

(651) 284-5005
1-800-342-5354

Division Opinion

Inquiry Number:	2015-01
Subject:	Ducts installed in floors over unconditioned spaces
Code:	2015 Minnesota Residential Code Sections R402.2.7 and R403.2.2
Approved By:	Scott McLellan, State Building Official
Issue Date:	May 14, 2015

R403.2.2 Duct tightness

Question:
Can ducts installed in a floor over unconditioned space be considered to be within the conditioned space of the building envelope? If so, are the ducts required to be tested for leakage in accordance with section R403.2.2?

Answer:
Yes. These ducts can be considered to be within the conditioned space of the building envelope but do not have to be tested for air tightness provided the following items are met:

1. Ducts, including the duct boot where they intersect the floor above must be sealed in accordance with provisions of section R403.2.2 using materials listed in the Minnesota Mechanical Code section 603.9.

2. The insulation in the floor assembly must not be compressed, must meet the required "R" value listed in Table R402.1.1, and be installed completely below the duct.

3. If the duct is also used to provide cooled conditioned air to the room or space above, it shall be insulated to a minimum of an R-8 with a vapor retarder installed in accordance with section 604.11 of the Minnesota Mechanical Code.

R402.2.7 Floors

- Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking.

TABLE R402.4.1.1
AIR BARRIER AND INSULATION INSTALLATION

COMPONENT	CRITERIA[a]
Air barrier and thermal barrier	A continuous air barrier shall be installed in the building envelope. 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 sealed. Access openings, drop down stair or knee wall doors to unconditioned attic spaces shall be sealed.
Walls	Corners and headers shall be insulated and the junction of the foundation and sill plate shall be sealed. The junction of the top plate and top of exterior walls shall be sealed. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier. Knee walls shall be sealed.
Windows, skylights and doors	The space between window/door jambs and framing and skylights and framing shall be sealed.
Rim joists	Rim joists shall be insulated and include the air barrier.
Floors (including above-garage and cantilevered floors)	Insulation shall be installed to maintain permanent contact with underside of subfloor decking. The air barrier shall be installed at any exposed edge of insulation.
Crawl space walls	Where provided in lieu of floor insulation, insulation shall be permanently attached to the crawlspace walls. Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.
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 air tight, IC rated, and sealed to the drywall.
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	Exterior walls adjacent to showers and tubs shall be insulated and the air barrier installed separating them from the showers and tubs.
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.
Fireplace	An air barrier shall be installed on fireplace walls. Fireplaces shall have gasketed doors.


Floor 4
Floor 3
Floor 2

R402.2.7 Floors

COMMENTS:

Insulation:

Approved with the following condition:
3 foot high space above the garage under occupied bedroom shall have blocking (OSB) installed at the boundary of the building thermal envelope (above the wall between the house and garage) and space shall be completely filled with insulation

R403.2.3 Building cavities

- Building framing cavities shall not be used as ducts or plenums.

(MN Amendment)
R403.5 Mechanical ventilation

- The building shall be provided with a balanced mechanical ventilation system that is +/- 10% of the system's design capacity and meets the requirements of R403.5.5 which establishes the **continuous** and **total** ventilation requirements for dwelling unit ventilation.

(MN Amendment) R403.5.5 HRV/ERV systems

- All balanced systems shall be balanced so that the air intake is within 10% of the exhaust output.

  A HRV or ERV shall meet either:

  1. HVI Standard 920, 72 hours minus 13 Fahrenheit cold weather test.
  2. Certified by a registered professional engineer

...ONLY"
...ÉRIEURE SEULEMENT"
Fabriqué au Canada

HZ 60
AMP 1.5

c UL us LISTED

E147773
4M43

DUCTED HEAT RECOVERY VENTILATOR

Type:
I-ID

2100 HVI CERTIFIED

CERTIFIED RATINGS

Model AVS 1.5ES Constructo
Options installed:Defrost

Complete ratings at:
www.hvi.org

Rated Air Flow @ 0.2 in wg (50 PA) 174 cfm (82 l/s)
0.4 in wg (100PA) 150 cfm (71 l/s)

Energy Performance Net Supply Air Flow	Apparent Sensible Effectiveness	Sensible Recovery Efficency	Moisture Transfer
66 cfm (31 l/s) at 32°F (0°C)	79%	67%	-1%
86 cfm (40 l/s) at 32°F (0°C)	75%	65%	-1%
115 cfm (54 l/s) at 32°F (0°C)	70%	61%	-1%
81 cfm (38 l/s) at -13°F (-25°C)*	76%	60%	2%
- (-) at 95°F (35°C)	N/A	N/A	N/A

* Test performed with optional active defrost installed

*Total Recovery Efficiency

déc. 2014


E15 HRV
RON'S MECHANICAL INC.
952-445-8585

(MN Amendment) R403.5.6.1.1 Forced air systems

- When an outdoor air supply is not ducted to the forced air system, controls shall be installed to allow the system to provide an average circulation flow rate of 0.15 cfm/s.f.

(MN Amendment)
R403.5.6.1.1 Forced air systems

- When an outdoor air supply is ducted to the forced air system, the mixed air temperature shall not be less than the heating equipment manufacturer's installation instructions and controls shall be installed to allow the system to provide an average circulation flow rate of 0.075 cfm/s.f.

(MN Amendment)
R403.5.6.1.3 Airflow verification

- All mechanical ventilation system airflows greater than 30 cfm at the building intake and exhaust shall be tested and verified.


MAGNEHELIC
HRV CONSTRUCTO® 1.5ES
USER MANUAL
(952) 835-7777
BALANCED VENTILATION
MAINTENANCE RECORD


INCHES OF WATER
.10
.20
.30
.40
0
5
10
15
20
25
50
X 100 FPM
0
MAGNEHELIC
CALIBRATED FOR
VERTICAL POSITION

(MN Amendment)
R403.5.14 Controls

- When the mechanical ventilation system is not designed to operate whenever the forced air circulation system is operating, the mechanical ventilation system shall incorporate an accessible backflow damper to prevent flow from the outside when the mechanical ventilation system is off.

(MN Amendment)
R403.5.17 Climatic conditions

- HVAC equipment shall be sized according to ACCA Manual S or an equivalent method based on ACCA Manual J. Oversizing of heating equipment shall not exceed 40% and oversizing of cooling equipment shall not exceed 15%.

(MN Amendment)
IMC Chapter 5 Exhaust systems

- **501.3 Exhaust discharge.**
  - The air removed by every mechanical exhaust system shall be discharged outdoors at a point where it will not cause a nuisance…and the exhaust system shall be equipped with a backdraft damper at the point of discharge.

Questions?

- Tim Manz

  Senior Building Inspector

  City of Blaine

  tmanz@ci.blaine.mn.us

  763-785-6175