

# 2015 IECC Residential Mechanical Systems & Ventilation



Brent Ursenbach, C.B.O. LEED AP  
Energy/Mechanical Specialist  
801-381-1449  
West Coast Code Consultants, Inc.



## Funding for Energy Code Training



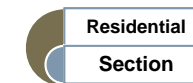
## Residential

### Relationship Between IRC & IECC

- ✓ IECC addresses only energy
- ✓ IRC addresses all topics (*structural, plumbing, etc.*)
  - Allows builder to carry only one code book
  - Chapter 11 covers energy efficiency- virtually identical to the Residential Chapters in the IECC
- ✓ In 2012, IECC consolidated with IRC energy chapter (actually a change to the IRC, not the IECC)
- ✓ IECC addresses both residential and commercial; IRC addresses subset of residential, detached one- and two-family dwellings and townhouses 3 stories or fewer



## Structure of the 2015 IECC



- Ch. 1 Scope and Application / Administrative and Enforcement
- Ch. 2 Definitions
- Ch. 3 General Requirements
- Ch. 4 Commercial Energy Efficiency
- Ch. 5 Existing Buildings - **NEW**
- Ch. 6 Referenced Standards
- Index

- Ch. 1 Scope and Application / Administrative and Enforcement
- Ch. 2 Definitions
- Ch. 3 General Requirements
- Ch. 4 Residential Energy Efficiency
- Ch. 5 Existing Buildings - **NEW**
- Ch. 6 Referenced Standards
- Index

**Additions, alterations, existing buildings moved from Ch. 1. Includes several changes and new requirements**

**Section R401.3 - Certificate NEW**

**Permanently posted on a wall in the space where the furnace is located, a utility room or an approved location inside the building**

- ✓ Don't cover or obstruct the visibility of other required labels
- ✓ Includes the following:
  - R-values of insulation installed for the thermal building envelope, including ducts outside conditioned spaces
  - U-factors and SHGC for fenestration
  - Area-weighted U-factor and SHGC calculations
  - Results from any required duct system and building envelope air leakage testing
  - **HVAC efficiencies and types**
  - **SWH equipment**
  - **Duct sealing, duct and pipe insulation and location**
  - **Air sealing details**

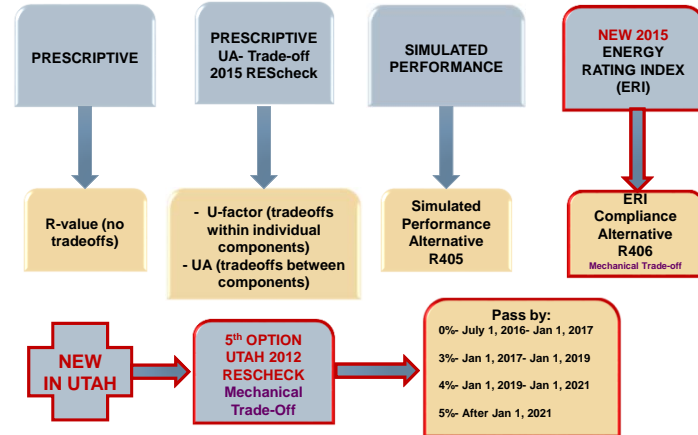
Component	R-value	U-factor	SHGC
Above-Grade Wall	24.00		
Below-Grade Wall	15.00		
Floor	8.00		
Ceiling / Roof	49.00		
Ductwork (unconditioned spaces)			
Door	0.32	0.30	
Window	0.32	0.30	
Door	0.32	0.30	
Forced Hot Air	90 AFUE		
Cooling System			
Water Heater			

**Accurate SEER Rating-AHRI or Manufacturers' Data**

- ✓ Certificate lists "gas-fired unvented room heater", "electric furnace", or "baseboard electric heater"; however no listing of an efficiency for those heating types

**THE CODE ALLOWS ANY OF THESE COMPLIANCE OPTIONS**

**IECC Compliance - Four Options + One = 5 in Utah**



**Overview of Residential Code Requirements**

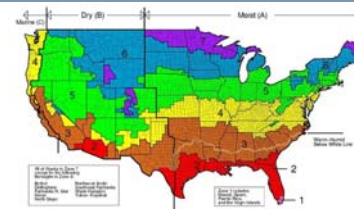
- ✓ Focus is on building envelope
  - Ceilings, walls, windows, floors, foundations
  - Sets insulation and fenestration levels, and solar heat gain coefficients
  - Infiltration control - caulk and seal to prevent air leaks, and test
- ✓ Ducts, air handlers, filter boxes – seal, insulate, and test
- ✓ Limited space heating, air conditioning, and water heating requirements
  - Federal law sets most equipment efficiency requirements, not the I-codes
- ✓ No appliance requirements
- ✓ Lighting equipment – 75% of lamps to be high-efficacy lamps or 75% of lighting fixtures to have only high-efficacy lamps



**Residential IECC- Overview of Structure**

**Climate-Specific Requirements:**

- Roofs
  - ✓ Above grade walls
  - ✓ Foundations
    - Basements
    - Slabs
    - Crawlspace
  - ✓ Skylights, windows, and doors
  - ✓ Solar Heat Gain Coefficient in warm climates



**Mandatory Requirements (apply everywhere):**

- ✓ Infiltration control
- ✓ Duct insulation, sealing & testing, **no-use-of-building-cavities amended out**
- ✓ HVAC controls
- ✓ Piping Insulation and circulating service hot water requirements
  - **Underground service hot water piping insulation amended out NEW**
- ✓ Equipment sizing
- ✓ Dampers
- ✓ Lighting - No longer amended out- 75% must be High Efficacy **NEW**

**VIRTUALLY EVERY ITEM ABOVE IMPACTS THE HOME HVAC SYSTEMS**

## Energy Code Guide – R402.4.1

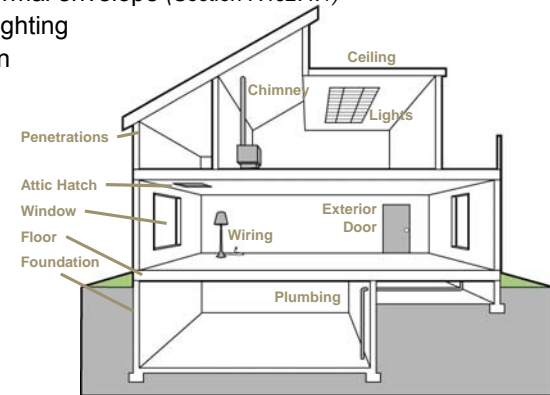
**R402.4.1 Building Thermal Envelope**  
Comply with Table 402.4.1.1  
**OR**  
Blower Door Test  
per R402.4.1.2.

The 2015 IECC requires blower door testing and compliance with the Insulation and Air Barrier Table. The state amendment gives a choice- either blower door testing or a comprehensive inspection of all Table items.

### Mandatory Requirements

**Section R402.4 - Air Leakage**

- ✓ Building thermal envelope (Section R402.4.1)
- ✓ Recessed lighting
- ✓ Fenestration
- ✓ Fireplaces
- ✓ Rooms with fuel burning appliances



### Air Leakage Control Section R402.4.1



**NEW**

### Building Thermal Envelope

**Section R402.4.1 – Air Leakage**

Code requires BOTH:

- ✓ Whole-house pressure test

Air Leakage Rate	Climate Zone	Test Pressure
≤ 5 ACH	1-2	50 Pascals
≤ 3 ACH	3-8	50 Pascals

- Testing may occur any time after creation of all building envelope penetrations
- ✓ Field verification of items listed in Table R402.5.1.1
- State amendment continues to allow either the blower door test  
**OR**
- the field verification

### Building Thermal Envelope - Section R402.4.1 – Air Leakage

Two options to demonstrate compliance

- ✓ Whole-house pressure test
  - By State Amendment, all climate zones test to 5 ACH @ 50 pa
  - January 1, 2019- 3.5 ACH @ 50 pa
  - January 1, 2021- 3.0 ACH @ 50 pa
  - Testing may be by any certified testing individual- including contractors and sub contractors
  - Testing may occur any time after creation of all building envelope penetrations



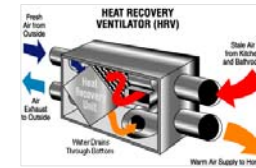
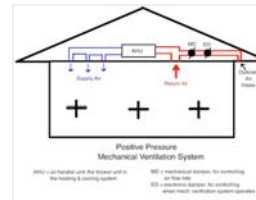
- OR**
- ✓ Field verification of items listed in Table R402.4.1.1

- ✓ Homes testing 3 ACH @ 50 pa require mechanical ventilation- IRC 303.4
- HVAC penetrations and duct leakage outside the envelope impacts testing

### Mechanical Ventilation - Section R403.6 –

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



### IRC Chapter 15 – Whole-House Ventilation

TABLE M1507.3.3(1) CONTINUOUS WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM AIRFLOW RATE REQUIREMENTS

DWELLING UNIT FLOOR AREA (square feet)	NUMBER OF BEDROOMS				
	0 – 1	2 – 3	4 – 5	6 – 7	> 7
< 1,500	30	45	60	75	90
1,501 – 3,000	45	60	75	90	105
3,001 – 4,500	60	75	90	105	120
4,501 – 6,000	75	90	105	120	135
6,001 – 7,500	90	105	120	135	150
> 7,500	105	120	135	150	165

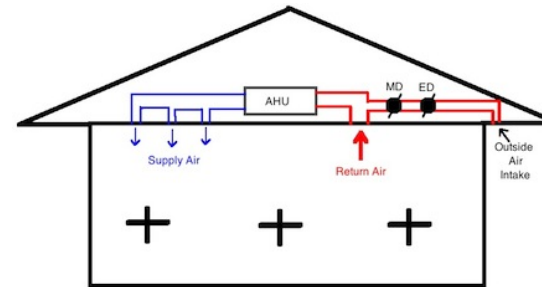
For SI: 1 square foot = 0.0929 m<sup>2</sup>; 1 cubic foot per minute = 0.0004719 m<sup>3</sup>/s.

TABLE M1507.3.3(2) INTERMITTENT WHOLE-HOUSE MECHANICAL VENTILATION RATE FACTORS<sup>a, b</sup>

RUN-TIME PERCENTAGE IN EACH 4-HOUR SEGMENT	25%	33%	50%	66%	75%	100%
Factor <sup>a</sup>	4	3	2	1.5	1.3	1.0

a. For ventilation system run time values between those given, the factors are permitted to be determined by interpolation.  
b. Extrapolation beyond the table is prohibited.

### Positive Pressure Ventilation



- Continuous or 1 hour every 4 hours
- If intermittent, must close damper when not in operation
- Furnace Air/handler must have ECM motor
- Path to outside envelope leakage

## Exhaust Only- Negative Pressure

WhisperGreenSelect  
VENTILATION FAN



Most Efficient  
2018  
ENERGY STAR

- Continuous Operation or 1 hr. every 4 hrs. @ 4 time the CFM
- Backdraft damper
- Set at minimum CFM
- Jump to higher speed
  - Occupancy sensor
  - Humidity sensor
  - Manual switch
- Leaks replacement air into the house

## Heat Recovery/Energy Recovery Ventilators – Balanced Ventilation

HRV or ERV?

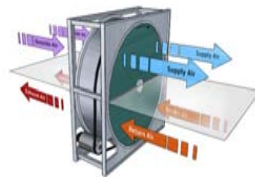
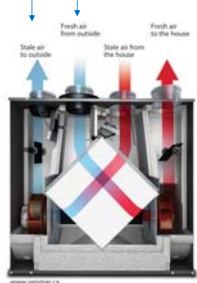
- If you live in a colder climate with a longer heating season such as Canada or the northern US, the HRV will provide the most comfort and efficiency.
- In the Midwest and southern states, where humidity removal is needed for the incoming air, an ERV provides year-round efficiency.

HRV/ERV is now in the IECC for some commercial applications requiring large quantities of ventilation air



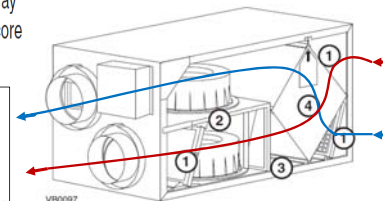
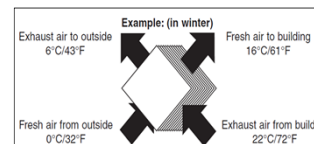
## HRV/ERV – Installation Instructions

All air to and from outside must have duct insulated

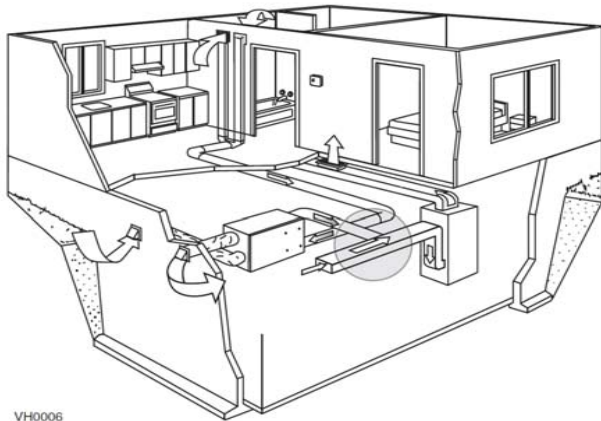


HRV/ERV  
Internal View

1. Filters
2. Blowers
3. Condensation tray
4. Heat recovery core



## Typical HRV Installation



VH0006

## Energy Code Guide – R402.4.4

### 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.

## NEW

### Rooms Containing Fuel-burning Appliances - OPEN COMBUSTION AIR *Both Residential and Commercial Buildings- IECC Requirement*

- Appliances and combustion air openings to be located outside the building thermal envelope or enclosed in a room isolated from inside the thermal envelope in [Climate Zones 3-8- ALL of Utah](#)
- Where open combustion air ducts provide combustion air to open combustion *fuel-burning appliances*
  - *Furnaces, boilers, water heaters*
- Rooms to be sealed and insulated per envelope requirements
- Doors into the rooms fully gasketed
- Water lines and ducts insulated
- **Combustion air ducts that pass through conditioned space, insulated to  $\geq$  R-8**
- Does not apply if combustion air is drawn from inside the home



- Exceptions:**
- Direct Vent
  - Fireplaces
  - Stoves

## NEW

### Section R403 - Mandatory Requirements - Systems

#### Controls

- ✓ Heat pump supplementary heat
- ✓ Hot water boiler outdoor temperature setback
- ✓ Ducts
  - Sealing (Mandatory)
  - Insulation (Prescriptive)
- ✓ HVAC piping insulation – mechanical piping
- ✓ Hot water systems
- ✓ Ventilation
  - Dampers
- ✓ Equipment sizing
- ✓ Systems serving multiple dwelling units- commercial
- ✓ Snow melt controls
- ✓ Pools and in-ground permanently installed spas

**Section R403.1.1 – Controls - Programmable Thermostat**

- ✓ At least one programmable thermostat controlling the primary heating/cooling per dwelling unit
- ✓ Capability to set back or temporarily operate the system to maintain zone temperatures
  - down to 55°F (13°C) or
  - up to 85°F (29°C)
- ✓ Initially programmed by manufacturer with:
  - heating temperature set point no higher than 70°F (21°C) and
  - cooling temperature set point no lower than 78°F (26°C)



**Section R403.2 - Hot Water Boiler Outdoor Temp. Setback**

- One- or two-pipe heating systems have an outdoor setback control to lower boiler temperature based on outdoor temperature.



**Section R403.3.1 - Prescriptive - Duct Insulation**

- ✓ Supply and return ducts in **attics**: R-8 where  $\geq 3"$  diameter, R-6 if  $< 3"$
- ✓ Other areas: R-6 where  $\geq 3"$  diameter, R-4.2 if  $< 3"$

Location	Duct Diameter $\geq 3"$ or $< 3"$
Attic	R-8 or R-6
Conditioned Space	NR
Vented Crawlspace	R-6 or R-4.2
Conditioned Crawlspace	NR
Basement – Conditioned	NR
Basement – Unconditioned	R-6 or R-4.2
Exterior Walls	R-6 or R-4.2



**Energy Code Guide**

**R403.3.2 Duct Sealing**  
 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 Sealing****Section R403.3.2 - Mandatory**

## ✓ Sealing (Mandatory)

- Joints and seams to comply with IMC or IRC
- All ducts, air handlers, and filter boxes to be sealed (*Section R403.3.2.1*)

• **Exceptions**

- No additional joint seals required for air-impermeable spray foam products
- Continuously welded and locking-type joints and seams **other than snap-lock and button-lock types and ducts** having static pressures < 2 in. w.c. pressure classification don't require additional closure systems

**Energy Code Guide****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\*

**Section R403.3.3- Mandatory - Duct Testing**

- Ducts shall be pressure tested to determine air leakage by either of the following:
  - **Rough-in test**
    - Total leakage measured with a pressure differential of 0.1 inch w.g. (25 Pa) **across the system** including manufacturer's air handler enclosure
      - All registers taped or otherwise sealed
  - **Post-construction test**
    - Total leakage measured with a pressure differential of 0.1 inch w.g. (25 Pa) **across the entire system** including manufacturer's air handler enclosure
      - All registers taped or otherwise sealed
- Exception
  - Duct air leakage test not required where ducts and air handlers are **partially** within the building thermal envelope
    - 50% inside- Current 2012 - Dec 31, 2017
    - 65% inside- Beginning January 1, 2017
    - 75% inside- Beginning January 1, 2019
    - 80% inside- Beginning January 1, 2021
- A written report of results of test signed by the party conducting test and provided to code official

**Duct Leakage****Section R403.3.4 - Prescriptive**

Total leakage of ducts, where measured in accordance with Section 403.3.3 shall be as follows:

- ✓ **Rough-in test**
  - Total leakage ≤ **4** 8 cfm/per 100 ft<sup>2</sup> of conditioned floor area (**Currently 10 CFM**)
    - if air handler not installed at time of test
      - Total air leakage ≤ 3.6 cfm/per 100 ft<sup>2</sup> (**Currently 7.5 CFM**)
- ✓ **Post-construction test** Total leakage ≤ **4** 8 cfm/per 100 ft<sup>2</sup> of conditioned floor area (**Currently 10 CFM**)

**Phase In**

- 8 CFM beginning January 1, 2017
- 7 CFM beginning January 1, 2019
- 6 CFM beginning January 1, 2021





## Building Cavities

### Section R403.3.5 - Mandatory

Framing cavities cannot be used as ducts ~~or plenums~~

State amendment allows panning

Difficult to pass a duct test if panned



## Piping Insulation – Circulating Hot Water

### R403.4 Mechanical System Piping Insulation

Carrying fluids > 105°F or < 55°F, insulate to R-3 min.

### R403.5 Circulating and Demand Hot Water Systems

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

### R403.6 Mechanical Ventilation

Per IRC 303.4 & M1507 with automatic or gravity dampers on outdoor air intake and/or exhaust.

## Mechanical System Piping Insulation

### Section R403.4 - Mandatory

#### ✓ R-3 required on

– HVAC systems

- Exception: Piping that conveys fluids between 55 and 105°F

#### • If exposed to weather,

– protect from damage, including

- Sunlight
- Moisture
- Equipment maintenance
- Wind

– Provide shielding from solar radiation that can cause degradation of material

– Adhesive tape is not allowed



## Section R403.7 - Equipment Sizing and Efficiency Rating

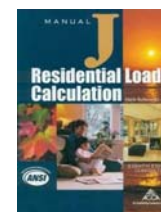
### ✓ Equipment Sizing

- Load calculations determine the proper capacity (size) of equipment
  - Goal is big enough to ensure comfort but no bigger

- Sizing shall be performed in accordance with ACCA Manual S based on loads calculated in accordance with ACCA Manual J (other approved methods)

### ✓ Efficiency Rating

- New or replacement heating/cooling equipment shall have an efficacy rating equal to or greater than minimum required by federal law for geographic location of installation



### R403.7 Equipment Sizing

Per ACCA Manual S, based on loads calculated per ACCA Manual J.

### Hot Water Boiler Outdoor Temp. Setback - Section R403.2

- Hot water boiler heating systems shall have an outdoor setback control to lower boiler temperature based on outdoor temperature.



## Energy Code Guide

**R403.6 Mechanical Ventilation**  
Per IRC 303.4 & M1507 with automatic or gravity dampers on outdoor air intake and/or exhaust.



## A Mechanical Code Change.....

Do these cheap 3" fans work?

**DESCRIPTION**

- For baths up to 40 sq. ft., other rooms up to 60 sq. ft.
- Installs in ceiling or 2" x 4" wall ducts.
- Mounts on either 1/2" or 3/4" O.C. joist or stud.
- Discharge is through 3" round duct through roof or wall.
- Sturdy mounting brackets of double metal thickness (noted on housing) for vertical mounting adjustments.
- Extra large outlet box area.
- Efficient smaller blower wheel.
- Attractive white polymeric grille with torsion springs to adjust for thickness variations in ceiling or wall.
- Polypropylene weather damper.
- Refer to Nalor's catalog for a complete listing of accessories to effectively adapt this Bathroom Fan to your construction requirements.

**DESIGN FEATURES**

Air Delivery: 50 CFM at 0.10" S.P.  
Sound Level: 4.0 Sones.  
Dimensions: Housing: 7 1/2" long x 7 1/4" wide x 2 1/2" high.  
Grille: 9 1/2" long x 8 1/2" wide x 1 1/2" thick.  
Housing: Galvanized steel.  
Grille: Engineered Plastic.  
Motor: Shaded pole, thermally protected, 120VAC, 60 Hz, 0 amp.  
Blower Wheel: One-piece polypropylene.  
Duct Size: 3" diameter.

**Ceiling/Wall Blower**  
MODELS: 696N

**ARCHITECT'S SPECIFICATIONS**

1. Exhaust Fan shall be Nalor's Model Number 696N as manufactured by Nalor according to listed specifications. Fan shall ventilate 50 CFM at 0.10" S.P. at a sound level of 4.0 Sones. Housing shall be 7 1/2" x 7 1/4" x 2 1/2" and connect to 3" duct.

## New in 2015 IRC- Chapter 15 – Exhaust Fans

**TABLE M1506.2  
DUCT LENGTH**

DUCT TYPE	FLEX DUCT						SMOOTH-WALL DUCT									
	50	80	100	125	150	200	250	300	50	80	100	125	150	200	250	300
Fan airflow rating (CFM @ 0.25 inch w.c.)	Maximum length <sup>a, b</sup> (feet)															
Diameter <sup>c</sup> (inches)																
3	X	X	X	X	X	X	X	X	5	X	X	X	X	X	X	X
4	56	4	X	X	X	X	X	X	114	31	10	X	X	X	X	X
5	NL	81	42	16	2	X	X	X	NL	152	91	51	28	4	X	X
6	NL	NL	158	91	55	18	1	X	NL	NL	NL	168	112	53	25	9
7	NL	NL	NL	NL	161	78	40	19	NL	NL	NL	NL	NL	148	88	54
8 and above	NL	NL	NL	NL	NL	189	111	69	NL	NL	NL	NL	NL	NL	198	133

For SI: 1 foot = 304.8 mm.

a. Fan airflow rating shall be in accordance with ANSI/AMCA 210-ANSI/ASHRAE 51.

b. For noncircular ducts, calculate the diameter as four times the cross-sectional area divided by the perimeter.

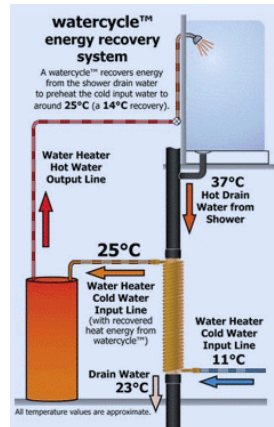
c. This table assumes that elbows are not used. Fifteen feet of allowable duct length shall be deducted for each elbow installed in the duct run.

d. NL = no limit on duct length of this size.

e. X = not allowed. Any length of duct of this size with assumed turns and fittings will exceed the rated pressure drop.

### Drain Water Heat Recovery Units Section R403.5.4

- When Installed
- Comply with CSA B55.2 and tested in accordance with CSA B55.1
- Portable water-side pressure loss of drain water heat recovery units shall be < 3 psi for individual units connected to 1 or 2 showers
  - < 2 psi if connected to  $\geq 3$  showers



### Heat Pump Supplementary Heat Section R403.1.2 - Controls

Prevent supplementary electric-resistance heat when heat pump can meet the heating load

Manufacturer may list OUTDOOR STATS as an optional accessory for an Air to Air Heat Pump; however it's mandatory by 2015 code where there is electric supplementary heat.

#### Exception

- ✓ During defrost



### Snow Melt System Controls Section R403.9

Snow- and ice-melting system controls

- ✓ Automatic shutoff when pavement temperature is > 50°F and no precipitation is falling
- ✓ Automatic or manual shutoff when outdoor temperature is > 40°F



**R403.9 Snowmelt Controls**  
Mandatory controls- Auto shutoff: no moisture, pavement T > 50°F and air T > 40°F.

### Fireplaces Section R402.4.2

- New wood-burning fireplaces shall have tight fitting flue dampers or doors, and outdoor combustion air
- Tight fitting doors on fireplaces that are:
  - Factory built – listed and labeled per UL 127
  - Masonry – listed and labeled per UL 907



**NEW**

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### Pools and Permanent Spa Energy Consumption

#### Section R403.10 - Mandatory

- ✓ Pools and spas in accordance with APSP-145
- ✓ Heaters
  - with a readily accessible on-off switch that is integral part of heater mounted on the exterior of heater or external to within 3 feet of heater
  - Switch shall not change the setting of heater thermostat
  - Switches shall be in addition to the circuit breaker for the power to the heater
  - fired by natural gas not allowed to have continuously burning pilot lights
- ✓ Time switches (or other control method) to automatically turn off and on heaters and pumps according to a preset schedule installed on all heaters and pump motors
- ✓ Note: heaters, pumps, and motors with built-in timers meet the requirement
  - Exceptions
    - Public health standards requiring 24-hour pump operation
    - Pumps operating pools with solar and waste-heat recovery heating systems



### Covers

#### Section R403.10.4

### On outdoor heated pools and outdoor permanently installed spas

- ✓ Vapor-retardant cover OR
- ✓ Other approved vapor retarder means

#### **Exception:**

- ✓ If >70% of energy from site-recovered energy



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**NEW**

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### Portable Spas

#### Section R403.11 - Mandatory

- Energy consumption of electric-powered portable spas shall be controlled by the requirements of APSP-14



### Existing Building Chapter 5 – NEW CHAPTER

#### Section R501 - General

- ✓ Additions, alterations, or repairs
- ✓ Existing buildings
- ✓ Maintenance
- ✓ Compliance
- ✓ New and replacement materials
- ✓ Buildings designated as historic
  - ✓ *Must show IECC requirements will threaten, degrade or destroy the historic form, fabric or function of the building.*



**Section R503 - Alterations - Existing Buildings****• Heating and Cooling**

- New HVAC systems and duct systems that are part of the alteration to comply with Section 403.1, R403.2, R403.3 and R403.6
  - Exception: Where duct from an existing HVAC system are extended, duct systems with < 40 linear feet in unconditioned spaces are not required to be tested in accordance with Section R403.3.3

**• Service hot water (SHW) systems**

- New SHW systems that are part of the alteration to comply with R403.4

**Repairs**

- Work on non-damaged components necessary for the required repair or damaged components shall be considered part of the repair and are not subject to the alterations requirements



## Thank You!

- Questions/comments may be addressed to me at:
- Brent Ursebach
- [bursenbach@gmail.com](mailto:bursenbach@gmail.com)
- [brentu@WC-3.com](mailto:brentu@WC-3.com)
- C: 801-381-1449

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