

**2020 Connecticut State Building and Fire Codes** Find the most current schedule at <https://portal.ct.gov/DASCodeChange>

Completed: 2020 Amendments Drafted and Code Change Proposals Received

- 6/30/19 Committees/Work Groups Review
- 8/31/19 Final Drafts Developed
- 10/31/19 Drafts Reviewed
- 11/13/19 Codes and Standards Drafts Approval
- 2/29/20 Public Comment Period
- 5/31/20 Legislative Review/Approval
- 10/1/20 Code Takes Effect

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**Residential Code Series – Building Exteriors and Energy Conservation Code**  
Fall 2019 Career Development Series  
Michael C. DeWein  
DAS Office of Education and Data Management

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**Introductions...**



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**NEW ENERGY STORE**

**ALLIANCE TO SAVE ENERGY**  
Using less. Doing more.

**Current/Past Code Cmtes.:**

- ICC SEHPCAC
- ASHRAE 189
- NYS – Energy Technical
- USGBC
- MA BBRS Energy

**NEW YORK STATE ENERGY OFFICE**

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**Before We Start...**

**Is the Energy Code a Life Health Safety Code?**

**Yes...**  
**No...**  
**Maybe...**

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**What Have We got Here?!**

**Water Damage Assessment**

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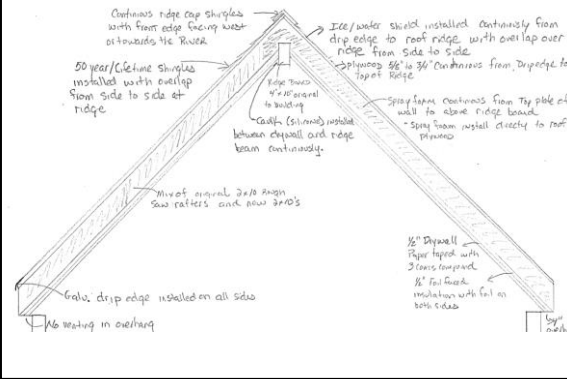
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**Might This Might Result in Structural Failure?!**




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**And This?!**



**...Unenforced/ Badly Detailed Energy Code Requirements!!! - Second Highest Insurance Claim In NY**

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**And This?!**



**...Unenforced/ Badly Detailed Energy Code Requirements!!! - MAJOR Cause of CO Poisoning/Death!**

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### Agenda

- Review a case study project for Energy Code and Residential Code problem areas requirements
- Discuss required documentation and tools provided for Building Exteriors Plan Review and Site Inspections
- Conduct a Plan Review of our case study project
- Us Plan Review findings and compliance tools to prepare for a Site Inspection
- Conduct a mock Site Inspection of the project

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### Your Handouts

- Project Plans
  - REScheck Reports
  - Air Leakage/Insulation Installation Checklists for CT
  - Manual J Report
- Do we want to use the Complete Energy Code checklists I developed, or just briefly review as a tool they can use if they want

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### I - Plan Review

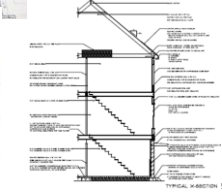
#### Documentation and Checklists



REScheck Software Version 4.6.0  
**Inspection Checklist**  
 Energy Code 2015 ECC

Measurements (R) are addressed directly in the REScheck software. Item in the "Measurement required" column is provided by the user in the REScheck Measurement screen. For each measurement, the user provides data in the appropriate column and the software calculates a compliance status. All other measurements are being calculated. When a compliance is required in a separate table, it is shown in that table if provided.

Item ID	Measurement/Requirement	Plan Section/Detail	Field Section/Detail	Compliance	Measurement/Requirement
101.1	Minimum Insulation			Compliant	
101.2	Minimum Insulation			Compliant	
101.3	Minimum Insulation			Compliant	
101.4	Minimum Insulation			Compliant	
101.5	Minimum Insulation			Compliant	
101.6	Minimum Insulation			Compliant	
101.7	Minimum Insulation			Compliant	
101.8	Minimum Insulation			Compliant	
101.9	Minimum Insulation			Compliant	
101.10	Minimum Insulation			Compliant	
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### Plan Review - Objectives

At the conclusion of this plan review section, participants should be able to:

- Evaluate plans, construction documents, manufacturers' installation instructions and REScheck reports to determine compliance with the 2015 IRC and IECC portions of the 2018 CT State Building Code.
- Identify key building exterior components including but not limited to house wraps, siding, insulation, flashing, roofing, walls, doors and window systems on plans and specifications.
- Determine compliance of design components of exterior walls, air sealing details, sealing protrusions, installed R-values of insulation, fenestrations, u-values, energy efficiency ratings of building, mechanical and ventilation systems.
- Develop inspection checklists for the building exteriors and energy conservation.

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### Minimum Documentation

#### Documentation for Energy Code and Enclosure Permit Applications Residential 1 & 2 Family and MF < 3 Stories

Please provide the following documentation to demonstrate compliance with the CT Residential & Energy Code for any project you submit for a building permit:

- Drawings shall include full Energy Code compliance details and specifications (preferably on a single sheet) including but not limited to:
  - Also, Walls, Foundation Insulation Spaces
  - Window U-Value & Infiltration Spaces
  - Air & Vapor Barrier Spaces
  - Cool Insulating & Insulation Spaces
  - Heating Piping Insulation Spaces
  - Water Mitigation and Drainage Spaces
  - Heating & Cooling Systems Spaces
  - Service Water Heating Spaces
  - Mechanical Ventilation System Spaces
  - Elec. Power & Lighting System Spaces
  - Programmable Thermostat Spaces
  - WRB and Flashing
- Statement on Drawing documenting that the Design meets the Energy Code per ECCCNYS Section R103.2.2
- Energy Code Compliance Path Documentation (One of the following is required):
  - Prescriptive Approach including All Compliance Documentation (R402.1)
  - Total UA Alternative (R402.1.5 - REScheck) reports if those methods are used for Compliance)
  - Simulated Performance Alternative (R405 - Statement from a HERS Rater outlining Compliance with Performance Approach including sufficient reports to demonstrate Mandatory Requirements have been met)
  - Energy Rating Index (R406 - Statement from a HERS Rater outlining Compliance with the ERI method including sufficient reports to demonstrate Mandatory Requirements have been met)
- Manual J&S Sizing Documentation

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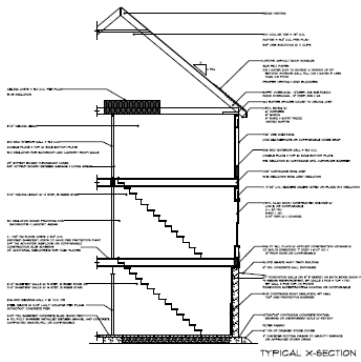
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### Documentation and Checklists - Examples Enclosure Sections



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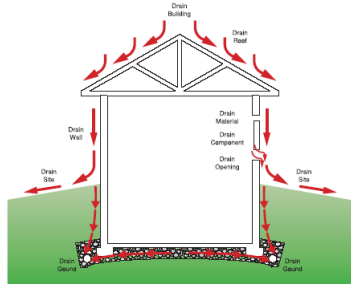






### Exterior/Enclosure Features and the IRC Water and Moisture Mitigation - Making it all work together

Everything Has to Work!



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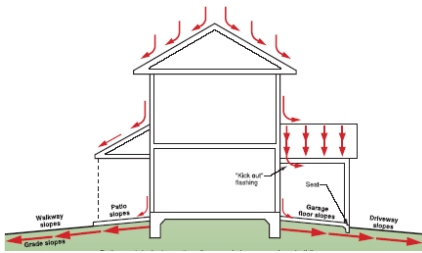
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### Exterior/Enclosure Features and the IRC Water and Moisture Mitigation - Making it all work together

Everything!



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### Some of the Requirements, "Barriers"



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**Vapor Retarders**

Energy - Chapter 4

- Energy Code – Chapter 402.1.1, Referencing IRC R702.7 Vapor retarder required on winter warm side... I, II, or III

ZONE	CLASS III VAPOR RETARDERS PERMITTED FOR:
5	Vented cladding over OSB Vented cladding over Plywood Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value > 5 over 2 x 4 wall Insulated sheathing with R-value > 7.5 over 2 x 6 wall
6	Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value > 7.5 over 2 x 4 wall Insulated sheathing with R-value > 11.25 over 2 x 6 wall

- Exempt in Zone 4, MANY Improvements

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**Vapor Retarders**

Residential - Chapter 3

- Residential Code – Section R702.1 “Moisture Vapor Retarder”
  - Removed from Energy
  - Charlotte 2009 Version
- Intent of Code – Slow Water Vapor Migration by Diffusion
- Type I a BAD idea wherever A/C used, especially Central

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**Vapor Retarders**

- Example:  
Poly Vapor Retarder  
*BE CAREFUL!!*



▶ Example:  
Kraft-Faced Vapor Retarder

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### Incorrect Combination of Materials



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### Physics - Second Law of Thermo- Dynamics States:

- Air Moves From **High** to **Low** Pressure.
- Heat Moves From **Warm** to **Cold**.
- Moisture Moves From **Warm** to **Cold** AND From **Wet** toward **Dry**.
- Stuff Rolls Down Hill! (The DeWein Corollary...)



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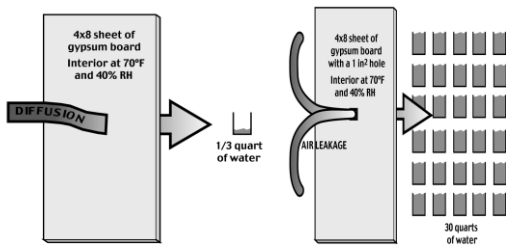
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### Diffusion



EEBA BFG

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**Vapor Retarders - Best Practice**

- Match the Wall Materials to Climatic and other Design conditions
- Do we want a Poly Vapor Retarder where we are both heating and cooling the house?
- Do we need a Vapor Retarder in Walls that are blown with Foam?
- What do we do for Wet Spray Cellulose in Walls WRT Vapor Retarder?
- Alternate ("Smart") Vapor Retarders?

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**Representative Vapor Permeability Info**

Material	Dry Cup	Wet Cup	Comments
Plywood	.75	3.5	Semi-permeable
OSB	.75	2	Semi-
Fiberboard (Al)	14.5	15	Permeable
Thermo Ply	0.5	0.6	impermeable
XPS	1	1	Semi (but with skin, im-)
EPS	5	5	Semi-
6-mil poly	.06	.06	Impermeable
Kraft paper	1	>>1?	Semi- (variable)
MemBrain™	1	10+	Variable, by design
Tyvek®	14	?	permeable
Latex paint (primer + 1 coat)	3.6	6	Semi-

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**Smart Vapor Retarders**




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**A Water Management Problem?**




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**Water Management (Drainage Plane)**

R700

- Energy code – Only deals with Vapor Retarder requirement – does it need more? YES!
- Residential Code Section 703 – Exterior Covering
  - 703.1 – Intent to prevent moisture from getting into wall
  - 703.2 – Weather –resistant sheathing paper or material tested to ASTM D 226 (Housewraps, other building papers)
  - ONLY required under Brick and Stone veneer
  - This will be changing in future, in '06 to include Hard Board lap and panel siding, soon for all sidings.
    - 703.7.5 and .8 - Flashing required, vague around siding other than Stone or Brick
  - Required around openings, doors, windows, fairly vague

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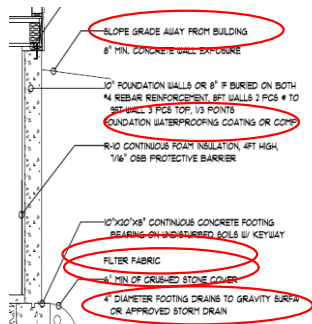
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**Exterior/Enclosure Features and the IRC:**

Foundations and Moisture/Water – R406

- Slope Grade Away
- Waterproofing
- Filter Fabric
- Crushed Stone
- Footer Drains




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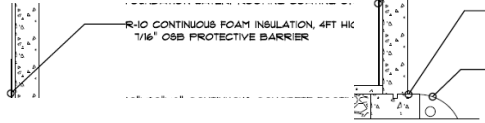


### Exterior/Enclosure Features and the IRC:

#### Foam Plastic Insulation - R316.4

#### Fire Protection?

- Must be protected from flame spread
- Minimum ½" Drywall
- Does The OSB Qualify as a Protective Barrier in this application?



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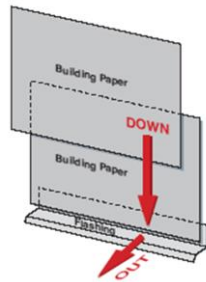
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### Exterior/Enclosure Features and the IRC

#### WRBs & Flashing R703

- Builders are used to applying basic water management principles daily
  - Shingles
  - Building paper
- Where do we mess up?
  - Almost always at the joints and connections where different things come together



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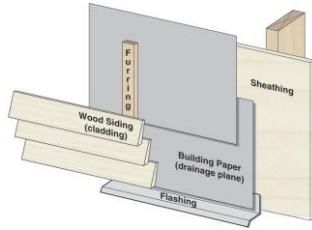
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### Water Management Simplicity

- Let's look at the basic components of wall water management.

One Solution...



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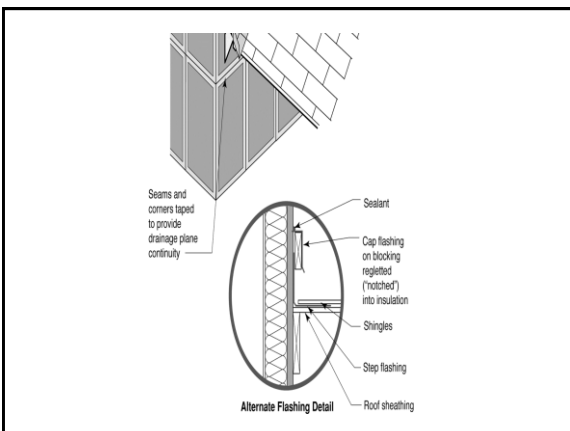
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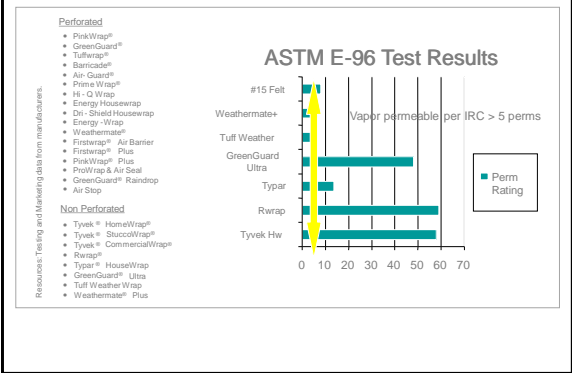
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### Permeability of WRBs



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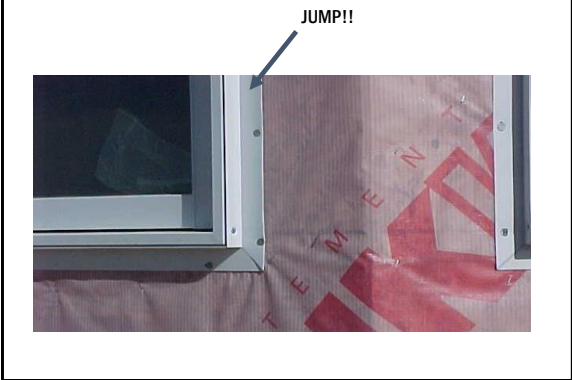
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### Window Leaks



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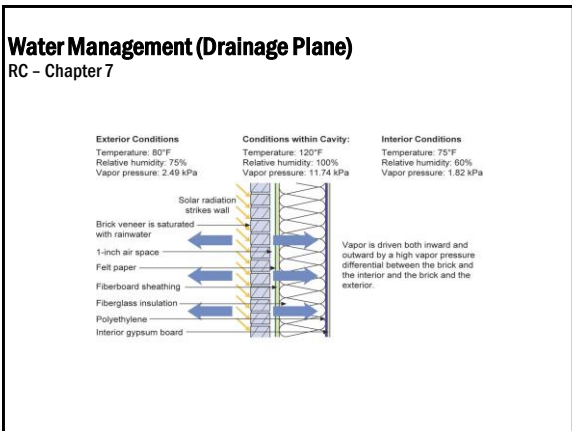
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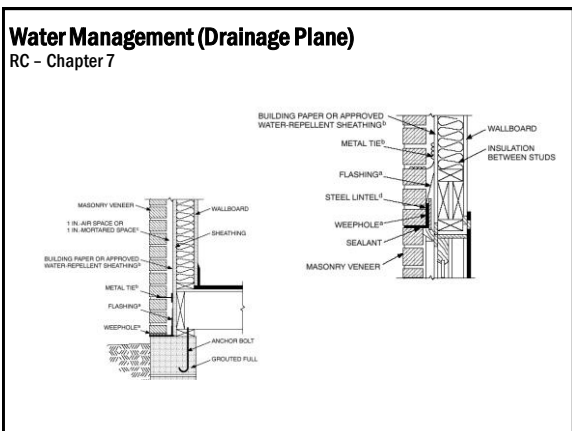
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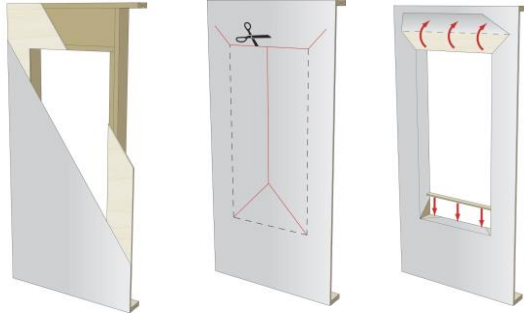
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### Window and Door Flashing!



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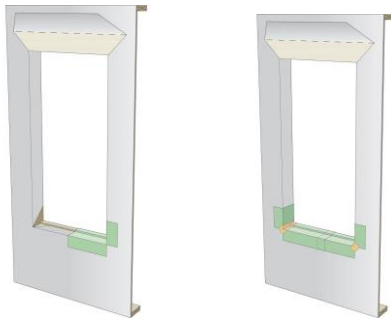
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### Preparing for the Window...



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### Sill Flashing

- Can use continuous or multi-piece flashing approach
- Key is integration into whole wall system



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### Integrate Windows




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### Continuous Drainage Plane




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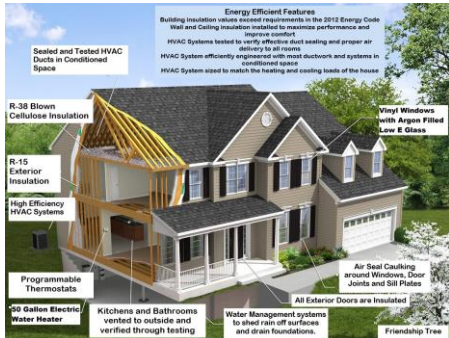
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### Plan Review Energy & Exterior Features




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### Energy Features

Review *REScheck*™ Materials



REScheck Software Version 4.6.5  
**Compliance Certificate**

- Basic Project Details
- Climate Zone
- Conditioned Area
- Glazing Area
- Bldg. Orientation
- Compliance Path

<b>Project</b> Unit #* Castle Heights <b>Energy Code</b> 2015 IECC <b>Location</b> Cheshire, Connecticut <b>Construction Type</b> Single-Family <b>Project Type</b> New Construction <b>Orientation</b> S85g, face 9 deg. from North <b>Conditioned Floor Area</b> 4,743 R2 <b>Glazing Area</b> 2% <b>Climate Zone</b> 5 (S792 HDD) <b>Permit Date</b> <b>Permit Number</b>	<b>Construction Site</b> Cheshire, CT 06412 <b>Owner/Agent:</b>	<b>Designer/Contractor:</b> Johnny Carter P.E. Carter Group, Inc. 68A S Canal St. Plainville, CT 06062 (860) 733-4826 johnny@cgbycarter.com
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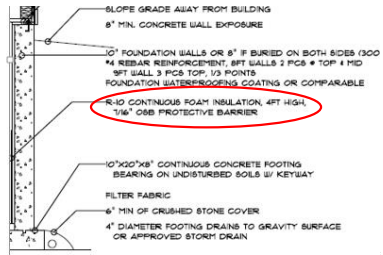
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### Energy Features

Reviewing Plans, Specs & and Docs – Foundation

- Does this Foundation/Basement Insulation Detail Comply?
- Does It Match *REScheck* Report?



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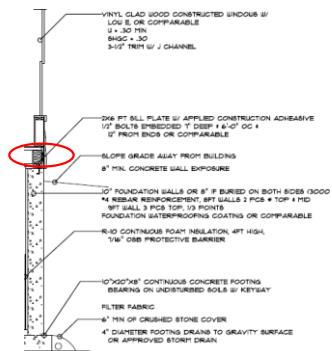
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### Energy Features

Air Barrier & Insulation

What Have We got?

- Window U-factor
- SHGC – don't need
- R-10 Foam Foundation Insulation
  - This Comply?
- Caulking, Air Sealing?
- Air Barrier?
- Rim Band Insulation?



**TYPICAL X-SECTION**

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## Site Inspection - Objectives

At the conclusion of this inspection section, participants should be able to:

- Develop a checklist for inspection of the building exterior and energy conservation components of a residential structure to determine compliance with the state building code.
- Identify noncompliant construction and/or installation of exterior building components including but not limited to roofing, house wraps, siding, insulation, flashing, walls, doors and window systems.
- Write a compliance report on project and develop a punch list of corrective measure for project code compliance.

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## Site Inspection-Bulk Water and Moisture Preparation

Exterior Elements – Water, Moisture, Air Barrier peer CT Residential Code

- Foundation Drainage
- Foundation Waterproofing
- Site Drainage
- WRB
- Flashing

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## Site Inspection-Energy Materials Tools and Preparation

### Envelope Assemblies

Assembly	U-Value	Quality	Cost	Weight	IRB
Door 1 - 48 wood prefinished exterior door	0.20	0.0	0.25	0	0
Window 1 - 48 wood prefinished exterior window	0.20	0.0	0.25	0	0
Window 2 - 48 wood prefinished exterior window	0.20	0.0	0.25	0	0
Window 3 - 48 wood prefinished exterior window	0.20	0.0	0.25	0	0
Window 4 - 48 wood prefinished exterior window	0.20	0.0	0.25	0	0
Window 5 - 48 wood prefinished exterior window	0.20	0.0	0.25	0	0
Window 6 - 48 wood prefinished exterior window	0.20	0.0	0.25	0	0
Window 7 - 48 wood prefinished exterior window	0.20	0.0	0.25	0	0
Window 8 - 48 wood prefinished exterior window	0.20	0.0	0.25	0	0
Window 9 - 48 wood prefinished exterior window	0.20	0.0	0.25	0	0
Window 10 - 48 wood prefinished exterior window	0.20	0.0	0.25	0	0

### REScheck Software Version 4.6.5 Inspection Checklist

Item	Requirement	Compliance	Comments/Measurements
1.01	Foundation Drainage	Compliant	
1.02	Foundation Waterproofing	Compliant	
1.03	Site Drainage	Compliant	
1.04	WRB	Compliant	
1.05	Flashing	Compliant	

Assembly	U-Value	Quality	Cost	Weight	IRB
Wall 1 - 8" solid concrete exterior wall	0.05	0.0	0.00	0.00	0.00
Wall 2 - 8" solid concrete exterior wall	0.05	0.0	0.00	0.00	0.00
Wall 3 - 8" solid concrete exterior wall	0.05	0.0	0.00	0.00	0.00
Wall 4 - 8" solid concrete exterior wall	0.05	0.0	0.00	0.00	0.00
Wall 5 - 8" solid concrete exterior wall	0.05	0.0	0.00	0.00	0.00
Wall 6 - 8" solid concrete exterior wall	0.05	0.0	0.00	0.00	0.00
Wall 7 - 8" solid concrete exterior wall	0.05	0.0	0.00	0.00	0.00
Wall 8 - 8" solid concrete exterior wall	0.05	0.0	0.00	0.00	0.00
Wall 9 - 8" solid concrete exterior wall	0.05	0.0	0.00	0.00	0.00
Wall 10 - 8" solid concrete exterior wall	0.05	0.0	0.00	0.00	0.00

Compliance Statement: The proposed building design described here is consistent with the building plans, specifications, and other information submitted with the permit application. The proposed building has been designed to meet the 2015 IRC requirements in REScheck version 4.6.5 and to comply with the mandatory requirements listed in the REScheck Inspection Checklist.

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### Site Inspection-Foundation

#### Foundation Insulation, Site Drainage & Water/Damp Proofing

- Drainage Details
- Water/ Damp Proofing
- Foundation Insulation
  - R-value matches Plans and REScheck?
  - Properly Positioned?
  - Review Energy vs. REScheck Report

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### Site Inspection-Foundation

#### Foundation Insulation, Site Drainage & Water/Damp Proofing

- **NOT** Entered IN REScheck
- From Bottom Up – NOT Top Of Foundation down
- Send Back for proper, complying REScheck?

Assembly	Energy Rate Perimeter	Cost Per Linear Foot	U-factor	REScheck U-factor	U-factor
Roof 1: All Wood joist/Trap/Over Outside Air	27	30.0	0.0	0.026	1
Ceiling 1: R-10 or Energy from	13.629	15.0	0.0	0.020	17
Ceiling 2: R-10 or Energy from	80	30.0	2.5	0.024	2
Wall 1: Wood Frame, 2x4 w. i. n.	843	19.0	0.0	0.059	43
Window 1: Vinyl/Bargain Frame/Double Pane with Low E	56			0.270	23
Window 2: Vinyl/Bargain Frame/Double Pane with Low E	61			0.170	33
Window 3: Vinyl/Bargain Frame/Double Pane with Low E	843	19.0	0.0	0.059	43
Window 4: Vinyl/Bargain Frame/Double Pane with Low E	134			0.270	33
Window 5: Vinyl/Bargain Frame/Double Pane with Low E	727	19.0	0.0	0.059	37
Window 6: Vinyl/Bargain Frame/Double Pane with Low E	56			0.270	33
Window 7: Vinyl/Bargain Frame/Double Pane with Low E	43			0.280	33
Wall 1: Wood Frame, 2x4 w. i. n.	727	19.0	0.0	0.059	37
Window 8: Vinyl/Bargain Frame/Double Pane with Low E	76			0.270	33
Wall 1: Wood Frame, 2x4 w. i. n.	495	0.0	0.0	0.077	35
Wall 2: Wood Concrete or Masonry Interior Insulation	495	0.0	0.0	0.077	35
Window 9: Vinyl/Bargain Frame/Double Pane with Low E	495	0.0	0.0	0.077	35
Wall 3: Wood Concrete or Masonry Interior Insulation	495	0.0	0.0	0.077	35
Window 10: Vinyl/Bargain Frame/Double Pane with Low E	495	0.0	0.0	0.077	35
Wall 4: Wood Concrete or Masonry Interior Insulation	495	0.0	0.0	0.077	35

Report date: 01/20/19  
Page 3 of 20

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Project foundation insulation

And Use generic best practice pic as well

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### Site Inspection - Framing/Weather-In

#### Drainage Plane

- WRB Installed Right?
- Fasteners
- Taped Seams?
- Caulked to Foundation/Sill?



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### Site Inspection - Water and Moisture

#### Flashing, Cladding, Windows and Doors



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**Site Inspection - Water and Moisture**  
**Foundation**




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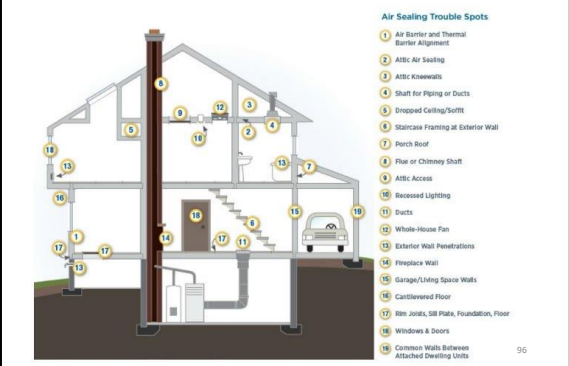
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**Site Inspection - Energy Code Features**  
**Other Key Details & Miscues**




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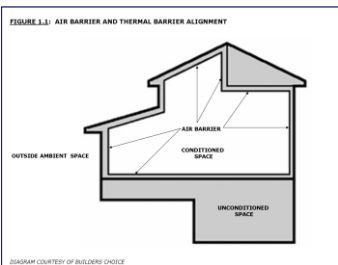
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**Site Inspection - Energy Code Features**  
**Other Key Details & Miscues**

- What Is the Air Barrier?
- What Is The Conditioned Space?
- Insulation installed in full contact with the air barrier
- Provides continuous alignment of insulation & the air barrier.




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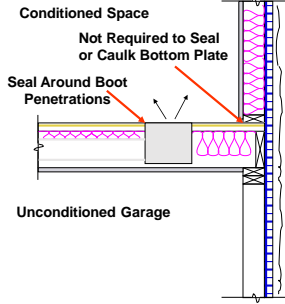
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### Site Inspection – Energy Code Features

#### Other Key Details & Miscues

- Floor Over Conditioned Space




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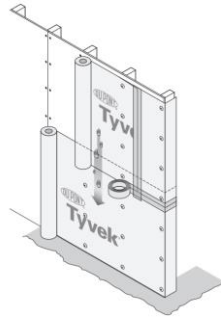
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### Site Inspection – Energy Code Features

#### Other Key Details & Miscues

#### Installation as an air barrier:

1. Install shingle-fashion (start at the bottom)
2. Fasten with broad crown staples (or equiv.)
3. Clean surface of debris before taping
4. Tape all seams – vertical AND horizontal



DuPont Tyvek Water-Resistive and Air Barrier Installation Guidelines 99

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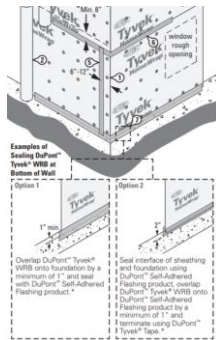
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### Site Inspection – Energy Code Features

#### Other Key Details & Miscues

4. Overlap house wrap onto foundation
5. Seal wrap to foundation



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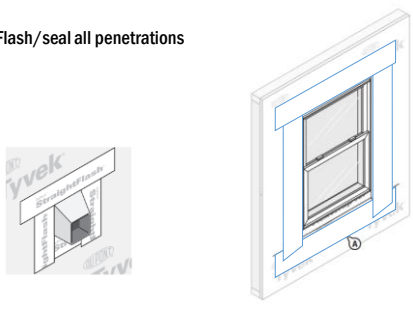
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**Site Inspection – Energy Code Features**  
Other Key Details & Miscues

6. Flash/seal all penetrations



DuPont Tyvek Water-Resistive and Air Barrier Installation Guidelines 101

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**Site Inspection – Energy Code Features**  
Other Key Details & Miscues



Courtesy of the Department of Energy's Building America Solution Center (<http://www.energycd.com>) 102

Is This An Air Seal?

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**Site Inspection – Energy Code Features**  
Other Key Details & Miscues



© The GreenSource Building Center 103

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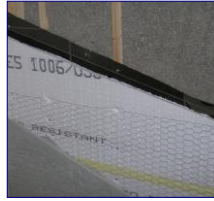
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### Site Inspection – Energy Code Features

#### Other Key Details & Miscues



- Air barrier at tub/shower enclosure
- located on an exterior wall
- Insulation is in full contact with air barrier

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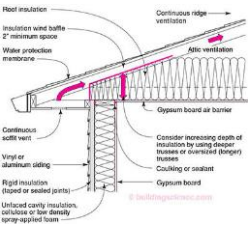
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### Site Inspection – Energy Code Features

#### Other Key Details & Miscues



- Eave Baffle
- Chutes
- Other Air Sealing
- BIG Hole – Attic Kneewall – Air Sealing, Insulation

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### Site Inspection – Energy Code Features

#### Other Key Details & Miscues

- Bonus Room Construction




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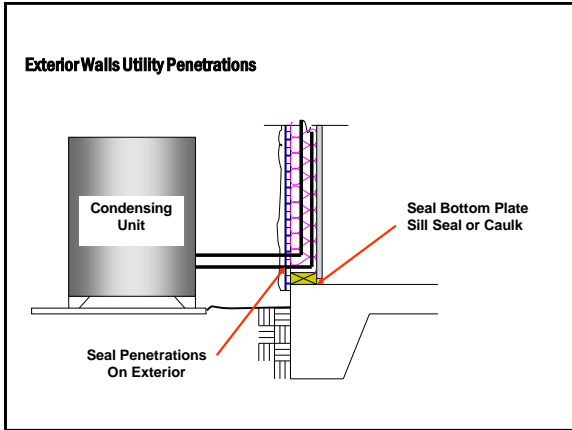
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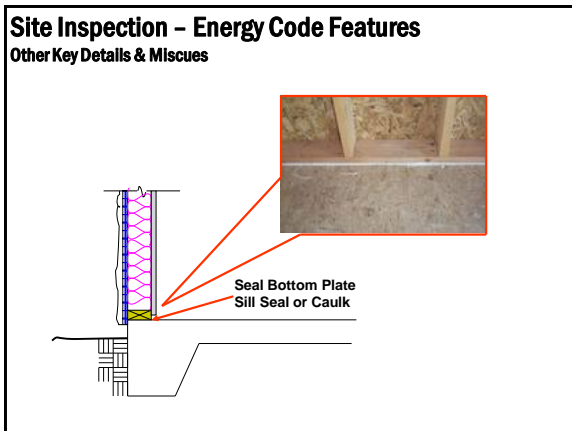
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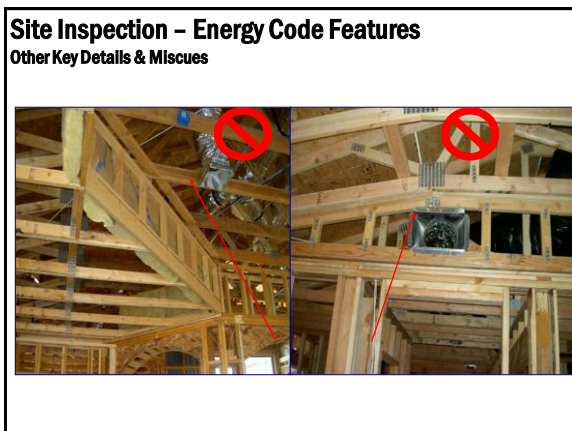
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### Site Inspection - Energy Code Features

Other Key Details & Miscues



- OSB or plywood backing attic side



- Thermoply backing installed on attic.

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### Site Inspection - Energy Code Features

Other Key Details & Miscues



Spray Foam Works Great!



Another Way - but must insulate to WALL levels.



Is stuffing batts insulation here gonna cut it?

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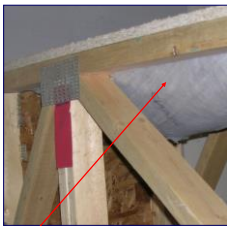
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### Site Inspection - Energy Code Features

Other Key Details & Miscues



- Cantilevered floor
- Insulation installed in contact with sub-floor



- Mock up of cantilevered floor
- Insulation installed in contact with sub-floor

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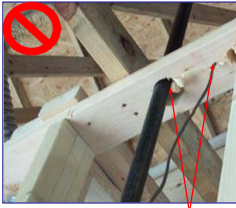
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### Site Inspection – Energy Code Features

Other Key Details & Miscues



• All penetrations into unconditioned space need to be sealed!



• HVAC penetrations into unconditioned space need sealing

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### Site Inspection – Energy Code Features

Other Key Details & Miscues



• Correct The picture at the left depicts the correct way to seal penetrations of the air barrier between conditioned space and unconditioned space.

• The duct work, draft stop, sewer and water lines are sealed using caulk or expansive foam.

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### Site Inspection – Energy Code Features

Other Key Details & Miscues

Other Areas to Air Seal - Fireplace Chimney Penetrations



Air Sealing Installation That Will Not Comply



Air Sealing Installation That Will Comply

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### Site Inspection – Energy Code Features

#### Other Key Details & Miscues



Manufactured fireplace installed with air barrier (gypsum board, Thermoply, or equivalent) in place. All seams caulked, taped, or sealed with expansive foam.



The interior gypsum board, OSB or equivalent is sealed with caulk to the sheet metal flap or fire stop. Seal all joints, seams, and penetrations with caulk or sealant. Seal the sheet metal collar at the flue with fire rated caulk. Maintain all clearances per manufacturer's specifications.

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### This Is Why I Do Energy Code Work!



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### Acknowledgements

We thank the following organizations and sources for some of the graphics, photos and content included in this presentation:

- North Branch Services
- US-DOE Building Energy Codes Program (BECP)
- US-DOE Building America Program
- Building Science Corporation

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### Use of OEDM Training Materials

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### Technical Code Questions and Support

**State of Connecticut**  
**Department of Construction Services**  
Office of the State Building Inspector  
(860) 713 - 5900  
Office of the State Fire Marshal  
(860) 713 - 5750  
Office of Education and Data Management  
(860) 713- 5522

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### Thank You!

**Mike DeWein**  
North Branch Services

- Energy Code T/A
- Training
- Energy Code Consulting & Municipal Services
- Plan Review Services
- Air Barrier Inspections
- Large Building Blower Door Testing



[dewein53@gmail.com](mailto:dewein53@gmail.com)  
518-369-7545

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