

New York State Energy Code

Energy Code Enforcement Manual

For Code Enforcement Officers

June 2019



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Technical Advisory Group

Jeffrey Rios: AFK In Posse

Jeffrey Geary: AVID Designs, Inc.

Arie Golden: ads Engineers

Justin Harbinger: Building Inspector Town of Bethlehem

Scott Corp: TY Lin

Rudi Sherbansky: ASPA Engineering LLC

Miguel Lopez: Glisanz Murray Steficek

Juan Torro: Glickman Engineering Associates

Chris Wescott: Syska Hennessy Group, Inc.

Rachel Stuckey: Erdman Anthony

Michael Mehl: JB&B

Review Committee

Emily Hoffman: PE, CEM, LEED AP, Director Energy Code Compliance NYC Department of Buildings

Gina Bocra: AIA, LEED Fellow, Chief Sustainability Officer NYC Department of Buildings

Christopher Sgroi: Project Manager, NYSERDA

Joseph Hill: RA Department of State, New York State

Stephen Finkle: Senior Project Manager, Commercial New Construction NYSERDA

Priscilla Richards: Program Manager, NYSERDA

Table of Contents

Acknowledgements	2
Forward.....	4
Acronyms and Abbreviations.....	7
Standards.....	8
Definitions.....	9
1 Resources and Commentary.....	10
Thermal Properties	10
Energy Analysis Software.....	11
Infiltration.....	11
Energy Code.....	11
Inspections.....	11
Website Resources.....	12
Guide.....	13
2 Commercial Plan Review Methods.....	38
Scope and Administration.....	38
Permit Set Review.....	40
Amendments and Resubmissions.....	52
3 Residential Plan Review Methods.....	53
Scope and Administration.....	53
Permit Set Review.....	55
Supporting Documentation.....	58
4 Existing Buildings.....	61
Scope of Work.....	61
Existing Building Compliance Path Options.....	62
5 Inspections.....	67
Commercial Inspections.....	67
Residential Inspections.....	81

Forward

This manual, designed as a resource for code enforcement officers, is a how-to guide for approaching and reviewing construction documents, energy analyses, and field construction sites to ensure compliance with the New York Energy Code. Ultimately, the goal is to streamline the compliance approval process so that it is efficient, user-friendly, and facilitates energy code compliance for all projects.

We recognize that the Energy Conservation Construction Code of New York is a complex and sophisticated technical body of knowledge that is administered through mandatory, prescriptive, and performance-based approaches. The complexity and sophistication offer flexibility to designers and promotes innovation in the market place—yet regulates the minimum standard of care. Administering the codes should support these values as well as a process that endorses a multi-faceted approach where each step supports the next.

Since 2002, the energy code has been updated about every three years. To deal with the ever-changing document, some jurisdictions have adopted alternative means of complying with the energy code. For example, some jurisdictions require ENERGY STAR® certification for residential projects and/or LEED green building certification for commercial projects. Building to these more stringent requirements ensures the jurisdiction's construction and renovation projects can meet, if not exceed, energy code requirements. Consequently, the manual seeks to be a companion to the New York Energy Code and describes the processes by which to perform plan reviews and inspections. The manual intentionally avoids quoting specific code values to circumvent becoming inapplicable or outdated. As such, CEOs should find the manual beneficial regardless of the energy code version they are using.

Acronyms and Abbreviations

ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigeration and Air-Conditioning Engineers
BCAP	Building Codes Assistance Project BECP Building Energy Codes Program BIM
BIM	Building Information Modeling
BTP	U.S. Department of Energy, Building Technologies Program
CMU	Concrete Masonry Units
DOE	U.S. Department of Energy
Ev	Ventilation Efficiency
HERS	Home Energy Rating System
HVAC	Heating, Ventilation, and Air Conditioning
ICC	International Code Council
IES	Illuminating Engineering Society
IECC	International Energy Conservation Code
IgCC	International Green Construction Code
NYSERDA	New York State Energy Research and Development Authority
RESNET	Residential Energy Services Network
UA	Sum of the U-factor times assembly area
VFD	Variable Frequency Drive
VSD	Variable Speed Drive

Standards

ASHRAE

90.1—Energy Standard for Buildings Except Low-Rise Residential Buildings

90.2—Energy-Efficient Design of Low-Rise Residential Buildings

90.4—Energy Standard for Data Centers

62.1—Ventilation for Acceptable Indoor Air Quality

170—Ventilation of Health Care Facilities

62.2—Ventilation for Acceptable Indoor Air Quality in Residential Buildings

202—Commissioning Process for Buildings and Systems

183—Peak Cooling and Heating Load Calculations in Buildings Except Low-Rise Residential Buildings

111—Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems

SMACNA

007—Residential Comfort System Installation Standards

016—HVAC Air Duct Leakage Test Manual

1966—HVAC Duct Construction Standards

Definitions

Each code compliance path includes definitions that are critical to understanding and applying the energy code. These definitions are as much a part of the code as the specific requirements listed in the subsequent sections.

The following definitions refer to terms used in this manual. They are not necessarily exclusive to energy code terminology but are useful for understanding the processes involved in code compliance.

Compliance. Design values covered by the energy code that are equal to or better than the prescribed code values.

Consistent. Design values submitted for compliance match values documented on the permit drawings.

Dimensioning. Use dimensions listed on drawings to determine the scale or measurements of areas. Alternately, use a scale ruler to determine the dimensions of objects.

Energy Code. As of the published date on this manual the New York State Energy Conservation Construction Code is contained in Title 19 of the New York Codes, Rules, and Regulations (NYCRR), Part 1240. The publications incorporated by reference are (1) 2015 International Energy Conservation Code, (2) ANSI/ASHRAE/IES Standard 90.1 2013, (3) Energy Standard for Buildings Except Low-Rise Residential buildings, and (4) 2016 Supplement to the New York State Energy Conservation Construction Code (Revised August 2016). Buildings located within the City of New York and not in the custody of a State agency are subject to the 2016 NYC Energy Conservation Code. All references to chapters and specific language relate back to this version of the code.

General/Key Note. A reference addressing requirements that span the entire set of that division of labor's construction documents and/or cover the scope of work on the sheet or in a document.

Mandatory Provisions. Requirements that all projects must meet regardless of compliance method (e.g., COMCheck, Total Building Performance, Energy Cost Budget Method, or Performance Rating Method).

Numbered Note. A specific reference to an object on a plan/detail prescribing a unique process or condition. Signified with cardinal numbers or alphanumeric values.

Performance Path. A set of rules that allow a project to trade-off among design elements across disciplines by using software to compute annual energy use/cost of a building compared to a baseline design.

Prescriptive Provisions. Requirements that depend on project design choices and need not meet specified values if the design can improve upon other requirements (e.g., lower thermal performance of a wall versus higher thermal performance of a roof).

Supporting Documents. The group of construction documents (drawings and specifications) and all other supporting data submitted with a permit application.

Trade-off Path. Requirements that allow trade-off between building envelope components as long as the whole envelope is compliant.

1 Resources and Commentary

To assist in the energy code review process, several common auxiliary documents are explained, and detailed maps of websites are provided. Each resource is labeled based on where it is usually applied during a typical code review.

A visual guide has been included to provide a quick reference in explaining how to handle common items during a code review that may occur.

Thermal Properties

Opaque Assemblies

ASHRAE 90.1 Appendix A: Generally accepted methodology for determining assembly U-factors, C-factors, F-factors and heat capacities of typical building constructions.

Common misapplications of the calculation methodology:

- Extrapolation is specifically disallowed.
- Air gap as a thermal layer may only be claimed when it does not directly touch an insulation layer, and if there is no communication with the outside air.
- Custom assemblies may only differ from the table values if the additional material changes the overall assembly R value by at least R-1.

Computer Model: Two- or three-dimensional finite difference and finite volume models are an acceptable methodology to calculate the heat transfer of off-site manufactured assemblies and custom assemblies that have to account thermal bridging outside the scope of other methods.

- Such analysis is performed for all cross sections in an assembly that are different or additional information is provided demonstrating that the cross sections analyzed constitute the worst thermal cases. The results are averaged together by the surface area they represent.

ASHRAE 90.2 Energy Efficient Design of Low-Rise Residential Buildings: Includes methodology acceptable for residential applications for determining the overall U-factor by the parallel path correction factor method.

Fenestration

National Fenestration Rating Council: Testing and labeling agency for glazing units.

- Visit <http://cmast.nfrc.org/Product/ProductFind.aspx> to verify the thermal properties for a submitted fenestration product.
- Visit <http://cmast.nfrc.org/Project/CertificateFind.aspx> to verify the value of a labeled fenestration product.

WINDOW software: Computer program developed by Berkley Labs in accordance with ISO 15099 for calculating center of glass and overall glazing thermal performance.

- When reviewing software outputs confirm that the overall assembly U-factor is submitted rather than the center of glass and that the calculated glazing dimensions are consistent with the installed system.

Energy Analysis Software

COMcheck/REScheck: Visit energycodes.gov/compliance for the most recent version of the software.

- Template compliance checklists are available via the website.

HERS (Home Energy Rating System): System used to generate ERI compliance path analysis for residential applications.

- Visit www.resnet.us to confirm the standing of a submitted energy rater.

Energy Modeling:

- Refer to Performance-Based Energy Code Enforcement Manual by Karpman and New York Energy Research and Development Authority (NYSERDA).

Infiltration

Visit www.bpi.org for records of individuals certified in blower door testing procedures.

Energy Code

The Department of State Division of Building Standards & Codes provides access to the energy code.

Visit dos.ny.gov/dcea/CodeUpdate.html for the most recent code and supplement. Note that the link to the energy code on this page states “as adopted,” which means that it is the most current adopted version of the International Energy Conservation Code (IECC) by New York State.

Design teams interested in filing a variance should be directed to dos.ny.gov/DCEA/pdf/varianceapp_311.pdf for instructions on applying.

Inspections

Energy Inspector’s Guide: Base on the 2015 International Energy Conservation Code—A pocket guide that presents the code in an alternate form by dividing the material between required inspections for residential and commercial provisions. Provides tips on what to look for in the field.

Website Resources

Building America Solution Center (BASC): Department of Energy (DOE) repository of information on high-performance residential construction techniques.

Root Website—asc.pnnl.gov

- /program-checklists—Central location for accessing DOE labeling program checklists such as EnergyStar, Zero Energy Ready Homes, Water Sense products and Indoor airPLUS.
- /building-components—Online tool providing visual guides to specifying and proper installation of residential building components.
 - Useful for checking plans/details and field conditions against best practices for various construction methods.
- /solutions—Page for downloading and installing the BASC Field Kit App, which allows offline access to the building-components tool on mobile devices.
 - Useful for the job site. Able to generate illustrations of best practices for construction techniques to assist in answering questions.
- /code-compliance—Briefs in PDF format that provide technical code-related information based on DOE research into best practices.

Building Energy Codes Program (BECP): Division within the DOE supporting energy code development, adoption, implementation, and enforcement.

Root Website—energycodes.gov

- /resource-center—A central page for accessing publications and resource guides. Of note is the Building Energy Codes Resource Guide: Code Officials Edition.
- /training—Page for accessing numerous self-paced training courses. Including the Adoption Compliance and Enforcement (ACE) Learning Series.

New York State Energy Research and Development Authority (NYSERDA): Offers objective information and analysis, innovative programs, technical expertise, and support to help New Yorkers increase energy efficiency, save money, use renewable energy, and reduce reliance on fossil fuels.

Root Website—nysesda.ny.gov

- All-Programs/Programs/Energy-Code-Training—Page for accessing several training programs specifically geared towards improving compliance with the energy code.

Guide

The following is a collection of visual details of common items that may be encountered during the review process. The guide is not intended to cover all possible scenarios. Some of the examples provided reference values and requirements of the 2016 Energy Code, and their accuracy should be confirmed for future versions of the energy code.

Visit 1.nyc.gov/assets/buildings/pdf/h2g_all.pdf for a copy of the guide.

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Opaque Envelope Assemblies

R-value Documentation

For each building envelope type (e.g., roof, above-grade/below-grade walls, floors over unconditioned space, etc.) a section detail indicates the overall R-value of the insulation.

Alternatively, details call out each of the proposed insulation types, thickness, and published manufacturer R-value per inch.

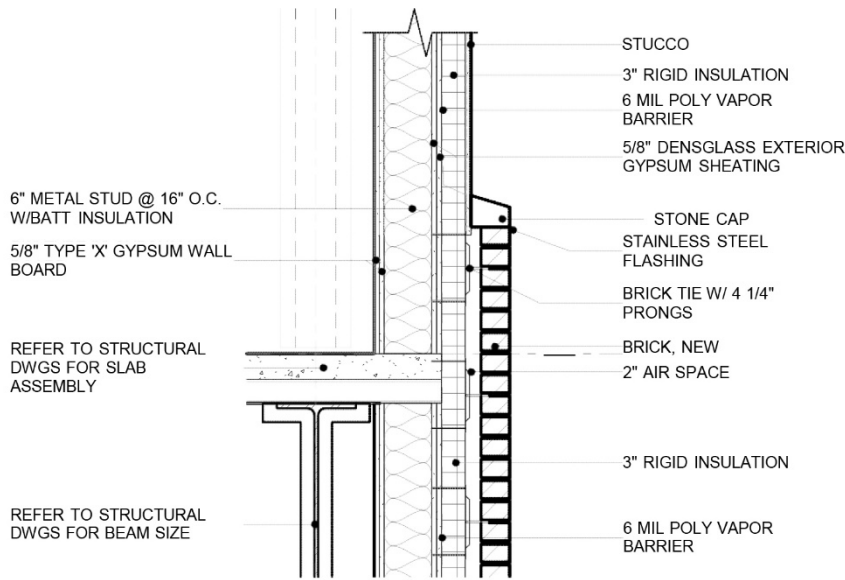
U-Factor Documentation

A project demonstrating compliance prescriptively with an assembly U-factor includes a calculation table documenting the methodology used to reach the U-factor for each assembly type in the energy analysis.

- These tables include a reference to the source of the overall U-factor (e.g., ASHRAE 90.1 Appendix A Table), and a reference to the representative detail they are based on.

Area weighting calculations are also provided where multiple assemblies make up the values on the energy analysis.

Figure 1. Sample CMU Wall Detail with Accompanying U-Factor Table



WALL TYPE WT-1	
Typical Wall Assembly	R-value
3" R-15 Rigid Insulation	15.00
6" Metal Stud Wall, R-19 between studs	8.83
5/8" gypsum board	0.56
Total Effective R-value of Wall assembly	24.40
U-factor of Wall Assembly	0.041
<i>U-factor from ASHRAE Table A3.3</i>	
Slab Edge Assembly	R-value
3" R-15 Rigid Insulation	10.75
10" Thick Solid Concrete (Density 1.44 lb/cu ft)	1.60
Total Effective R-value of Slab Edge	12.34
U-factor of Slab Edge	0.081
<i>U-factor from ASHRAE Table A3.1A</i>	

Area Weighted Assembly U-factor Calculation for WT1			
Typical 10'6" floor to floor height (10" slab + 9'-8" wall height)			
Assembly	U-factor	Height (in)	UA
3" R-15 Rigid Insulation	0.041	116	4.756
6" Metal Stud Wall, R-19 between studs	0.081	10	0.810
Total		126	5.566
Area-Weighted Assembly U-factor			0.044
<i>Code-Allowed Maximum U-factor</i>			0.900

Fenestration Schedules

U-Factor and SHGC Values

Fenestration and door schedules include design U-factor and Solar Heat Gain Coefficient (SHGC) values that match those listed on the energy analysis.

Schedules include manufacturer and model number of the basis of design and include as a note or footnote to what standard the assemblies are tested (e.g., NFRC).

Air Leakage Rate and Visible Transmittance (VT)

Where a separate schedule or notes do not exist, the fenestration and door schedules include the manufacturer's listed air leakage rates.

Where the project employs daylighting, the visible transmittance (VT) of the proposed glazed fenestration is listed.

Table 1. Sample Window and Door Schedule

FENESTRATION SCHEDULE								
TAG	TYPE	MATERIAL	NOMINAL DIM. (W×H)	MANUFACTURER - MODEL NO.	ASSEMBLY U-FACTOR	SHGC	VT	AIR LEAKAGE RATE (CFM/CF)
W1	FIXED	ANNO. ALUMINUM	7'-0" × 7'-0"	ABC WINDOWS - D999 SERIES OR APPROVED EQUAL	0.33	0.38	0.51	0.16
W1A	FIXED & CASEMENT	ANNO. ALUMINUM	7'-0" × 7'-0"	ABC WINDOWS - D999 SERIES OR APPROVED EQUAL	0.35	0.39	0.51	0.18
W2	CASEMENT	ANNO. ALUMINUM	4'-6" × 2'-3"	ABC WINDOWS - EF00 SERIES OR APPROVED EQUAL	0.42	0.39	0.51	0.18
SW1	SKYLIGHT	ANNO. ALUMINUM	2'-10" × 5'-2"	SKL CORP. - GHT000 SERIES OR APPROVED EQUAL	0.40	0.38	0.5	0.18
W5	STOREFRONT - FIXED GLAZING	ANNO. ALUMINUM	VARIES; SEE A-301 ~305 FOR LOCATIONS & DIM.	GLD CO. - STR #Z111 OR APPROVED EQUAL	0.36	0.38	0.53	0.05

Air Barrier Compliance

Continuous Air Barrier

To ensure air barrier continuity in the building thermal envelope, drawings must specify applicable air barrier construction methods and indicate that the building envelope is composed of the following:

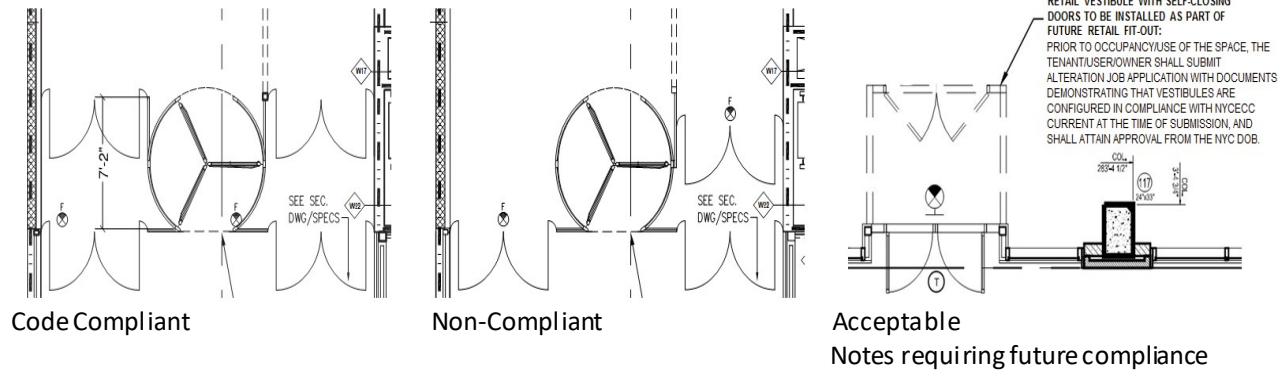
- Building materials not exceeding maximum allowed permeability
- OR
- Assemblies not exceeding allowed maximum rated air leakage

Openings in the Building Envelope

Drawings identify specific construction methods, configuration, devices, and/or performance standards to limit air leakage in the building envelope including, but not limited to the following:

- Fenestration and doors: Labeled for a rated air leakage
- Outdoor air intake and exhaust openings: Maximum rated air leakage on shut-off dampers
- Shut-off dampers are motorized unless allowed per exception
- Doors/Access Hatches: Openings to shafts, chutes, vents, stairways and elevator lobbies are equipped with gasketing, weather stripping, and sealing.
- Loading dock doors: Weather seals to restrict infiltration
- Vestibules: Proper configuration and self-closing devices on doors
- Recessed Lighting: IC-rated, labeled with code-prescribed maximum air leakage rate, and sealed with gasket or caulk

Figure 2. Sample Vestibule Plans



Thermal Bridging in Building Envelope

Projects account for thermal bridging where required by the energy code using THERM modeling or by a method used to generate the thermal properties (e.g., ASHRAE 90.1 Appendix A).

Drawings address all thermal-bridging-prone areas in the building envelope either by specifying supplemental insulation materials in such areas (prescriptive path), or by reporting the most conservative thermal resistance of the areas in the energy analysis (envelope trade-off path).

Thermal bridging commonly occurs in floor slab/joist edges, floor and balcony connections, slab-on-grade conditions, and roof and wall connection areas among others.

Projects submitting for compliance prescriptively must demonstrate that each of the thermal-bridging-prone areas meet the insulation requirement.

Trade-Offs in the Envelope—Total UA (sum of U-factor times assembly area) Alternative

Projects submitting for compliance by the Trade-Off path must break out each thermal-bridging-prone area as a separate UA entry where required.

Code compliant UA is based on the envelope type for the thermal bridging which may differ from the rest of the assembly.

Figure 3. Sample Slab Edge Detail and matching Envelope COMcheck

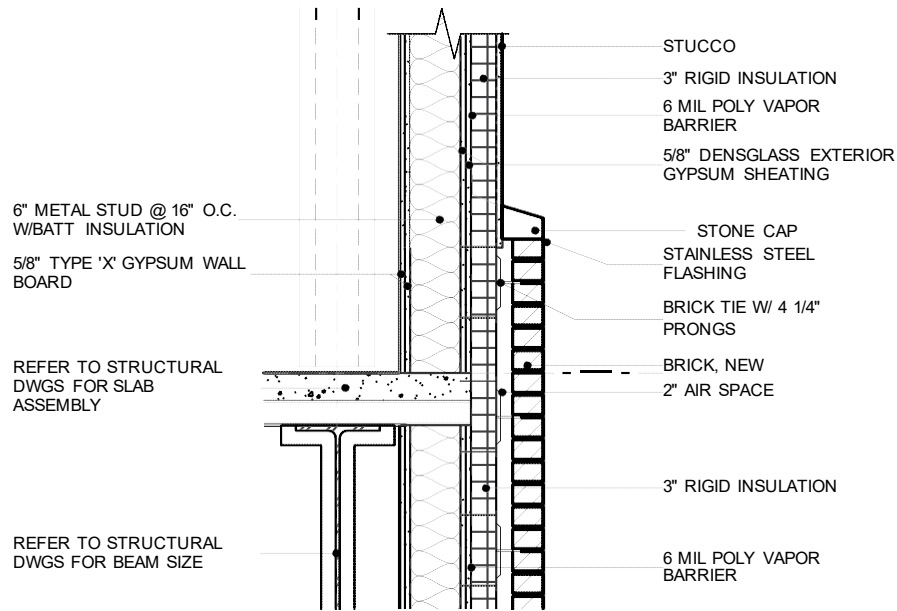
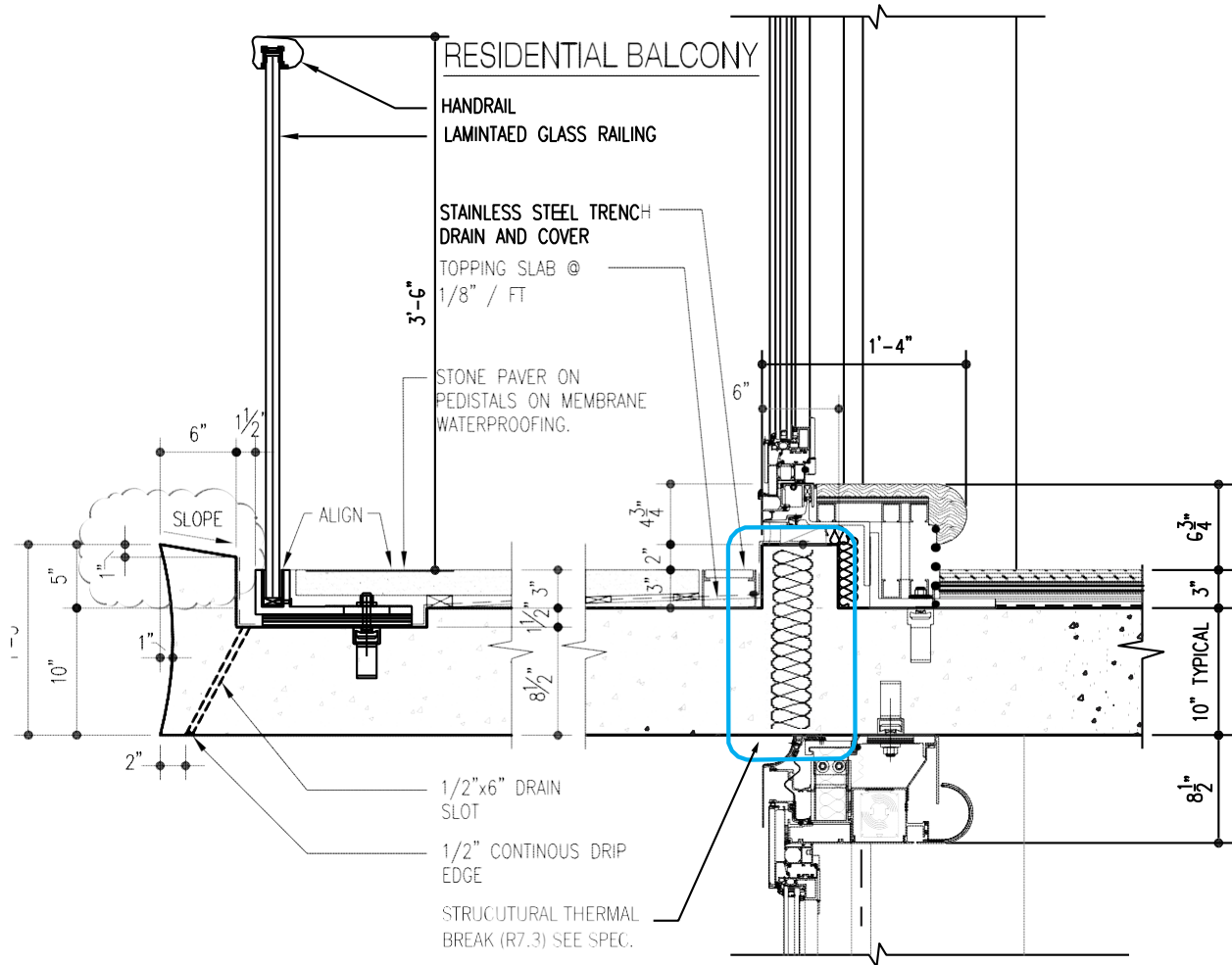


Table 2

Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor _(a)
WT-1: 6" Steel Framed, 16" o.c., [Bldg. Use 1 – Multifamily]	5,360	19	17	0.038	0.064
WT-1: Slab edge: Solid Concrete, 10" Thickness, Normal Density, Furring: None, [Bldg. Use 1 – Multifamily]	378	—	17	0.053	0.090

Figure 4. Sample Thermally Broken Balcony Detail and Matching Envelope COMcheck Report

① BALCONY CONNECTION WITH THERMAL BREAK



Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor (a)
WT-2: Concrete Slab, 6" thickness, Medium Density, Furring 16" o.c., [Bldg. Use 1–Multifamily]	1780	16	—	0.082	0.090
Window 1: Metal Frame fixed, Per Specs: SHGC 0.39, VT 1.00	580	—	—	0.280	0.38
WT-2: Slab Edge; Solid Concrete, 10" thickness, Medium Density Structural Thermal Break [Bldg. Use 1–Multifamily]	255	—	7.3	0.103	0.090

Figure 5. Sample Balcony without Thermal Break Detail and Matching Envelope COMcheck

② BALCONY CONNECTION WITHOUT THERMAL BREAK

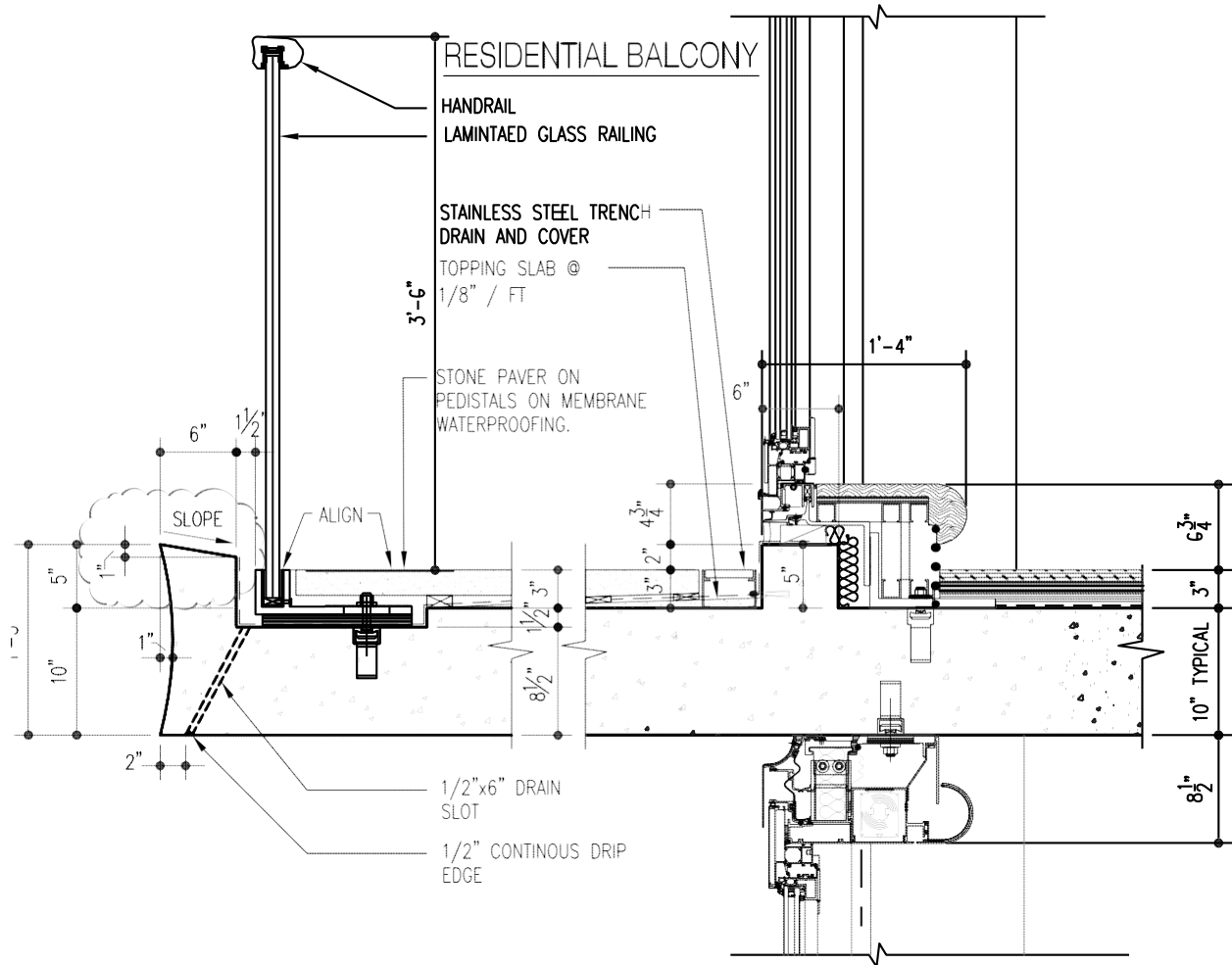


Table 3

Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor (a)
WT-2: Concrete Slab, 6" thickness, Medium Density, Furring 16" o.c., [Bldg. Use 1 – Multifamily]	1780	16	—	0.082	0.090
Window 1: Metal Frame fixed, Per Specs: SHGC 0.39, VT 1.00	580	—	—	0.280	0.38
WT-2: Slab Edge; Solid Concrete, 10" thickness, Medium Density, [Bldg. Use 1 – Multifamily]	255	—	—	0.450	0.090

Equipment Penetrations in Building Envelope

When reviewing energy analysis, be cognizant of penetrations and recessed areas in the thermal barrier. These areas are not specifically addressed in the code manual but are a requirement of properly applying any accepted method of calculating thermal performance.

Recessed Equipment

For commercial projects, it may be necessary to account for equipment recessed in a manner as to affect the insulation thickness.

Any submission where the area of recessed equipment is not accounted for in the energy analysis and the total area of recessed equipment appears to be greater than or equal to the threshold area as required by the thermal performance method, the following is requested of the permit applicant:

- Clarification through additional details on the drawings, documenting where and how often recessed equipment does not affect the insulation thickness.
- Calculations documenting the area of all recessed equipment and verification that this area is less than the threshold, or revised energy analysis provides thermal accounting for these areas.

Equipment Penetration

For commercial projects, verify that the equipment penetrations of the thermal barrier are less than the allowed threshold by the documented thermal barrier calculation methodology.

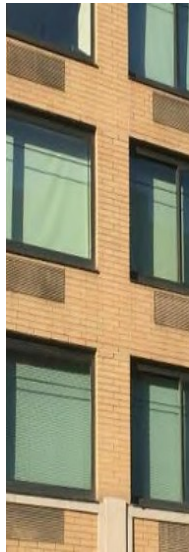
Where it is not clear that the total area is less than these limits, the following is requested of the permit applicant:

- Clarification through additional details on the drawings, documenting where and how often equipment does penetrate the thermal barrier.
- Calculations documenting the area of all equipment penetrations and verification that this area is less than the limit, revised energy analysis provides thermal accounting for these areas.

The U-factor for penetrations accounted for in the energy analysis must be consistent with the thermal barrier calculation methodology.

Climate-Specific Envelope Requirements

Figure 6. Sample Envelope COMcheck Report with PTAC Penetration Area Accounted for as a Separate Opaque Wall Type



Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor (a)
Roof Type A: Insulation Entirely Above Deck [Bldg. Use 1 – Multifamily]	1,776	—	30.0	0.032	0.032
Exterior Wall – Type 1A: 8" Concrete Block, Partially Grouted, Cells Empty, Normal Density, Furring: None, [Bldg. Use 1 – Multifamily]	4,350	—	10	0.082	0.090
Window WF1: Double Pane Metal Frame with Thermal Break: Fixed, Per Specs: SHGC 0.38, VT 1.00, [Bldg. Use 1 – Multifamily]	78	—	—	0.350	0.380
Windows 1-2: Double Pane Metal Frame with Thermal Break: Operable, Per Specs: SHGC 0.40, VT 1.00, [Bldg. Use 1 – Multifamily]	1,568	—	—	0.420	0.104
Mech PTAC Units Through-Wall: Other Mass Wall, Heat capacity 5.0, [Bldg. Use 1 – Multifamily] (b)	462	—	—	0.50	0.090

Optimal Equipment Size

Residential Buildings

Sizing Statement (see Figure 7): Verify that a statement has been provided on drawings indicating the total heating and cooling design loads have been determined in accordance with ACCA Manual J and equipment has been sized per ACCA Manual S, or other approved calculation methodologies.

- Where the validity of such values is in question, request copies of the calculations.

Minimum Efficiency: New or replacement heating and cooling equipment must meet or exceed the minimum efficiency rating required by federal law.

Commercial Buildings

Sizing Statement (see Figure 7): Verify that a statement has been provided on drawings indicating the building heating and cooling design loads have been determined in accordance with ANSI/ASHRAE/ACCA Standard 183, or other approved equivalent computational methods.

- Where the validity of such values is in question, request copies of the load calculations.

Figure 7. Sample Commercial Sizing Statement

MECHANICAL COMPLIANCE NOTES	
COOLING LOAD CALCULATIONS:	
ALL HEATING AND COOLING CALCULATIONS ARE DONE IN ACCORDANCE WITH THE ASHRAE/ACCA 183.	
TESTING AND BALANCING NOTES:	
A. SET HVAC SYSTEM'S AIR FLOW RATES AND WATER FLOW RATES WITHIN THE FOLLOWING TOLERANCES:	
1. SUPPLY, RETURN, AND EXHAUST FANS AND EQUIPMENT WITH FANS: PLUS OR MINUS 10 PERCENT.	
2. AIR OUTLETS AND INLETS: PLUS OR MINUS 10 PERCENT.	
3. HEATING-WATER FLOW RATE: PLUS OR MINUS 10 PERCENT.	
4. PROVIDE BALANCING REPORT FOR WATER AND AIR SYSTEMS	
5. COMMISSIONING TO BE IN ACCORDANCE WITH ASHRAE 90.1 - 6.7.2.4	
SERVICE WATER:	
1. ALL SERVICE WATER PIPING SHALL BE INSULATED PER 404.5. MIN 1" THICK INSULATION WITH MAX K=0.27 (R=4 PER INCH OR GREATER) SHALL BE PROVIDED. SEE INSULATION CHART ON THIS DRAWING.	
2. TEMPERATURE IS SET AT 90°F FOR FIXTURES IN RESIDENTIAL UNITS AND 110°F FOR LAVATORY FAUCETS IN PUBLIC FACILITY RESTROOMS. STORAGE TEMPERATURE IS SET AT 140°F TO CONTROL LEGIONELLOSIS PER NYS DOH GUIDELINES.	
3. TEMPERATURE MAINTENANCE CONTROLS SHALL BE PROVIDED ON HEAT TRACE PER SECTION 7.4.4.2.	
4. THE CONDENSER WATER RETURN WILL BE UTILIZED TO PREHEAT THE DOMESTIC WATER.	
GENERAL NOTES:	
ALL PROPOSED EQUIPMENT MEETS OR EXCEEDS MINIMUM EFFICIENCY REQUIREMENTS.	

Minimum Equipment Efficiency/Performance

Complete Equipment Schedules

Verify that for all HVAC and Service Water Heating (SWH) equipment schedules the following are clearly documented:

- equipment efficiency or performance rating
- type
- size
- capacity
- fuel type

Verify that for all energy code regulated equipment, the rated efficiency/performance ratings identified in the equipment schedule meets or exceeds the corresponding code-prescribed value at the same test conditions.

Values on Construction Drawings Match Energy Analysis

Verify that information on the schedules matches what is on the energy analysis.

Figure 8. Equipment Schedule and Matching COMcheck

VARIABLE REFRIGERANT FLOW - SPLIT TYPE - HEAT PUMP UNITS (00000000 OR APP)												
OUTDOOR UNITS												
TAG	LOCATION	MODEL	COOLING CAPACITY (@ 95 F) (BTUH)	HEATING CAPACITY (@ 47 F) (BTUH)	ELECTRICAL			WEIGHT LBS	REFRIGERANT	EER/SEER	COP	HSPF
					V/PH/Hz	MCA	REC. BREAKER SIZE					
HPC-1	ROOF	PURY-HP144SKMU-A-H	144,000	160,000	208/1/60	44	60	552	R410A	12.5	3.46	
					208/1/60	44	60	552				
HPC-2	ROOF	PURY-HP96TKMU-A-H	96,000	108,000	208/1/60	60	80	552	R410A	16.5	3.46	
HPC-3	ROOF	PURY-HP96TKMU-A-H	96,000	108,000	208/1/60	60	80	552	R410A	16.5	3.46	
HPC-4	ROOF	PURY-HP96TKMU-A-H	96,000	108,000	208/1/60	60	80	552	R410A	16.5	3.46	
HPC-5	ROOF	PURY-HP96TKMU-A-H	96,000	108,000	208/1/60	60	80	552	R410A	16.5	3.46	
HPC-6	ROOF	PURY-HP96TKMU-A-H	96,000	108,000	208/1/60	60	80	552	R410A	16.5	3.46	
HPC-7	ROOF	PURY-HP96TKMU-A-H	96,000	108,000	208/1/60	60	80	552	R410A	16.5	3.46	
HPC-8	ROOF	PURY-HP96TKMU-A-H	96,000	108,000	208/1/60	60	80	552	R410A	16.5	3.46	
HPC-9	ROOF	MUZ-HE24NA	22,500	20,000	208/1/60	17.1	20	119	R410A	18.0		8.5

PROVIDE CENTRAL CONTROL FOR SYSTEM. SYSTEM SHALL CONTROL SETPOINTS AND OPERATION OF ALL UNITS. LOCATION ON CONTROLLER TO BE DETERMINED

HVAC System Controls

Projects submitted using the Performance Path are not required to meet prescriptive control requirements. These projects will demonstrate an energy penalty in their energy analysis for not having such controls.

Thermostatic Controls

Verify that thermostatic controls are shown on the drawings for all proposed systems.

Confirm that notes or specifications are included requiring programmable thermostats or automatic time-clock controls capable of independent seven-day programmability.

As applicable, thermostatic controls also include the following:

- Heat pump supplementary heat controls
- Minimum 5°F deadband
- Setpoint overlap restrictions

Off-Hour Controls: Verify that thermostatic controls include allowances for setback controls through either an automatic time clock or a programmable control system for each zone.

Narratives on Operations and Controls

Verify that control drawings/sequence of operations are included, and sufficient detail is provided in the supporting documents to confirm that specified mandatory control systems have functions meeting or exceeding code requirements. Also verify specified set points for equipment and controls.

HVAC System Controls—Economizers

Requirement for Each Cooling System

There are numerous exceptions that can be used by projects, which vary between the IECC and ASHRAE versions of the code. Where economizer controls are documented verify that at least one exception is met. The most common exceptions are as follows:

- Comfort cooling systems have cooling capacity <54,000 Btu/hr. **(ASHRAE only)**
- Individual fan cooling units with *direct expansion coils* having capacity <54,000 Btu/hr. **(IECC only)**
- Up to 720,000 Btu/hr.—1,720,000 Btu/hr. of chilled-water capacity depending on source (water-cooled chiller, air-cooled chiller, or district) and climate zone **(IECC only)**
- Cooling systems that are 42–56% more efficient than code depending on climate zone **(ASHRAE only)**
- Systems that include code compliant heat recovery **(IECC only)**
- Systems expected to operate less than 20 hours per week.

The indoor unit capacity for split systems and VRF systems should be used to determine whether an economizer is required.

The number of systems that can claim an exception must not exceed 20% of the total cooling capacity for all fan-cooling units, or 300,000 Btu/hr.

DX Cooling Stage Requirements

Verify that DX-cooling systems larger than 65,000 BTU/hr. with economizers have three- or four-stage cooling documented. The number of stages is based on rated capacity. The economizer provides partial cooling even if the outdoor air is not cool enough to satisfy the entire cooling load.

Verify that sequences of operation include the required controls and compressors have the correct number of stages for unloading and displacement per stage.

High-Limit Shutoff

Confirm in the control drawings that high-limit, shut-offs are specified for each control type (e.g., fixed temperature limit, fixed enthalpy limit, differential enthalpy). For fixed type controls verify that the shut-off temperature exceeds the minimum code temperature.

Where equipment includes both economizer controls and energy recovery verify that the shut-off conditions of the two systems are coordinated such that when the system enables economizer controls, the energy recovery is locked out and bypassed.

Economizer Fault Detection and Diagnostics (FDD)—NYS ECCC only

Air-cooled unitary DX and Variable Refrigerant Flow (VRF) with economizers have integral controls for fault detection and Diagnostics (FDD). Due to the technical nature of these code requirements, request associated specification sections to verify compliance.

HVAC System Controls–Ventilation

Natural and mechanical ventilation rates are calculated in accordance with the mechanical code (e.g., NYS, NYC) independent of which path of the energy code is followed. For projects submitting under the performance path, verify if there is an energy penalty assessed for exceeding the minimum mechanical code ventilation rate.

Demand Controlled Ventilation (DCV)—Mandatory

It is recommended, to save time, that compliance with DCV requirements be verified through a multi-step process:

Airside Controls: Verify in the control drawings and/or schedules that required controls are provided, or exception is met.

Occupant Load: For all systems that meet the control requirements, review mechanical plans for spaces with occupancy classification that have default occupancy density greater than 25 people/1000 sq. ft. (see figure below). Those spaces must have DCV controls documented.

Table 4. Excerpt from Table 403.3 of NYS Mechanical Code, Chapter 4

TABLE 403.3 MINIMUM VENTILATION RATES				
OCCUPANCY CLASSIFICATION	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE CFM/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE R, CFM/FT ^{2a}	DEFAULT OCCUPANT DENSITY #/1000 FT ^{2a}	EXHAUST AIRFLOW RATE CFM/FT DENSITY #/1000 FT ^{2a}
Education				
Auditoriums	5	0.06	150	—
Corridors (see public spaces)	—	—	—	—
Media center	10	0.12	25	—
Lecture hall (fixed seats)	7.5	0.06	150	—
Art classroom	10	0.18	20	0.7
Science laboratories	10	0.18	25	1
Offices				
Conference rooms	5	0.06	50	—
Office spaces	5	0.06	5	—
Reception areas	5	0.06	30	—
Telephone/data entry	5	0.06	60	—
Main entry lobbies	5	0.06	10	—

Energy Recovery Ventilation Systems (ERV)—Mandatory NYS ECCC and Prescriptive ASHRAE

The size of a system required to have energy recovery depends on whether the annual run hours are greater or less than 8,000 hours and the percentage of outdoor air.

Run Time: To verify operating hours consult the proposed building's use and where applicable hours of operation are documented on the application. Request stamped narratives from the engineer of record if there are questions about the validity of a system's operating time, clarifying the intended number of operating hours.

Percentage Outdoor Air: Consult mechanical schedules to determine percentage of outdoor air at full design airflow rate to be compared against code requirements.

Exceptions: There are numerous exceptions that can be used by projects. The most common exceptions are as follows:

Commercial kitchen hoods and other applicable process ventilation systems where potential recirculation is prohibited.

Systems serving spaces that are heated to less than 60°F and are not cooled (e.g., warehouse applications).

Minimum Efficiency: Verify on mechanical schedules that the proposed enthalpy efficiency is at least 50% for both summer and winter conditions.

HVAC System Controls—Fan Specific Controls

VAV System Controls for Multiple Zones

- Verify on mechanical schedules and/or control drawings that proper controls are documented when a complex mechanical system serving multiple zones is provided to reduce the air flow to a code required set point.
- Verify controls that automatically reset the supply-air temperature or confirm exception.
- Verify that systems with direct digital controls of zone boxes are capable of automatically reducing outdoor air intake flow in response to changes in system ventilation efficiency (Ev).

Fan Airflow Control—Mandatory NYS ECCC/Prescriptive ASHRAE 90.1

- Confirm direct expansion (DX) cooling systems $\geq 65,000$ Btu/hr. are scheduled with a minimum of two stages of fan speed control. Variable speed drive (VSD) or variable frequency drive (VFD) meet this requirement.
- Verify that where chilled-water and evaporative cooling systems with fan motor power $\geq \frac{1}{4}$ hp are proposed, that schedules include a minimum of two stages of fan speed control.

Points of Reference

A year has 8760 hours.

A fan operating 22 hours a day 7 days a week will run 8030 hours over the year.

A system running 24/7 with 2 days off-line for maintenance every month will exceed 8,000 hours/year.

Fan Motor Power Limitation and Fan Efficiency—Mandatory NYS ECCC/Prescriptive ASHRAE 90.1

Drawings indicate (e.g., mechanical schedule) the code fan power prescriptive value in accordance with the following:

- Option 1: motor nameplate horsepower

Or

- Option 2: fan system brake horsepower

A copy of calculations under Option 2 must be available upon the request.

The fan brake horsepower for each fan listed on the schedules must be \leq the first available motor size greater than the hp value calculated. Fans with motor nameplate horsepower >5 hp are designed to have a rated fan efficiency grade (FEG) ≥ 67 .

The total efficiency of the fan at the design point of operation is within 15 percentage points of the maximum total efficiency of the fan.

FEG grade requirements apply to the combined fan power when multiple fans operate in series or parallel are operated as the functional equivalent of a single fan (e.g., fan walls).

Design and peak fan efficiency must be certified per AMCA 205.

HVAC System Controls—Boiler Controls

Temperature Setback Control

For one- or two-pipe hydronic systems, verify drawings' specific setback controls:

Where the design output capacity $\geq 500,000$ Btu/hr. (or, $> 300,000$ Btu/hr. when following ASHRAE), the supply water temperature is reset by representative building loads.

For all other hydronic systems, demonstrated controls automatically lower the boiler supply/return water temperature based on the outdoor air temperature.

Specific requirements vary based on the compliance path.

Modulating Burner—Mandatory NYS ECCC/Prescriptive ASHRAE 90.1

Confirm that scheduled boilers include remarks/notes with the appropriate turndown ratio or modulating controls. For hydronic systems with multiple boilers, add up the turndown ratios of individual units to determine compliance.

Boiler/Pump Isolation

Confirm controls are provided on drawings that automatically shut off all fluid flow through a boiler when that equipment is shut down.

HVAC System Controls—Heat Rejection Controls

Fan

Where scheduled heat rejection equipment has motors with nameplate horsepower greater than specified by the code, verify controls are provided to reduce the fans to operate at two-thirds of full speed or less.

The code has *additional* heat rejection requirements specific to hydronic heat pump systems.

Include a minimum speed requirement where equipment schedules specify variable speed/frequency drives (VSD/VFD).

Multiple-Cell Cooling Towers

Verify that control documentation for heat rejection systems with multiple cells and VFD controls have simultaneous unloading controls for all fans down to the minimum speed before fans are staged.

The intent is to maintain proper airflow across the heat rejection surface over the operation of the equipment.

Open Circuit Cooling Tower Flow Turndown

Verify—where open-circuit cooling towers are designed to serve water-cooled chillers and the associated hydronic system is configured with VFD condenser water pumps—that controls are provided allowing all cells to run in parallel with sequencing as allowed by the code.

Limit on Centrifugal Fan Open-Circuit Towers

Towers with centrifugal fans beyond code specified water flow rates and design temperatures meet efficiency requirements for axial towers.

HVAC System Controls—Chiller Controls

Chilled-Water Temperature Reset Controls

For chilled water systems with a design output capacity $\geq 500,000$ Btu/hr. (or, $> 300,000$ Btu/hr. when following ASHRAE) confirm that automatic controls to reset supply water temperatures by representative building loads or outdoor air temperature are provided on drawings.

Supply Temperature Reset and Deadband

For hydronic systems of heating fluids that have been previously mechanically cooled, or hydronic systems of cooling fluids that have been previously mechanically heated, confirm that controls are provided on drawing, specifying supply temperature reset controls and/or a supply temperature deadband between changeovers.

Chiller Isolation

Confirm controls are provided on drawings that automatically shut-off all fluid flow through a chiller when that equipment is shut down.

HVAC System Controls–Miscellaneous

Shutoff Dampers

Where drawings include motorized shutoff dampers of the class required by code, confirm that notes/remarks are included specifying a rated air leakage rate prescribed by code.

Where gravity (non-motorized) dampers are indicated verify that they are allowed per code.

Enclosed Parking Garage Ventilation

Where designs include enclosed parking garage ventilation systems, verify that controls are provided to monitor contaminant (CO) levels and automatically throttle the fan power in response to these levels.

Where an enclosed parking garage is included in the design without a ventilation system, confirm that the project meets an exception of the code.

Pump Controls: Hydronic Variable Flow Systems

On pump schedules where the total pump power for a system is greater than code specified motor nameplate horsepower, confirm that controls are provided to reduce pump flow rates to code specified minimum flow rates.

Where the proposed chilled water system is designed to be a variable-flow system, confirm on pump schedules that all individual pumps with motor nameplate horsepower greater than code specified value have controls and devices that will result in specified pump power at specified minimum flow rates. (e.g., variable speed controls)

Hot Gas Bypass Limitation

Where cooling systems note hot gas bypass or other evaporator pressure control systems, confirm that such systems include notes specifying multiple steps of unloading or continuous capacity modulation.

Where hot gas bypass is permitted, confirm that the scheduled maximum capacity is limited based on the rated capacity of the equipment as specified by code.

Service Water Heating Systems

Submitted projects using the performance path are not required to meet prescriptive control requirements. These projects must demonstrate an energy penalty in their energy analysis for not having such controls.

Circulation Pumps and Heat Trace Systems

Where heated-water circulation systems are provided/required, verify that such systems provide documentation for controls that automatically turned on and off circulation pumps by the hot water demand in the system.

Heat trace systems used for freeze protection are addressed under separate code requirements.

For systems used for hot water heating requiring electric heat trace, verify that documentation is provided for controls to automatically adjust the energy input to maintain the desired water temperature in the piping and to be automatically turned off when there is no hot water demand.

Heat Recovery for Service Water Heating

Confirm that condenser heat recovery systems are documented for facilities with the following properties:

Operating 24 hours per day

Total installed heat capacity of water-cooled systems greater than the heat rejection capacity limit

AND total design service water heating load > code limit

Ducts and Piping

Duct and Plenum Insulation

Confirm that drawings include duct insulation schedules and that all listed insulation exceeds the code minimum values based on installation environment.

Duct System Sealing

Confirm that notes are provided on drawing to demonstrate compliance with the following:

Joints, seams, and connections of ducts, air handlers, and filter boxes are sealed.

Pressure classifications of the proposed duct systems in accordance with mechanical code.

For high-pressure duct systems that operate at a static pressure > 3 inches water gauge, notes require duct leakage test requirements in accordance with the SMACNA HVAC Air Duct Leakage Test Manual.

Piping Insulation

Confirm that drawings include pipe insulation schedules for all service heating, cooling, and domestic hot water systems, and that all listed insulation exceeds the code minimum values based on installation environment.

Where schedules list minimum pipe insulation thickness rather than overall R-value, the schedules must also include associated fluid temperature range and rated thermal conductivity of basis of design insulation for that temperature range.

Maximum Pipe Length/Volume

Confirm that domestic hot water systems include notes demonstrating compliance with either the maximum allowance pipe length method or the pipe volume method.

Requirements for Special Functions

Radiant Heating for Outdoor Use

Confirm all systems designed to provide heat outside a building are radiant systems and documentation is provided for automatic controls based on occupancy or timer switch.

Hotel Guest Rooms

For hotels and motels with greater than 50 guestrooms, verify that documentation indicates automatic setback control for HVAC systems during unoccupied hours and/or a captive key card system.

Refrigeration Equipment and System

Where the design includes refrigeration equipment and systems, confirm that documentation indicates and meets all applicable code provisions including but not limited to the following:

- Maximum allowable daily energy use in kilowatt-hours (kWh), by equipment type
- Factory-built, walk-in coolers/freezers and refrigerated warehouse coolers/freezers
- Site-built, walk-in coolers/freezers
- Site-built refrigerated display cases
- Refrigeration systems with remote compressors/condensers not located in a condensing unit

Pools and Spas

Where the design includes pools and permanent spas, confirm that documentation indicates the following:

- Heaters with readily accessible on/off switch and centrally set thermostat
- Time switches that automatically turn on/off heaters and pump motors
- AND Vapor-retardant cover for outdoor heated pools

Snow-and-Ice Melt System Controls

Where the design includes snow-and-ice melting systems, confirm that documentation indicates automatic and/or manual controls capable of shutting off the system in response to the pavement temperature and outdoor weather conditions.

Freeze Protection System Controls

Where freeze protection systems are documented, verify that they include controls to automatically shut off in response to outdoor temperature (> 40°F) and verify the protected fluid conditions.

ASHRAE-Specific Requirements

Direct Digital Control (DDC)

For new buildings with chilled-water and hot-water plants $\geq 300,000$ Btu/hr., or fan systems ≥ 10 hp. See the energy code for extensive DDC requirements applicable per building types and system types. Confirm that documentation is provided addressing all applicable requirements.

Door Switches

Verify that controls are documented for doors separating conditioned space from the outdoors to disable or reset mechanical heating and cooling operations within 5 minutes of the door opening.

Interior Lighting Power

Only one method, Building Area Method or Space-by-Space Method, is used in an entire project to demonstrate compliance.

Recommended best practice lighting documentation provides lighting fixture schedules with counts on each floor layout, or where such schedules are central, a breakdown of the lighting count by floor to facilitate the design's compliance.

Space-by-Space Method

Interior Lighting Power Allowance = Sum of the floor area of each Space type × the LPD value for the Space type from Code LPD Tables.

For spaces with use that do not match types listed on the table shall select the most closely represents type. Trade-offs among spaces are permitted in this method.

Building Area Method

Interior lighting power allowance = the floor area of each building area type × the LPD value for the building area type from Code LPD tables.

For the purposes of this method, a *building area* is defined as all contiguous spaces that accommodate or are associated with a single building, including ancillary spaces such as storage rooms that aid in the primary use.

Table 5. Sample Lighting Fixture Schedule for Retail Space Fit-Out

LIGHTING FIXTURE SCHEDULE									
Fixture ID	ASHRAE SPACE TYPE	MANUFACTURER, MODEL	LAMP TYPE	NUMBER OF LAMPS/FIXTURE	BALLAST TYPE	TOTAL NUMBER OF FIXTURES	FIXTURE WATTAGE (W)	TOTAL WATTAGE	COMMENTS
L1	Sales Area	000000 LIGHTING ECS-LPW-4	TRACK LIGHT	N/A	ELECTRONIC	10 Linear Feet	N/A	300	330W/LF X 10 LF =300W (per ASHRAE 9.1.4 -c.1)
L2	Sales Area	0000 LIGHTING 2221W-B1-F-10-LRT D3	LED	1	ELECTRONIC	32	14	448	See narratives for lighting controls.
L3	Dressing/ Fitting Rooms	0000 LIGHTING M40-2-3-OCT-ELD-UN	FLUORE-SCENT	2	ELECTRONIC	4	64	256	Integral Occupancy Sensor
L4	Storage	0000 LIGHTING LRTA3-8414-M4-30KS	LED	1	ELECTRONIC	58	14	812	See narratives for lighting controls.
L5	Restrooms	0000 LIGHTING 999W-D1-A-10-EEE3	LED	1	ELECTRONIC	18	14	252	See narratives for lighting controls.

Lighting Controls

Confirm occupancy sensor controls are documented on the lighting plans and/or schedules where required.

Confirm lighting reduction controls are documented where required.

For spaces where no lighting reduction controls are provided but are required check for daylight responsive controls.

Daylight-Responsive Controls

Confirm that lighting plans indicate all daylight zones with notes on obstructions and provide documentation for daylighting controls as recommended in the following passages.

Submitted projects using the performance path are not required to meet prescriptive control requirements. These projects will demonstrate an energy penalty in their energy analysis for not having such controls.

Sidelight Daylight Zone

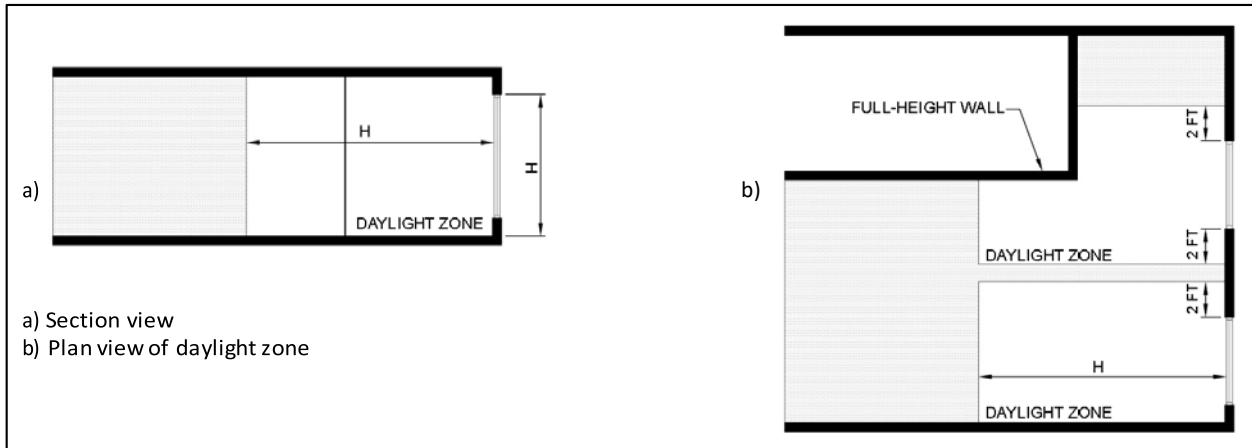
When confirming sidelight daylight zones, and the lighting fixtures located within those zones, verify the following:

The depth of the zone from the fenestration is determined by the head height of the fenestration which is confirmed on the architectural elevations.

The width of the zone is 2 ft. beyond the extents of the fenestration or a full-height wall. Fenestration less than 2 ft. apart is treated as a single zone.

For the criteria of daylight zone following ASHRAE, refer to the definition of *daylight area* in ASHRAE Section 3.2.

Figure 9. Excerpt of Sidelight Daylighting Zone Calculation from Code



Toplight Daylight Zone

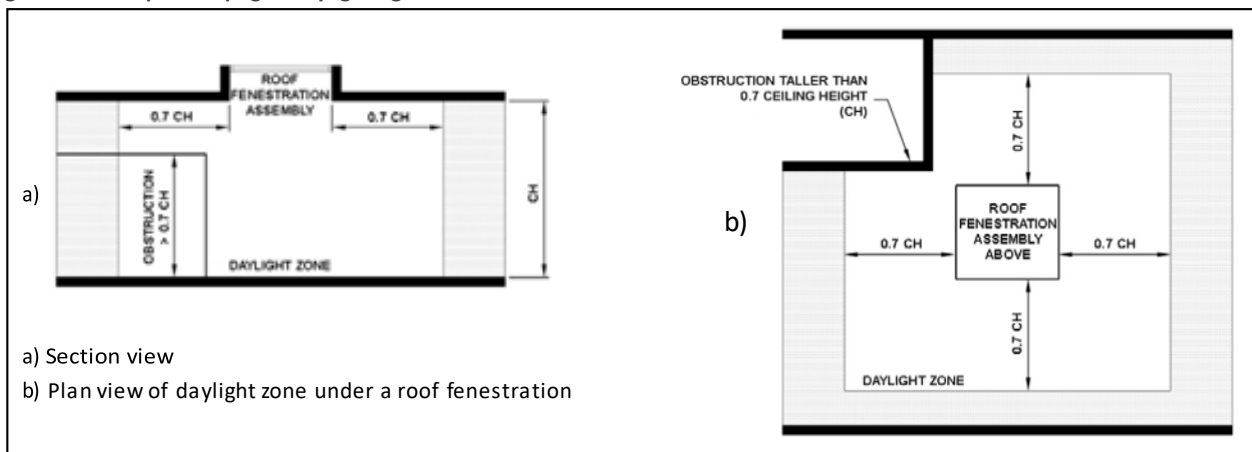
When confirming toplight daylight zones and the lighting fixtures located within them, verify the following:

The area is defined as 0.7 times the ceiling height. Such ceiling heights do not include the additional depth of the fenestration curb.

Obstructions to this area are considered any continuous object that is taller than 0.7 times the ceiling height.

For the criteria of daylight zone following ASHRAE, refer to the definition of *daylight area* in ASHRAE section 3.2.

Figure 10. Excerpt of Toplight Daylighting Zone Calculation from Code



Residential Building Specific Requirements

Controls

Programmable Thermostat: Drawings indicate where thermostats are to be installed and provide notes indicating capabilities. Notes must stipulate specific capabilities rather than state, “compliant with code.”

Figure 11. Sample Numbered Note

⑤ Provide programmable thermostat with at least two schedule periods per day.

Heat Pump Supplementary Heat: Drawings indicate necessary controls for supplementary electric-resistance heat to prevent unnecessary operation.

Outdoor Temperature Setback for Hot Water Boilers: Drawings indicate outdoor setback controls on all one- or two-pipe heating systems served by a HW boiler.

Duct and Piping Insulation

Verify—where mechanical system pipes carry *heated* or *cooled* fluids—that drawings demonstrate a minimum insulation R-value matching or exceeding code.

High-Efficacy Lamps

Confirm—through the lighting schedule and fixture count for residential buildings or for dwelling units within commercial buildings—that the percentage of the lamps of new and permanent lighting fixtures are considered high-efficacy (in lumens/watt) and exceed the code required percentage.

Energy analysis includes the percentage of high-efficacy lamps to be confirmed.

Duct Leakage Testing

Verify that drawings include notes/statement about when duct leakage testing will be performed (either rough-in or post-construction) and the maximum allowable leakage rate.

Service Water Heating

Heat Trace Temperature Control: Where the submitted design includes an electric heat trace system, verify that drawings specify controls that automatically adjust the energy input to the heat tracing to maintain a water setpoint temperature in response to the occupant’s hot water use.

Demand Recirculation Systems: Where the submitted design includes recirculation pumps, verify that drawings indicate controls that automatically start/turn off the pump in response to hot water demand and/or water temperature in the system.

Insulation: Verify that notes or schedules are provided for domestic hot water pipe insulation, and they show code required values or better.

Ventilation

Dampers: Verify all outdoor air intakes and exhausts call for automatic or gravity dampers. For automatic dampers confirm that they will be closed when the ventilation system is not operating. Confirm that notes or specifications address leakage allowance for dampers (see Air Barrier Plan).

Fan Efficacy: Compare the design fan efficacy listed for the mechanical ventilation schedules (range hoods, bathroom/utility fans, inline fans) to the code values for compliance.

Residential Building Specific Requirement–Energy Rating Index (ERI)

ERI is a score-based rating system which alternatively determines energy code compliance of a new residential building based on its energy performance. It allows applicants to approach the energy code with the same flexibility of the Simulated Performance Alternative, yet it uses third-party energy modeling and in-field inspection to confirm that results are achieved.

ERI Reference Design versus Rated Design

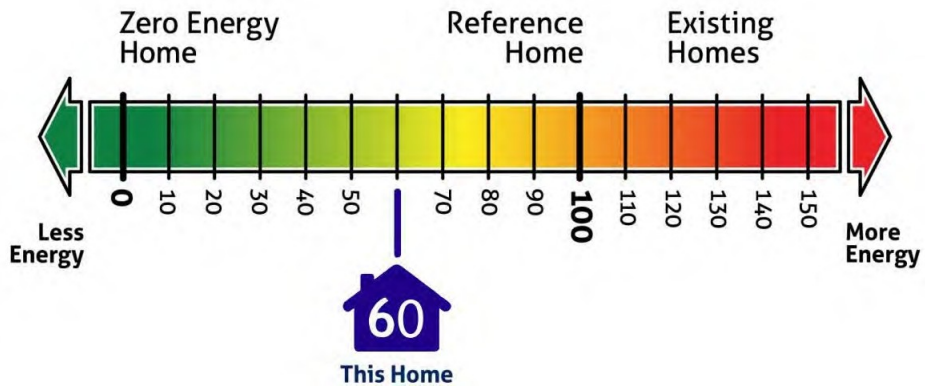
The ERI Reference Design, representing ERI score of 100, means the building design meets the minimum requirements of the 2006 IECC. For Rated Design of a newly proposed residential building to demonstrate compliance, the ERI analysis on the building must result in an ERI score less than what code requires for the climate zone. For example, a score of 54 or less would be compliant in climate zone 4. For compliance through ERI approach, confirm the following are documented:

- All mandatory provisions are met
- The building thermal envelope meets the prescriptive requirements
- Information necessary to verify the standings of the third party intended to confirm the energy modeling and in-field inspections

Additional documentation clarifying the following:

- Compliance software tools used
- Compliance report
- Other additional documentation that may be required by the Authority Having Jurisdiction (AHJ)
- Calculation software tools, where used, meet the requirements on minimum capabilities, specific approval, and input values.

Figure 12. Sample ERI Index Scale



2 Commercial Plan Review Methods

This section serves the function of a rubric for reviewing commercial design documents. The methods provided have been written to be independent of the version adopted by the energy code. The methods serve as a basis to efficiently locate all the information on the permit submission needed to validate the design and confirm compliance.

Scope and Administration

General

The Commercial Provisions of the energy code consist of the following:

- IECC Commercial Provisions as amended by Part 1 of the NYS Energy Code Supplement
- ASHRAE 90.1 as amended by Part 2 of the NYS Energy Code Supplement

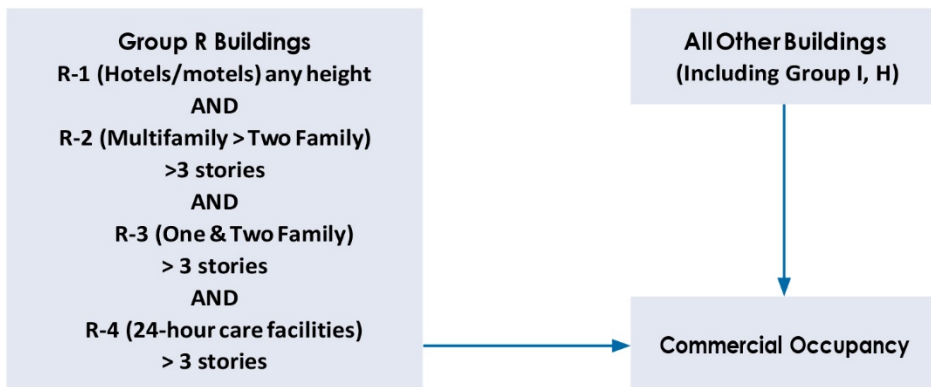
A commented version of the energy code is available with the code supplement included.

Occupancy

A plan review includes identifying all occupancies within the submitted design. Performing this occupancy analysis first saves time because an error with the submission's stated occupancy invalidates all the other submitted analyses. Where multiple occupancy types exist in one building a separate plan review should be performed for each.

The following chart indicates which occupancies/buildings follow the Commercial Provisions in the energy code:

Figure 13. Building Types Required to be Commercial Occupancy



Alternative Materials, Methods of Construction, Design, or Insulating Systems

The energy code will not prohibit any method of construction, design, or insulating system as long as such methods have been approved by the Authority Having Jurisdiction as achieving energy savings equivalent or greater than prescribed methods. Such determinations are made under section 11-106 of the NYS Energy Law which requires them to be submitted for approval through the Secretary of State.

It is not the responsibility of local Code Enforcement Officials to make variance and/or modifications decisions. Any design team interested in such an approval should be directed to contact the Department of State, Codes Division.

Construction Documents

All construction and supporting documents are stamped by a registered design professional as required by the New York State Education Law. This includes signing and stamping the energy analysis. For design teams that choose to submit the energy analysis as a separate document must sign and stamp these documents.

Information on Construction Documents

The energy code provides a clear outline of the kinds and format of information required to be recorded on the construction documents. The list of items in the 2016 Energy Code include the following:

- Insulation materials and their R-values
- Fenestration U-factor and solar heat gain coefficient (SHGC)
- Area-weighted U-factor and solar heat gain coefficient (SHGC) calculations
- Mechanical system design criteria
- Mechanical and service water heating system and equipment types, sizes, and efficiencies
- Economizer description
- Equipment and system controls
- Fan motor horsepower (hp) and controls
- Duct sealing, duct, and pipe insulation and location
- Lighting fixture schedule with wattage and control narrative
- Location of daylight zones on floor plans
- Air-sealing details

The code also calls for drawings to outline the building's thermal envelope, providing specific notes where partitions separate conditioned space from semi-heated space and outline required commissioning work.

Expect that these items to be missing or poorly documented in the construction documents. The information provided later in this section helps to identify where these mistakes happen.

To reduce the number of mistakes due to poor documentation, it may be advantageous to have documentation available to designers before they start the permit process. The DOE Building Energy Codes Program has many resources useful to designers available online. The companion document Energy Code Manual for Design Professionals in New York State also serves as a primer for design teams not familiar with the energy code.

Written Statement

The energy code requires that when plans or specifications are signed and sealed the registered design professional shall include “a written statement that to the best of his or her knowledge, belief and professional judgement, such plans or specifications are in compliance with the energy code.” The statement on the drawings reinforces that the design professionals are liable, it does not preclude reviewing any aspect of the design documents for compliance.

Permit Set Review

The energy code documents what type of information is necessary for compliance but not where this information should be provided. There is a large variance in where information can be located which complicates the plan review process. The required information for energy code compliance can be broken down into three main components.

- **Application.** Provides basic details on the project such as use group, gross floor area number of stories, and if the project is new construction or renovation.
- **Energy Analysis.** The summary documents that provide the variable design values and the code required values they are compared against. Also addressed is how mandatory provisions are met and where in the supporting documentation the compliance is demonstrated.
- **Supporting Documentation.** The collection of permit drawings, specifications, and any auxiliary documents from which the energy analysis is developed.

Application

A permit application includes information important to all plan reviews. The energy code review is specifically interested in the occupancy classification, gross floor area of the building, and the number of stories. The occupancy classification and number of stories are utilized in the occupancy analysis. (commercial or residential).

The application may include special inspections needed for compliance with the other Building Codes. The special inspections should be reviewed to identify if they impact the energy code compliance.

Energy Analysis

For straightforward projects, the energy analysis is presented separately in each of the discipline's specific series of drawings. More complex projects, particularly submitted projects using the performance compliance path, have a dedicated series of drawings.

Figure 14. Example of Energy Series Drawing Tag

Drawing Title: ENERGY ANALYSIS SHEET NO.1
Drawing No.: EN001.00

Energy analysis submitted consists of three parts with an optional third:

- **Compliance Calculation.** An itemized list of building assemblies, HVAC equipment, lighting fixtures, or plumbing equipment that documents compliance against the code values.
- **Mandatory Requirements.** Documentation of how the Energy Code—Mandatory Provisions have been met.
- **Inspection Checklist (optional).** Compliance software generates project specific checklists for the inspectors' use. It is at the discretion of the jurisdiction to require the checklists for every submission.

As prescribed in the energy code, energy analysis generated by compliance software, such as COMcheck, is acceptable. Design teams gravitate towards this method of generation due to the ease of inputs, the flexibility to check compliance through all stages of the design, and its ability to generate a compliance report. When reviewing an analysis generated by compliance software confirm the following use:

- The adopted energy code (e.g., NYS ECCC versus IECC)
- The correct version of the energy code (e.g., 2016 NYS ECCC versus 2014 NYS ECCC, or ASHRAE 90.1-2013 versus 90.1-2010)
- Each design discipline (Envelope, HVAC, Service Hot Water, Interior and Exterior Lighting) uses the same energy code compliance path (e.g., NYS ECCC vs ASHRAE 90.1)

It is common for projects in which the design professionals represent multiple firms to have issues with the above items due to a lack of coordination.

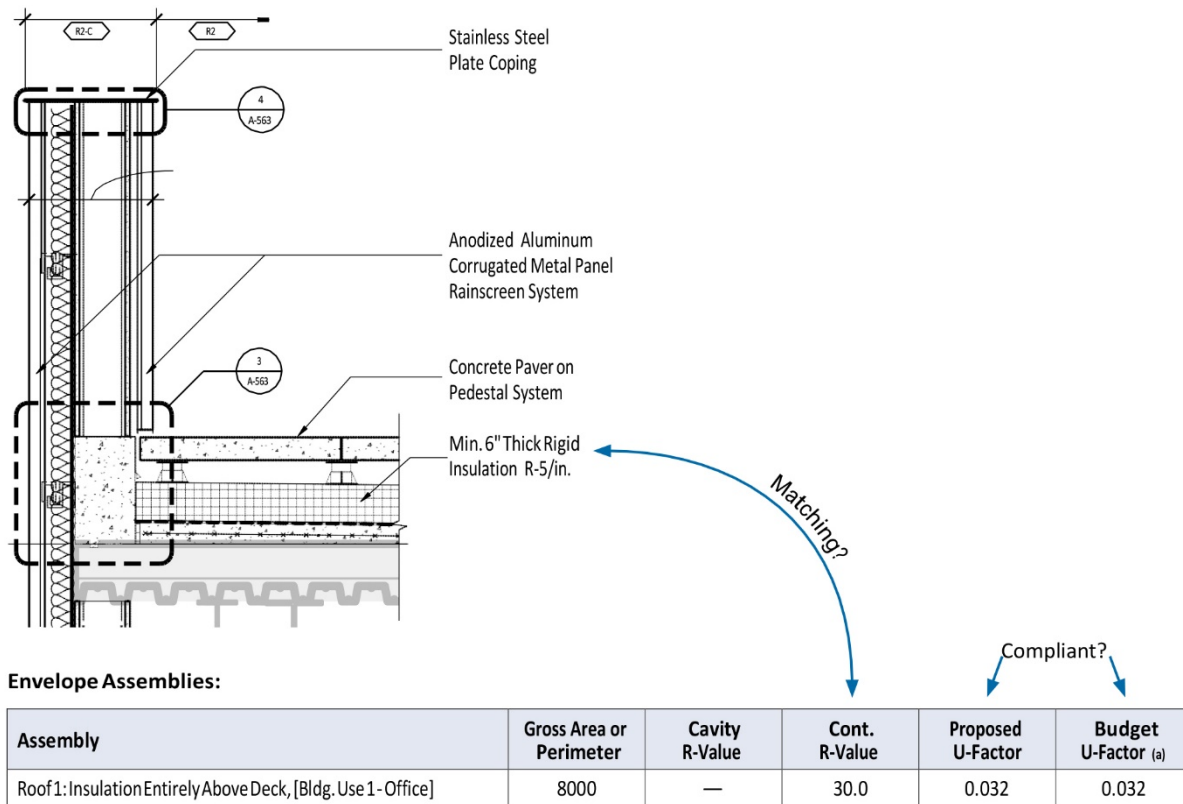
Energy analysis from compliance software is advantageous because the values are laid out in a logical manner and show the design values side-by-side with the code compliant values. The reports generated by the software also include the full-code verbiage for each applicable mandatory provision with the explanation and reference to the drawings listed next to it.

It is recommended that similar forms be created and distributed to design teams. Such forms direct all other energy analyses to provide the code compliant value next to the proposed value and similarly include the full-code verbiage for each applicable mandatory provision next to the required explanation.

Energy Analysis–Compliance Review

During a plan review, the values in the energy analysis are used as a check against the information listed in the supporting documents and are checked to verify that they demonstrate compliance against the code values.

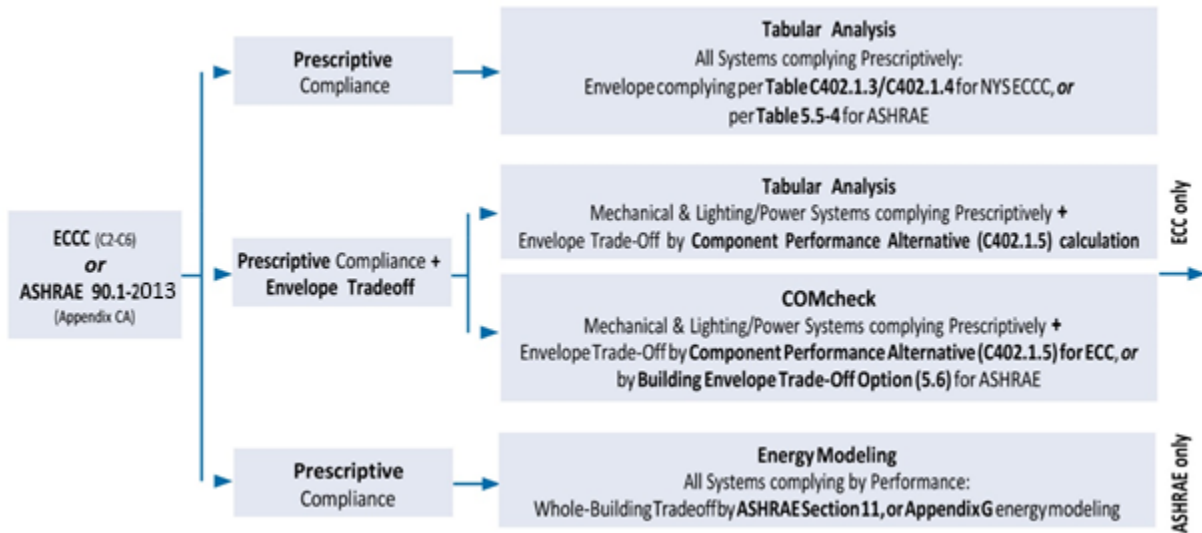
Figure 15. Example of Energy Analysis Use



(C402.1.4) Tabular Energy Analysis

When checking the submitted energy analysis for compliance, determine which path the submission follows:

Figure 16. Compliance Paths



- **Prescriptive.** All listed design values meet or exceed code.
- **Compliance Performance Alternative.** The sum difference of the component UA is less than or equal to zero.
- **Lighting (building area method).** A prescriptive method using a building-wide code compliant lighting power density (LPD) to determine the code compliant interior lighting power allowance.
- **Lighting (space-by-space method).** A prescriptive method using lighting power densities (LPD) assigned based on the space use type to determine the code compliant interior lighting power allowance. Credit may be taken for a certain amount above code lighting controls as trade-off against the design lighting power.
- **Performance.** Compare and analyze the inputs and outputs of a design and baseline energy model to assess the validity of the annual energy cost-difference calculation.

The following should also be checked as part of the energy analysis’s compliance review.

2.1.1 Energy Analysis Review—All Compliance Paths

Envelope

- Confirm that the listed code compliant U-values/R-values match the actual code tables.
- Check that the design U-factors are from a defensible source (e.g., In Figure 3.3.2.1-1, a footnote should be provided confirming the source, such as ASHRAE 90.1, Appendix A used to generate the U-factors).

Mechanical

- Check that the HVAC equipment type is consistent with the cooling and heating source and listed code compliant efficiencies match the tables in the code.
- Check that the energy analysis includes design fan power and the Fan Power Allowance. Check that the design motor efficiencies are listed and meet the code.
- Check that any exterior heating systems are radiant.
- Verify design commercial refrigeration equipment efficiency against manufacturer's data (see section 1 of this manual—Website Resources—for links to testing websites).

Electrical—Interior Lighting

- Check that the listed gross lit area is consistent with the gross floor area listed in the application and envelope portion of the energy analysis.
- Check that the building area types or space area types are consistent with the use of the building. No combination of the two methods is accepted for the same occupancy group (residential/non-residential).
- If the building area method is used, check that no additional allowances are taken. Where decorative lighting allowances are taken, check that it is permitted by code.

Electrical—Exterior Lighting

- For the exterior lighting calculation, check trade-offs are not being taken with non-tradable surfaces.
- Check that all mandatory requirements are listed and are marked either *compliant*, *exception as noted*, or *not applicable*.

Plumbing

- Check if the energy analysis clarifies heat traps are not integral to the equipment.
- Check that domestic hot water heat recovery is provided for facilities with 24-hour occupancy.

Mandatory Provisions

- Check that all mandatory requirements are listed and are accompanied by an explanation as to how they are met. Requirements that do not apply are still listed and marked *not applicable*. Requirements that comply by exception are marked *exception as noted* with the exception path noted.
- For all applicable mandatory requirements check that the designer describes where on the supporting documents the requirements are met.

Trade-Off Path

- Check that the areas used in calculating the UA for the proposed design are consistent with the size of the building.
- Check that the code compliant UA has the same proportion of mass wall to frame wall as the design.

Energy Analysis Review–Performance Path

Submitted projects using any of the performance-based compliance options (energy cost budget method, performance rating method, total building performance), should provide energy analysis that documents both the regulated proposed design and referenced standard design inputs for the modeling software. They should also provide required output reports of the software.

Submissions following this path take multiple trade-offs including between disciplines, making the review of individual proposed values for compliance ineffective. The review process instead includes the following:

- Verify proposed design values in the submitted energy analysis are reflected in the supporting documents. This is the same process as is described in the Supporting Document section of this section.
- Review referenced standard design values against the code prescribed values for the application.
- Review simulation output reports to verify that the proposed and referenced standard design were modeled as is described on the energy analysis.
- Verify that the annual cost savings (annual energy savings in certain jurisdictions) is sufficient for the code path used. (Strictly less than for ASHRAE and less than 85% of the standard reference design for Total Building Performance). Verify the mandatory requirements of the code are met.

This manual does not address the details necessary to review projects seeking energy code compliance using the performance-based compliance option. The Performance Path Review Manual by NYSERDA is a good resource to assist in the review of submittals for such projects. The companion document focuses on verifying submitted values for ASHRAE 90.1 Section 11, Energy Cost Budget Method (ECB), and Appendix G Performance Rating Method (PRM), but the same process applies for projects using NYC ECCC with the standard reference design.

The companion document notes that to review a performance-based energy analysis the jurisdiction needs a certain amount of available resources and technical knowledge about how model inputs/outputs are generated. To reiterate a point the companion document makes about how to accommodate such submissions if a jurisdiction doesn't have resources:

“The AHJs that do not have the needed resources may engage external reviewers and charge the applicant for the review. The AHJs planning to engage third-party reviewers should establish the associated policies and maintain a pool of preapproved reviewers who are trained on performing the reviews and can be assigned to projects as needed.”¹

¹ “Performance – based Energy Code Enforcement Manual” (M Karpman, NYSERDA 2018)

Supporting Documents

Supporting documents are defined as the group of construction drawings and specifications and any other supporting data submitted with a permit application. This collection of documents should be reviewed to confirm that all the values listed are contained in the energy analysis.

While reviewing keep in mind that the final set of approved documents are the basis for the field inspections. Issues caught during plan review will help the inspection process.

The following serves as a rubric for reviewing supporting documents.

Specifications

Almost all projects use specifications to create a complete description of a project, and these specifications must also be checked. However, specifications include a lot of information necessary to the construction of a project but is beyond the scope of demonstrating code compliance.

To avoid warehousing complete specifications, some municipalities may require that all code compliance information be contained on drawings. This requires design teams to maintain duplicate information on the drawings and in the specifications. From a practical perspective, this can lead to conflicts during the life of the project if design changes are not updated in both places.

Architectural Documents

To start, the code enforcement officer will need to verify the following architectural documents with the information noted:

- Floor Plans with dimensions
- Elevations with dimensions
- Sections and Details
- Glazing Schedule
- Door Schedule

The information in the energy analysis should logically track back to the information on the architectural documents. For example, envelope types in the analysis should have unique identifiers (e.g., WT-1, WT-2, R-1, WI-1, FL-1), or could be keyed to the sheet and detail numbers (e.g., 5/A404). Another example, mandatory fenestration air leakage rates in the analysis should be addressed with a remark indicating that values can be found on the fenestration schedules 5/A500.

For general compliance items, the documents should include the following:

- Floor Plans
 - Dimensioned and with a graphic scale
 - Section lines

Elevations

- Dimensioned and with a graphic scale
- Wall, window, and door type diagrams and keys for each unique envelope construction (e.g., slab edges, typical walls, walls in front of columns, spandrel panels)
- Wall, window, and door area takeoffs by orientation and overall
- Wall, window, and door U-factors by type with separate overall U-factors for walls and windows

Sections and Details—Above and Below Grade Walls, Roofs, Floors, Soffits

- Details call out each element of the construction with enough detail to confirm U-factor calculations. (e.g., material type, thickness, stud type, beam spacing and concrete density)
- U-factor calculation for each wall type
- Corresponds with elevation summaries
- Source for each U-factor used in the calculation. Hierarchy of sources:
 - COMCheck values based on cavity and continuous inputs
 - ASHRAE 90.1 Appendix A: Pre-calculated assembly U-factors, C-factors, F-factors, or Heat Capacities.
 - ASHRAE 90.1 Appendix A: Applicant determined assembly U-factors, C-factors, F-factors, or Heat Capacities with building official approval
 - Two- or three-dimensional finite difference and finite volume computer models
 - Testing per approved standards in ASHRAE 90.1 Appendix A
 - Component U-factor calculations per building official approval, and per requirements in ASHRAE 90.1 Appendix A
- Request justification if a source other than ASHRAE 90.1 Appendix A is used

Window, Door and Skylight Schedules

- U-factor, Solar Heat Gain Coefficient (SHGC), Visible Transmittance (VT), and Haze Factor shall be based on the entire fenestration unit including the frame
- U-factor: Center of glass is not acceptable
 - SHGC: Center of glass is conservative and thus acceptable
 - VT: Center of glass is not acceptable
 - Skylight and monitor performance values must be based on installed orientation of the glazing
- Performance factors are per applicable code required standards. (e.g., NFRC, ASTM, ANSI/DASMA)
- Doors with 50% or more glazing are considered windows for code compliance

For air barrier specific compliance, the documents should include the following:

Continuous Air Barrier:

- Air barrier is indicated for the entire thermal barrier
- Notes call out that envelopes are wrapped, sealed, caulked, gasketed and/or taped at envelope junctions specified by the code
- Window, Skylight, and Doors:
 - Schedules to include allowable air leakage rates
- Outdoor Air Intake and Exhaust Openings:
 - Maximum rated air leakage rate on shut-off dampers
 - Motorized dampers are called out where required
- Vestibules
 - Proper configuration and self-closing devices on doors
- Recessed Lighting
 - IC-rated
 - Labeled with code-prescribed maximum air leakage rate
 - Notes call for sealing between fixture and air barrier rated assemblies or materials

Mechanical Documents

To start, the code enforcement officer will need to verify, at minimum, the following mechanical documents:

- Floor and Ceiling Plans with equipment and thermostats listed
- Detail sheets
- Schematic sheets including control drawings
- Schedule sheets

The information in the energy analysis should logically track back to the information on the mechanical documents. For example, any chillers in the analysis should have unique identifiers (e.g., CH-1, CH-ABS), or could be keyed to the sheet and schedule title (M505—Reciprocating Chiller Schedule). Another example, mandatory duct insulation in the analysis should be addressed as a remark indicating that values can be found on the M000 Symbol & Notes page in the Duct Insulation Schedule.

For general compliance items, the documents should include the following:

- Duct and Piping Plans (including roof plans as needed)
 - Dimensioned with a graphic scale
 - Thermostats are documented and indicate what equipment they control
- Control Diagrams and Sequences of Operation
 - Sequence of operations covers all required controls

- Air and Water Riser Diagrams
 - Damper types indicated
 - Valve types indicated
 - Listed flow values are consistent with equipment schedule values
 - Confirm any dedicated outdoor air configurations
- Sections, Details, and Diagrams
 - Insulation installation procedures
 - Insulation protection requirements
 - Louver and damper air-sealing techniques
 - Plant configuration including isolation techniques
- Room Layout
 - Zone controls
 - Secondary zone equipment (e.g., baseboard heat)

For equipment schedule items, the documents should include the following:

- Both Design and Code Compliant Efficiencies are Listed
 - Proper test conditions are listed for both.
- Both Design and Code Compliant Limit Fan powers are listed
 - Components that increase pressure drop are listed (e.g., MERV9 filter)
 - Listed components account for the difference between the two fan powers
- Piping and Duct Insulation Schedules
 - Insulation thickness listed is based on size and thermal conductivity at rated temperature or minimum insulation R-value based on size

Electrical Documents

To start, the code enforcement officer will need to verify at minimum the following electrical documents:

- Interior and Exterior Lighting plans
- Power Plans Indicating Meters and Motors Detail/Schematic Sheets
- Electrical General Notes and Symbols Sheets Lighting Fixture Schedules
- Lighting Controls Narratives (Sequence of Operation)

The information in the energy analysis should logically track back to the information on the electrical documents. For example, any light fixtures in the analysis should have unique identifiers (e.g., A-1, L-

DIM), or could be keyed to the sheet and schedule title (E600—2nd Floor Lighting Fixture Schedule). Another example, mandatory lighting controls in the analysis should be addressed as a remark indicating that values can be found on the E000 Symbol and Notes sheet as a series of numbered notes.

For general compliance items, the documents should include the following:

- Interior and Exterior Lighting Plans (including roof plans as needed)
 - Dimensioned with a graphic scale
 - Lighting fixtures listed with their associated fixture tag
 - Wiring to switches and other automatic controls
 - Spaces intended to have occupancy controls
 - Spaces intended to have daylighting controls
- Power Plans (ASHRAE compliance path)
 - Meter and sub-meter locations
 - Wiring of receptacles to automatic controls
- Details, Schematics, and Panel schedules
 - Motor power and efficiency
 - Metering and sub-metering configuration (ASHRAE compliance path)
 - Occupancy control parameters
 - Daylighting control parameters
- General Notes and Symbols
 - Air-sealing techniques
 - Lighting control narratives covering mandatory controls
 - Daylighting documentation includes minimum fixture control fraction and modulating controls

For lighting fixture schedule items, the documents should include the following:

- All fixtures are listed along with their bulb power, total fixture power and all integral controls.
- Where a fixture count has been included with the schedule, verify values.
 - Confirm counts on plans.

Plumbing Documents

To start, the code enforcement officer will need to verify at minimum the following plumbing documents:

- Plans

- Details
- Water Risers
- Fixture Schedules
- Sequences of Operation

The information in the energy analysis should logically track back to the information on the plumbing documents. For example, any domestic hot water heater fixtures in the analysis should have unique identifiers (e.g., DHW-1, TANK-1), or could be keyed to the sheet and schedule title (P300—Hot Water Heater Schedule). Another example, mandatory plumbing recirculation controls in the analysis should be addressed as a remark indicating that those values can be found on the 4/P700 Heat Trace Wiring Detail.

For general compliance items, the documents must include the following:

- Piping Plans (including roof plans as needed)
 - Dimensioned with a graphic scale
 - Plumbing fixtures listed with their associated fixture tag
 - Wiring to switches and other automatic controls
 - Fixtures intended to have thermostatic controls
 - Fixtures intended to have flow controls
- Details, Domestic Water Risers
 - Heat trap location where installed externally
 - Equipment isolation
 - Recirculation system configuration
- Sequences of Operation
 - Confirm all recirculation controls
 - Controls for domestic water heat recovery
 - Where an HVAC boiler plant is also used to heat domestic water controls to operate equipment where no heating load on the building exists

For plumbing fixture schedule items, the documents must include the following:

- Both Design and Code Efficiencies are Listed
 - Test procedure and conditions are listed and match code requirements
- Any Integral Pump Controls are Noted (e.g., integral float switch on elevator pit sump)

Amendments and Resubmissions

In accordance with the energy code, design changes to a project during the permit approval process, or after a permit has been issued is documented and submitted to the code official for review and approval.

The following scheme is provided as a reference if such situations become an issue during the plan review process:

Proposed Resubmission and Amendment Procedures for Design Teams

- Provide narrative responses to address reviewer comments. Include description of where in the design documents comments have been addressed.
- All changes made to the design documents since the initial submission should be marked using standard revision numbering and all revised areas should be clouded.
- Updated energy analysis is submitted, demonstrating the design is still compliant.

3 Residential Plan Review Methods

The review process for residential plans is the same as for commercial plans. If the code enforcement officer has already read through the Commercial Plan Review Methods, note that much of the general information in this section is the same. The section serves as an independent rubric for reviewing residential design documents and provides details specific to residential projects.

Scope and Administration

The Scope and Administration chapter of the NYS Energy Code Residential Provisions includes a basic bulleted outline for requirements in a compliant design.

General

The Residential Provisions of the energy code consists of the following:

- IECC Residential Provisions as amended by Part 3 of the NYS Energy Code Supplement
- A commented version of the energy code is available with the included code supplement

Occupancy

A plan review includes identifying all occupancies within the submitted design. Performing this occupancy analysis first saves time because an error with the submission’s occupancy will invalidate all other submitted analysis. Where multiple occupancy types existing in one building, a separate plan review should be performed for each.

The following chart indicates which occupancies/buildings follow the Residential Provisions in the energy code:

Figure 17. Building Types Required to be Residential Occupancy



Alternative Materials, Methods of Construction, Design, or Insulating Systems

The energy code will not prohibit any method of construction, design, or insulating system as long as such methods have been approved by the authority having jurisdiction as achieving energy savings equivalent or greater than prescribed methods. Although, such determinations are made under Section 11-106 of the NYS Energy Law, which requires alternative materials and methods of construction, design, or insulating systems to be submitted for approval through the Secretary of State.

It is not the responsibility of local code enforcement officials to make variance and/or modifications decisions. Any design team interested in such an approval should be directed to contact the Department of State, Code Division.

Construction Documents

All construction documents and supporting documents should be stamped by a registered design professional as required by the New York State Education Law. This includes signing and stamping the energy analysis. For design teams that choose to submit the energy analysis as a separate document, the documents must still be signed and stamped.

For single-family homes less than 1,500 sq. ft., construction documents are not required to be stamped, but their compliance with the energy code is still required.

Information on Construction Documents

The energy code provides a clear outline of the information and format required to be recorded on the construction documents. The list of items in the 2016 Energy Code include the following:

- Insulation materials and their R-values
- Fenestration U-factor and solar heat gain coefficient (SHGC)
- Area-weighted U-factor and solar heat gain coefficient (SHGC) calculations
- Mechanical system design criteria
- Mechanical and service water heating system and equipment types, sizes, and efficiencies
- Equipment and system controls
- Duct sealing, duct, and pipe insulation and location
- Air-sealing details

The code also calls for drawings to outline the building's thermal envelope, providing specific notes where partitions separate conditioned space from semi-heated space and outline required commissioning work.

Expect that these items to be missing or poorly documented in the construction documents. The information provided later in this section helps to identify where these mistakes happen.

To reduce the number of mistakes due to poor documentation, it may be advantageous to provide sample documentation and checklists to designers before they start the permit process. The DOE Building America Solution Center provides best practices for documenting building practices. Other tools are listed in section 1 of this manual—Resources and Commentary. The companion document energy code Manual for Design Professionals in New York State also serves as a primer for design teams not familiar with the energy code.

Written Statement

The energy code requires the registered design professional to include a written statement when plans or specifications are signed and sealed that “to the best of his or her knowledge, belief, and professional judgment, such plans or specifications are in compliance with the energy code.”

The statement on the drawings reinforces that the design professionals are liable, it does not preclude reviewing any aspect of the design documents for compliance.

Permit Set Review

The energy code documents what type of information is necessary for compliance but not where this information should be provided. There is a large variance in where information can be located, which complicates the plan review process.

The required information for energy code compliance is broken down into three main components.

- **Application.** Provides basic details on the project such as use group, gross floor area number of stories, and if the project is new construction or renovation.
- **Energy Analysis.** The summary document that provides the design values against the code required values and addresses how mandatory provisions are met.
- **Supporting Documentation.** Constitutes the set of permit drawings and any auxiliary documents from which the energy analysis was developed.

Application

A permit application includes information important to all plan reviews. The energy code review is specifically interested in the occupancy classification, gross floor area of the building, and the number of stories. The occupancy classification and number of stories are utilized in the occupancy analysis (commercial or residential).

The application may include special inspections needed for compliance with the other building codes, which should be reviewed to identify impact on the energy code compliance.

Energy Analysis

Energy analysis submitted consists of three parts:

- **Compliance Calculation.** An itemized list of building assemblies, HVAC equipment, lighting fixtures, or plumbing equipment that documents compliance against the code values.
- **Mandatory Requirements.** Documentation of how the Energy Code—Mandatory Provisions have been met.
- **Inspection Checklists (optional).** Compliance software generate project-specific checklists for use by the inspector. It is at the discretion of the jurisdiction to require these for every submission.

As prescribed in the energy code, energy analysis generated by compliance software, such as REScheck, is acceptable. Design teams use this method of generation due to the ease of inputs, flexibility to check compliance through all stages of the design, and its ability to generate a compliance report. When reviewing energy analysis generated by compliance software confirm the following use:

- The adopted energy code (e.g., NYSECC vs IECC),
- The correct version of the energy code (e.g., 2016 NYS ECCC vs 2014 NYS ECCC)

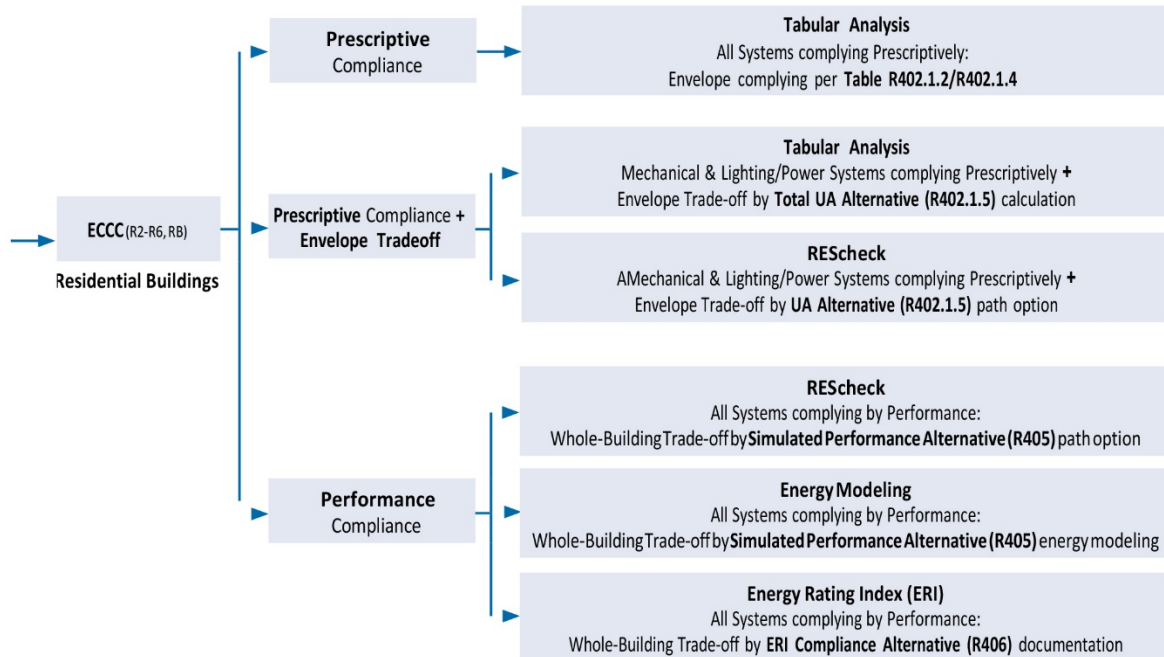
Energy analysis from compliance software is advantageous because the values are laid out in a logical manner and show the design values side-by-side with the code compliant values. The reports generated by this software also include the full-code verbiage for each applicable mandatory provision with the explanation and reference next to the drawings.

It is recommended that similar forms be created and distributed to design teams. Such forms will direct all other energy analyses to provide the code compliance value next to the proposed value and similarly include the full-code verbiage for each applicable mandatory provision next to the required explanation.

Energy Analysis—Compliance Review

During a plan review, the values in the energy analysis are used as a check against the information listed in the supporting documents and should be checked to verify that they demonstrate compliance against the code values.

To check for compliance, the code official needs to determine which path is being used.



- **Prescriptive.** All design values meet or exceed code.
- **Envelope Trade-off.** The area weighted design U-value is less than or equal to the area weighted baseline U-value.
- **Performance.** Compliance is demonstrated through an energy model that performs a comparative analysis on the annual energy cost of the design against a code compliant design. The method allows trade-offs for prescriptive requirements but not for mandatory requirements. There are specific rules delineated for how the energy models are created for the baseline and the design models.
- **Energy Rating Index (ERI).** Compliance is demonstrated through the calculation of a numerical integer value from 0-100. Represents the total energy use of the proposed design and demonstrates a lower threshold value than outlined by the energy code. The method allows trade-offs for prescriptive requirements but not for mandatory requirements.

In general, reviewing energy analysis for compliance is a straightforward matter of checking that the listed design values are better than the code compliant values and all mandatory requirements are properly addressed.

For energy analysis submitted using the Energy Rating Index Compliance Alternative, compliance is completed by an approved third party. However, the following still needs to be part of the plan review:

- Credentials of the third party
- The compliance report submitted with the plans
- Mandatory provisions comply
- Confirm the building thermal envelope is better than or equal to the index year's energy code.

Supporting Documentation

Supporting documents are defined as the group of construction drawings and specifications and any other supporting data submitted with a permit application. The collection of documents in the manual is reviewed to confirm that all values listed are contained in the energy analysis.

While reviewing keep in mind that the final set of approved documents will be the basis for the field inspections. Issues caught during plan review help the inspection process.

The following serves as a rubric for reviewing supporting documents.

Supporting Document Review: Foundation

Verified Values

- Conditioned basement wall insulation R-value
- Depth (in feet) of insulation installed
- Confirm notes on how insulation is protected
- Snow-and-ice melting system control method

Framing/Rough-In

Verified Values

- Door U-factors match energy analysis
- Glazing U-factor per fixture schedule (area weighted average where applicable)
- U-factors of fenestration products are determined in accordance with the National Fenestration Rating Council, Incorporated (NFRC) test procedure or taken from the default table
- Skylight U-factors per fixture schedule (area weighted average where applicable)
- Air barrier and thermal barrier are specified to meet mandatory requirements
- Fenestration that is not site built is listed and labeled as meeting AAMA/WDMA/CSA 101/I.S.2/A440 or has infiltration rates per NFRC 400 that do not exceed code limits
- IC-rated recessed lighting fixtures
- Supply and return ducts located in attics are insulated—building cavities are not used as ducts or plenums
- Insulation schedules for HVAC piping conveying heated or cooled fluids documentation outlining the protection of insulation on HVAC piping
- Automatic or gravity dampers are documented on all outdoor air intakes and exhausts

Insulation

Verified Values

- The drawings prescribe that insulation is labeled with the rated R-value or manufacturer's certification on installation
- Floor insulation R-value (note if wood or steel studs)
- Floor sections document insulation to be installed in substantial contact with the underside of the subfloor, or floor-framing cavity insulation is in contact with the top side of sheathing, or continuous insulation is installed on the underside of floor framing and extends from the bottom to the top of all perimeter floor-framing members
- Wall insulation R-value (note if wood or steel studs)—if this is a mass wall with at least half of the wall insulation on the wall exterior, the exterior insulation requirement applies
- Wall insulation prescribed to be installed per manufacturer's instructions
- Ceiling insulation R-value (note if wood or steel studs)
- Ceiling insulation prescribed to be installed per manufacturer's instructions
- Attic access hatch and door insulation \geq R-value of the adjacent assembly
- A cross section is provided demonstrating how vented attics with air permeable insulation include baffle adjacent to soffit and eave vents that extends over insulation

Systems

Verified Values

- Heating: _____ Specified heating and cooling equipment is sized per ACCA Manual S
Cooling: _____ based on loads calculated per ACCA Manual J.
- Blower door test procedures are provided in accordance with code
- Wood-burning fireplaces have tight fitting flue dampers and outdoor air for combustion
- Duct tightness test procedures are specified
- Air handler schedule specifies leakage rates of all equipment at design airflow
- Programmable thermostats shown on plans and specified per code
- Heat pump thermostats are specified for all heat pumps
- Circulating service hot water systems have automatic or accessible manual controls
- All mechanical ventilation system fans, not part of tested and listed HVAC equipment, meet efficacy and air flow limits
- Hot water boilers supplying heat through one- or two-pipe heating systems have outdoor setback control to lower boiler water temperature based on outdoor temperature

- Any electric heat trace systems have controls specified to automatically adjust the energy input to the heat tracing to maintain the desired water temperature in the piping
- Water distribution systems with recirculation lines and pumps have controls to manage operation of the pump and limit the temperature of the water entering the cold-water piping
- Drain water heat recovery units specified to be tested in accordance with energy code standard
- Appropriate percentage of permanent lamps have high-efficacy lamps (does not apply to low-voltage lighting)
- Fuel gas lighting systems are specified without continuous pilot light
- The requirements for the Compliance Certificate and Manufacturer Manuals for mechanical and water heating systems have been specified

4 Existing Buildings

The energy code prescribes under what circumstances the work performed within existing buildings needs to comply with the requirements for new construction. That work involves additions, alterations, changes in occupancy and repairs.

Reviewing plan submissions for work in existing buildings has the added complexity of needing to assess the scope of the proposed work. Similar to new construction designs, modifications to existing buildings are submitted along one compliance path (NYS ECCC or ASHRAE) and must meet all the requirements in that path alone. Buildings that meet the definition for historic buildings are exempt from any requirements on the energy code under both paths. The Existing Building Compliance Path Options, provided later in this section, helps identify if a scope of work is demonstrating compliance based on the compliance paths.

Scope of Work

For modifications to existing buildings, both commercial and residential, the plan review process is as follows:

- Determine the code compliance path (e.g., NYSECCC or ASHRAE 90.1)
- Review the scope of the work to determine whether the claims for any exemptions or exceptions are valid
- For valid exemptions/exceptions determine whether the energy analysis and the supporting documentation is clear and complete—and whether any compliance requirements specific to the exemption/exception have been met
- Review the rest of the scope of addition, alteration, replacement, or repair as though it were new construction

Note that in general to qualify for any of the alteration or repair exemptions/exceptions, the building-energy use cannot increase. For example, if the glass in a window is replaced within the existing sash and frame, the glass must have equal or lower thermal (U-factor) AND solar (SHGC) performance as the existing glass.

Both commercial and residential permit sets follow the same requirements, and provide the same level of detail, for new construction. However, a permit application for additions, alterations, replacements, and repairs in an existing building also includes a well-defined set of demolition plans that incorporate notes regarding the following:

- Items to remain *as is*—not considered part of the renovation or repairs
- Extent of work to be altered, replaced, or repair (e.g., interior finish to be removed and replaced, existing studs to remain, and wall insulation in stud cavities to be removed and replaced.)
- Condition of existing constructions before the alteration (e.g., existing walls are uninsulated wall)
- Performance of existing equipment or systems (e.g., chiller efficiency)
- 5.7 COP/Single pane glazing $U_{cog} = 0.9$ and $SHGC_{cog} = 0.88$)
- Items to be removed and relocated
- Items to be disposed of and/or removed

Note that exceptions in energy code that refer to exposing wall cavities are referring specifically to stud cavities. The purpose of air cavities within a brick cavity wall construction is to allow a drainage plane where moisture weeping through the brick can be directed back to the exterior. When brick façades are being repaired or replaced, exposing the air cavities does not trigger requirements to fill the cavity with insulation. This would defeat the inherent purpose of the cavity.

Such designs should also be clear about the areas that are unknown until demolition activities commence. New work drawings line-up with the demolition drawings in terms of scope.

The following tables address common situations and indicate what compliance path they would otherwise fall under. These tables are only a guide and are not intended to cover all possible situations.

Existing Building Compliance Path Options

Commercial Additions

Conditions	Allowable Compliance Paths		
	IECC Mandatory & Prescriptive Requirements	ASHRAE 90.1 Mandatory & Prescriptive Requirements	ASHRAE 90.1 Energy Cost Budget (ECB) Method
GENERAL			
Energy Analysis for Addition only	•	•	•
Energy Analysis for Addition and Existing Building	•	•	•
Window to Wall Area Ratio (WWR)			
WWR of Addition <30% & Addition + Existing Building <30%	•	•	•
WWR of Addition + Existing Building between 30-40%, or VFA of Addition >30%	With daylight allowances	With daylight allowances	•
WWR of Addition + Existing Building >40%		With street side Fenestration Allowance	•

Skylight to Roof Area Ratio (SRR)			
SRR of Addition <3% & Addition + Existing Building <3%	•	•	
SRR of Addition + Existing Building between 3-5%, or SA of Addition >3%	With daylight allowances	With daylight allowances	
SRR of Addition + Existing Building >5%		Up to 6% with daylighting & thermal allowances	•
LIGHTING – Separate from GENERAL			
Interior Lighting Addition Only	•	•	
Interior Lighting Addition + Existing Building	•	•	
Exterior Lighting Addition Only	•	•	
Exterior Lighting Addition Only	•	•	

Commercial Alterations

Conditions	Scope of Work falls under New Construction		
	All	Partial	None
GENERAL			
Storm windows over existing fenestration			•
Surface-applied window film on existing single pane fenestration			•
Insulated existing ceiling, wall or floor cavities exposed during construction			•
Construction where existing roof, wall or floor cavity is not exposed			•
Creating conditioned space from existing unconditioned/semi-heated space	•		
ROOF			
Roof recovering			•
Roof replacement including thermal envelope components	•		
Air barriers for roof recovering, where no other alterations, renovations, or repairs are performed on the remainder of the envelope			•
LIGHTING			
Less than the compliance path prescribed % of luminaires replaced in a space			If pre-alteration lighting power is greater than post-alteration power

Commercial Repairs

Conditions	Scope of Work falls under Alterations		
	All	Partial	None
GENERAL			
Work on damaged and non-damaged building components justified by the required repair or maintenance of the existing building			•
SPECIFIC			
Glass-only replacement in fenestration			•
Work on the roof water proofing			•
Replacement of the lamps and/or ballast within existing luminaires			As long as installed lighting power does not increase
Replacement of existing door to conditioned space			As long as the work does not affect an existing vestibule

Commercial Change of Occupancy or Use

Conditions	Scope of Work falls under New Construction		
	All	Partial	None
GENERAL			
Spaces seeking a change in occupancy or use that would result in increased energy use in fossil fuel or electricity	•		•

Residential Additions

Conditions	Allowable Compliance Paths		
	Mandatory & Prescriptive Requirements	Mandatory & Simulated Performance	Mandatory & ERI Alternative
GENERAL			
Additions to Single-Family Homes ≤3 stories	IECC Path Only		
Additions to Multifamily Residential ≤3 stories	•		
BUILDING ENVELOPE			
Additions that turn unconditioned space to conditioned space	UA for new building ≤ UA for existing building as well	Only if model addition + existing portion	
Demising walls	•		
HEATING & COOLING SYSTEMS			
Extensions of existing systems with less than 40 ft of duct work in unconditioned space	Exempt from R403.3.3		
SERVICE HOT WATER SYSTEMS			
	•		
LIGHTING			
	•		

Residential Alterations

Conditions	Scope of Work falls under New Construction		
	All	Partial	None
GENERAL			
Storm windows over existing fenestration			•
Surface-applied window film on existing single pane fenestration			•
Insulated existing ceiling, wall or floor cavities exposed during construction			•
Construction where existing roof, wall or floor cavity is not exposed			•
ROOF			
Roof recovering			•
Roof replacement where part of the thermal envelope	•		
LIGHTING			
Less than compliance path prescribed % of luminaires replaced in a space	•		If pre-alteration lighting power is greater than post-alteration power
CHANGE IN OCCUPANCY			
Work that would result in increased energy use in fossil fuel or electricity	•		
Using simulated performance option	Allowed up to 110% annual energy cost		
Spaces converted to dwelling units from any previous commercial occupancy	•		

Residential Repairs

Conditions	Scope of Work falls under Alterations		
	All	Partial	None
GENERAL			
Work on damaged and non-damaged building components justified by the required repair or maintenance of the existing building			•
SPECIFIC			
Glass-only replacement in fenestration			•
Work on the roof water proofing			•
Replacement of the bulbs and/or ballast within existing luminaires			As long as installed lighting power does not increase
Replacement of existing door to conditioned space			As long as the work does not affect an existing vestibule

5 Inspections

During construction inspectors provide third-party verification of compliance with the approved construction documents. However, in the field, installation techniques and products may be different than what is described in the approved construction documents. The discrepancy, in turn, puts the inspector on the spot to determine if the differences affect compliance. The information in this section is intended to help the code officer get ahead of the difficult position.

While there are similarities between residential and commercial inspection procedures, the types of construction are presented separately in this section.

Commercial Inspections

The phases of construction that require inspection according to the energy code are as follows:

- Pre-inspection
- Footing and foundation inspection
- Framing and rough-in inspection
- Plumbing rough-in inspection
- Mechanical rough-in inspection
- Electrical rough-in inspection
- Final inspection

Projects that submit their energy analysis generated by COMcheck have provided a set of inspection checklists based on the information put into the software. These checklists contain information specific to the project parameters and the compliance path. COMcheck generates different checklists for projects complying via ASHRAE 90.1 than those complying via NYS ECCC.

COMcheck terminology and checklists based on NYS ECCC are used in this section for illustration purposes only. Jurisdictions may create their own inspection checklists, but it is suggested that any custom checklist include at least the level of information provided by COMcheck. Using a checklist based on COMcheck, may reduce the number of errors found in the field by having design teams fill-out the inspection checklists and submit them when submitting plans for review.

Pre-inspection

The basis of this phase of the process is to organize the rest of the phases. To do that, the permit documentation should be reviewed along with any plan review notes and preliminary field inspection notes should be developed.

Checklist Review

Verify that all appropriate inspection checklists have been provided. Flag any items which need to be inspected earlier or later than usual (e.g., insulated pipes located below the slab will need to be inspected prior to pouring the slab).

Where COMcheck generated inspection checklists are used, review them for the following:

- The referenced code and compliance path are consistent across all checklists.
- Conflicts between the approved energy code and the unamended code used by COMcheck are addressed.
- Additional requirements imposed by the approved energy code are addressed.

Depending on user input, COMcheck generates inspection checklists based on the applicable version of the IECC or ASHRAE 90.1. Any changes made by the NYS supplement may not be addressed. The approved energy code and the unamended versions of ASHRAE 90.1 and IECC may differ from and are not limited to as follows:

- HVAC certification requirements
- Demising wall insulation
- Voltage drop requirements
- Lighting controls

Document Coordination

Verify that the permit documentation is coordinated, complete, and addresses the following questions:

- **Plan Review Verification.** Has a full-plan review been completed and approved, or is it a segmented approval process (e.g., envelope separate from HVAC and lighting)?
- **Coordinated Documents.** Request a copy of the on-site construction drawings. Verify that the drawings match the approved construction documents. If they differ, execute the following:
 - Check that the changes made to the on-site construction drawings are equal to or better than the values listed on the approved documents
 - Confirm that the changes have been made in compliance with mandatory provisions
 - Issue stop order if any of the changes negatively affect the compliance with energy code, and the design team and contractor should issue new amended drawings proving compliance
- **Submittal Check (optional).** Where resources allow, ask for copies of the reviewed and approved submittals to examine prior to the site visit. Common submittals that are useful prior to inspection include the following:
 - Window submittals with overall unit SHGC and U-factor rated per code required standards
 - Curtainwall submittals with manufacturer provided thermal calculations
 - HVAC equipment submittals with efficiencies rated per code required standards

Footing and Foundation Inspection

The footing and foundation inspections take place after the basement wall or slab-edge insulation is installed but before backfilling. The following areas are included in the footing and foundation inspection, but consult the energy code for the complete requirements:

Envelope

- **Thermal Performance.** Verify that all insulation is labeled with R-value and installed thicknesses match approved documents.
- **Installation.** Verify that the insulation is properly installed as required by drawings and manufacturers recommendations.
- **Protection.** Verify that insulation is properly protected as required by code.

HVAC/Plumbing

- System components that are below grade—such as snow/ice melting system sensors, radiant floors, or insulated hydronic pipes—if applicable.

Figure 18. Sample Footing/Foundation Inspection Checklist

Figure 18. Sample Footing/Foundation Inspection Checklist

Section # & Req.ID	Footing/Foundation Inspection	Complies?	Comments/Assumptions
C303.2 [FO2] ²	Below-grade wall insulation installed per manufacturer's instructions.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C303.2.1 [FO6] ¹	Exterior insulation protected against damage, sunlight, moisture, wind, landscaping and equipment maintenance activities.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.1.4 [FO1] ²	Below-grade wall insulation R-value.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C403.2.4.5, C403.2.4.6 [FO9] ³	Snow/ice melting system sensors for future connection to controls. Freeze protection systems have automatic controls installed.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Framing and Rough-In Inspections

The inspection takes place before the application of the interior and exterior finishes since they conceal the work. The fenestration assemblies should be installed along with the insulation. The air-sealing systems should be visible and accessible.

The following areas are included in the framing and rough-in inspections, but consult the energy code for the complete and specific requirements:

Envelope

- **Identification.** All components, including fenestration and doors, are properly labeled as required by code.
- **Thermal Performance.** Insulation R-value, insulation thickness, and vision glazing SHGC match drawings.
- **Installation.** Verify that the insulation is properly installed as required by the drawings and manufacturers recommendations.
- **Protection.** Verify that insulation is properly protected from damage and moisture as required by code.
- **Air Leakage.** Vestibules and components of the air barrier system are installed per the approved documents. All components such as fenestration and doors meet air leakage requirements (e.g., confirm on submittals). Penetrations are sealed in accordance with drawing requirements.

A sample framing inspection follows:

Figure 19. Framing/Rough-In Inspection Checklist

Section # & Req.ID	Framing / Rough-In Inspection	Complies?	Comments/Assumptions
C303.1.3 [FR12] ²	Fenestration products rated in accordance with NFRC.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C303.1.3 [FR13] ¹	Fenestration products are certified as to performance labels or certificates provided.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.4.3 [FR10] ¹	Vertical fenestration SHGC value.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.4.3 [FR11] ¹	Skylight SHGC value.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.4.3, C402.4.3.4 [FR8] ¹	Vertical fenestration U-Factor.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.4.3.4 [FR9] ¹	Skylight fenestration U-Factor.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.4.4 [FR14] ²	U-factor of opaque doors associated with the building thermal envelope meets requirements.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.5.1.2.1 [FR19] ¹	The building envelope contains a continuous air barrier that is sealed in an approved manner and material permeability ≤ 0.004 dfm/ft ² . Air barrier penetrations are sealed in an approved manner.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.5.2, C402.5.4 [FR18] ³	Factory-built fenestration and doors are labeled as meeting air leakage requirements.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Insulation Inspections

The Insulation checklist automatically generated by COMcheck includes a Plan Verified Value and Field Verified Value for above grade opaque assembly insulation R-values. Due to the effects of thermal bridging, these R-values are not necessarily sufficient to validate that the assembly meets the design U-factors. The installed insulation and construction need to match the approved documents. Take for example, the following sample insulation checklist:

Figure 20. Sample Insulation Inspection Checklist

Section # & Req.ID	Insulation Inspection	Complies?	Comments/Assumptions
C303.1 [IN3] ¹	Roof insulation installed per manufacturer's instructions. Blown or poured loose-fill insulation is installed only where the roof slope is ≤ 3 in 12.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C303.1 [IN10] ²	Building envelope insulation is labeled with R-value or insulation certificate providing R-value and other relevant data.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C303.2 [IN7] ¹	Above-grade wall insulation installed per manufacturer's instructions.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C303.2.1 [IN14] ²	Exterior insulation is protected from damage with a protective material. Verification for exposed foundation insulation may need to occur during Foundation Inspection.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.2.1 [IN4] ³	Skylight curbs are insulated to the level of roofs with insulation above deck or R-5.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.2.1 [IN17] ³	Insulation intended to meet the roof insulation requirements cannot be installed on top of a suspended ceiling. Mark this requirement compliant if insulation is installed accordingly.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.2.3 [IN6] ¹	Above-grade wall insulation R-value.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.2.6 [IN18] ³	Radiant panels and associated components, designed for heat transfer from the panel surfaces to the occupants or indoor space are insulated with a minimum of R-3.5.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.2.2 [IN2] ¹	Roof R-value. For some ceiling systems, verification may need to occur during Framing Inspection.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.5.1.1 [IN1] ¹	All sources of air leakage in the building thermal envelope are sealed, caulked, gasketed, weather stripped or wrapped with moisture vapor-permeable wrapping material to minimize air leakage.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

R-Value Verification

For assemblies where the thermal performance compliance is determined via the R-value based method of NYS ECCC, also verify that the following items match the approved construction documents:

- Framing type, spacing and depth, where applicable
- Insulation attachment method (pins, clips, etc.)
- Insulation thickness

U-Factor Verification

For assemblies where the thermal performance compliance is determined via the U-factor basis of NYS ECCC or ASHRAE 90.1, in addition to the above items, verify that the construction methods observed in the field are consistent with the approved documents.

For site fabricated assemblies, or portions of assemblies, where the thermal performance was determined via thermal analysis (e.g., THERM), verify that the wall construction matches all section details exactly. The most critical items are the following:

- Structural material, spacing and depth
- Insulation attachment method (pins, clips, z-girt, etc.)
- Insulation location
- Rated insulation R-value

For assemblies, or portions of assemblies, that are manufactured off site, the thermal performance should be verified via submittal data. That data must include, at a minimum, the following:

- Thermal analysis reports (e.g., THERM)
- Testing data with rating authority noted and per code required standards

Example. Inspecting a Combination Assembly

The following example and accompanying figures (6.1.5.2.1 and 6.1.5.2.2) illustrate the procedure for inspecting an assembly in which both on-site and off-site components are used.

Pre-inspection. In reviewing the submitted permit plans the wall assembly detail (Figure 6.1.4.2-1) and associated energy analysis (Figure 6.1.4.2-2) were identified as requiring access to an approved manufacturer's submittal.

Pre-insulation Inspection. A copy of the manufacturer's spandrel submittal is requested of the contractor when notified that the project is ready for an insulation inspection. The submittal is reviewed and confirmation that the layers of the system match is made. The detail and the system achieve an overall U-factor of 0.22, which is consistent with the energy analysis.

Field Verification: During the field inspection it is confirmed that the submittal matches the conditions found on site. Additionally, the depth of the air gap and 8" CMU in the approved documents match the construction found in the field.

Figure 21. Sample Wall Detail

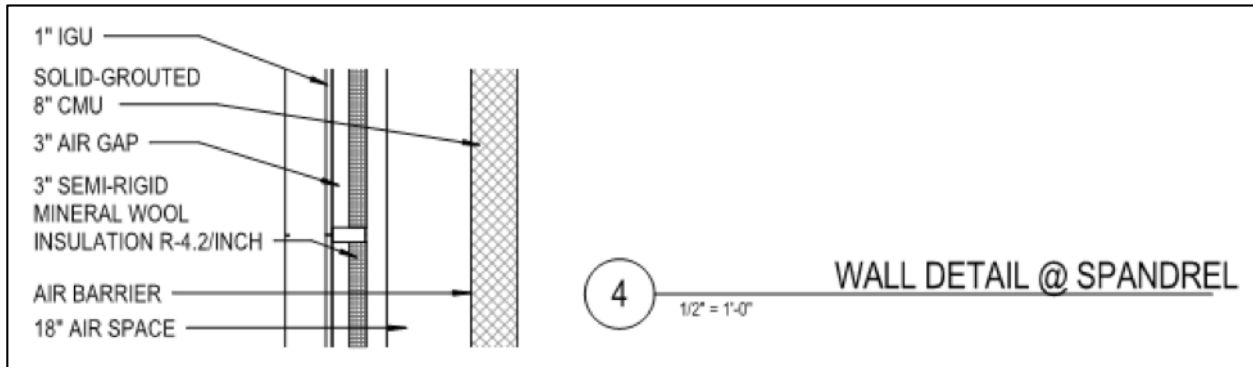


Figure 22. Sample U-Factor Calculation from Approved Documents

Layer	R-Value	U-Value	Source	Inspection
Exterior air film	4.55		U-0.22 for spandrel glass, per window spec	Verify adequate documentation of U-value exists (submittal, test results, thermal analysis, etc)
1" IGU				
3" air gap				
NotObservable				
Interior air film				
18" air space	0.91		ASHRAE90.1TableA9.4A-wall,3.5"airspace	Verify construction matches drawings
8" CMU, solid-grouted	0.87		ASHRAE90.1TableA3.1C-8inchCMU,solid-grouted,115lb/ft3	Verify construction matches drawings
Total	6.33	0.158		

To take the above example one step further, consider how the process would be affected if everything didn't line up so conveniently. During the field verification, it is instead discovered that the spandrel system's submittal is different than what was sent. In reviewing the new submittal, the code officer confirms an overall U-factor of 0.30 and prepares to shut the project down until confirmation is assessed, determining that the revised energy analysis still demonstrates compliance. The contractor then directs the officer to the fact that they have installed 2 inches of mineral wool and reduced the air space to 16 inches. At that point, the officer discerns the new assembly will have a lower U-factor than what was provided by the energy analysis. It is at the code officer's discretion to shut the project down until proper documentation can be provided or allow a temporary work allowance with the caveat that such changes to the energy analysis would be submitted to the officer's records.

Plumbing Rough-In Inspection

This inspection takes place before the application of the interior finishes. The pipe insulation and plumbing equipment should be visible and accessible. The following areas are included in the plumbing rough-in inspection, but consult the energy code for the complete requirements:

- Service water heating system efficiency ratings
- Service water piping insulation thickness and volume
- Water distribution system controls

Figure 23. Sample Plumbing Rough-In Inspection Checklist

Section # & Req.ID	Plumbing Rough-In Inspection	Complies?	Comments/Assumptions
C404.5, C404.5.1, C404.5.2 [PL6] ³	Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.5, C404.5.1, C404.5.2 [PL6] ³	Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.6.3 [PL7] ³	Pumps that circulate water between a heater and storage tank have controls that limit operation from startup to <= 5 minutes after end of heating cycle.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.6.3 [PL7] ³	Pumps that circulate water between a heater and storage tank have controls that limit operation from startup to <= 5 minutes after end of heating cycle.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.7 [PL8] ³	Water distribution system that pumps water from a heated-water supply pipe back to the heated-water source through a cold-water supply pipe is a demand recirculation water system. Pumps within this system have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance and limits the temperature of the water entering the cold-water piping to 104°F.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.7 [PL8] ³	Water distribution system that pumps water from a heated-water supply pipe back to the heated-water source through a cold-water supply pipe is a demand recirculation water system. Pumps within this system have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance and limits the temperature of the water entering the cold-water piping to 104°F.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Mechanical Rough-In Inspection

Inspections occur after the installation of all ductwork and HVAC equipment, but before the installation of finishes. The following areas are included in the mechanical rough-in inspection, but consult the energy code for complete and specific requirements:

- HVAC equipment sizes and efficiency ratings
- HVAC piping and duct insulation thickness and protection
- HVAC system controls
- HVAC equipment insulation
- Ventilation and damper controls and rated leakage rates
- Parking garage contaminant detection
- Fan nameplate power, motor efficiency, and controls

- Variable speed drive requirements for pumps and fans
- Demand controlled ventilation
- Energy recovery systems
- Duct air leakage
- Refrigeration controls (e.g., hot gas-bypass limits)

Figure 24. Sample Mechanical Rough-In Inspection Checklist

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C402.2.6 [ME41] ³	Thermally ineffective panel surfaces of sensible heating panels have insulation \geq R-3.5.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.5.5, C403.2.4.3 [ME3] ³	Stair and elevator shaft vents have motorized dampers that automatically close.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.5.5, C403.2.4.3 [ME58] ³	Outdoor air and exhaust systems have motorized dampers that automatically shut when not in use and meet maximum leakage rates. Check gravity dampers where allowed.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.12.1 [ME65] ³	HVAC fan systems at design conditions do not exceed allowable fan system motor nameplate hp or fan system bhp.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Mechanical Systems list for values.
C403.2.12.3 [ME117] ²	Fans have efficiency grade (FEG) \geq 67. The total efficiency of the fan at the design point of operation \leq 15% of maximum total efficiency of the fan.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.13 [ME71] ²	Unenclosed spaces that are heated use only radiant heat.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.3 [ME55] ²	HVAC equipment efficiency verified.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Mechanical Systems list for values.
C403.2.5.1 [ME114] ²	Hot water boilers supplying heat via one- or two-pipe systems include outdoor setback control.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.6.1 [ME59] ¹	Demand control ventilation provided for spaces >500 ft ² and >25 people/1000 ft ² occupant density and served by systems with air side economizer, auto modulating outside air damper control, or design airflow $>3,000$ cfm.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.6.2 [ME115] ³	Enclosed parking garage ventilation has automatic contaminant detection and capacity to stage or modulate fans to 50% or less of design capacity.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Electrical Rough-In Inspection

Inspections are made after the installation of electrical wiring, lighting, and lighting control systems. The following areas are included in the electrical rough-in inspection; consult the energy code for the complete requirements:

- Interior and exterior required lighting controls
- Interior and exterior lighting power
- Controls for daylight zones, where required
- Exit signs, rated power limit
- Electric motor efficiency
- Receptacle controls, where required
- Electric metering

Figure 25. Sample Electrical Rough-In Inspection Checklist

Section # & Req.ID	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
C405.2.1 [EL15] ¹	Lighting controls installed to uniformly reduce the lighting load by at least 50%.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.2.1 [EL18] ¹	Occupancy sensors installed in required spaces.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.2.1, C405.2.2, 3 [EL23] ²	Independent lighting controls installed per approved lighting plans and all manual controls readily accessible and visible to occupants.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.2.2. 1 [EL22] ²	Automatic controls to shut off all building lighting installed in all buildings.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.2.3 [EL16] ²	Daylight zones provided with individual controls that control the lights independent of general area lighting.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.2.3, C405.2.3. 1, C405.2.3. 2 [EL20] ¹	Primary sidelighted areas are equipped with required lighting controls.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.2.3, C405.2.3. 1, C405.2.3. 3 [EL21] ¹	Enclosed spaces with daylight area under skylights and rooftop monitors are equipped with required lighting controls.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.2.4 [EL4] ¹	Separate lighting control devices for specific uses installed per approved lighting plans.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.2.4 [EL8] ¹	Additional interior lighting power allowed for special functions per the approved lighting plans and is automatically controlled and separated from general lighting.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.2.5 [EL25] ^{n/ull}	Automatic lighting controls for exterior lighting installed. Controls will be daylight controlled, set based on business operation time-of-day, or reduce connected lighting > 30%.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.3 [EL6] ¹	Exit signs do not exceed 5 watts per face.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Final Inspection

The final inspection is made after the installation of all building systems and controls have been installed, deficiencies from other inspections corrected, and required commissioning, if any, has been completed.

The following areas are included in the final inspection, but consult the energy code for the complete requirements:

- Operation and maintenance manuals
- Commissioning plans
- Open combustion air duct isolation
- Weather-seals
- As-built documents
- Mechanical systems and controls
- Service water heating systems and controls
- Lighting systems and controls
- Elevator systems, if applicable

Commissioning

Commissioning reports should be provided prior to the final mechanical, service water-heating, and lighting inspections for projects. The project team should provide at least the following:

- Commissioning plan/Operations and management manual
- System balancing reports
- Functional testing reports
- Preliminary commissioning report

All commissioning reports should provide the names of individuals who performed the work and their license numbers for such testing. The final commissioning report, excluding tests that have been deferred due to climatic conditions, should be available within the code specified timeframe.

Figure 26. Sample Final Inspection Checklist

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C303.3, C408.2.5.2 [FI17] ³	Furnished O&M instructions for systems and equipment to the building owner or designated representative.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C303.3, C408.2.5.3 [FI8] ³	Furnished O&M manuals for HVAC systems within 90 days of system acceptance.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.5.3 [FI51] ³	Where open combustion air ducts provide combustion air to open combustion fuel burning appliances, the appliances and combustion air opening are located outside the building thermal envelope or enclosed in a room, isolated from inside the thermal envelope. Such rooms are sealed and insulated.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.5.6 [FI37] ¹	Weatherseals installed on all loading dock cargo doors.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.5.8 [FI26] ³	Recessed luminaires in thermal envelope to limit infiltration and be IC rated and labeled. Seal between interior finish and luminaire housing.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.2 [FI27] ³	HVAC systems and equipment capacity does not exceed calculated loads.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.4.1 [FI47] ³	Heating and cooling to each zone is controlled by a thermostat control. Minimum one humidity control device per installed humidification/dehumidification system.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.4.1.2 [FI38] ³	Thermostatic controls have a 5 °F deadband.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.4.1.3 [FI20] ³	Temperature controls have setpoint overlap restrictions.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.4.2 [FI39] ³	Each zone equipped with setback controls using automatic time clock or programmable control system.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.4.2.1, C403.2.4.2.2 [FI40] ³	Automatic Controls: Setback to 55°F (heat) and 85°F (cool); 7-day clock, 2-hour occupant override, 10-hour backup	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Residential Inspections

The phases of construction that require inspection are as follows:

- Pre-inspection
- Footing and Foundation Inspection
- Framing and Rough-In Inspection
- Plumbing Rough-In Inspection
- Mechanical Rough-In Inspection
- Final Inspection

Projects that submit their energy analysis generated by REScheck provide a set of inspection checklists based on the information in the software. These checklists contain material specific to the project parameters.

REScheck terminology and checklists based on NYS ECCC are used in this section for illustration purposes only. Jurisdictions may create their own inspection checklists, but it is suggested that any custom checklist include at least the level of information provided by REScheck. It may reduce the number of errors found in the field by having design teams partially fill out the inspection checklists and submit them when they submit plans for review.

Pre-inspection

During this phase, review all changes to the construction documents that occurred after the plan review and permit issuance. Review the permit set and any submitted inspection checklists. Flag the following:

- Areas that may need to be inspected earlier or later than usual
- The referenced code and compliance path

Checklists provided along with REScheck energy analysis are based on the applicable version of the IECC. They do not address changes made by the NYS supplement. The approved energy code and the unamended versions of the IECC may differ but the differences are limited to the following items:

- Demising wall insulation
- HVAC Certification requirements
- Voltage drop requirements
- Lighting controls

Document Coordination

Verify that the permit documentation is coordinated and completely addresses the following questions:

- **Plan Review Verification.** Has a full-plan review been completed and approved or does it have a segmented approval process?
- **Coordinated Documents.** Request a copy of the on-site construction drawings. Does it match the approved permit drawings with any amendments? If they differ, execute the following:
 - Check that the changes made to the on-site construction drawings are equal to or better than the values listed on the approved energy analysis.
 - Confirm that the changes have been made in compliance with mandatory provisions.
 - Issue stop order if any of the changes negatively affect the compliance with energy code. The design team and contractor should issue new amended drawings proving compliance.
- **Submittal Check (optional).** Where resources allow, ask for copies of the reviewed and approved submittals. Review for compliance prior to the site visit. Common submittals that are useful to review early include the following:
 - Window submittals with overall unit SHGC and U-factor rated per code requirements
 - Blown insulation submittals and installation details
 - HVAC equipment submittals rated per code requirements

Footing and Foundation Inspection

Such inspections take place after the basement wall or slab-edge insulation is installed but before backfilling. Verify the insulation R-value, location, depth of burial and protection as documented by the approved plans and specifications.

Figure 27. Sample Footing and Foundation Inspection Checklist

Section # & Req.ID	Foundation Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
402.1.1 [FO4] ¹	Conditioned basement wall insulation R-value. Where interior insulation is used, verification may need to occur during Insulation Inspection. Not required in warm-humid locations in Climate Zone 3.	R-_____ R-_____	R-_____ R-_____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
303.2 [FO5] ¹	Conditioned basement wall insulation installed per manufacturer's instructions.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
402.2.9 [FO6] ¹	Conditioned basement wall insulation depth of burial or distance from top of wall.	_____ft	_____ft	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
303.2.1 [FO11] ²	A protective covering is installed to protect exposed exterior insulation and extends a minimum of 6 in. below grade.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.9 [FO12] ²	Snow- and ice-melting system controls installed.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Slab-edge insulation

Slab-on-grade floors transfer energy primarily through their perimeter. Heat travels both down through the ground in this region as well as through the air along the slab edge. Where insulation is installed vertically verify that it covers the entire slab edge. In a case where both horizontal and vertical insulation are expected, the inspection may need to be performed before the slab is poured.

Framing and Rough-In Inspections

This inspection takes place before the application of the interior finishes. The glazing assemblies should be installed along with the insulation, and the air-sealing system should be accessible. Checklists generated by REScheck cover all rough-in inspections: framing, mechanical, and plumbing. If it is not conducive to perform all inspections at once, the inspections may be broken up as work is performed.

The following areas are included in the framing and rough-in inspection, but consult the energy code for the complete requirements:

- **Identification.** All components, including fenestration and doors, are properly labeled as required by code.
- **Thermal Performance.** Insulation R-value, insulation thickness, and vision glazing SHGC match drawings.
- **Installation.** Verify that the insulation is properly installed as required by the drawings and manufacturers recommendations.
- **Protection.** Verify the insulation is properly protected from damage and moisture as required by code.
- **Air Leakage.** Verify that the air barrier system is installed per manufacturer recommendations. Check that any penetrations of the air barrier are sealed appropriately.

Figure 28. Sample Framing/Rough-In Inspection Checklist

Section # & Req.ID	Framing / Rough-In	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
402.1.1, 402.3.4 [FR1] ¹	Door U-factor.	U- _____	U- _____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
402.1.1, 402.3.1, 402.3.3, 402.5 [FR2] ¹	Glazing U-factor (area-weighted average).	U- _____	U- _____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
303.1.3 [FR4] ¹	U-factors of fenestration products are determined in accordance with the NFRC test procedure or taken from the default table.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
402.1.1, 402.3.3, 402.3.6, 402.5 [FR5] ¹	Skylight U-factor.	U- _____	U- _____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
402.4.1.1 [FR23] ¹	Air barrier and thermal barrier installed per manufacturer's instructions.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
402.4.3 [FR20] ¹	Fenestration that is not site built is listed and labeled as meeting AAMA /WDMA/CSA 101/I.S.2/A440 or has infiltration rates per NFRC 400 that do not exceed code limits.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
402.4.5 [FR16] ²	IC-rated recessed lighting fixtures sealed at housing/interior finish and labeled to indicate ≤2.0 cfm leakage at 75 Pa.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.3.1 [FR12] ¹	Supply and return ducts in attics insulated ≥ R-8 where duct is ≥ 3 inches in diameter and ≥ R-6 where < 3 inches. Supply and return ducts in other portions of the building insulated ≥ R-6 for diameter ≥ 3 inches and R-4.2 for < 3 inches in diameter.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.3.5 [FR15] ³	Building cavities are not used as ducts or plenums.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.4 [FR17] ²	HVAC piping conveying fluids above 105 °F or chilled fluids below 55 °F are insulated to ≥R-3.	R- _____	R- _____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.4.1 [FR24] ¹	Protection of insulation on HVAC piping.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Glazing/Door U-Factor and Solar Heat Gain Coefficient (SHGC)

Glazing assemblies remain labeled throughout construction. It is also acceptable to have a binder with manufacturer information covering overall rated U-factor, SHGC, and testing agency.

For projects demonstrating compliance using the prescriptive R-value approach and taking a code allowance for an area of fenestration or opaque door U-factor exemption, verify that the field conditions are less than the code allowance.

Insulation (ceiling, walls, floors)

All insulation is labeled with the overall rated R-value of the product. It is also acceptable to have the manufacturer's installation information, including rated U-factor. Blow-in insulation products may need to be inspected as part of the final inspection, as they rely on the finished surfaces to support them.

Demising walls separating dwelling units in the same residential structures are also inspected for compliance. These walls may not show up on checklists generated by REScheck.

Figure 29. Sample Insulation Inspection Checklist

Section # & Req.ID	Insulation Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
303.1 [IN13] ²	All installed insulation is labeled or the installed R-values provided.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
402.1.1, 402.2.6 [IN1] ¹	Floor insulation R-value.	R- _____ <input type="checkbox"/> Wood <input type="checkbox"/> Steel	R- _____ <input type="checkbox"/> Wood <input type="checkbox"/> Steel	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
303.2, 402.2.7 [IN2] ¹	Floor insulation installed per manufacturer's instructions and in substantial contact with the underside of the subfloor, or floor framing cavity insulation is in contact with the top side of sheathing, or continuous insulation is installed on the underside of floor framing and extends from the bottom to the top of all perimeter floor framing members.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
402.1.1, 402.2.5, 402.2.6 [IN3] ¹	Wall insulation R-value. If this is a mass wall with at least ½ of the wall insulation on the wall exterior, the exterior insulation requirement applies (FR10).	R- _____ <input type="checkbox"/> Wood <input type="checkbox"/> Mass <input type="checkbox"/> Steel	R- _____ <input type="checkbox"/> Wood <input type="checkbox"/> Mass <input type="checkbox"/> Steel	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
303.2 [IN4] ¹	Wall insulation is installed per manufacturer's instructions.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Air Sealing of the Building Envelope

The code required blower door test is part of the final inspection procedures. During the rough-inspection, it is important to check that the components of the air barrier system have been installed in accordance with the code and manufacturer's instructions.

At this phase of construction, access and visually inspect the following:

- Sealing methods of glazing and door penetrations in the thermal barrier
- Separation between conditioned and unconditioned spaces
- Demising separations

All sealing between dissimilar materials allows for proper differential expansion and contraction. Sealing required for recessed fixtures such as lights, outlets, and grilles are addressed as part of the final inspection.

Plumbing Rough-In Inspection

Before the plumbing inspection, all plumbing is roughed in, water heating equipment installed, required hot water piping fully insulated, and all insulation protection systems are installed in accordance with manufacturer's recommendations.

If the hot water generating equipment, such as a domestic hot water heater and boilers are installed and able to be isolated, the mandatory controls may be inspected at this time. Drain water heat recovery units are also inspected and the associated manufacturer's information reviewed for proper installation techniques. This inspection also includes reviewing all new penetrations of the thermal barrier for proper sealing.

Mechanical Rough-In Inspection

Inspections are made after the installation of all ductwork and HVAC equipment but before the installation of finishes. This inspection verifies controls, duct sealing, insulation R-value, dampers, whole-house ventilation, minimum fan efficiency, and HVAC equipment size.

Controls

For the rough-in inspection verify the location of the thermostats based on the control wiring and confirm that at least one is provided for each separate HVAC system. Confirm that the thermostat meets the code requirements during the final inspection.

Duct and HVAC System Sealing and Insulation

Verify the sealing method of all duct work. Any installed air handler should have manufacturer's information available to confirm an air leakage rate not exceeding code requirements as testing in accordance with ASHRAE 193.

Projects demonstrating compliance for the duct pressure testing by the Rough-in Test shall have such results available at the time of the rough-in inspection.

All supply and return ducts running through any unconditioned or semi-conditioned space are insulated. Semi-conditioned space includes within envelope assemblies that are part of the thermal barrier.

Mechanical Ventilation

All air intakes and exhaust penetrations are equipped with automatic or gravity dampers and are closed when not in operation. When inspecting these components also confirm sealing of all associated penetrations of the air barrier. All mechanical ventilation system fans should meet the minimum efficiency requirements of the energy code.

Final Inspection

The building's final inspection includes the following:

- Verification of proper installation and operation of all required building systems
- Required number of permanently installed high-efficacy lamps and fixtures
- Verification of results for all previously outstanding tests
- Installation of the permanent energy certificate

Figure 30. Sample Final Inspection checklist

Section # & Req.ID	Final Inspection Provisions	Plans Verified Value	Field Verified Value	Complies?	Comments/ Assumptions
402.1.1, 402.2.1, 402.2.2, 402.2.6 [FI1] ¹	Ceiling insulation R-value.	R-_____ <input type="checkbox"/> Wood <input type="checkbox"/> Steel	R-_____ <input type="checkbox"/> Wood <input type="checkbox"/> Steel	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
303.1.1.1, 303.2 [FI2] ¹	Ceiling insulation installed per manufacturer's instructions. Blown insulation marked every 300 ft ² .			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
402.2.3 [FI22] ²	Vented attics with air permeable insulation include baffle adjacent to soffit and eave vents that extends over insulation.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
402.2.4 [FI3] ¹	Attic access hatch and door insulation ≥R-value of the adjacent assembly.	R-_____	R-_____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
402.4.1.2 [FI17] ¹	Blower door test @ 50 Pa. ≤5 ach in Climate Zones 1-2, and ≤3 ach in Climate Zones 3-8.	ACH 50 = _____	ACH 50 = _____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
402.4.2 [FI8] ²	Wood-burning fireplaces have tight fitting flue dampers and outdoor air for combustion.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.3.4 [FI4] ¹	Duct tightness test result of ≤4 _____ cfm/100 ft ² across the system or ≤3 cfm/100 ft ² without air handler @ 25 Pa. For rough-in tests, verification may need to occur during Framing Inspection.	_____ cfm/100 ft ²	_____ cfm/100 ft ²	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Section # & Req.ID	Final Inspection Provisions	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
403.3.3 [FI27] ¹	Ducts are pressure tested to determine air leakage with either: Rough-in test: Total leakage measured with a pressure differential of 0.1 inch w.g. across the system including the manufacturer's air handler enclosure if installed at time of test. Postconstruction test: Total leakage measured with a pressure differential of 0.1 inch w.g. across the entire system including the manufacturer's air handler enclosure.	_____cfm/100 ft ²	_____cfm/100 ft ²	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.3.2.1 [FI24] ¹	Air handler leakage designated by manufacturer at <=2% of design air flow.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.1.1 [FI9] ²	Programmable thermostats installed for control of primary heating and cooling systems and initially set by manufacturer to code specifications.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.1.2 [FI10] ²	Heat pump thermostat installed on heat pumps.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.5.1 [FI11] ²	Circulating service hot water systems have automatic or accessible manual controls.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.6.1 [FI25] ²	All mechanical ventilation system fans not part of tested and listed HVAC equipment meet efficacy and air flow limits.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.2 [FI26] ²	Hot water boilers supplying heat through one- or two-pipe heating systems have outdoor setback control to lower boiler water temperature based on outdoor temperature.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.5.1.1 [FI28] ²	Heated water circulation systems have a circulation pump. The system return pipe is a dedicated return pipe or a cold water supply pipe. Gravity and thermosyphon circulation systems are not present. Controls for circulating hot water system pumps start the pump with signal for hot water demand within the occupancy. Controls automatically turn off the pump when water is in circulation loop is at set-point temperature and no demand for hot water exists.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.5.1.2 [FI29] ²	Electric heat trace systems comply with IEEE 515.1 or UL 515. Controls automatically adjust the energy input to the heat tracing to maintain the desired water temperature in the piping.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Section # & Req.ID	Final Inspection Provisions	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
403.5.2 [FI30] ²	Water distribution systems that have recirculation pumps that pump water from a heated water supply pipe back to the heated water source through a cold water supply pipe have a demand recirculation water system. Pumps have controls that manage operation of the pump and limit the temperature of the water entering the cold water piping to 104°F.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
403.5.4 [FI31] ²	Drain water heat recovery units tested in accordance with CSA B55.1. Potable water-side pressure loss of drain water heat recovery units < 3 psi for individual units connected to one or two showers. Potable water-side pressure loss of drain water heat recovery units < 2 psi for individual units connected to three or more showers.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
404.1 [FI6] ¹	75% of lamps in permanent fixtures or 75% of permanent fixtures have high efficacy lamps. Does not apply to low-voltage lighting.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
404.1.1 [FI23] ³	Fuel gas lighting systems have no continuous pilot light.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
401.3 [FI7] ²	Compliance certificate posted.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
303.3 [FI18] ³	Manufacturer manuals for mechanical and water heating systems have been provided.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Permanent Energy Certificate

The permanent certificate is posted on a wall within the space that the furnace is located, or within a readily accessible utility room. The certificate should not obstruct any other required signage in the building and contains the following information:

- Predominant R-value of ceiling and roof areas, walls, foundations, and ducts outside conditioned space
- Fenestration rated overall U-factors and SHGC
- Results of duct system air leakage testing
- Results of building envelope air-leakage testing
- HVAC equipment size, type, and rated efficiency
- Service water heating equipment size, type, and rated efficiency

Gas-fired unvented room heaters, electric furnaces, and electric baseboard heaters are listed but do not require a rated efficiency.



State of New York

Andrew M. Cuomo, Governor

New York State Energy Research and Development Authority

Richard L. Kauffman, Chair | Alicia Barton, President and CEO