Version 1.7 Summary of Changes

Prerequisites and Prescriptive Path Checklist
Prescriptive Path Checklist and Prescriptive Tables 1,2 &3
6.1,6.2,6.3 - LIGHTING

Version 1.6 Summary of Changes

Project Info
Prerequisites Checklist
Prescriptive Path Checklist and Prescriptive Tables 1,2 &3
ERMs

1.1 - APPLIANCES thru 9.1 METERS

1.1 - APPLIANCES thru 9.1 METERS

1.1 - APPLIANCES thru 9.1 METERS
3.1, 3.2, 3.3, 4.1, 8.1
4.1 - GARAGES_CMPTZ & HEATING
8.2 - VENT_SCHEDULE&TAB REPORT
8.2 - VENT_SCHEDULE&TAB REPORT
1.1 - APPLIANCES thru 9.1 METERS
1.1 - APPLIANCES thru 9.1 METERS
5.2, 5.4 - COOLING
6.1,6.2,6.3 - LIGHTING

Per 2015 policy record, updated language related to DHW pipe insulation and mixing valves.

Corrections to slab insulation, CFM for ventilation duct leakage and error checking formula

This worksheet can be completed prior to As-Built;not required for Proposed Design Submittal. Performance Path Calculator lig

Added field to identify the equivalent ASHRAE 90.1 Standard that applies to the project. This may change the Performance Ta
Requesting county in order to verify climate zone.

Added hyperlinks to columns C through F to facilitate navigation throughout the worksheets.

These tabs have been hidden and will only re-appear if Prescriptive Path is selected in the Project Info tab (cell C4).

Modified hidden comments to prompt user input and pre-populated more fields in the Baseline column (white cells do not need

Added buttons at top of each worksheet to navigate back to Table of Contents, ERMs, Prerequisites and Overview worksheets
within each worksheet are also hyperlinked to the related Prerequisite in the Prerequisites Checklist.

Added "Check empty cells" button at top right corner of each protocol tab to help identify mandatory cells not filled out. By click
cell's background will show highlighted in pink and a warning message will appear. After the empty cells have been filled out, b
color.

Where needed, clarified and renamed column headers of tables/schedules.

Revised language to clarify that following *ENERGY STAR Certified Homes Thermal Enclosure System Rater Checklist Section*

Revised language to clarify the prerequisites related to pipe freeze protection and snow- and ice-melt systems in garages.

Revised row 141 to reference correct ASHRAE requirement 62.2 - 2007, consistent with Program requirements.

Revised row 77 to have "Apt # or Space" in each shaft columns; since these tables are to be used for apartment and non-apart

Removed Statement of Substantial Completion row for items where a Statement is not applicable.

Added more details to the Inspection Checklist Comments instructions.

Clarified that cooling pipe insulation prerequisite also applies to refrigerant pipe/lines.

Added measurement option for illumination as alternative to design calculations

T&V Worksheets Version 1.7- Instructions

OMB Control Number: 2060-0586
Expiration Date: 01-31-2024
EPA Form Number: 5900-269

Click the link below or paste the web address into your browser to watch the *T&V Worksheets* Training Video:
http://www.youtube.com/watch?v=gco7heVBBZY

1.0 General Formatting

1.1 Cells

= Proposed ERM and Values used for Energy Model. *Enter data in these orange cells in the 'ERMs' worksheet ONLY. All other orange cells in this workbook link back to the 'ERMs' worksheet for relevant data.*

= Comments made during Plan Review. *Enter data in these blue cells in the Inspections Worksheets ONLY. All other blue cells (including those in the 'ERMs' and 'Overview' worksheets) link back to the Inspection Worksheets for relevant data.*

= Fill data in this cell after site Inspection

= Baseline Reference - ASHRAE 90.1

= Information in this cell is fed to other spreadsheets

1.2 Worksheets

= Introductory Worksheets

= Performance Values & Deliverables

= Inspection Worksheet, *typically completed during Pre-Drywall or Drywall Inspection*

= Inspection Worksheet, *typically completed during Finishes*

= Inspection Worksheet, *typically completed during Construction Close-out*

2.0 Summary

2.1 Energy reduction measures are first described in the 'ERMs' Worksheet in the column labeled "Proposed Method of Compliance". Energy reduction measures are determined by the Design Team when following the *MFHR Performance Path* or by the requirements listed in the *ENERGY STAR MFHR Prescriptive Path* for your climate zone.

2.2 When following the *Performance Path*, data entered in the "Proposed Method of Compliance" column of the 'ERMs' worksheet provide guidance for energy modeling inputs & assumptions entered in the adjacent "Values used in Energy Model" Column.

2.3 Both the "Proposed Method of Compliance" and the "Values Used in Energy Model" columns are linked to relevant cells/worksheets throughout the individual *T&V Worksheets*. For both the *Performance Path* and the *Prescriptive Path*, this provides the person responsible for reviewing construction documents and on site inspections necessary information to confirm whether program goals and design intent have been met.

2.4 After the construction documents have been reviewed and feedback provided in the *T&V Worksheets*, it is linked back to the 'Overview' Worksheet which serves as a summary of the plan review. The next step is either to make revisions to the modeling inputs and/or provide feedback to the project team on how to bring the design in line with the assumptions made in the energy model or requirements as specified in the *Prescriptive Path*. The 'Overview' Worksheet can also be used as the deliverable to provide feedback to the project team. Rows and columns can be hidden as review items become closed, or if the deliverable is being sent to the project Architect or Engineer and only certain items are applicable. This helps minimize the size and makes the document a more manageable discussion piece.

2.5 All prerequisites listed in the *T&V Worksheets* are linked to the 'Prerequisites Checklist'; all requirements of the *Prescriptive Path* are linked to the 'Prescriptive Path Checklist'. Prior to submitting the *T&V Worksheets* to EPA, review the applicable checklist to confirm that all prerequisites or prescriptive requirements have been verified.

2.6 After the final plan review confirms all recommendations have been integrated in to the construction documents, the *T&V Worksheets* are intended to be printed and brought to the field. They list measures and building components to be inspected as well as mandatory requirements and/or energy modeling assumptions to be confirmed and any additional relevant information identified during the plan review.

2.7 Post-inspection feedback entered into each worksheet is linked back to the 'ERMs' Worksheet as a summary for updating the Final Building energy model per as-built conditions or to identify measures needing corrections. They are also linked to the 'Overview' Worksheet serving as a project overview from design to completion.

2.8 The *T&V Worksheets* in the As-Built submittal will represent the conditions of the Final Building and do not need to include information from each site visit as long as the Final Building meets the requirements of the *Prescriptive Path* or has an energy model that complies with the Performance Target, and the prerequisites have been met or exceeded. In other words, it's not necessary to update the digital version of the worksheets after each site visit, as long as the final conditions are documented in the submitted version. At a minimum, *T&V Worksheets* filled in by hand at each inspection shall be kept on file in the case further information is requested by EPA.

3.0 Navigating

3.1 The Worksheet labeled 'Table of Contents' can be used to quickly jump to the desired *T&V Worksheet*. Additionally each green protocol worksheet has buttons at the top that bring you back to the various worksheets.

4.0 *T&V Worksheets* - Overview

4.1 Each *T&V Worksheet* is formatted similarly to easily locate the sections used at different stages throughout the project. The header contains the name of the project, building component being reviewed/inspected and a box to enter the date inspections occur and who conducted them.

4.2 Each *T&V Worksheet* also contains sections titled "Schedule", "Equipment Needed" and "Sampling Requirements". The "Schedule" section gives recommendations about the appropriate time to begin inspecting that particular component and sometimes suggests the minimum number of inspections. "Sampling Requirements" outlines appropriate sampling rates, minimum sample set requirements and mandatory photographs to be included as documentation.

4.3 Most *T&V Worksheets* contain sections titled "Notes for Drawings and Specifications". This is meant to be used in the plan review stage for easy access to language to be copied and pasted into the cells labeled "Plan Review Comment". This section and any others not needed can be hidden when printing for the field to condense the size as much as possible. The more complex building components, such as HVAC, do not have the "Notes for Drawings and Specifications" section because there are too many notes to put in one cell; they are broken up line by line in elements below.

4.4 Some *T&V Worksheets* have schedules for building HVAC equipment or envelope assemblies for easier tracking of characteristics specific to that type of component. These rows have been left unlocked so they can be copied for various assemblies, or rows can be inserted for additional equipment.

4.5 Each *T&V Worksheet* lists the individual elements from the *ENERGY STAR MFHR Testing and Verification Protocols (T&V Protocols)* that needs to be checked either in the design phase and/or during construction. For both the "Plan Review" and "Inspection" columns, there is a comment box for feedback as well as a verification input where you can choose one of the following after reviewing that particular element. This information links back to the 'ERMs', 'Overview', and 'Prerequisites Checklist' Worksheets for easy reference when updating the model, communicating with the project team or EPA.

a) Yes - Verified
b) No - Not Verified
c) N/A - Not Applicable

4.6 After the plan review or inspection has been completed, the *T&V Worksheets* or sections of the 'Overview' Worksheet can be printed and used as deliverables to provide feedback to the project team.

5.0 Help

5.1 Send questions and comments to MFHR@energystar.gov

Project Name:	
Compliance Path:	
State Energy Code (or Equivalency)	
Street Address:	
City, State, Zip & County:	
Climate Zone	

For Project Applications submitted on or after January 1, 2015, state energy code is used to determine th
For Project Applications submitted prior to January 1, 2015, you may select ASHRAE 90.1-2007, regardle

Is this project participating in any state or local ENERGY STAR program?	

Is this project participating in NYSERDA's Multifamily Performance Program?	

Team	First Name	Last Name	Email	Office Phone
Developer				
Marketing Consultant				
Architect				
MEP Engineer				
General Contractor				
MEP Contractor				

e appropriate ASHRAE Baseline &
ess of current state energy code.

Direct Line

T&V Protocol Number and Description	*T&V Worksheet*	Potential Inspection Schedule Categories
Protocol 1.1 - ENERGY STAR Certified Appliances	1.1 - APPLIANCES	Post-Completion
Protocol 2.1 - Central DHW Systems (Serving 5+units/spaces)	2.1-2.2, 5.1, 5.3 - HEATING&DHW	Finishes
Protocol 2.2 - Distributed DHW (Individual Apartment or Common Space) Systems	2.1-2.2, 5.1, 5.3 - HEATING&DHW	Finishes
Protocol 3.1 - Wall Construction/Insulation, R-value	3.1 - ENV_BELOW GRADE WALL	Pre-Drywall
	3.1 - ENV_ABOVE GRADE WALL	Pre-Drywall
	8.1 - INF_EXT AIR BARRIER	Pre-Drywall
Protocol 3.2 - Roof Construction/Insulation, R-value	3.2 - ENV_ROOF	Pre-Drywall
Protocol 3.3 - Floor Construction/Insulation, R-value	3.3 - ENV_FLOORS	Pre-Drywall
Protocol 3.4 - Window Selection, U-value, and SHGC	3.4 - ENV_WINDOWS	Pre-Drywall
	8.1 - INF_EXT AIR BARRIER	Pre-Drywall
Protocol 3.5 - Exterior Door Selection, Entranceway Design, Use of Vestibules, Weather-stripping, and Air Leakage	3.5 - ENV_EXTERIOR DOORS	Post-Completion
	8.1 - INF_EXT AIR BARRIER	Pre-Drywall
Protocol 4.1 – Heating and Compartmentalization	4.1 - GARAGES_CMPTZ & HEATING	Pre-Drywall
Protocol 5.1 - Central Heating Systems (Serving 5+ units/spaces)	2.1-2.2, 5.1, 5.3 - HEATING&DHW	Finishes
Protocol 5.2 - Central Cooling Systems (Serving 5+ units/spaces)	5.2, 5.4 - COOLING	Finishes
Protocol 5.3 - Distributed (Individual Apartment or Common Space) Heating Systems	2.1-2.2, 5.1, 5.3 - HEATING&DHW	Finishes
Protocol 5.4 - Distributed (Individual Apartment or Common Space) Cooling Systems	5.2, 5.4 - COOLING	Finishes
Protocol 6.1 - Common Areas, In-Unit, Garage and Exterior Lighting	6.1, 6.2, 6.3 - LIGHTING	Finishes
Protocol 6.2 – Emergency Lighting (Exit Signs)		Finishes
Protocol 6.3 – Controls		Finishes
Protocol 7.1 - Motors	7.1 - MOTORS	Finishes
Protocol 8.1 - Building Envelope Air Sealing and Compartmentalization Testing	8.1 - INF_EXT AIR BARRIER	Pre-Drywall
	8.1-INF_COMPTZN VIS INSPECTION	Pre-Drywall
	8.1 - INF_BLOWER DOOR TEST	Post-Completion
Protocol 8.2 - Common Area and In-Unit Ventilation (CFM), Fan Efficiency, Central Exhaust Duct Leakage	8.2 - VENT_SCHEDULE&TAB REPORT	Finishes
	8.2 - VENT_DUCT TIGHTNESS	Pre-Drywall
Protocol 9.1 - Metering Configuration	9.1 - METERS	Post-Completion

Energy Reduction Measures

Building Component	Baseline for Energy Model ASHRAE 90.1-2007 or 90.1-2010 (Performance Path Only)	Date Revised: By: Proposed Method of Compliance (by PM/client)	Date Revised: By: Values Used in Energy Model (Performance Path Only) Modeling Submittal Notes
APPLIANCES			
Refrigerators	*Fed Min Std Refrigerator 529 kWh*		
Dishwashers	*Fed Min Std Dishwasher EF=0.46, 206 kWh/yr, 1,290 gal/yr*		
Clothes Washers	*Enter In-Unit or Common*		
Ceiling fans	*Not modeled explicitly*		
Vending Machines	*Not modeled explicitly*		
Stove	*Enter Fuel*	Enter Fuel	
Dryer	*Enter Fuel*	Enter Fuel	
DOMESTIC HOT WATER	*DHW measures listed below must comply with ASHRAE Standard 90.1-2007 Section 7.4 in addition to the listed requirements below.*		
Domestic Hot Water-Type & Efficiency	*Select one based on Proposed Design: Central Gas Boiler: 80% Thermal Efficiency In-Unit Gas Storage: 0.62-0.0019V EF; In-Unit Electric Storage: 0.93-0.00132V EF*		
Domestic Hot Water - Storage Insulation	*Unfired Storage tank: R-12.5 In-Unit Storage: NA (included in EF)*		
Domestic Hot Water - Low Flow Fixtures	*Showerheads: 2.5 gpm Kitchen Faucets: 2.5 gpm Lavatory Faucets: 2.5 gpm Toilets: 1.6 gallons per flush*		
ENVELOPE	*The envelope measures listed below must comply with ASHRAE Standard 90.1-2007 Section 5.4 in addition to the listed requirements.*		
Below Grade Wall Insulation	*Select climate zone on 'Project Info' tab*		
Above Grade Wall Insulation	*Select climate zone on 'Project Info' tab*		
Floor Perimeter/Plank Edge Insulation	*Select climate zone on 'Project Info' tab*		
Roof Insulation	*Select climate zone on 'Project Info' tab*		
Floor Insulation Above Unconditioned Space	*Select climate zone on 'Project Info' tab*		
Below Grade Slab Floor Insulation	*Uninsulated*		
Slab-on-Grade Insulation (unheated)	*Select climate zone on 'Project Info' tab*		
Slab-on-Grade Insulation (embedded heated only)	*Select climate zone on 'Project Info' tab*		
Windows & Window to Wall Ratio	*Enter value from ASHRAE Table 5.5-1 through 5.5-8 for Vertical Glazing and Proposed frame material Window to wall Ratio not to exceed 40%*		
Exterior Doors-Opaque, Swinging	*Select climate zone on 'Project Info' tab*		
HEATING & COOLING	*The Heating and Cooling measures listed below must comply with ASHRAE Standard 90.1-2007 Section 6.4 in addition to the listed requirements below.*		
Space Heating - Type & Efficiency	*Gas Heat: One or two 80% Et or 82% Ec Natural Gas Boiler(s), check ASHRAE Table 6.8 Electric Heat: PTHP, 2.81 COP, electric resistance back-up at <40F For spaces that are heat-only: May use warm-air furnace, based on predominant building heating source*		
Pipe Freeze Protection & Ice/Snow Melt Systems	*No energy use in Baseline*		
Space Heating Distribution -Fan Power	*Gas Heat: hydronic and 0.0003 kW/CFM PTAC Electric Heat: 0.0003 kW/CFM PTHP*		

Energy Reduction Measures

Building Component	Baseline for Energy Model ASHRAE 90.1-2007 or 90.1-2010 (Performance Path Only)	Date Revised: By: Proposed Method of Compliance (by PM/client)	Date Revised: By: Values Used in Energy Model (Performance Path Only) Modeling Submittal Notes
Space Heating - Sizing	*Enter baseline capacity as calculated by energy modeling software. Per Appendix G, Section G3.1.2.2, unmet load hours shall not exceed 300 hours and 25% oversizing is allowed for sizing baseline heating systems.*		
Space Heating - Design Temperatures	*Per Appendix G, Section G3.1.3.3: Hot Water Design Supply Temperature: 180F Hot Water Design Return Temperature: 130F*		
Space Heating - Controls	*Per Appendix G, Section G3.1.3.4: Outdoor reset: 180F at 20F and below, 150F at 50F and above.*		
Thermostat Setting	*Heating: 70/72 Cooling: 78/80*	Heating: 70/72 Cooling: 78/80	
Space Cooling - Type and Efficiency	*Gas Heat: PTAC, 9.305 EER Electric Heat: PTHP, 9.105 EER*		
Space Cooling Distribution -Fan Power	*0.0003 kW/CFM*		
Space Cooling - Sizing	*Enter baseline capacity as calculated by energy modeling software. Per Appendix G, Section G3.1.2.2, unmet load hours shall not exceed 300 hours and 15% oversizing is allowed for sizing baseline cooling systems.*		
Space Cooling - Controls	*NA*		
LIGHTING			
Lighting Controls	*Occupancy Sensors per 3.6.3.3 of the Simulation Guidelinesand ASHRAE 90.1*		
Common Area Lighting	*ASHRAE 90.1-2010 Baseline LPD's Lobby: 0.9 W/Sf Corridor: 0.66 W/Sf Stairs: 0.69 W/Sf Elevator: 0.9 W/Sf Storage, Active: 0.63 W/Sf Storage, Inactive: 0.63 W/Sf Restroom: 0.98 W/Sf Office: 1.11 W/Sf Multipurpose: 1.23 W/Sf Elec/Mech: 0.95 W/Sf Garage: 0.19 W/Sf*		
Exit Signs	*5 W/face, # signs*		
Exterior Lights	*ASHRAE 90.1 Baseline Watts, with photo sensors*		
In-Unit Lighting	*1.1 W/Sf*		
MOTORS (3-PHASE , > 1 HP)			
Heating Circulating Pumps	*NEMA Standard motors, 19W/GPM (hot-water), no VFD (unless over 120,000 SF); 22W/GPM (chilled-water)*		
Cooling Circulating Pumps and Cooling Tower Fans	*NEMA Standard motors, 19W/GPM (hot-water), no VFD (unless over 120,000 SF); 22W/GPM (chilled-water)*		
DHW Circulating Pumps	*Use system parameters (head, efficiency) or Ppump=BHP*746/Pump Motor Efficiency to model pump power. Use ASHRAE Table 10.8 to determine Motor Efficiency*		
VENTILATION			

Energy Reduction Measures

Building Component	Baseline for Energy Model ASHRAE 90.1-2007 or 90.1-2010 (Performance Path Only)	Date Revised: By: Proposed Method of Compliance (by PM/client)	Date Revised: By: Values Used in Energy Model (Performance Path Only) Modeling Submittal Notes
Ventilation: System Type & Rates (Apartments and Common Areas)	*Apartment: Same as Proposed or As-Built, but not to exceed ASHRAE 62.2-2007 rates by more than 50%* *## CFM / bath, ## CFM / kitchen, ## CFM / unit* *Common Space: Same as Proposed or As-Built, but not to exceed ASHRAE 62.1-2007 rates by more than 50%*		
Ventilation: Thermal (Heat Recovery)	*No Heat Recovery Required*		
Ventilation: Thermal (Duct Sealing)	*Add 5 CFM per floor per shaft and 5 CFM per register per shaft to Exhaust CFM to represent ventilation duct leakage for central systems: ## CFM*		
Whole-House Ventilation: Electric (Apartments)	*0 kW* *Fan power associated with whole-house ventilation is already included in the HVAC Supply Fan Power*		
Local Exhaust Ventilation: Electric (Apartments)	*## kW* *Fan power exclusively for local exhaust, can be added to the Baseline, using these rates* *Ceiling Exhaust: 1.2 CFM/W* *Range hoods & Inline Exhaust: 2.3 CFM/W*		
Ventilation: Electric (Non-Apartment)	*## kW* *Use Pfan=BHP*746/Fan Motor Efficiency to determine ventilation fan power. Use ASHRAE Table 10.8 to determine Fan Motor Efficiency*		
Ventilation: Demand Control	*No demand control on any ventilation system.*		
Ventilation: Thermal & Electric (Garage Exhaust fan)	*## kW* *Use Pfan=BHP*746/Fan Motor Efficiency to determine ventilation fan power. Use ASHRAE Table 10.8 to determine Fan Motor Efficiency*		
MISC.			
Renewables	*NA*		
CHP	*NA*		

Energy Reduction Meas

Building Component	# REVIEW: 75% and 100% Design Completion Review Prepared by: Date: **Plan Review Comments**	**Location (dwg / spec)**	AS BUILT REVIEW: Prepared by: Date: **Inspection Comments**
APPLIANCES			
Refrigerators	0	0	0
Dishwashers	0	0	0
Clothes Washers	0	0	0
Ceiling fans	0	0	0
Vending Machines	0	0	0
Stove	0	0	0
Dryer	0	0	0
DOMESTIC HOT WATER			
Domestic Hot Water-Type & Efficiency	0	0	0
Domestic Hot Water - Storage Insulation	0	0	0
Domestic Hot Water - Low Flow Fixtures	0	0	0
ENVELOPE			
Below Grade Wall Insulation	0	0	0
Above Grade Wall Insulation	0	0	0
Floor Perimeter/Plank Edge Insulation	0	0	0
Roof Insulation	0	0	0
Floor Insulation Above Unconditioned Space	0	0	0
Below Grade Slab Floor Insulation	0	0	0
Slab-on-Grade Insulation (unheated)	0	0	0
Slab-on-Grade Insulation (embedded heated only)	0	0	0
Windows & Window to Wall Ratio	0	0	0
Exterior Doors-Opaque, Swinging	0	0	0
HEATING & COOLING			
Space Heating - Type & Efficiency	0	0	0
Pipe Freeze Protection & Ice/Snow Melt Systems	0	0	0
Space Heating Distribution -Fan Power	0	0	0

Energy Reduction Meas

Building Component	# REVIEW: 75% and 100% Design Completion Review Prepared by: Date: **Plan Review Comments**	**Location (dwg / spec)**	AS BUILT REVIEW: Prepared by: Date: **Inspection Comments**
Space Heating - Sizing	0	0	0
Space Heating - Design Temperatures	0	0	0
Space Heating - Controls	0	0	0
Thermostat Setting	N/A	N/A	N/A
Space Cooling - Type and Efficiency	0	0	0
Space Cooling Distribution -Fan Power	0	0	0
Space Cooling - Sizing	0	0	0
Space Cooling - Controls	0	0	0
LIGHTING			
Lighting Controls	0	0	0
Common Area Lighting	0	0	0
Exit Signs	0	0	0
Exterior Lights	0	0	0
In-Unit Lighting	0	0	0
MOTORS (3-PHASE , > 1 HP)			
Heating Circulating Pumps	0	0	0
Cooling Circulating Pumps and Cooling Tower Fans	0	0	0
DHW Circulating Pumps	0	0	0
VENTILATION			

Energy Reduction Meas

Building Component	# REVIEW: 75% and 100% Design Completion Review Prepared by: Date: **Plan Review Comments**	**Location (dwg / spec)**	AS BUILT REVIEW: Prepared by: Date: **Inspection Comments**
Ventilation: System Type & Rates (Apartments and Common Areas)	0	0	0
Ventilation: Thermal (Heat Recovery)	0	0	0
Ventilation: Thermal (Duct Sealing)	0	0	0
Whole-House Ventilation: Electric (Apartments)	0	0	0
Local Exhaust Ventilation: Electric (Apartments)	0	0	0
Ventilation: Electric (Non-Apartment)	0	0	0
Ventilation: Demand Control	0	0	0
Ventilation: Thermal & Electric (Garage Exhaust fan)	0	0	0
MISC.			
Renewables			
CHP			

Prerequisites Checklist

<Select One - Plan Review or Final Inspection>

Component	*Prerequisite Checklist* **The proposed design shall AT LEAST meet each of these requirements for each indicated measure or system, or applicable Local, State, or National codes, whichever is more stringent.**	Location in Specs/ DWGs	Verified in Plan Review	Verified by Inspector	Explanation for N/A or Non-Verified Requirements
1. Appliances					
(a) Appliances	When provided in common areas and/or apartments, refrigerators, dishwashers, clothes washers, ceiling fans and vending machines must be ENERGY STAR certified.	-	-	-	-
	Refrigerators	0	0	0	
	Dishwashers	0	0	0	
	Clothes Washers	0	0	0	
	Ceiling fans	0	0	0	
	Vending Machines	0	0	0	
2. Domestic Water Heating					
(a) General	Domestic water heating systems must comply with ASHRAE Stan	0	0	0	
(b) Water Heating Type	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	0	0	0	
	If storage is provided, the maximum storage tank capacity shall be	0	0	0	
(c) Water Heating Temperature	The temperature setting of in-unit storage water heaters must not	0	0	0	
(d) Water Heating Controls	When mixing valves are specified to control hot water temperature	0	0	0	
(e) Water Heating Pipe Insulation	Piping carrying liquid with temperatures greater than 105°F must I	0	0	0	
(f) Plumbing Fixtures	• The average flow rate for all faucets must be ≤ 2.0 gallons per m	0	0	0	
3. Envelope					
(a) General	Assembly U-value determinations must follow ASHRAE 90.1-2007 Appendix A.	-	-	-	-
	• Below Grade Walls	0	0	0	
	• Above Grade Walls	0	0	0	
	• Floor Perimeter/ Plank Edges	0	0	0	
	• Roof	0	0	0	
	• Floors Over Unconditioned Spaces	0	0	0	
	• Below Grade Slab Floors	0	0	0	
	• Slab-On-Grade Floors (unheated Only)	0	0	0	
	• Slab-On-Grade Floors (embedded heated Only)	0	0	0	
	The envelope components must comply with ASHRAE Standard 90.1-2007 Section 5.4. All roof, wall, floor and slab insulation shall achieve RESNET-defined Grade I installation or, alternatively, Grade II for surfaces that contain a layer of continuous, air impermeable insulation (≥R-3 in CZ 1-4 and ≥R-5 in CZ 5-8).	-	-	-	-

	• Below Grade Walls	0	0	0	
	• Above Grade Walls	0	0	0	
	• Floor Perimeter/ Plank Edges	0	0	0	
	• Roof	0	0	0	
	• Floors Over Unconditioned Spaces	0	0	0	
	• Below Grade Slab Floors	0	0	0	
	• Slab-On-Grade Floors (unheated Only)	0	0	0	
	• Slab-On-Grade Floors (embedded heated Only)	0	0	0	
	• Exterior Doors	0	0	0	
	For steel-framed and metal building walls, continuous exterior insu	0	0	0	
(b) Vertical Glazing	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	0	0	0	
(c) Vestibules	When required by local building code, entranceways shall be desi	0	0	0	
(d) AC Sleeves	If installing sleeves for through-wall AC units, insulated covers mu	0	0	0	
4. Garages and Sidewalks					
(a) Air Infiltration	Attached garages shall be fully compartmentalized from the rest o	0	0	0	
(b) Pipe Freeze Protection	Garages, including plenums and dropped ceilings within the garag	0	0	0	
(c) Ice Prevention	Radiant heating, either wall or ceiling-mounted or within the garag	0	0	0	
5. Heating and Cooling					
(a) General	The heating and cooling systems must comply with ASHRAE 90.1-2007 Section 6.4.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
(b) Heating System Type	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	0	0	0	

(c) Heating System Sizing	Load sizing calculations that reflect the design; installed capacity	0	0	0	
(d) Cooling System Type	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	0	0	0	
(e) Cooling System Sizing	Load sizing calculations must reflect the design; installed capacity	0	0	0	
(f) Control Valves	For hydronic distribution systems, all terminal heating and cooling distribution equipment must be separated from the riser or distribution loop by a control valve or terminal distribution pump, so that heated or cooled fluid is not delivered to the apartment distribution equipment when there is no call from the apartment thermostats.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
(g) Flexible Ducts	Heating and cooling ductwork that is specified as flex duct shall follow the Sheet Metal and Air Conditioning Contractors' (SMACNA) installation standards for flex ducts (see *Appendix A* of the *Performance Path*).	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
(h) Duct Sealing and Insulation	Heating and cooling ductwork shall be sealed at all transverse joints and connections, including ductwork connections through drywall or other finish materials, using UL-181 compliant methods and materials. Construction documents shall specify that ductwork must be inspected before access is covered up.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
	Total duct leakage for in-unit systems shall be ≤8 CFM25 per 100 ft^2 of conditioned floor area. Sampling procedures and tolerances are described in the *T&V Worksheets*. As an alternative to meeting total duct leakage requirements post-construction, total duct leakage measured at rough-in, ≤4 CFM25 per 100ft2, with air handler and all ductwork installed, is accepted.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
(i) Cooling Piping Insulation (Chilled water, brine and refrigerant piping)	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	0	0	0	

(j) Heating Piping Insulation	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	0	0	0	
(k) Outside Air Dampers	For systems designed with outdoor-air supplied to the heating, cooling, or ventilation distribution system, provide motorized dampers that will automatically shut when systems or spaces are not in use. Continuously running ventilation would not be subject to either damper, as they are always in use.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
	• Ventilation	0	0	0	
(l) Thermostats	Terminal heating and cooling distribution equipment serving an apartment shall be controlled by a thermostat(s) within the same apartment.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
(m) Hydronic Distribution Design	For hydronic distribution systems without automatic balancing valves, all supply/return headers must be designed in a “reverse return” configuration (i.e. first riser supplied is the last returned, etc.) and/or sized based on a water velocity of less than 4 ft/s. Total pressure drop of terminal unit branch piping and fittings between a supply and return riser must be significantly greater than the total pressure drop from the top to the bottom of these risers.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
	Calculations and assumptions for sizing circulating pumps must meet Chapter 43 of the ASHRAE Handbook, HVAC Systems and Equipment or equivalent industry accepted standard.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
(n) Duct Distribution Design	For in-unit forced air distribution systems, perform design calculations (using *ACCA Manuals J and D*, the ASHRAE Handbook of Fundamentals, or an equivalent procedure) and install ducts accordingly.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
	Bedroom must be pressure-balanced using any combination of transfer grills, jump ducts, dedicated return ducts, and/or undercut doors.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
6. Lighting					
(a) Occupancy Controls	All non-apartment spaces, except those intended for 24-hour oper	0	0	0	
(b) Common Area Lighting	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	0	0	0	
	Total specified lighting power for the combined non-apartment spa	0	0	0	
(c) Exit Signs	All exit signs shall be specified as LED (not to exceed 5W per fac	0	0	0	
(d) Exterior Lighting	Fixtures must include automatic switching on timers or photocell c	0	0	0	
	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	0	0	0	

(e) In-Unit Lighting	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	0	0	0	
(f) Illumination Levels	At a minimum, interior lighting must be designed to meet light leve	0	0	0	
7. Motors					
(a) Heating Pump Motor Efficiency	All three-phase pump motors 1 horse-power or larger shall meet c	0	0	0	
(b) Cooling Pump Motor Efficiency	All three-phase pump motors 1 horse-power or larger shall meet c	0	0	0	
(c) DHW Pump Motor Efficiency	All three-phase pump motors 1 horse-power or larger shall meet c	0	0	0	
8. Ventilation & Infiltration					
(a) Building Air Barrier	The building plans shall demonstrate a continuous, unbroken air b	0	0	0	
(b) Apartment Infiltration	Apartments shall be sealed to reduce air exchange between the a	0	0	0	
(c) Non-Apartment Ventilation	Common area ventilation systems shall be designed and tested to	0	0	0	
(d) In-Unit Ventilation	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	0	0	0	
	Apartment in-line and ceiling exhaust fans must be ENERGY STA	0	0	0	
(e) Duct sealing at joints and connections	Ventilation system ductwork shall be sealed at all transverse joints	0	0	0	
	Ductwork penetrating the building envelope shall be sealed to pre	0	0	0	
9. Metering					
(a) Nonresidential Associated Spaces	Post-construction, the utility consumption of the residential-associ	0	0	0	

(b) Direct-Metered Utilities	For buildings that are direct-metered for utilities to the apartments	N/A	N/A	0	
[1] Many motors are NEMA labeled and this label alone does not ensure that a motor is energy-efficient. This requirement refers specifically to the **NEMA Premium** energy efficient motors program. Participating companies may be found at: http://www.nema.org/Policy/Energy/Efficiency/Documents/NEMA_Premium_Partners.pdf					

Prescriptive Path Checklist		<Select One - Plan Review or Final Inspection>			
Component	***Prescriptive Path*** **The proposed design shall AT LEAST meet each of these requirements for each indicated measure or system, or applicable Local, State, or National codes, whichever is more stringent.**	Location in Specs/ DWGs	Verified in Plan Review	Verified by Inspector	Explanation for N/A or Non-Verified Requirements
1. Appliances					
(a) Appliances	When provided in common areas and/or apartments, refrigerators, dishwashers, clothes washers, ceiling fans and vending machines must be ENERGY STAR certified.	-	-	-	-
	Refrigerators	0	0	0	
	Dishwashers	0	0	0	
	Clothes Washers	0	0	0	
	Ceiling fans	0	0	0	
	Vending Machines	0	0	0	
2. Domestic Water Heating					
(a) General	Domestic water heating systems must comply with ASHRAE 90.1-2007 Sections 7.4 and 7.5.	0	0	0	
(b) Water Heating Type and Efficiency	Domestic water heating equipment shall be ENERGY STAR certified, where applicable, and meet minimum efficiencies below. ENERGY STAR certification must be verified through the ENERGY STAR website. Atmospherically vented gas water heaters, tankless coils and side-arm water heaters shall not be specified. Indirect water heaters, with or without storage, are acceptable. Water Heater Minimum Efficiencies • In-Unit Electric OR Gas Water Heaters (storage or instantaneous) - Gas (EF): 0.69-(0.002 x Tank Gallon Capacity) - Electric (EF): 0.97-(0.001 x Tank Gallon Capacity) • Hot Water Supply Boiler (Oil or Gas): 85% Et	0	0	0	
	If storage is provided, the maximum storage tank capacity shall be specified based on occupancy.	0	0	0	
(c) Water Heating Temperature	The temperature setting of in-unit storage water heaters must not exceed 140°F. For both in-unit and central DHW systems, temperatures measured at faucets and showerheads must not exceed 125°F.	0	0	0	
(d) Water Heating Controls	When mixing valves are specified to control hot water temperature for central domestic water heating systems serving apartments, electronic mixing valves shall be used.	0	0	0	
(e) Water Heating Pipe Insulation	Piping carrying liquid with temperatures greater than 105°F must have a minimum of 1" of insulation. Pipes 1.5" in diameter and greater must have a minimum of 1.5" of insulation. Extent and location to be determined by ASHRAE 90.1-2007 Section 7.4.3 or local code.	0	0	0	
(f) Plumbing Fixtures	• The average flow rate for all showers must be ≤ 1.75 gallons per minute per stall (as rated at 80 psi) and all showerheads must be WaterSense labeled. • If flow ratings at 80 psi are not available, WaterSense labeled faucets or aerators may be used to meet this prerequisite. • All lavatory faucets or aerators must be WaterSense labeled. • The average flow rate for all other faucets must be ≤ 2.0 gallons per minute (as rated at 80 psi). • All tank-type toilets must be WaterSense labeled.	0	0	0	
3. Envelope					
(a) General	Assembly U-value determinations must follow ASHRAE 90.1-2007, Appendix A. See Tables 2 and 3 for climate specific envelope requirements for the following components: roof insulation; above grade and below grade wall insulation; floor and slab insulation; exterior doors; and vertical glazing.	-	-	-	-
	• Below Grade Walls	0	0	0	
	• Above Grade Walls	0	0	0	
	• Floor Perimeter/ Plank Edges	0	0	0	
	• Roof	0	0	0	
	• Floors Over Unconditioned Spaces	0	0	0	
	• Below Grade Slab Floors	0	0	0	
	• Slab-On-Grade Floors (unheated Only)	0	0	0	
	• Slab-On-Grade Floors (embedded heated Only)	0	0	0	

	• Exterior Doors	0	0	0	
	The envelope components must comply with ASHRAE 90.1-2007 Sections 5.4. All roof, wall, floor and slab insulation shall achieve RESNET-defined Grade I installation or, alternatively, Grade II for surfaces that contain a layer of continuous, air impermeable insulation (≥R-3 in CZ1-4 and ≥R-5 in CZ 5-8).	-	-	-	-
	• Below Grade Walls	0	0	0	
	• Above Grade Walls	0	0	0	
	• Floor Perimeter/ Plank Edges	0	0	0	
	• Roof	0	0	0	
	• Floors Over Unconditioned Spaces	0	0	0	
	• Below Grade Slab Floors	0	0	0	
	• Slab-On-Grade Floors (unheated Only)	0	0	0	
	• Slab-On-Grade Floors (embedded heated Only)	0	0	0	
	• Exterior Doors	0	0	0	
	For steel-framed and metal building walls, continuous exterior insulation (≥R-3) is required on above grade walls. For mass or masonry walls with metal framing, continuous interior or exterior insulation (≥R-3) is required on above grade walls. Projected balconies are currently exempt, however, EPA recommends that they are thermally broken.	0	0	0	
(b) Vertical Glazing	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	0	0	0	
	Maximum allowable glazing area: 30% Window-to-Wall Ratio	0	0	0	
(c) Vestibules	When required by local building code, entranceways shall be designed with vestibules with weather-stripping hard-fastened to the door or frame.	0	0	0	
(d) AC Sleeves	If installing sleeves for through-wall AC units, insulated covers must be provided by the building for use during heating season and when AC units are not installed.	0	0	0	
4. Garages and Sidewalks					
(a) Air Infiltration	Attached garages shall be fully compartmentalized from the rest of the building through air sealing. All pipe and conduit penetrations shall be sealed with material compatible with the surface and resilient to temperature fluctuations.	0	0	0	
(b) Pipe Freeze Protection	Garages, including plenums and dropped ceilings within the garage, shall not be heated for comfort or to prevent pipes from freezing. Piping design and layout shall locate piping within conditioned spaces or grouped and properly insulated to prevent freezing. Heat tracing for freeze protection may not be used.	0	0	0	
(c) Ice Prevention	Radiant heating, either wall or ceiling-mounted or within the garage floor (or sidewalks) may be used to prevent ice formation on the ground as a safety feature only and temperature-based controls must comply with ASHRAE 90.1-2007 Section 6.4.3.8.	0	0	0	
5. Heating and Cooling					
(a) General	The heating and cooling systems must comply with ASHRAE 90.1-2007 Sections 6.4 and 6.5.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
(b) Heating System Type	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	0	0	0	
(c) Electric Resistance Heating	Electric resistance space heating not permitted in any space. In Climates Zones 1 through 6, if the prescriptive Heating Season Performance Factors are met for air-source heat pumps, electric resistance back-up heating is allowed, if programmable thermostats with adaptive recovery technology are installed.	0	0	0	

(d) Heating System Sizing and Efficiency	Load sizing calculations must reflect the design; installed capacity cannot exceed design by more than 20%, except when smaller sizes are not available. Heating loads shall be calculated, equipment capacity shall be selected, and duct systems shall be sized according to the latest editions of ACCA Manual J, S, & D, respectively, ASHRAE 2009 Handbook of Fundamentals, or a substantively equivalent procedure. Indoor temperatures shall be 70°F for heating, outdoor temperatures shall be the 99.0% design temperature, as published by the ASHRAE Handbook of Fundamentals.	0	0	0	
	Based on the climate zone, the specified heating equipment meets the Prescriptive requirements for efficiency. If ENERGY STAR certification is required, it must be verified through the ENERGY STAR website.	0	0	0	
(e) Cooling System Sizing and Efficiency	Load sizing calculations must reflect the design; installed capacity cannot exceed design by more than 20%, except when smaller sizes are not available. Cooling loads shall be calculated, equipment capacity shall be selected, and duct systems shall be sized according to the latest editions of ACCA Manual J, S, & D, respectively, ASHRAE 2009 Handbook of Fundamentals, or a substantively equivalent procedure. Indoor temperatures shall be 75°F for cooling, outdoor temperatures shall be the 1.0% design temperature, as published by the ASHRAE Handbook of Fundamentals.	0	0	0	
	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	0	0	0	
(f) Control Valves	For hydronic distribution systems, all terminal heating and cooling distribution equipment must be separated from the riser or distribution loop by a control valve or terminal distribution pump, so that heated or cooled fluid is not delivered to the apartment distribution equipment when there is no call from the apartment thermostats.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
(f) Flexible Ducts	Heating and cooling ductwork that is specified as flex duct shall follow the Sheet Metal and Air Conditioning Contractors' (SMACNA) installation standards for flex ducts (see Appendix A of the *Prescriptive Path*).	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
(h) Duct Sealing and Insulation	Heating and cooling ductwork shall be sealed at all transverse joints and connections, including ductwork connections through drywall or other finish materials, using UL-181 compliant methods and materials. Construction documents shall specify that ductwork must be inspected before access is covered up.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
	Total duct leakage for in-unit systems shall be ≤8 CFM25 per 100 ft² of conditioned floor area. Sampling procedures and tolerances are described in the *T&V Worksheets*. As an alternative to meeting total duct leakage requirements post-construction, total duct leakage measured at rough-in, ≤4 CFM25 per 100ft2, with air handler and all ductwork installed, is accepted.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	

(i) Cooling Piping Insulation (Chilled water, brine and refrigerant piping)	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	0	0	0	
(j) Heating Piping Insulation	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	0	0	0	
(k) Outside Air Dampers	For systems designed with outdoor-air supplied to the heating, cooling, or ventilation distribution system, provide motorized dampers that will automatically shut when systems or spaces are not in use. Continuously running ventilation would not be subject to either damper, as they are always in use.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
	• Ventilation	0	0	0	
(l) Thermostats	Terminal heating and cooling distribution equipment serving an apartment shall be controlled by a thermostat(s) within the same apartment.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
(m) Hydronic Distribution Design	For hydronic distribution systems without automatic balancing valves, all supply/return headers must be designed in a “reverse return” configuration (i.e. first riser supplied is the last returned, etc.) and/or sized based on a water velocity of less than 4 ft/s. Total pressure drop of terminal unit branch piping and fittings between a supply and return riser must be significantly greater than the total pressure drop from the top to the bottom of these risers.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
	Calculations and assumptions for sizing circulating pumps must meet Chapter 43 of the ASHRAE Handbook, HVAC Systems and Equipment or equivalent industry accepted standard.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
(n) Duct Distribution Design	For in-unit forced air distribution systems, perform design calculations (using *ACCA Manuals J and D*, the ASHRAE Handbook of Fundamentals, or an equivalent procedure) and install ducts accordingly.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
	Bedroom must be pressure-balanced using any combination of transfer grills, jump ducts, dedicated return ducts, and/or undercut doors.	-	-	-	-
	• Heating	0	0	0	
	• Cooling	0	0	0	
6. Lighting					
(a) Occupancy Controls	All non-apartment spaces, except those where automatic shutoff would endanger the safety of occupants, must have occupancy sensors or automatic bi-level lighting controls. Automatic controls must be specified for spaces intended for 24-hour operation such as corridors and stairwells.	0	0	0	

(b) Common Area Lighting	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	0	0	0	
	Total specified lighting power for the combined non-apartment spaces must not exceed ASHRAE 90.1-2010 allowances for those combined spaces. Lighting power densities and allowances must be determined using ASHRAE 90.1-2010, Table 9.5.1 or Table 9.6.1. Lighting controls may not be used to reduce the specified lighting power for compliance with this requirement. For senior living, an increase in lighting power densities and allowances corresponding to the increase in footcandles, is permitted. If following the Prescriptive Path, when calculating overall lighting power density, use 1.1 W/ft2 for spaces where lighting is not installed.	0	0	0	
(c) Exit Signs	All exit signs shall be specified as LED (not to exceed 5W per face) or photo-luminescent and shall conform to local building code; fixtures located above stairwell doors and other forms of egress shall contain a battery back-up feature.	0	0	0	
(d) Exterior Lighting	Fixtures must include automatic switching on timers or photocell controls except fixtures intended for 24-hour operation, required for security, or located on apartment balconies.	0	0	0	
	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	0	0	0	
	Total specified exterior lighting power cannot exceed ASHRAE 90.1-2010 allowances.	0	0	0	
(e) In-Unit Lighting	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	0	0	0	
(f) Illumination Levels	At a minimum, interior lighting must be designed to meet light levels (footcandles) by space type as recommended by the Illumination Engineering Society (IESNA) Lighting Handbook, 9th edition. Values for commonly used spaces are listed in the Prescriptive Path. For senior housing, minimum illumination requirements may follow recommendations in IESNA's 2007 Lighting and the Visual Environment for Senior Living. See Appendix B of the Prescriptive Path to determine lamp lumens.	0	0	0	
7. Motors					
(a) Heating Pump Motor Efficiency	All three-phase pump motors 1 horse-power or larger shall meet or exceed efficiency standards for NEMA Premium™ motors, where available. Motors 5 horse-power or larger for circulating pumps serving hydronic heating systems must be specified with variable frequency drives.	0	0	0	
(b) Cooling Pump Motor Efficiency	All three-phase pump motors 1 horse-power or larger shall meet or exceed efficiency standards for NEMA Premium™ motors, where available. Motors 5 horse-power or larger for circulating pumps serving hydronic cooling systems must be specified with variable frequency drives. Cooling tower fan motors must be equipped with VFD controlled by a temperature sensor on the condenser water supply pipe.	0	0	0	
(c) DHW Pump Motor Efficiency	All three-phase pump motors 1 horse-power or larger shall meet or exceed efficiency standards for NEMA Premium™ motors, where available.	0	0	0	
8. Ventilation & Infiltration					

(a) Building Air Barrier	The building plans shall demonstrate a continuous, unbroken air barrier separating the conditioned space of the building from the exterior, unconditioned spaces within the building, commercial spaces, mechanical rooms vented with unconditioned air, mechanical chases opening to unconditioned spaces, elevator shafts, and garages or other vehicle/equipment storage facilities.	0	0	0	
(b) Apartment Infiltration	Apartments shall be sealed to reduce air exchange between the apartment and outside as well as the apartment and other adjacent spaces. A maximum air leakage rate of 0.30 CFM50 per square feet of enclosure is allowed.	0	0	0	
(c) Non-Apartment Ventilation	Common area ventilation systems shall be designed and tested to satisfy minimum requirements of ASHRAE 62.1-2007, without exceeding the minimum ventilation rates by more than 50%.	0	0	0	
	Central exhaust fans 1/16 HP and less must be direct-drive and have variable speed controllers. Central exhaust fans greater than 1/16 HP and less than 1 HP must be direct-drive with ECM motors and variable speed controllers. Central exhaust fans 1 HP and larger must have NEMA Premium efficient motors.	0	0	0	
	Powered common laundry ventilation must be installed with automatic demand control to turn off ventilation fans when no dryers are operating.	0	0	0	
(d) In-Unit Ventilation	<Confirm if project is participating in NYSERDA MPP on Project Info tab>	0	0	0	
	Central exhaust and in-line exhaust systems serving apartments must have self-balancing dampers at each register.	0	0	0	
	Central exhaust fans 1/16 HP and less must be direct-drive and have variable speed controllers. Central exhaust fans greater than 1/16 HP and less than 1 HP must be direct-drive with ECM motors and variable speed controllers. Central exhaust fans 1 HP and larger must have NEMA Premium efficient motors.	0	0	0	
	Apartment in-line and ceiling exhaust fans must be ENERGY STAR certified.	0	0	0	
(e) Duct sealing at joints and connections	Ventilation system ductwork shall be sealed at all transverse joints and connections including boot to wall/ceiling connections through drywall using UL-181 compliant materials and methods. Central exhaust systems that serve one or more apartments must be tested for duct leakage, which cannot exceed the sum of 2.5 CFM50 per register per shaft plus 2.5 CFM50 per floor per shaft.	0	0	0	
	Ductwork penetrating the building envelope shall be sealed to prevent air leakage through the duct system and/or the building envelope. This includes but is not limited to roof curbs and exterior wall exhaust/intake vents.	0	0	0	
(f) Garage Ventilation Control	When garage exhaust is required by code, CO and NO_2 sensors must be installed that control exhaust fan operation.	0	0	0	
9. Metering					
(a) Nonresidential Associated Spaces	Post-construction, the utility consumption of the residential-associated spaces must be capable of evaluation independent of any commercial/retail spaces. These nonresidential associated parts of the building shall be separately metered (or sub-metered) for electricity, gas, fuel oil, water, steam, and hot water for domestic and/or space heating purposes.	0	0	0	
(b) Direct-Metered Utilities	For buildings that are direct-metered for utilities to the apartments, the building owner must secure signed releases from individual apartment occupants to allow for benchmarking or find alternative methods to assessing whole building energy consumption, such as a whole-building meter or asking the utility for aggregated data. All data uploaded to Portfolio Manager is strictly confidential and only used to estimate the energy performance of the building as a whole, not of individual apartments.	N/A	N/A	0	
[1] Many motors are NEMA labeled and this label alone does not ensure that a motor is energy-efficient. This requirement refers specifically to the **NEMA Premium** energy efficient motors program. Participating companies may be found at: http://www.nema.org/Policy/Energy/Efficiency/Documents/NEMA_Premium_Partners.pdf					

Table 1 *ENERGY STAR MFHR Prescriptive Path* – Minimum Heating and Cooling Equipment Efficiencies

Equipment Type	Minimum Efficiency per ASHRAE 90.1 2007 Climate Zones
	<select climate zone on 'Project Info' tab>
Room AC (window, through-wall, ductless mini-splits)	#N/A
Air conditioner (<13 KBtu/h)	#N/A
Air conditioner (≥13 and <65 KBtu/h)	#N/A
Air conditioner ((≥65 and <240 KBtu/h)	#N/A
Air conditioner (≥240 and < 760 KBtu/h)	#N/A
Electric resistance space heating	#N/A
Warm-Air Furnace (<225 KBtu/h, common areas)	#N/A
Warm-Air Furnace (≥225 KBtu/h)	#N/A
Packaged Terminal Air Conditioner (PTAC)	#N/A
Packaged Terminal Heat Pump (PTHP)	#N/A
Air cooled heat pump (≥13 and <65 KBtu/h)	#N/A
Air cooled heat pump (≥65 and <240 KBtu/h)	#N/A
Air cooled heat pump (≥240 KBtu/h)	#N/A
Water-source heat pump (<135 KBtu/h)	#N/A
Boilers, hot water (<300,000 Btu/h)	#N/A
Boilers, hot water (≥300,000 Btu/h)	#N/A
VRF Air Conditioners and Heat Pumps	#N/A
Air-cooled chillers with or without condenser	#N/A
Water-cooled chiller, positive displacement (<75 tons)	#N/A
Water-cooled chiller, positive displacement (75-150 tons)	#N/A
Water-cooled chiller, positive displacement (150-300tons)	#N/A
Water-cooled chiller, positive displacement (>300 tons)	#N/A
Water-cooled, centrifugal (<300 tons)	#N/A
Water-cooled, centrifugal (≥300 and <600 tons)	#N/A
Water-cooled, centrifugal (≥600 tons)	#N/A
Air-cooled absorption single effect chiller	#N/A
Water-cooled absorption single effect chiller	#N/A
Absorption double effect indirect-fired chiller	#N/A
Absorption double effect direct-fired chiller	#N/A
Open-loop propeller or axial fan cooling towers[2]	#N/A
Closed-loop propeller or axial fan cooling towers[2]	#N/A
Open-loop centrifugal fan cooling towers[2]	#N/A
Closed-loop centrifugal fan cooling towers[2]	#N/A

1. In Climates Zones 1 through 6, if the prescriptive Heating Season Performance Factors are met for air-source heat pumps, electric resistance bac
2. In Climate Zone 7 and 8, dual-fuel backup is not required for ENERGY STAR certified heat pumps that have no backup heating because the hea
3. Cooling tower fan motors must be equipped with VFD controlled by a temperature sensor on the condenser water supply pipe.

Tables 2 & 3 Climate Specific Envelope Requirements for Climate Zones 1-8

Envelope Component	Nominal R Value (Minimum)	Assembly U-Value (maximum)
	<select climate zone on 'Project Info' tab>	<select climate zone on 'Project Info' tab>
Roof Insulation		
Insulation entirely above deck	#N/A	#N/A
Metal Building	#N/A	#N/A
Attic and Other	#N/A	#N/A
Above Grade Wall Insulation		
Mass	#N/A	#N/A
Metal Building	#N/A	#N/A
Steel-Framed	#N/A	#N/A
Wood-framed and other	#N/A	#N/A
Below Grade Wall Insulation		
Conditioned and Indirectly Conditioned space	#N/A	#N/A
Unconditioned space	#N/A	#N/A
Floor Insulation		
Mass	#N/A	#N/A
Steel-Joist	#N/A	#N/A
Wood-framed and other	#N/A	#N/A
Slab Insulation		
Unheated (non-radiant) and on-grade	#N/A	#N/A
Heated (radiant)	#N/A	#N/A
Exterior Doors		
Opaque - All	#N/A	#N/A
Vertical Glazing		
Nonmetal framing	#N/A	#N/A
	Assembly Max U.	Assembly Max. SHGC
Metal framing (curtain wall/ storefront)	#N/A	#N/A
Metal framing (entrance door)	#N/A	#N/A
Metal framing (all other)	#N/A	#N/A

Minimum Efficiency per ASHRAE 90.1 2007 Climate Zones				
Climate Zone 1	**Climate Zone 2**	**Climate Zone 3**	**Climate Zone 4**	**Climate Zone 5**
ENERGY STAR certified	ENERGY STAR certified	ENERGY STAR certified	ENERGY STAR certified	ENERGY STAR certified
13 SEER	13 SEER	13 SEER	13 SEER	13 SEER
16 SEER	16 SEER	ENERGY STAR certified	ENERGY STAR certified	ENERGY STAR certified
11.5 EER/12.0 IEER	11.5 EER/12.0 IEER	11.5 EER/12.0 IEER	11.5 EER/12.0 IEER	11.5 EER/12.0 IEER
10.0 EER/10.5 IEER	10.0 EER/10.5 IEER	10.0 EER/10.5 IEER	10.0 EER/10.5 IEER	10.0 EER/10.5 IEER
Not permitted in any space using the Prescriptive Path	Not permitted in any space using this approach	Not permitted in any space using this approach	Not permitted in any space using this approach	Not permitted in any space using this approach
78% AFUE or 80% Et	78% AFUE or 80% Et	78% AFUE or 80% Et	78% AFUE or 80% Et	78% AFUE or 80% Et
80% Et (gas) or 81% Et (oil)	80% Et (gas) or 81% Et (oil)	80% Et (gas) or 81% Et (oil)	80% Et (gas) or 81% Et (oil)	80% Et (gas) or 81% Et (oil)
13.8 – (0.300 X Cap/1000) EER	13.8 – (0.300 X Cap/1000) EER	13.8 – (0.300 X Cap/1000) EER	13.8 – (0.300 X Cap/1000) EER	13.8 – (0.300 X Cap/1000) EER
Cooling: 14.0– (0.3 X Cap/1000) EER Heating: 3.7– (0.052 X Cap/1000) COP	Cooling: 14.0– (0.3 X Cap/1000) EER Heating: 3.7– (0.052 X Cap/1000) COP	Cooling: 14.0– (0.3 X Cap/1000) EER Heating: 3.7– (0.052 X Cap/1000) COP	Cooling: 14.0– (0.3 X Cap/1000) EER Heating: 3.7– (0.052 X Cap/1000) COP	Cooling: 14.0– (0.3 X Cap/1000) EER Heating: 3.7– (0.052 X Cap/1000) COP
15.0 SEER/ 12.5 EER/ 8.2 HSPF	15.0 SEER/ 12.5 EER/ 8.2 HSPF	ENERGY STAR certified 8.2HSPF	ENERGY STAR certified 8.5HSPF	ENERGY STAR certified 9.25HSPF
Cooling: 11.1 EER/11.6 IEER Heating: 3.3 COP (@47°F DB)	Cooling: 11.1 EER/11.6 IEER Heating: 3.3 COP (@47°F DB)	Cooling: 11.1 EER/11.6 IEER Heating: 3.3 COP (@47°F DB)	Cooling: 11.1 EER/11.6 IEER Heating: 3.3 COP (@47°F DB)	Cooling: 11.1 EER/11.6 IEER Heating: 3.3 COP (@47°F DB)
Cooling: 9.6 EER/9.6 IEER Heating: 3.2 COP (@47°F DB)	Cooling: 9.6 EER/9.6 IEER Heating: 3.2 COP (@47°F DB)	Cooling: 9.6 EER/9.6 IEER Heating: 3.2 COP (@47°F DB)	Cooling: 9.6 EER/9.6 IEER Heating: 3.2 COP (@47°F DB)	Cooling: 9.6 EER/9.6 IEER Heating: 3.2 COP (@47°F DB)
Cooling: 14.0 EER(86°F entering water) Heating: 4.2 COP(68°F entering water)	Cooling: 14.0 EER(86°F entering water) Heating: 4.2 COP(68°F entering water)	Cooling: 14.0 EER(86°F entering water) Heating: 4.2 COP(68°F entering water)	Cooling: 14.0 EER(86°F entering water) Heating: 4.2 COP(68°F entering water)	Cooling: 14.0 EER(86°F entering water) Heating: 4.2 COP(68°F entering water)
85% AFUE	85% AFUE	85% AFUE	85% AFUE	85% AFUE
87% Et (86% Et with additional requirements; 89% Et if using heat pumps)	87% Et (86% Et with additional requirements; 89% Et if using heat pumps)	87% Et (86% Et with additional requirements; 89% Et if using heat pumps)	87% Et (86% Et with additional requirements; 89% Et if using heat pumps)	87% Et (86% Et with additional requirements; 89% Et if using heat pumps)
See Tables 6.8.1I and 6.8.1J of ASHRAE 90.1-2010	See Tables 6.8.1I and 6.8.1J of ASHRAE 90.1-2010	See Tables 6.8.1I and 6.8.1J of ASHRAE 90.1-2010	See Tables 6.8.1I and 6.8.1J of ASHRAE 90.1-2010	See Tables 6.8.1I and 6.8.1J of ASHRAE 90.1-2010
10.0 EER / 12.5 IPLV	10.0 EER / 12.5 IPLV	10.0 EER / 12.5 IPLV	10.0 EER / 12.5 IPLV	10.0 EER / 12.5 IPLV
0.780 kW/ton (Full load) / 0.630 kW/ton (IPLV)	0.780 kW/ton (Full load) / 0.630 kW/ton (IPLV)	0.780 kW/ton (Full load) / 0.630 kW/ton (IPLV)	0.780 kW/ton (Full load) / 0.630 kW/ton (IPLV)	0.780 kW/ton (Full load) / 0.630 kW/ton (IPLV)
0.775 kW/ton (Full load) / 0.615 kW/ton (IPLV)	0.775 kW/ton (Full load) / 0.615 kW/ton (IPLV)	0.775 kW/ton (Full load) / 0.615 kW/ton (IPLV)	0.775 kW/ton (Full load) / 0.615 kW/ton (IPLV)	0.775 kW/ton (Full load) / 0.615 kW/ton (IPLV)
0.680 kW/ton (Full load) / 0.580 kW/ton (IPLV)	0.680 kW/ton (Full load) / 0.580 kW/ton (IPLV)	0.680 kW/ton (Full load) / 0.580 kW/ton (IPLV)	0.680 kW/ton (Full load) / 0.580 kW/ton (IPLV)	0.680 kW/ton (Full load) / 0.580 kW/ton (IPLV)
0.620 kW/ton (Full load) / 0.540 kW/ton (IPLV)	0.620 kW/ton (Full load) / 0.540 kW/ton (IPLV)	0.620 kW/ton (Full load) / 0.540 kW/ton (IPLV)	0.620 kW/ton (Full load) / 0.540 kW/ton (IPLV)	0.620 kW/ton (Full load) / 0.540 kW/ton (IPLV)
0.634 kW/ton (Full load) / 0.596 kW/ton (IPLV)	0.634 kW/ton (Full load) / 0.596 kW/ton (IPLV)	0.634 kW/ton (Full load) / 0.596 kW/ton (IPLV)	0.634 kW/ton (Full load) / 0.596 kW/ton (IPLV)	0.634 kW/ton (Full load) / 0.596 kW/ton (IPLV)
0.576 kW/ton (Full load) / 0.549 kW/ton (IPLV)	0.576 kW/ton (Full load) / 0.549 kW/ton (IPLV)	0.576 kW/ton (Full load) / 0.549 kW/ton (IPLV)	0.576 kW/ton (Full load) / 0.549 kW/ton (IPLV)	0.576 kW/ton (Full load) / 0.549 kW/ton (IPLV)
0.570 kW/ton (Full load) / 0.539 kW/ton (IPLV)	0.570 kW/ton (Full load) / 0.539 kW/ton (IPLV)	0.570 kW/ton (Full load) / 0.539 kW/ton (IPLV)	0.570 kW/ton (Full load) / 0.539 kW/ton (IPLV)	0.570 kW/ton (Full load) / 0.539 kW/ton (IPLV)
0.6 COP	0.6 COP	0.6 COP	0.6 COP	0.6 COP
0.70 COP	0.70 COP	0.70 COP	0.70 COP	0.70 COP
1.00 COP / 1.05 IPLV	1.00 COP / 1.05 IPLV	1.00 COP / 1.05 IPLV	1.00 COP / 1.05 IPLV	1.00 COP / 1.05 IPLV
1.00 COP / 1.00 IPLV	1.00 COP / 1.00 IPLV	1.00 COP / 1.00 IPLV	1.00 COP / 1.00 IPLV	1.00 COP / 1.00 IPLV
>40 gpm/hp (@95°F entering water, 85°F leaving water, 75°F web entering air)	>40 gpm/hp (@95°F entering water, 85°F leaving water, 75°F web entering air)	>40 gpm/hp (@95°F entering water, 85°F leaving water, 75°F web entering air)	>40 gpm/hp (@95°F entering water, 85°F leaving water, 75°F web entering air)	>40 gpm/hp (@95°F entering water, 85°F leaving water, 75°F web entering air)
>15 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)	>15 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)	>15 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)	>15 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)	>15 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)
>22 gpm/hp (@95°F entering water, 85°F leaving water, 75°F wb entering air)	>22 gpm/hp (@95°F entering water, 85°F leaving water, 75°F wb entering air)	>22 gpm/hp (@95°F entering water, 85°F leaving water, 75°F wb entering air)	>22 gpm/hp (@95°F entering water, 85°F leaving water, 75°F wb entering air)	>22 gpm/hp (@95°F entering water, 85°F leaving water, 75°F wb entering air)
>8 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)	>8 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)	>8 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)	>8 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)	>8 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)

:k-up heating is allowed, if programmable thermostats with adaptive recovery technology are installed.

t pump is capable of meeting 100% of the design heating load.

Nominal R Value (Minimum)				
Climate Zone 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 5
R-25.0 continuous	R-25.0 continuous	R-25.0 continuous	R-25.0 continuous	R-25.0 continuous
R-19.0 + R-11.0 Ls	R-19.0 + R-11.0 Ls	R-19.0 + R-11.0 Ls	R-19.0 + R-11.0 Ls	R-19.0 + R-11.0 Ls
R-49.0	R-49.0	R-49.0	R-49.0	R-49.0
R-7.6 continuous	R-9.5 continuous	R-11.4 continuous	R-13.3 continuous	R-15.2 continuous
R-13.0 + R-6.5 ci	R-13.0 + R-13.0 ci	R-13.0 + R-13.0 ci	R-13.0 + R-13.0 ci	R-13.0 + R-13.0 ci
R-13.0 + R-5.0 c.i.	R-13.0 + R-10.0 ci	R-13.0 + R-10.0 ci	R-13.0 + R-10.0 c.i.	R-13.0 + R-10.0 c.i.
R-13.0 + R-3.8 ci	R-13.0 + R-3.8 ci	R-13.0 + R-3.8 ci	R-13.0 + R-7.5 ci	R-13.0 + R-10.0 c.i.
NR	NR	NR	R-10.0 continuous	R-10.0 continuous
NR	NR	NR	NR	NR
R-4.2 ci	R-8.3 ci	R-8.3 ci	R-12.5 ci	R-14.6 ci
R-19.0	R-30.0	R-30.0	R-38.0	R-38.0
R-19.0	R-30.0 + R-7.5 ci	R-30.0 + R-7.5 ci	R-30.0 + R-7.5 ci	R-30.0 + R-7.5 ci
NR	NR	NR	R-15.0 for 24 in. vertical or horizontal	R-15.0 for 24 in. vertical or horizontal
R-7.5 for 12 in. + R-5 ci below	R-7.5 for 12 in. + R-5 ci below	R-7.5 for 12 in. + R-5 ci below	R-10.0 for 24 in. + R-5 ci below	R-15.0 for 36 in. + R-5 ci below
-	-	-	-	-
ENERGY STAR	ENERGY STAR	ENERGY STAR	ENERGY STAR	ENERGY STAR
U-1.20	U-0.70	U-0.50	U-0.40	U-0.35
U-1.20	U-1.10	U-0.80	U-0.75	U-0.70
U-1.20	U-0.75	U-0.55	U-0.45	U-0.45

Climate Zone 6	Climate Zone 7	Climate Zone 8
ENERGY STAR certified	ENERGY STAR certified	ENERGY STAR certified
13 SEER	13 SEER	13 SEER
13 SEER	13 SEER	13 SEER
11.5 EER/12.0 IEER	11.5 EER/12.0 IEER	11.5 EER/12.0 IEER
10.0 EER/10.5 IEER	10.0 EER/10.5 IEER	10.0 EER/10.5 IEER
Not permitted in any space using this approach	Not permitted in any space using this approach	Not permitted in any space using this approach
78% AFUE or 80% Et	78% AFUE or 80% Et	78% AFUE or 80% Et
80% Et (gas) or 81% Et (oil)	80% Et (gas) or 81% Et (oil)	80% Et (gas) or 81% Et (oil)
13.8 – (0.300 X Cap/1000) EER	13.8 – (0.300 X Cap/1000) EER	13.8 – (0.300 X Cap/1000) EER
Cooling: 14.0– (0.3 X Cap/1000) EER Heating: 3.7– (0.052 X Cap/1000) COP	Cooling: 14.0– (0.3 X Cap/1000) EER Heating: 3.7– (0.052 X Cap/1000) COP	Cooling: 14.0– (0.3 X Cap/1000) EER Heating: 3.7– (0.052 X Cap/1000) COP
ENERGY STAR certified 9.5HSPF	Duel fuel back-up	Duel fuel back-up
Cooling: 11.1 EER/11.6 IEER Heating: 3.3 COP (@47°F DB)	Cooling: 11.1 EER/11.6 IEER Heating: 3.3 COP (@47°F DB)	Cooling: 11.1 EER/11.6 IEER Heating: 3.3 COP (@47°F DB)
Cooling: 9.6 EER/9.6 IEER Heating: 3.2 COP (@47°F DB)	Cooling: 9.6 EER/9.6 IEER Heating: 3.2 COP (@47°F DB)	Cooling: 9.6 EER/9.6 IEER Heating: 3.2 COP (@47°F DB)
Cooling: 14.0 EER(86°F entering water) Heating: 4.2 COP(68°F entering water)	Cooling: 14.0 EER(86°F entering water) Heating: 4.2 COP(68°F entering water)	Cooling: 14.0 EER(86°F entering water) Heating: 4.2 COP(68°F entering water)
90% AFUE	90% AFUE	90% AFUE
87% Et (86% Et with additional requirements; 89% Et if using heat pumps)	87% Et (86% Et with additional requirements; 89% Et if using heat pumps)	87% Et (86% Et with additional requirements; 89% Et if using heat pumps)
See Tables 6.8.1I and 6.8.1J of ASHRAE 90.1-2010	See Tables 6.8.1I and 6.8.1J of ASHRAE 90.1-2010	See Tables 6.8.1I and 6.8.1J of ASHRAE 90.1-2010
10.0 EER / 12.5 IPLV	10.0 EER / 12.5 IPLV	10.0 EER / 12.5 IPLV
0.780 kW/ton (Full load) / 0.630 kW/ton (IPLV)	0.780 kW/ton (Full load) / 0.630 kW/ton (IPLV)	0.780 kW/ton (Full load) / 0.630 kW/ton (IPLV)
0.775 kW/ton (Full load) / 0.615 kW/ton (IPLV)	0.775 kW/ton (Full load) / 0.615 kW/ton (IPLV)	0.775 kW/ton (Full load) / 0.615 kW/ton (IPLV)
0.680 kW/ton (Full load) / 0.580 kW/ton (IPLV)	0.680 kW/ton (Full load) / 0.580 kW/ton (IPLV)	0.680 kW/ton (Full load) / 0.580 kW/ton (IPLV)
0.620 kW/ton (Full load) / 0.540 kW/ton (IPLV)	0.620 kW/ton (Full load) / 0.540 kW/ton (IPLV)	0.620 kW/ton (Full load) / 0.540 kW/ton (IPLV)
0.634 kW/ton (Full load) / 0.596 kW/ton (IPLV)	0.634 kW/ton (Full load) / 0.596 kW/ton (IPLV)	0.634 kW/ton (Full load) / 0.596 kW/ton (IPLV)
0.576 kW/ton (Full load) / 0.549 kW/ton (IPLV)	0.576 kW/ton (Full load) / 0.549 kW/ton (IPLV)	0.576 kW/ton (Full load) / 0.549 kW/ton (IPLV)
0.570 kW/ton (Full load) / 0.539 kW/ton (IPLV)	0.570 kW/ton (Full load) / 0.539 kW/ton (IPLV)	0.570 kW/ton (Full load) / 0.539 kW/ton (IPLV)
0.6 COP	0.6 COP	0.6 COP
0.70 COP	0.70 COP	0.70 COP
1.00 COP / 1.05 IPLV	1.00 COP / 1.05 IPLV	1.00 COP / 1.05 IPLV
1.00 COP / 1.00 IPLV	1.00 COP / 1.00 IPLV	1.00 COP / 1.00 IPLV
>40 gpm/hp (@95°F entering water, 85°F leaving water, 75°F web entering air)	>40 gpm/hp (@95°F entering water, 85°F leaving water, 75°F wb entering air)	>40 gpm/hp (@95°F entering water, 85°F leaving water, 75°F wb entering air)
>15 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)	>15 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)	>15 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)
>22 gpm/hp (@95°F entering water, 85°F leaving water, 75°F wb entering air)	>22 gpm/hp (@95°F entering water, 85°F leaving water, 75°F wb entering air)	>22 gpm/hp (@95°F entering water, 85°F leaving water, 75°F wb entering air)
>8 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)	>8 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)	>8 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)

Climate Zone 6	Climate Zone 7	Climate Zone 8	Climate Zone 1
R-30.0 continuous	R-35.0 continuous	R-35.0 continuous	U-0.039
R-25.0 + R-11.0 Ls	R-30.0 + R-11.0 Ls	R-30.0 + R-11.0 Ls	U-0.035
R-49.0	R-60.0	R-60.0	U-0.021
R-20.0 continuous	R-20.0 continuous	R-31.3 continuous	U-0.123
R-13.0 + R-13.0 ci	R-13.0 + R-19.5 ci	R-13.0 + R-26.0 ci	U-0.079
R-13.0 + R-10.0 c.i.	R-13.0 + R-18.8 ci	R-13.0 + R-21.9 ci	U-0.077
R-13.0 + R-10.0 c.i.	R-13.0 + R-21.9 ci.	R-13.0 + R-18.8 ci	U-0.064
R-10.0 continuous	R-12.5 continuous	R-15.0 continuous	NR
NR	NR	NR	NR
R-16.7 ci	R-20.0 ci	R-20.0 ci	U-0.137
R-38.0 + R-12.5 ci	R-38.0 + R-12.5 ci	R-38.0 + R-12.5 ci	U-0.052
R-30.0 + R-7.5 ci	R-30.0 + R-7.5 ci	R-30.0 + R-7.5 ci	U-0.051
R-20.0 for 24 in. vertical or horizontal	R-15.0 for 24 in. + R-5 ci below	R-15.0 for 24 in. + R-5 ci below	NR
R-15.0 for 36 in. + R-5 ci below	R-20.0 for 36 in. + R-5 ci below	R-20.0 for 36 in. + R-5 ci below	R-7.5 for 12 in. + R-5 ci below
-	-	-	U-0.6
ENERGY STAR	ENERGY STAR	ENERGY STAR	ENERGY STAR
U-0.35	U-0.30	U-0.30	SHGC-0.25
U-0.70	U-0.70	U-0.70	SHGC-0.25
U-0.45	U-0.35	U-0.35	SHGC-0.25

Assembly U-Value (maximum)				
Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 5	Climate Zone 6
U-0.039	U-0.039	U-0.039	U-0.039	U-0.032
U-0.035	U-0.035	U-0.035	U-0.035	U-0.031
U-0.021	U-0.021	U-0.021	U-0.021	U-0.021
U-0.104	U-0.090	U-0.080	U-0.071	U-0.060
U-0.052	U-0.052	U-0.052	U-0.052	U-0.052
U-0.055	U-0.055	U-0.055	U-0.055	U-0.055
U-0.064	U-0.064	U-0.051	U-0.045	U-0.045
NR	NR	U-0.092	U-0.092	U-0.092
NR	NR	NR	NR	NR
U-0.087	U-0.087	U-0.064	U-0.057	U-0.051
U-0.038	U-0.038	U-0.032	U-0.032	U-0.023
U-0.026	U-0.026	U-0.026	U-0.026	U-0.026
NR	NR	R-15.0 for 24 in. vertical or horizontal	R-15.0 for 24 in. vertical or horizontal	R-20.0 for 24 in. vertical or horizontal
R-7.5 for 12 in. + R-5 ci below	R-7.5 for 12 in. + R-5 ci below	R-10.0 for 24 in. + R-5 ci below	R-15.0 for 36 in. + R-5 ci below	R-15.0 for 36 in. + R-5 ci below
U-0.6	U-0.6	U-0.6	U-0.4	U-0.4
ENERGY STAR	ENERGY STAR	ENERGY STAR	ENERGY STAR	ENERGY STAR
SHGC-0.25	SHGC-0.25	SHGC-0.40	SHGC-0.40	SHGC-0.40
SHGC-0.25	SHGC-0.25	SHGC-0.40	SHGC-0.40	SHGC-0.40
SHGC-0.25	SHGC-0.25	SHGC-0.40	SHGC-0.40	SHGC-0.40

Climate Zone 7	Climate Zone 8
U-0.028	U-0.028
U-0.029	U-0.029
U-0.017	U-0.017
U-0.060	U-0.043
U-0.039	U-0.031
U-0.037	U-0.033
U-0.045	U-0.032
U-0.075	U-0.063
NR	NR
U-0.043	U-0.043
U-0.023	U-0.023
U-0.026	U-0.026
R-15.0 for 24 in. + R-5 ci below	R-15.0 for 24 in. + R-5 ci below
R-20.0 for 36 in. + R-5 ci below	R-20.0 for 36 in. + R-5 ci below
U-0.4	U-0.4
ENERGY STAR	ENERGY STAR
SHGC-NR	SHGC-NR
SHGC-NR	SHGC-NR
SHGC-NR	SHGC-NR

ENERGY STAR

Project Name: 0
Address: 0
City, State, Zip: 0
Climate Zone 0

0

Item #	BUILDING COMPONENT	# REVIEW: 75% and 100% Design Completion Review Prepared by: Date: Plan Review Comments	Dwg/ Spec	Final Design Complies
1.0	**APPLIANCES - ENERGY STAR**			
1.1.1	**Refrigerators**	0	0	0
1.1.2	**Dishwashers**	0	0	0
1.1.3	**Clothes Washers**	0	0	0
1.1.4	**Ceiling fans**	0	0	0
1.1.6	**Vending Machines**	0	0	0
1.1.7	**Stoves**	0	0	0
1.1.8	**Dryers**	0	0	0
1.1.9	**Statement of Substantial Completion**	NA	NA	NA
2.0	**DOMESTIC HOT WATER**			
2.1.1	**Compliance Statement**	0	0	0
	MODELING INPUTS			
2.2.1	**DHW - Type & Efficiency**	0	0	0
2.2.2	**DHW - Storage Insulation**	0	0	0
2.2.3	**DHW - Low Flow Fixtures**	0	0	0
	DHW CONFIGURATION, CONTROLS, DISTRIBUTION & DOCUMENTATION			
2.3.1	**DHW Central Plant - Boiler room location and venting**	0	0	0
2.3.2	**DHW - Insulation for Piping**	0	0	0
2.3.3	**DHW - Temperature**	0	0	0
2.3.4	**DHW - Controls**	0	0	0
2.3.5	**DHW - Training and Manuals**	NA	NA	NA
2.3.6	**DHW - Manufacturer's Product Data**	NA	NA	NA
3.0	**ENVELOPE**			
	BELOW GRADE WALLS			
3.1.1	**Below Grade Walls - Notes for Drawings and Specifications**	0	0	0
3.1.2	**Overall U-Value for Below Grade Walls**	0	0	0
3.1.3	**Below Grade Walls - Compliance Statement**	0	0	0
3.1.4	**Below Grade Walls - Insulation Installation Requirements**	0	0	0
3.1.5	**Below Grade Walls - Wood-Framed Construction**	0	0	0
3.1.6	**Below Grade Walls - Final Inspection**	NA	NA	NA
	ABOVE GRADE WALLS			
3.2.1	**Above Grade Walls - Notes for Drawings and Specifications**	0	0	0
3.2.2	**Overall U-Value for Above Grade Walls**	0	0	0
3.2.3	**Overall U-Value for Floor Perimeter/Plan Edge**	0	0	0
3.2.4	**Above Grade Walls - Compliance Statement**	0	0	0
3.2.5	**Above Grade Walls - Insulation Installation Requirements**	0	0	0

3.2.6	**Floor Perimeter/Plank Edge - Insulation Installation Requirements**	0	0	0
3.2.7	**Above Grade Walls - Continuous Insulation Requirements**	0	0	0
3.2.8	**Above Grade Walls - Wood-Framed Construction**	0	0	0
3.2.9	**Above Grade Walls - Final Inspection**	NA	NA	NA
	ROOF			
3.3.1	**Roof - Notes for Drawings and Specifications**	0	0	0
3.3.2	**Overall U-Value for Roofs**	0	0	0
3.3.3	**Roof - Compliance Statement**	0	0	0
3.3.4	**Roof - Insulation Installation Requirements**	0	0	0
3.3.5	**Wood-Framed Construction**	0	0	0
3.3.6	**Final Inspection**	NA	NA	NA
	FLOORS			
3.4.1	**Floor - Notes for Drawings and Specifications**	0	0	0
3.4.2	**Overall U-Value for Floors Over Conditioned Spaces**	0	0	0
3.4.3	**Overall U-Value for Below Grade Slab Floors**	0	0	0
3.4.4	**Overall U-Value for Slab-On-Grade (unheated only) Floors**	0	0	0
3.4.5	**Overall U-Value for Slab-On-Grade (embedded only) Floors**	0	0	0
3.4.6	**Floors - Compliance Statement**	0	0	0
3.4.7	**Floor Insulation Above Unconditioned Space - Insulation Installation Requirements**	0	0	0
3.4.8	**Below Grade Slab Floor- Insulation Installation Requirements**	0	0	0
3.4.9	**Slab-on-Grade (unheated) - Insulation Installation Requirements**	0	0	0
3.4.10	**Slab-on-Grade (embedded heated only) - Insulation Installation Requirements**	0	0	0
3.4.11	**Wood-Framed Construction**	0	0	0
3.4.12	**Final Inspection**	NA	NA	NA
	WINDOWS			
3.5.1	**Windows - Notes for Drawings and Specifications**	0	0	0
3.5.2	**Windows - Compliance Statement**	0	0	0
3.5.3	**Window-to-Wall Ratio**	0	0	0
3.5.4	**Rough Openings**	NA	NA	NA
3.5.5	**Window/Wall Mock Up**	NA	NA	NA
3.5.6	**On-Going Site Inspections**	NA	NA	NA
3.5.7	**Air Tightness**	NA	NA	NA
3.5.8	**Windows - Manufacturer's Product Data**	NA	NA	NA
3.5.9	**Statement of Substantial Completion**	NA	NA	NA
	DOORS			
3.6.1	**Doors - Notes for Drawings and Specifications**	0	0	0
3.6.2	**Exterior Doors - Compliance Statement**	0	0	0
3.6.3	**Vestibules and Entryways**	0	0	0
3.6.4	**Operation and Fit**	NA	NA	NA

3.6.5	**Weather-Stripping**	NA	NA	NA
3.6.6	**Smoke Testing**	NA	NA	NA
3.6.7	**Statement of Substantial Completion**	NA	NA	NA
4.0	**GARAGES**			
4.1.1	**Garage Heating and Compartmentalization - Notes for Drawings and Specifications**	0	0	0
4.1.2	**Garage Heating**	0	0	0
4.1.2	**Garage Freeze Protection**	0	0	0
4.1.3	**Garage Compartmentalization**	0	0	0
4.1.4	**Wood-Framed Construction**	NA	NA	NA
4.1.5	**Doors Between Garage and Building**	NA	NA	NA
5.0	**HEATING**			
5.1.1	**Compliance Statement**	0	0	0
	MODELING INPUTS			
5.1.2	**Space Heating - Sizing**	0	0	0
5.1.3	**Space Heating - Type & Efficiency**	0	0	0
5.1.4	**Heating Terminal Units - Electric Resistance or Freeze Protection**	0	0	0
5.1.5	**Space Heating Distribution - Fan Power**	0	0	0
5.1.6	**Space Heating - Design Temperatures**	0	0	0
5.1.7	**Space Heating - Controls**	0	0	0
	BOILER CONFIGURATION AND HYDRONIC DISTRIBUTION			
5.2.1	**Space Heating Central Plant - Boiler room location and venting**	0	0	0
5.2.2	**Space Heating - Insulation for Piping**	0	0	0
5.2.3	**Heating Distribution - Piping Configuration**	0	0	0
5.2.4	**Heating Distribution - Pump Sizing**	0	0	0
5.2.5	**Heating Distribution - Pressure Control Set-points**	0	0	0
5.2.6	**Heating Terminal Units - Thermostatic Controls**	0	0	0
	ALL FORCED AIR HEATING SYSTEMS (Including Heat Pumps where applicable)			
5.3.1	**Heating Distribution - Outdoor Air Damper**	0	0	0
5.3.2	**Heating Distribution - Flex Duct Installation**	0	0	0
5.3.3	**Heating Distribution - Duct Insulation**	0	0	0
5.3.4	**Heating Distribution - Duct Sealing Details**	0	0	0
5.3.5	**Heating System - Combustion Venting**	NA	NA	NA
5.3.6	**Heating System - Refrigerant Charge, Airflow and Nameplate Data**	NA	NA	NA
	IN-UNIT FORCED AIR HEATING SYSTEMS			
5.4.1	**Heating Distribution - In-Unit Duct Sizing**	0	0	0
5.4.2	**Heating Distribution - In-Unit Pressure Balancing**	0	0	0
5.4.3	**Heating Distribution - In-Unit Duct Leakage Testing**	0	0	0

5.4.4	**Heating Distribution - HVAC Contractor Checklist**	0	0	0
	HEATING SYSTEMS MISC			
5.5.1	**Heating Distribution - Thermostat**	0	0	0
5.5.2	**Space Heating - Training and Manuals**	NA	NA	NA
5.5.3	**Space Heating - Manufacturer's Product Data**	NA	NA	NA
5.6	**COOLING**			
5.6.1	**Compliance Statement**	0	0	0
	MODELING INPUTS			
5.6.2	**Space Cooling - Sizing**	0	0	0
5.6.3	**Space Cooling - Type and Efficiency**	0	0	0
5.6.4	**Space Cooling Distribution - Supply Fan Power**	0	0	0
5.6.5	**Space Cooling - Controls**	0	0	0
	CHILLED WATER AND CONDENSER WATER SYSTEMS			
5.7.1	**Cooling Distribution - Piping Configuration**	0	0	0
5.7.2	**Cooling Distribution - Pump Sizing**	0	0	0
5.7.3	**Cooling Distribution - Pressure Control Set-points**	0	0	0
5.7.4	**Cooling Distribution - Pipe Insulation**	0	0	0
5.7.5	**Cooling Terminal Units - Thermostatic Controls**	0	0	0
5.7.6	**Cooling System - Airflow and Nameplate Data**	NA	NA	NA
	ALL FORCED AIR COOLING SYSTEMS (Including heat pumps, split system ACs, PTACs and room ACs where applicable)			
5.8.1	**Cooling Distribution System - In-Unit Duct Sizing**	0	0	0
5.8.2	**Cooling Distribution System - In-Unit Pressure Balancing**	0	0	0
5.8.3	**Cooling Distribution - Duct Insulation**	0	0	0
5.8.4	**Cooling System - Outdoor Air Damper**	0	0	0
5.8.5	**Cooling Distribution - Duct Sealing Details**	0	0	0
5.8.6	**Cooling Distribution - Flex Duct Installation**	0	0	0
5.8.7	**Cooling Distribution - In-Unit Duct Leakage Testing**	0	0	0
5.8.8	**Cooling System - HVAC Contractor Checklist**	0	0	0
5.8.9	**Cooling System - Refrigerant Charge, Airflow and Nameplate Data**	NA	NA	NA
COOLING SYSTEMS MISC				
5.9.1	**Cooling - A/C Sleeves**	0	0	0
5.9.2	**Cooling Distribution - Thermostat**	0	0	0
5.9.3	**Cooling - Training and Manuals**	NA	NA	NA
5.9.4	**Cooling - Manufacturer's Product Data**	NA	NA	NA
6.0	**LIGHTING**			
6.1.1	**Compliance Statement**	0	0	0

6.1.2	**Lighting Power Density**	0	0	0
6.1.3	**Lighting Controls - Verification**	0	0	0
6.1.4	**Common Area Lighting - ENERGY STAR**	0	0	0
6.1.5	**Common Area Lighting - LPD**	0	0	0
6.1.6	**Emergency Lighting - Exit Signs**	0	0	0
6.1.7	**Exterior Lighting - Controls**	0	0	0
6.1.8	**Exterior Lighting - ENERGY STAR**	0	0	0
6.1.9	**Exterior Lighting - LPD *(Prescriptive Path)***	0	0	0
6.1.10	**In-Unit Lighting**	0	0	0
	INSPECTION ONLY			
6.2.1	**Lighting - Ballasts**	NA	NA	NA
6.2.2	**Lighting - Statement of Substantial Completion - Non 24/7 Spaces**	NA	NA	NA
7.0	**MOTORS**			
7.1.1	**Motors - Notes for Drawings and Specifications**	0	0	0
7.1.3	**Heating Distribution - Motors**	0	0	0
7.1.4	**Cooling Distribution - Motors**	0	0	0
7.1.5	**DHW Distribution - Motors**	0	0	0
7.1.6	**Motors- Manufacturer's Product Data**	NA	NA	NA
7.1.7	**Heating and DHW - Training and Manuals**	NA	NA	NA
7.1.8	**Statement of Substantial Completion**	NA	NA	NA
8.0	**INFILTRATION**			
	EXTERIOR AIR BARRIERS			
8.1.1	**General Exterior Enclosure - Notes for Drawings and Specifications**	0	0	0
8.1.2	**Exterior Enclosure Air Barriers - Notes for Drawings and Specifications**	0	0	0
8.1.3	**Exterior Air Barrier - Compliance Statement**	0	0	0
8.1.4	**Wood-Framed Construction**	0	0	0
8.1.5	**Masonry Wall Preparation**	0	0	0
8.1.6	**Gypsum Sheathing Wall Preparation**	0	0	0
8.1.7	**General Coverage - Liquid Membrane**	0	0	0
8.1.8	**General Coverage at Adjacent Building Conditions - Liquid Membrane**	0	0	0
8.1.9	**General Coverage / Transition Membrane - Seams**	0	0	0
8.1.10	**Air Barrier Penetrations**	0	0	0
8.1.11	**Rough Openings (Concrete Masonry Construction) - Windows and Doors**	0	0	0
8.1.12	**Rough Openings (Steel Stud Construction) - Windows and Doors**	0	0	0
8.1.13	**Rough Openings - Pipes, Conduits, Ducts, Etc**	0	0	0
8.1.14	**Rough Openings - Cast Stone Sills**	0	0	0
8.1.15	**Rough Openings - Gap at Window Frame**	0	0	0
8.1.16	**Rough Openings - Gap at Door Frame**	0	0	0
8.1.17	**Doors - Weatherstripping**	0	0	0
8.1.18	**Rough Openings - A/C Sleeves**	0	0	0

8.1.19	**Plank Edges (Steel Stud Construction) - At plank / exterior sheathing joint**	0	0	0
8.1.20	**Plank Edges (Concrete Masonry Construction) - At plank / CMU joint**	0	0	0
8.1.21	**Plank Edges - At plank / steel girder joint**	0	0	0
8.1.22	**Steel Columns - Steel / CMU joints**	0	0	0
8.1.23	**Wall to Roof Connections**	0	0	0
8.1.24	**Transition between foundations and walls**	0	0	0
8.1.25	**Transition between one wall type and another**	0	0	0
8.1.26	**Transition at inside and outside corners**	0	0	0
8.1.27	**Transition between exterior enclosure and interior walls, floors and ceilings that bound non-conditioned spaces**	0	0	0
8.1.28	**Other**	0	0	0
	COMPARTMENTALIZATION - VISUAL INSPECTION			
8.2.1	**Compartmentalization - Notes for Drawings and Specifications**	0	0	0
8.2.2	**Compartmentalization Visual Inspection - General**	0	0	0
8.2.3	**Sample Unit - Visual Inspection**	NA	NA	NA
8.2.4	**Inspect framing layout**	NA	NA	NA
8.2.5	**Gypsum board to concrete floor plank connection**	NA	NA	NA
8.2.6	**Gypsum board to concrete ceiling plank connection**	NA	NA	NA
8.2.7	**Window to interior gypsum board**	NA	NA	NA
8.2.8	**A/C Sleeve Cover (if A/Cs provided by building)**	NA	NA	NA
8.2.9	**Air conditioner sleeve sealed to drywall**	NA	NA	NA
8.2.10	**Outlet/Electrical Box - Exterior and Demising Walls**	NA	NA	NA
8.2.11	**Heating pipe penetrations through exterior walls**	NA	NA	NA
8.2.12	**Heating pipe penetrations through interior partitions**	NA	NA	NA
8.2.13	**Plumbing / Sprinkler Pipe Penetrations**	NA	NA	NA
8.2.14	**Range Gas Line Penetration**	NA	NA	NA
8.2.15	**Gap between take off duct and gypsum board**	NA	NA	NA
8.2.16	**Electrical Panel**	NA	NA	NA
8.2.17	**HVAC Access Doors**	NA	NA	NA
8.2.18	**Thermostats**	NA	NA	NA
8.2.19	**Intercoms**	NA	NA	NA
8.2.20	**Lighting Fixtures**	NA	NA	NA
8.2.21	**Door Latch Hole**	NA	NA	NA
8.2.22	**Medicine Cabinet**	NA	NA	NA
8.2.23	**Other**	NA	NA	NA
	BLOWER DOOR TESTING			
8.3.1	**Blower Door Test - Notes for Drawings and Specifications**	0	0	0
8.3.2	**Blower Door Test - Compliance Statement**	0	0	0

8.3.3	**Preliminary Testing (Recommended)**	NA	NA	NA
8.3.4	**Final Verification Testing**	NA	NA	NA
8.3.5	**Fan Pressure Testing Method**	NA	NA	NA
8.5	**VENTILATION**			
8.5.1	**Ventilation - Notes for Drawings and Specifications**	0	0	0
8.5.2	**Ventilation *Prescriptive Path* - Notes for Drawings and Specifications**	0	0	0
8.5.3	**Garage Ventilation - Notes for Drawings and Specifications**	0	0	0
	COMPLIANCE STATEMENT			
8.6.1	**Compliance Statement**	0	0	0
	MODELING INPUTS - SIZING AND BALANCING			
8.6.2	**Non - Apartment Fan Efficiency**	0	0	0
8.6.3	**Apartment Fan Efficiency (Roof)**	0	0	0
8.6.4	**Apartment Fan Efficiency (In-Unit)**	0	0	0
8.6.5	**All Ventilation Systems - Capacity, Testing and Balancing**	0	0	0
8.6.6	**Demand Controls**	0	0	0
8.6.7	**Heat Recovery**	0	0	0
	GARAGE VENTILATION			
8.7.1	**Garage Exhaust Fan CFM and Efficiency**	0	0	0
8.7.2	**Test Sensor Operation**	0	0	0
8.7.3	**CO Sensor Locations**	0	0	0
8.7.4	**Garage Fan and CO Sensor - Manufacturer's Product Data**	0	0	0
	VENTILATION MISC			
8.8.1	**Toilet, Kitchen, General Exhaust Grilles and Corridor Supply Ventilation Grilles**	0	0	0
8.8.2	**Common Area Supply Ventilation - Outdoor Air Damper**	0	0	0
8.8.3	**Fresh Air Intake Systems - Operating Sequence**	0	0	0
8.8.4	**Fresh Air Intakes are Properly Located**	0	0	0
8.8.5	**Smoke Vents**	0	0	0
8.8.6	**Passive Intake Systems (Trickle Vents)**	NA	NA	NA
8.8.7	**Ventilation - Manufacturer's Product Data**	NA	NA	NA
8.8.8	**Ventilation - Training and Manuals**	NA	NA	NA
	DUCT TIGHTNESS			
8.9.1	**Duct Tightness - Notes for Drawings and Specifications**	0	0	0
8.9.2	**Duct Tightness - Compliance Statement**	0	0	0
8.9.3	**Duct Tightness - Roof Curbs**	0	0	0
8.9.4	**Duct Leakage Testing - Central Exhaust Systems Serving Apartments**	NA	NA	NA
8.9.5	**Roof Curb (Central)**	NA	NA	NA
8.9.6	**Transverse Joints (Central and Through Wall)**	NA	NA	NA
8.9.7	**Transitions (Central and Through Wall)**	NA	NA	NA
8.9.8	**Pinned Ducts (Central and Through Wall)**	NA	NA	NA
8.9.9	**Elbow Joints (Round Duct Work)**	NA	NA	NA

8.9.10	**Exterior Wall Connection (Through Wall)**	NA	NA	NA
9.0	**METERS**			
9.1.1	**Location - Residential**	0	0	0
9.1.2	**Location - Non Residential**	0	0	0
9.1.3	**Type**	NA	NA	NA
9.1.4	**Configuration**	NA	NA	NA
9.1.5	**Utility Release Forms**	NA	NA	NA
9.1.6	**Statement of Substantial Completion**	NA	NA	NA

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APPLIANCES - PROTOCOL 1.1

Date:	Field Verified By:

Schedule:

1) The developer or GC shall ensure that deliveries are inspected prior to accepting them to verify that product substitutions by the distributor or manufacturer have not resulted in non-ENERGY STAR certified appliances.
2) Minimum of one on-site inspection required, preferably immediately after installation so that corrective action can be taken if necessary. Delivery tickets may be used to verify complete shipments but on-site inspections of a sample of installed appliances is required.

Equipment Needed

1) Camera
2) Installation Schedule
3) Floor Plans

Sampling Requirements:

1) For spaces containing appliances, follow the modified RESNET sampling protocol outlined in the *How to Use this Manual* section of the *Testing and Verification Protocols.*
2) For buildings with common laundry rooms, RESNET sampling protocols are modified to require inspection of all the clothes washers in at least one (1) laundry room.
3) ***PHOTOS REQUIRED***
   - Photograph one (1) representative appliance faceplate of each type of appliance being inspected.
   - Photograph ENERGY STAR label or nameplate displaying model number and/or attach cut sheet.

NOTES FOR DRAWINGS AND SPECIFICATIONS

- Include a schedule with location and quantity.
- Require ENERGY STAR certified products and appliances (confirm online).

	PATH REQUIREMENT		PROPOSED ERM	ENERGY MODEL	MFR	MODEL #	QUANTITY	LOCATION	ENERGY STAR (Yes/No)	PLAN REVIEW COMMENTS	LOCATION (dwg/spec)	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Compliance Statement • ENERGY STAR certification must be confirmed on the ENERGY STAR website. • All refrigerators, dishwashers and clothes washers are consistent with the project specifications and Proposed Design model or meets or exceeds the requirements listed in the *Prescriptive Path.* Note: Kitchen range hoods are not required to be ENERGY STAR certified.	<Select compliance path on the 'Project Info' tab>	Refrigerators	0	0										
		Dishwashers	0	0										
		Clothes Washers	0	0										
		Ceiling fans	0	0										
		Vending Machines	0	0										

PROTOCOL	PROPOSED ERM	ENERGY MODEL	PLAN REVIEW COMMENTS	LOCATION (dwg/spec)	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Stoves • Electric or Gas	Enter Fuel	0					
Dryers • Electric or Gas	Enter Fuel	0					

Statement of Substantial Completion

• A Statement of Substantial Completion or approved proxy may be used to establish completion of the work associated with this protocol. A Statement of Substantial Completion is to be completed by the installation contractor or other qualified representative on company letterhead, complete with all information, photographs, cut sheets, etc., required in this protocol and in the corresponding *T&V Worksheet.*

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HVAC - DHW SYSTEMS - PROTOCOL 2.1, 2.2

Date:	Field Verified By:

Schedule:

1) The quality assurance and verification procedures occur during the pre-construction, construction, and post-construction phases of system installation. Refer to the appropriate standards (eg. NFPA) to determine exact timing of inspections.

2) Commissioning of the system occurs during pre-construction and construction phases of installation. Inspection, testing, and final commissioning are conducted during the turn over/accpetance phase of the installation of the system.

3) Training shall occur following installation of the system and completion of all quality assurance and verification procedures.

4) The developer or GC shall ensure that deliveries are inspected prior to accepting them to verify that product substitutions by the distributor or manufacturer have not resulted in plumbing fixtures with higher flow rates than those in the Proposed Design or required by the *Prescriptive Path*.

5) Minimum of one (1) on-site inspection required, preferably immediately after installation so that corrective action can be taken if necessary. Delivery tickets may be used to verify complete shipments but on-site inspections of a sample of installed plumbing fixtures is required.

Equipment Needed

1) Mechanical Schedule and Floor Plans
2) Camera

Sampling Requirements:

1) 100% of centralized primary equipment (i.e. DHW plants) shall be inspected in the quality assurance and verification process.

2) Individual spaces or apartments containing electric or fossil-fuel DHW systems shall be inspected and tested following the modified RESNET sampling protocol outlined in the *How to Use this Manual* section on page 11 of the *T&V Protocols*, including at least one of each unique type.

3) Spaces containing plumbing fixtures must be inspected following the modified RESNET sampling protocol outlined in the *How to Use this Manual* section on page 11 of the *T&V Protocols*, including at least one of each unique fixture.

4) All spaces with Domestic Hot Water service (i.e. bathrooms, kitchens, etc.) shall be tested for hot water delivery temperature following the modified RESNET sampling protocol outlined in the How to Use this Manual section on page 11 of the *T&V Protocols*, with the additional requirement that, for each central DHW system, the spaces sampled must include the first space supplied by the system and the last space supplied by the longest run of the system.

5) ***PHOTOS REQUIRED***

-Provide photos of the domestic hot water system and faceplates to verify proper installation and compliance with proposed design.
-Photograph one (1) representative fixture of each type of plumbing fixture being inspected.

ID -DHW System and Low-Flow Fixtures	DESCRIPTION	LOCATION	QUANTITY	MFR	MODEL #	CAPACITY (BTU/H, gallons or kW)	AHRI CERT #	EFFICIENCY (% Et or EF)	GPM/ GPF	ENERGY STAR/ Water Sense	LOCATION (dwg/spec)	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)

PROTOCOL	PATH REQUIREMENT	PROPOSED ERM	ENERGY MODEL	PLAN REVIEW COMMENTS	LOCATION (dwg/spec)	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Compliance Statement • All DHW systems are consistent with the project specifications and Proposed Design model or meets or exceeds the requirements listed in the *Prescriptive Path.*	<Select compliance path on the 'Project Info' tab>	See below	See below					
MODELING INPUTS								
DHW - Type & Efficiency • Provide Proposed DHW system type, efficiency, capacity, fuel; include number, efficiency and HP of pumps, and whether VFD is specified in the MOTOR section. • DHW equipment efficiency must be verified through AHRI ratings. If not available, OEM-provided performance data must be used, in compliance with ASHRAE 90.1-2007, Section 6.4.1.4.	<Select compliance path on the 'Project Info' tab>	0	0					
DHW - Storage Capacity • Storage tank capacity must be reviewed and verified that it was sized based on occupancy.	<Select compliance path on the 'Project Info' tab>	0	0					
DHW - Low Flow fixtures • Plumbing fixture flow rates for all showerheads, bath faucets and kitchen faucets match assumptions made in the Proposed Design model or the inputs have been adjusted accordingly. As an alternative to the *Performance Path*, projects must ensure that all of the requirements listed in the *Prescriptive Path* have been met or exceeded. • A schedule showing plumbing fixtures with GPM, location, WaterSense certification, and quantity has been included in the construction documents.	<Select compliance path on the 'Project Info' tab>	0	0					
DHW CONFIGURATION, CONTROLS, DISTRIBUTION & DOCUMENTATION								
DHW Central Plant - Boiler room location and venting • Verify location of domestic hot water systems (e.g., cellar or roof), combustion air venting configuration (e.g., combustion air piped to boilers, boiler room air used for combustion), and venting configuration (e.g., inducer fan specified and sequence of operation verified, if required).								
DHW - Insulation for Piping• Piping carrying liquid with temperatures greater than 105°F must have a minimum of 1" of insula								
DHW - Temperature• The temperature setting of in-unit storage water heaters must not exceed 140F. For both in-unit and ce								
DHW - Controls• If specified, verify electronic mixing valve is used to control hot water temperature for central domestic wat								
DHW - Training and Manuals • EPA recommends confirming that all applicable operating and specification manuals are delivered to the building staff. EPA also recommends verifying that staff members have been trained and are aware of their responsibilities to maintain and operate the systems properly. Summarize any training performed and personnel involved.								
DHW - Manufacturer's Product Data • Review manufacturer's cut sheets or invoice detailing system manufacturer, model, size, and location, and keep with the building file. DHW equipment efficiency must be verified through AHRI ratings. If not available, OEM-provided performance data must be used, in compliance with ASHRAE 90.1-2007, Section 6.4.1.4. If following the *Prescriptive Path* and ENERGY STAR certification is required, it must be verified through the ENERGY STAR website.								

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ENVELOPE - BELOW GRADE WALLS - PROTOCOL 3.1

Date:	Field Verified By:

Schedule:

1) Inspections must take place during construction: before pouring slab, before back-filling foundation walls, at framing (pre-insulation), post-insulation and pre-drywall, and post-completion.

2) Inspections of interior and cavity insulation must take place during construction: at framing pre-insulation, post-insulation and pre-drywall, and post-completion.

3) Inspections of exterior insulation, air, vapor, and weather barrier systems must be completed prior to enclosure.

Equipment Needed

1) Camera
2) Measuring Tape or ruler

3) Relevant Wall Sections and Details
4) Cellar Plan

Sampling Requirements:

1) Each unique assembly shall be inspected. (For example: If unique sections of the building are constructed differently, all distinct areas must be inspected independently; Also, if insulation specifications are different for living areas vs. common areas or other special use areas, each different specification shall be inspected independently.)

2) Sampling may be used to inspect wall assemblies that are consistent throughout large sections of the building. Inspections done from the exterior shall sample at least 15% of each wall area. For inspections done from interior spaces, follow the modified RESNET sampling protocol outlined in the How to Use this Manual section on page 11 of the T&V Protocols, for each unique wall type. In addition, the sample set must include, at a minimum, all unique assemblies. If problems are found in the sample set, additional inspections must be conducted to determine the full extent of the problems and to ensure that repairs are completed in all areas of the building where they are needed.

3) Documentation of post-repair conditions is required for correction of problems that represent large surface areas (greater than 50 square feet) and/or systemic problems (e.g. all corner units are insulated improperly). On-site inspection to verify corrections is preferable, but if this is not possible/practical due to construction schedules, photographic documentation of repairs submitted to the responsible party by the GC are an acceptable alternative.

4) *PHOTOS REQUIRED*

- Photo clearly identifying type of insulation to be installed and thickness using measuring tape or ruler (can do each individual piece of insulation or entire assembly)
- Photo showing continuous insulation around sample corner and other challenging details
- Photo of pre-insulation showing application of water/vapor/air barrier
- Photo of post-installation

NOTES FOR DRAWINGS AND SPECIFICATIONS	PLAN REVIEW COMMENTS	LOCATION (dwg/spec)	PLAN REVIEW
• Interior and cavity insulation must be protected from air intrusion, moisture intrusion, and free of voids, gaps, and compression. • Cavity insulation must be in contact with the interior wall surface (i.e. drywall) and completely fill the interior wall cavity. • Batt insulation must be installed properly using splices to surround wires, electrical outlet/switch/junction boxes, pipes, and other obstructions within the insulated cavity. • Insulation that is intended to be continuous (interior or exterior) must be installed without breaks and at full thickness at all locations. • Insulation must be installed such that they achieve RESNET-defined Grade I installation or, alternatively, Grade II for walls with continuous insulation. • Vapor impermeable air barriers for general coverage should only be specified on the warm side of insulation (i.e. interior side of insulation in predominately heating dominated climates). Vapor permeable air barriers should be specified in other cases. • An area weighted average of the U-factors of the wall and floor perimeter assemblies is acceptable in the energy model. When calculating the wall U-factor, the full R-value for any exterior wall insulation can only be used for portions of the assembly where shelf angles or other continuous metal fastened to the wall are not used. For portions of this assembly where shelf angles or other continuous metal fastened to the wall are used, the exterior insulation cannot contribute to the assembly R-value and an overall U-value shall be calculated based on an area weighted ratio.			

WALL TYPE: This section can be duplicated, copy and insert rows		DESCRIPTION Include: Stud-framing spacing (ex. 16" oc) Stud material (ex. wood or steel) Stud depth/configuration (ex. 2x4)	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
BG WALL ASSEMBLY 1	Layer 1					
Name:	Layer 2					
Location:	Layer 3					
% of BG wall area:	Layer 4					
Appendix A table referenced:	Layer 5					
BG ASSEMBLY 1 U-VALUE	Overall U-value					
BG WALL ASSEMBLY 2	Layer 1					
Name:	Layer 2					
Location:	Layer 3					
% of BG wall area:	Layer 4					
Appendix A table referenced:	Layer 5					
BG ASSEMBLY 2 U-VALUE	Overall U-value					

PATH REQUIREMENT	PROPOSED ERM	ENERGY MODEL	Overall Below Grade Wall U-Value	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	
<Select compliance path on the 'Project Info' tab>	0	0					

PROTOCOL	PATH REQUIREMENT	PLAN REVIEW COMMENTS	LOCATION (dwg/spec)	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Compliance Statement • All assemblies are compliant with the proposed design model or requirements of the *Prescriptive Path*, including framing factor assumptions. The effective R-value of the installed insulation shall be used in the Proposed Design model (from exterior finish to interior finish).						
Below Grade Walls - Insulation Installation Requireme	<Select compliance path on the 'Project Info' tab>					
Wood-Framed Construction (RECOMMENDED, NOT A PREREQUISITE) • For wood-framed construction, Version 3.0 of the *ENERGY STAR Certified Homes Thermal Enclosure System Rater Checklist Sections 3 and 5* is recommended to be followed in addition to all applicable *T&V Protocols.*						
Final Inspection • Verify proper enclosure of insulated cavities through visual inspection.						

*Estimated R-values for insulation that is improperly installed must be derated using the standards and procedures described in the *Mortgage Industry's National Home Energy Rating Systems, Section 303.4.1.4.2 and Appendix A, "On-Site Inspection Procedures for Minimum Rated Features".*

ENERGY STAR

MULTIFAMILY HIGH RISE PROGRAM

Project Name: 0

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ENVELOPE - ABOVE GRADE WALLS - PROTOCOL 3.1

Date:	Field Verified By:

Schedule:

A minimum of three (3) and as many as five (5) separate site visits are required for most multifamily high-rise buildings.

1) Inspections of interior and cavity insulation must take place during construction: at framing pre-insulation, post-insulation and pre-drywall, and post-completion.

2) Inspections of exterior insulation, air, vapor, and weather barrier systems must be completed prior to enclosure.

Equipment Needed

1) Camera
2) Measuring Tape or ruler
3) Relevant Wall Sections and Details
4) Floor Plans

Sampling Requirements:

1) Each unique wall assembly shall be inspected. (For example: if the basement walls are constructed differently from the upper floors, both areas must be inspected independently; also, if insulation specifications are different for living areas vs. common areas or other special use areas, each different specification shall be inspected independently.)

2) Sampling may be used to inspect wall assemblies that are consistent throughout large sections of the building. Inspections done from the exterior shall sample at least 15% of each wall area. For inspections done from interior spaces, follow the modified RESNET sampling protocol outlined in the How to Use this Manual section on page 11 of the *T&V Protocols*, for each unique wall type. In addition, the sample set must include, at a minimum, all unique assemblies. If problems are found in the sample set, additional inspections must be conducted to determine the full extent of the problems and to ensure that repairs are completed in all areas of the building where they are needed.

3) Documentation of post-repair conditions is required for correction of problems that represent large surface areas (greater than 50 square feet) and/or systemic problems (e.g. all corner units are insulated improperly). On-site inspection to verify corrections is preferable, but if this is not possible/practical due to construction schedules, photographic documentation of repairs submitted to the responsible party by the GC are an acceptable alternative.

4) *PHOTOS REQUIRED*

- Photo clearly identifying type of insulation to be installed and thickness using measuring tape or ruler (can do each individual piece of insulation or entire assembly)
- Photo showing continuous insulation around sample corner and other challenging details
- Photo of pre-insulation showing application of water/vapor/air barrier
- Photo of pre-installation to verify framing construction
- Photo of post insulation indicating proper installation
- Photo of completion showing proper drywall installation
- Photo of Plank/Slab Edge and Rim Joist Insulation between ceiling/floor levels before cladding is installed

NOTES FOR DRAWINGS AND SPECIFICATIONS	PLAN REVIEW COMMENTS	LOCATION (dwg/spec)	PLAN REVIEW
• Interior and cavity insulation must be protected from air intrusion, moisture intrusion, and free of voids, gaps, and compression. • Cavity insulation must be in contact with the interior wall surface (i.e. drywall) and completely fill the interior wall cavity. • Batt insulation must be installed properly using splices to surround wires, electrical outlet/switch/junction boxes, pipes, and other obstructions within the insulated cavity. • For steel-framed and metal buildings, continuous exterior insulation is required on above grade walls. For masonry buildings with metal framing, continuous interior or exterior insulation is required on above grade walls. • Insulation that is intended to be continuous (interior or exterior) must be installed without breaks and at full thickness at all locations. • Air barrier must be continuous around the entire building. Air barrier must be detailed at all penetrations and transitions including structural components, connections between dissimilar materials, and window rough openings. Flashing materials and sealants must be used at window openings, through-wall duct penetrations, the transition between the wall and roof barrier, and the transition between the wall and foundation barrier. • Insulation must be installed such that they achieve RESNET-defined Grade I installation or, alternatively, Grade II for walls with continuous insulation. • Vapor impermeable air barriers for general coverage should only be specified on the warm side of insulation (i.e. interior side of insulation in predominately heating dominated climates). Vapor permeable air barriers should be specified in other cases. • An area weighted average of the U-factors of the wall and floor perimeter assemblies is acceptable in the energy model. When calculating the wall U-factor, the full R-value for any exterior wall insulation can only be used for portions of the assembly where shelf angles or other continuous metal fastened to the wall are not used. For portions of this assembly where shelf angles or other continuous metal fastened to the wall are used, the exterior insulation cannot contribute to the assembly R-value and an overall U-value shall be calculated based on an area weighted ratio.			

WALL TYPE This section can be duplicated, copy and insert rows			DESCRIPTION Include: Stud-framing spacing (ex. 16" or 24" oc) Stud material (ex. wood or steel framed) Stud depth/configuration (ex. 2x4)	LOCATION (dwg/spec)	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
WALL ASSEMBLY 1		Layer 1					
Name:		Layer 2					
Location:		Layer 3					
% of total wall area:		Layer 4					
Appendix A table referenced:		Layer 5					
		Layer 6					
		Overall U-value					
WALL ASSEMBLY 2		Layer 1					
Name:		Layer 2					
Location:		Layer 3					
% of total wall area:		Layer 4					
Appendix A table referenced:		Layer 5					
		Layer 6					
		Overall U-value					
FLOOR EDGE ASSEMBLY 1		Layer 1					
Name:		Layer 2					
Location:		Layer 3					
% of total wall area:		Layer 4					
Appendix A table referenced:							
		Overall U-value					
FLOOR EDGE ASSEMBLY 2		Layer 1					
Name:		Layer 2					
Location:		Layer 3					
% of total wall area:		Layer 4					
Appendix A table referenced:							
		Overall U-value					

FLOOR TO CEILING U-VALUE	PATH REQUIREMENT	PROPOSED ERM	ENERGY MODEL	Floor to Ceiling Wall Assembly U-Value	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	
See Notes above for U-value calculation instructions. Non-vision glazing areas of window wall systems are to be treated as opaque walls per ASHRAE and when determining minimum Prescriptive Path U-values.	<Select compliance path on the 'Project Info' tab>	0	0					

FLOOR EDGE U-VALUE	PATH REQUIREMENT	PROPOSED ERM	ENERGY MODEL	Floor Edge Assembly U-Value	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	
See Notes above for U-value calculation instructions.	<Select compliance path on the 'Project Info' tab>	0	0					

PROTOCOL	PATH REQUIREMENT	PLAN REVIEW COMMENTS	LOCATION (dwg/spec)	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Compliance Statement • All assemblies are compliant with the proposed design model or requirements of the *Prescriptive Path*, including framing factor assumptions. The effective R-value of the installed insulation shall be used in the Proposed Design model (from exterior finish to interior finish).						
Above Grade Walls - Insulation Installation Requi	<Select compliance path on the 'Project Info' tab>					
Floor Perimeter/Plank Edge - Insulation Installati						
Continuous Insulation Requirements	• For steel-framed and metal buildings, continuous exteri					
Wood-Framed Construction (RECOMMENDED, NOT A PREREQUISITE) • For wood-framed construction, Version 3.0 of the *ENERGY STAR Certified Homes Thermal Enclosure System Rater Checklist Sections 3 and 5* is recommended to be followed in addition to all applicable *T&V Protocols.*						
Final Inspection • Verify proper enclosure of insulated cavities through visual inspection.						

*Estimated R-values for insulation that is improperly installed must be derated using the standards and procedures described in the *Mortgage Industry's National Home Energy Rating Systems, Section 303.4.1.4.2 and Appendix A, "On-Site Inspection Procedures for Minimum Rated Features"*.

ENERGY STAR

MULTIFAMILY HIGH RISE PROGRAM

Project Name: 0

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ENVELOPE - ROOF - PROTOCOL 3.2

Date:	Field Verified By:

Schedule:

1) Inspections must take place during construction: pre-insulation, post-insulation and pre-drywall or prior to roof finish, and post-completion.

Equipment Needed

1) Camera
2) Measuring Tape or ruler
3) Relevant Wall and Roof Sections and Details
4) Roof Plan

Sampling Requirements:

1) Each unique roof assembly shall be inspected. (For example: If there are exposed roofs on lower levels, that are constructed differently from the upper floors, both areas must be inspected independently; Also, if insulation specifications are different for living areas vs. common areas or other special use areas, each different specification shall be inspected independently.)

2) Sampling may be used to inspect roof assemblies that are consistent throughout large sections of the building. Inspections done from the exterior shall sample at least 15% of each roof area. For inspections done from interior spaces, follow the modified RESNET sampling protocol outlined in the *How to Use this Manual* section on page 11 of the *T&V Protocols*, for each unique roof type. In addition, the sample set must include, at a minimum, all unique assemblies. If problems are found in the sample set, additional inspections must be conducted to determine the full extent of the problems and to ensure that repairs are completed in all areas of the building where they are needed.

3) To verify the predicted overall R-value, 100% of locations where roof insulation achieves the minimum thickness are to be inspected. Insulation thickness at roof perimeters shall be inspected at one (1) location per 70 feet of roof perimeter. This shall include, at a minimum, two (2) instances where the roof insulation achieves its maximum thickness. Each location inspected cannot be within 70 feet of each other along the roof perimeter.

4) Documentation of post-repair conditions is required for correction of problems that represent large surface areas (greater than 50 square feet) and/or systemic problems (e.g. all corner units are insulated improperly). On-site inspection to verify corrections is preferable, but if this is not possible/practical due to construction schedules, photographic documentation of repairs submitted to the responsible party by the GC are an acceptable alternative.

5) *PHOTOS REQUIRED*

- Photo clearly identifying type of insulation to be installed and thickness using measuring tape or ruler (can do each individual piece of insulation or entire assembly)
- Photo showing continuous insulation around sample corner and other challenging details
- Post insulation photo (pre-drywall for cavity insulation, prior to roof finish for exterior rigid insulation) showing complete and even distribution of insulation
- Photo of proper enclosure of insulated cavities (if applicable)

NOTES FOR DRAWINGS AND SPECIFICATIONS	PLAN REVIEW COMMENTS	LOCATION (dwg/spec)	PLAN REVIEW
• Interior and cavity insulation must be protected from air and moisture intrusion, and free of voids, gaps, and compression. • Cavity insulation must be in contact with the interior wall surface (i.e. drywall) and completely fill the interior wall cavity. • Batt insulation must be installed properly using splices to surround wires, electrical outlet/switch/junction boxes, pipes, and other obstructions within the insulated cavity. • Insulation that is intended to be continuous (interior or exterior) must be installed without breaks and at full thickness at all locations. • Insulation must be installed such that they achieve RESNET-defined Grade I installation or, alternatively, Grade II for roofs with continuous insulation. • Vapor impermeable air barriers for general coverage should only be specified on the warm side of insulation (i.e. interior side of insulation in predominately heating dominated climates). Vapor permeable air barriers should be specified in other cases. • Sprinkler systems to be designed to not interfere with the performance of thermal and air barriers • For built-up insulation on flat roofs, minimum and average R-value for roof surfaces must be specified. Specifications must require contractor to submit roof insulation software calculator results (e.g. 'Taper Plus" or equivalent) which will be used to verify effective R-value. • An area weighted average of the U-factors of the roof assemblies is acceptable in the energy model.			

ROOF TYPE: This section can be duplicated, copy and insert rows (assembly name or number)			DESCRIPTION Include: Stud-framing spacing (ex. 16" or 24" oc) Stud material (ex. wood or steel framed) Stud depth/configuration (ex. 2x4)	LOCATION (dwg/spec)	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
ROOF ASSEMBLY 1	PITCH (*Pitched Plank, Built Up Roof)*						
Name:		Layer 1					
Location:		Layer 2					
% of roof area:		Layer 3					
Appendix A table referenced:		Layer 4					
		Layer 5					
ROOF ASSEMBLY 1 U-VALUE		Overall U-value					
ROOF ASSEMBLY 2	PITCH (*Pitched Plank, Built Up Roof)*						
Name:		Layer 1					
Location:		Layer 2					
% of roof area:		Layer 3					
Appendix A table referenced:		Layer 4					
		Layer 5					
ROOF ASSEMBLY 2 U-VALUE		Overall U-value					

PATH REQUIREMENT	PROPOSED ERM	ENERGY MODEL	Overall Roof U-Value	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	
<Select compliance path on the 'Project Info' tab>	0	0					

PROTOCOL	PATH REQUIREMENT	PLAN REVIEW COMMENTS	LOCATION (dwg/spec)	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Compliance Statement • All assemblies are compliant with the proposed design model or requirements of the *Prescriptive Path*, including framing factor assumptions. The effective R-value of the installed insulation shall be used in the Proposed Design model (from exterior finish to interior finish).						
Roof - Insulation Installation RequirementsIr	<Select compliance path on the 'Project Info' tab>					
Wood-Framed Construction (RECOMMENDED, NOT A PREREQUISITE) • For wood-framed construction, Version 3.0 of the *ENERGY STAR Certified Homes Thermal Enclosure System Rater Checklist Sections 3 and 5* is recommended to be followed in addition to all applicable *T&V Protocols.*						
Final Inspection • Verify proper enclosure of insulated cavities through visual inspection.						

*Estimated R-values for insulation that is improperly installed must be derated using the standards and procedures described in the *Mortgage Industry's National Home Energy Rating Systems, Section 303.4.1.4.2 and Appendix A, "On-Site Inspection Procedures for Minimum Rated Features".*

ENERGY STAR

MULTIFAMILY HIGH RISE PROGRAM

Project Name: 0

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ENVELOPE - FLOORS ABOVE UNCONDITIONED SPACES - PROTOCOL 3.3

Date:	Field Verified By:

Schedule:

1) Inspections must take place during construction: before pouring slab, before back-filling foundation walls, at framing (pre-insulation), post-insulation and pre-drywall, and post-completion.

Equipment Needed

1) Camera
2) Measuring Tape or ruler
3) Relevant Floor Plan Sections and Details

Sampling Requirements:

1) Each unique floor assembly shall be inspected. (For example: If unique sections of the building are constructed differently, all distinct areas must be inspected independently; Also, if insulation specifications are different for living areas vs. common areas or other special use areas, each different specification shall be inspected independently.)

2) Sampling may be used to inspect floor assemblies that are consistent throughout large sections of the building. At each stage of the inspection process, a minimum of 15% of total floor area must be inspected for each unique floor type. If problems are found in the sample set, additional inspections must be conducted to determine the full extent of the problems and to ensure that repairs are completed in all areas of the building where they are needed.

3) Documentation of post-repair conditions is required for correction of problems that represent large surface areas (greater than 50 square feet) and/or systemic problems (e.g. all corner units are insulated improperly). On-site inspection to verify corrections is preferable, but if this is not possible/practical due to construction schedules, photographic documentation of repairs submitted to the responsible party by the GC are an acceptable alternative.

4) *PHOTOS REQUIRED*

- Photo clearly identifying type of insulation installed and thickness using measuring tape or ruler (can do each individual piece of insulation or entire assembly)
- Photo showing continuous insulation around sample corner and/or trouble area
- Sub Slab insulation – Photo of insulation before pouring of concrete or backfill of foundation
- If moisture or insect protection is required, photo of proper installation is required
- Framed floors – Photo of post-insulation to show proper installation showing no signs of compromised R-Value

NOTES FOR DRAWINGS AND SPECIFICATIONS	PLAN REVIEW COMMENTS	LOCATION (dwg/spec)	PLAN REVIEW
• Interior and cavity insulation must be protected from air intrusion and moisture intrusion, and free of voids, gaps, and compression. • Cavity insulation must be in contact with the interior wall surface (i.e. drywall) and completely fill the interior wall cavity. • Batt insulation must be installed properly using splices to surround wires, electrical outlet/switch/junction boxes, pipes, and other obstructions within the insulated cavity. • Insulation that is intended to be continuous (interior or exterior) must be installed without breaks and at full thickness at all locations. • Insulation must be installed such that they achieve RESNET-defined Grade I installation or, alternatively, Grade II for floors with continuous insulation. • Vapor impermeable air barriers for general coverage should only be specified on the warm side of insulation (i.e. interior side of insulation in predominately heating dominated climates). Vapor permeable air barriers should be specified in other cases. • If specified, rim joists between ceiling/floor levels must be insulated around the entire perimeter, and necessity of shelf angles should be evaluated by structural engineer. • An area weighted average of the U-factors of the floor assemblies is acceptable in the energy model.			

FLOOR TYPE: This section can be duplicated, copy and insert rows		**DESCRIPTION** Include: Stud-framing spacing (ex. 16" or 24" oc) Stud material (ex. wood or steel framed) Stud depth/configuration (ex. 2x4)	**LOCATION** (dwg/spec)	PLAN REVIEW	INSPECTION	**INSPECTION COMMENTS** (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
FLOOR OVER UNCONDITIONED SPACE ASSEMBLY 1	Layer 1					
Name:	Layer 2					
Location:	Layer 3					
% of floor area:	Layer 4					
Appendix A table referenced:	Layer 5					
FLOOR OVER UNCONDITIONED SPACE ASSEMBLY 1 U-VALUE	Overall U-value					

PATH REQUIREMENT	PROPOSED ERM	ENERGY MODEL	Overall Floor Over Unconditioned Space U-Value	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	
<Select compliance path on the 'Project Info' tab>	0	0					

BELOW GRADE SLAB FLOOR ASSEMBLY 1		Layer 1					
Name:		Layer 2					
Location:		Layer 3					
% of BG slab area:		Layer 4					
Appendix A table referenced:		Layer 5					
BG SLAB FLOOR ASSEMBLY 1 U-VALUE		Overall U-value					

PATH REQUIREMENT	PROPOSED ERM	ENERGY MODEL	Overall Below Grade Slab Floor U-Value	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	
<Select compliance path on the 'Project Info' tab>	0	0					

SLAB-ON-GRADE (unheated) ASSEMBLY 1		Layer 1					
Name:		Layer 2					
Location:		Layer 3					
% of slab area:		Layer 4					
Appendix A table referenced:		Layer 5					
SLAB-ON-GRADE(unheated) ASSEMBLY 1 U-value		Overall U-value					

PATH REQUIREMENT	PROPOSED ERM	ENERGY MODEL	Overall Slab-On-Grade(unheated) U-Value	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	
<Select compliance path on the 'Project Info' tab>	0	0					

SLAB-ON-GRADE (embedded heat only) ASSEMBLY 1		Layer 1					
Name:		Layer 2					
Location:		Layer 3					
% of slab area:		Layer 4					
Appendix A table referenced:		Layer 5					
SLAB-ON-GRADE FLOOR (embedded heat only)		Overall U-value					

PATH REQUIREMENT	PROPOSED ERM	ENERGY MODEL	Overall Slab-On-Grade (embedded heat only) U-Value	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	
<Select compliance path on the 'Project Info' tab>	0	0					

PROTOCOL	PATH REQUIREMENT	PLAN REVIEW COMMENTS	LOCATION (dwg/spec)	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state “Same as Design”. If make/model numbers have changed, list them here.)
Compliance Statement • All assemblies are compliant with the proposed design model or requirements of the *Prescriptive Path*, including framing factor assumptions. The effective R-value of the installed insulation shall be used in the Proposed Design model (from exterior finish to interior finish).						
Floor Insulation Above Unconditioned Space -	<Select compliance path on the 'Project Info' tab>					
Below Grade Slab Floor- Insulation Installation						
Slab-on-Grade (unheated) - Insulation Installat						
Slab-on-Grade (embedded heated only) - Insul						

Wood-Framed Construction (RECOMMENDED, NOT A PREREQUISITE) • For wood-framed construction, Version 3.0 of the *ENERGY STAR Certified Homes Thermal Enclosure System Rater Checklist Sections 3 and 5* is recommended to be followed in addition to all applicable *T&V Protocols.*					
Final Inspection • Verify proper enclosure of insulated cavities through visual inspection.					
*Estimated R-values for insulation that is improperly installed must be derated using the standards and procedures described in the *Mortgage Industry's National Home Energy Rating Systems, Section 303.4.1.4.2 and Appendix A, "On-Site Inspection Procedures for Minimum Rated Features".*					

ENERGY STAR

MULTIFAMILY HIGH RISE PROGRAM

Project Name: 0

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ENVELOPE - WINDOWS - PROTOCOL 3.4	Date:	Field Verified By:

Schedule:

1) If the developer has elected, the initial sample installation shall be inspected upon completion. If problems are identified with the sample installation, a return site visit may be necessary to verify that the problems were properly addressed and corrected before proceeding with the installation of windows building-wide.

2) All other window inspections will take place on an ongoing basis during construction at the same time that other building envelope components are inspected to ensure specifications are being met throughout the construction process.

Equipment Needed

1) Camera
2) Measuring Tape or ruler
3) Window Schedule and Relevant Details

Sampling Requirements:

1) For spaces containing windows, follow the modified RESNET sampling protocol outlined in the *How to Use this Manual* section on page 11 of the *T&V Protocols*, which shall include, at a minimum, one of each different type of window installation based on different window types (fixed, double hung, etc.) and different energy performance specifications (e.g. if low e glass is specified on part of the building but not all of it).

2) In addition, the sample set shall include, at a minimum, the inspection of all windows in a representative apartment from each apartment style/type.

3) If problems are identified, additional windows must be inspected to determine if problems are systemic. Problems found will be reported to the GC for correction and re-inspection on an ongoing basis throughout construction.

4) *PHOTOS REQUIRED*

- Photo of each unique window type with third party verification (NFRC label if applicable) of U-Value, SHGC, and ENERGY STAR certification (if applicable)
- Photo of installed window that verifies proper fit and effective connections to envelope's weather and air barriers
- Photo with low-e sensor device verifying low-e

NOTES FOR DRAWINGS AND SPECIFICATIONS	PLAN REVIEW COMMENTS	LOCATION (dwg/spec)	PLAN REVIEW
• Include selection of window type (by operation, e.g. double-hung, single-hung, casement, fixed, etc.), dimensions, frame, U-value, low-emissivity, gas fill, SHGC, visual transmittance, and labeling by an independent third party (e.g. NFRC). If an NFRC label is not available, manufacturer must provide assembly U-values, not center-of-glass. Alternatively, LBNL's WINDOW 6.3 software or NFRC's CMAST may be used. • The specified windows shall be double or triple-pane, with low-emissivity glass or coatings. • Windows shall be installed properly to ensure weather tightness and air tightness performance within manufacturer's specifications in addition to proper operation. • All joints between window frame and rough opening should be sealed with minimum 20-year sealant compatible with all surfaces. • Specifications could include, at the discretion of the developer, the inspection of a sample mock-up installation by the responsible party prior to installation of windows building-wide.			

ID	WINDOW TYPE *(Double hung, awning, casement, fixed)*	QUANTITY	MFR/MODEL	WINDOW FRAME *(Alum, Fiberglass)*	GAS FILL *(Air / Argon)*	CENTER OF GLASS U-VALUE	ASSEMBLY U-VALUE	SHGC	LOW-E (Yes/No)	ENERGY STAR (Yes/No)	LOCATION (dwg/spec)	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)

	PATH REQUIREMENT	PROPOSED ERM	ENERGY MODEL	PLAN REVIEW COMMENTS	LOCATION (dwg/spec)	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Compliance Statement • Assembly is consistent with the project specifications and Proposed Design model • If following the *Prescriptive Path* confirm assembly U-values and SHGC for the climate zone are met.	<Select compliance path on the 'Project Info' tab>	0	0					
Window-to-Wall Ratio • Window-to-Wall ratio is taken as the sum of all window area divided by the total exterior above-grade wall area. All decorative glass and skylight window area contribute to the total window area to above-grade wall ratio (WWR). In addition, non-vision glazing areas must be treated as opaque walls (not fenestration) when calculating window-to-wall ratios. Maximum allowable glazing area for *Prescriptive Path*: 30% WWR								

Rough Openings
• The installation subcontractor is responsible for verifying that rough openings are properly constructed including: structural soundness of sill, header, and jambs; opening shall be square, level, and plumb; and building materials should be protected from moisture damage prior to window installation. Construction deficiencies should be reported to the developer or GC and corrected prior to installation of windows.

Window/Wall Mock Up
• If approved by the developer, the responsible party shall inspect a sample installation of the window prior to the installation of windows building-wide. The manufacturer's data shall be inspected to verify energy performance specifications (window type, frame, U-value factor, gas fill, SHGC). In addition, the installed window must be inspected for proper fit and operation and effective connections to the building envelope weather barrier and air barrier. Low-e glass must be verified using a low-e meter.

On-Going Site Inspections
• On inspection site visits, the responsible party shall check newly installed windows for compliance with the installation specifications and confirm the assumptions in the Proposed Design model. As an alternative to the modeling approach, verify all window requirements listed in the *Prescriptive Path* have been met or exceeded.

Air Tightness
• Visually confirm all joints between window frame and rough opening have been sealed. Optional: To verify air tightness of the weather stripping and window installation, use a smoke pencil around the window, casing, and frame.

Windows - Manufacturer's Product Data
• Review manufacturer's cut sheet or invoice detailing window construction, U-Value, SHGC, low–e, and ENERGY STAR qualification (if applicable). Alternatively, LBNL's WINDOW 6.3 software or NFRC's CMAST may be used.

Statement of Substantial Completion
• A Statement of Substantial Completion or approved proxy may be used to establish completion of the work associated with this protocol. A Statement of Substantial Completion is to be completed by the installation contractor or other qualified representative on company letterhead, complete with all information, photographs, cut sheets, etc., required in this protocol and in the corresponding *T&V Worksheet*.

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ENVELOPE - EXTERIOR DOORS - PROTOCOL 3.5

Date:	Field Verified By:

Schedule:

1) Final inspection may occur anytime following completion of installations .

Equipment Needed

1) Camera
2) Measuring Tape or ruler
3) Floor Plans
4) Door Manufacturer's Specifications
5) As-built Door Schedule provided by the developer
6) Smoke Pencil (Optional)

Sampling Requirements:

1) 100% of entryways and designed vestibule areas shall be inspected.

2) Visually verify proper installation of at least 50% of all common area exterior doors and check the manufacturer and model of all doors using the As-Built building door schedule provided by the developer. For garden-style apartments with doors to the exterior, follow the modified RESNET sampling protocol outlined in the *How to Use this Manual* section on page 11 of the *MFHR Testing and Verification Protocol*.

3) *PHOTOS REQUIRED*

- Photo of installed door that verifies proper fit and effective connections to envelope's weather and air barriers.
- Photo of each unique door type with third party verification, NFRC and/or ENERGY STAR certification (if applicable).

NOTES FOR DRAWINGS AND SPECIFICATIONS	PLAN REVIEW COMMENTS	LOCATION dwg / spec	PLAN REVIEW
• Design and specifications for exterior doors shall match assumptions made in the Proposed Design model or meets or exceeds the requirements listed in the *Prescriptive Path*. • Weather-stripping is mandatory at doors between conditioned spaces and the exterior; unconditioned spaces; and spaces vented to the outside. • Weather-stripping is recommended, but not required, at doors between corridors and stairwells; between apartments and corridors; and doors leading to mechanical rooms. • Weather-stripping at mandatory locations shall be installed with a rigid fastener and replaceable foam gasket specified for durability and less maintenance. • Weather stripping shall be installed to not interfere with door closing properly.			

ID	FLOOR / LOCATION	MFR/MODEL	ENERGY STAR (Yes/No)	U-VALUE	WEATHER-STRIPPING (Yes/No)	SELF CLOSING DEVICE (Yes/No)	VESTIBULE (Yes/No)	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)

PROTOCOL	PATH REQUIREMENT	ERM	ENERGY MODEL	PLAN REVIEW COMMENTS	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Compliance Statement • Assembly is consistent with the project specifications and Proposed Design model or meets or exceeds the requirements listed in the *Prescriptive Path*.	<Select compliance path on the 'Project Info' tab>	0	0					
Vestibules and Entryways • Inspect vestibule and entryway areas to verify construction is consistent with design specifications.	<Select compliance path on the 'Project Info' tab>							
Operation and Fit • Inspect exterior doors for proper operation, fit, and weather stripping.								
Weather Stripping • When required by local building code, verify entranceways contain vestibules with weather-stripping hard-fastened to the door or frame. • Weather-stripping is mandatory at doors between conditioned spaces and the exterior; unconditioned spaces; and spaces vented to the outside. • Weather-stripping is recommended, but not required, at doors between corridors and stairwells; between apartments and corridors; and doors leading to mechanical rooms. • Weather-stripping at mandatory locations shall be installed with a rigid fastener and replaceable foam gasket specified for durability and less maintenance.								

Smoke Testing • Option: Use a smoke pencil with the building under pressurization (or depressurization) from the ventilation system to verify air tightness of components.		
Statement of Substantial Completion • A Statement of Substantial Completion or approved proxy may be used to establish completion of the work associated with this protocol. A Statement of Substantial Completion is to be completed by the installation contractor or other qualified representative on company letterhead, complete with all information, photographs, cut sheets, etc., required in this protocol and in the corresponding *T&V Worksheet*.		

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GARAGES - HEATING & COMPARTMENTALIZATION - PROTOCOL 4.1

Date:	Field Verified By:

Schedule:

1) Inspect air sealing details at framing before insulation is installed.
2) Inspect insulation after installation and prior to enclosure with finish materials.
3) Final inspection may occur anytime following completion of installations.

Equipment Needed

1) Relevant floor plans and wall sections
2) Camera

Sampling Requirements:

1) Inspect 100% of the connections between the garage and the conditioned space of the building for air sealing.
2) Inspect 100% of heating elements and controls.

NOTES FOR DRAWINGS AND SPECIFICATIONS	PLAN REVIEW COMMENTS	LOCATION dwg / spec	PLAN REVIEW
• Provide piping layout or insulation details that demonstrate that the garage space is not heated. Radiant heating, either wall or ceiling-mounted or within the garage floor (or sidewalks), may be used to prevent ice formation on the ground as a safety feature only. • Include a list of elements to be sealed in the garage that would minimize air flow between the garage and the rest of the building, including entrance door(s) leading into building from garage.			

PROTOCOL		PLAN REVIEW COMMENTS	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Garage Pipe Freeze Protection • If pipes are located in garages or unconditioned spaces, heat tape is permitted, but only in the Performance Path, where the energy penalty associated with the electricity consumption can be modeled. If selecting this alternative, heat tape that is activated based on pipe wall temperature rather than air temperature is required and must comply with ASHRAE 90.1-2007 Section 6.4.3.8. Verify heat tape thermostat set point is no higher than 40°F.	<Select compliance path on the 'Project Info' tab>					
Garage Snow or Ice-melt Systems • Verify snow or ice melt systems in the garage, either wall or ceiling-mounted, are radiant (ie. "infrared") OR located within the garage floor/sidewalks. • Confirm that they are used to prevent ice formation on the ground as a safety feature ONLY (and not for comfort or pipe freeze protection) and include controls capable of shutting off the systems. • Snow- and ice-melting systems shall include automatic controls capable of shutting off the systems when the pavement temperature is above 50°F and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40°F so that the potential for snow or ice accumulation is negligible.	<Select compliance path on the 'Project Info' tab>					
Compartmentalization• Attached garages shall be fully compartmentalized from the rest of the building th						
Wood-Framed Construction (RECOMMENDED, NOT A PREREQUISITE) • For wood-framed construction, Version 3.0 of the *ENERGY STAR Qualified Homes Thermal Enclosure System Rater Checklist Sections 3 and 5* is recommended in addition to all applicable *T&V Protocols.*						
Doors Between Garage and Building • Inspect the door(s) leading into the building from the garage for proper operation, fit, and weather stripping. Optional: Use a smoke pencil around the door, casing, and frame with the garage ventilation system running.						

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HVAC - HEATING SYSTEMS - PROTOCOL 5.1, 5.3

Date:	Field Verified By:

Schedule:

1) The quality assurance and verification procedures occur during the pre-construction, construction, and post-construction phases of system installation. Refer to the appropriate standards (eg. NFPA) to determine exact timing of inspections.

2) Commissioning of the system occurs during pre-construction and construction phases of installation. Inspection, testing, and final commissioning are conducted during the turn over/accpetance phase of the installation of the system.

3) Training shall occur following installation of the system and completion of all quality assurance and verification procedures.

4) The developer or GC shall ensure that deliveries are inspected prior to accepting them to verify that product substitutions by the distributor or manufacturer have not resulted in plumbing fixtures with higher flow rates than those in the Proposed Design or required by the *Prescriptive Path*.

5) Minimum of one (1) on-site inspection required, preferably immediately after installation so that corrective action can be taken if necessary. Delivery tickets may be used to verify complete shipments but on-site inspections of a sample of installed plumbing fixtures is required.

Equipment Needed

1) Mechanical Schedule and Floor Plans
2) Camera

Sampling Requirements:

1) 100% of centralized primary equipment (i.e. heating plants) shall be inspected in the quality assurance and verification process.

2) Individual spaces or apartments containing electric or fossil-fuel heating systems shall be inspected and tested following the modified RESNET sampling protocol outlined in the *How to Use this Manual* section on page 11 of the *T&V Protocols*, including at least one of each unique type.

3) Spaces containing terminal devices (fan coils, PTHPS, unit heaters, VAV boxes) must be inspected following the modified RESNET sampling protocol outlined in the *How to Use this Manual* section on page 11 of the *T&V Protocols*, including at least one of each unique type.

4) ***PHOTOS REQUIRED***

-Provide photos of the space heating systems and faceplates to verify proper installation and compliance with proposed design.

ID	DESCRIPTION	LOCATION/SERVES	QUANTITY	MFR	MODEL #	CAPACITY (BTU/H, kW)	AHRI CERT #	EFFICIENCY (% Et, AFUE, COP)	FAN MOTOR POWER (HP, kW/CFM)	ENERGY STAR	Outdoor Air Supply (% or CFM)	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)

PROTOCOL	PATH REQUIREMENT	PROPOSED ERM	ENERGY MODEL	PLAN REVIEW COMMENTS	LOCATION (dwg/spec)	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Compliance Statement • All heating systems are consistent with the project specifications and Proposed Design model or meets or exceeds the requirements listed in the *Prescriptive Path.*	<Select compliance path on the 'Project Info' tab>	See below	See below					
MODELING INPUTS								
Space Heating - Type & Efficiency • Provide Proposed space heating system type, efficiency, capacity, fuel; include number, efficiency and HP of pumps, and whether VFD is specified in the MOTOR section. • Heating equipment efficiency must be verified through AHRI ratings. If not available, OEM-provided performance data must be used, in compliance with ASHRAE 90.1-2007, Section 6.4.1.4. • If following the *Prescriptive Path*, based on the climate zone, the specified heating equipment must meet the Prescriptive requirements for efficiency in Table 1, a list of equipment and minimum efficiencies per ASHRAE 90.1 – 2007 Climate Zones. Part load minimum efficiencies listed are only lapplicable to equipment with capacity modulation. See ASHRAE 189.1-2009, Appendix C, for equipment not listed in Table 1. • The appropriate climate zone for each building site shall be determined by ASHRAE 90.1–2007, Table B-1. Exception: The lappropriate climate zone for each building site in California will be determined by Title 24.	<Select compliance path on the 'Project Info' tab>	0	0					
Heating Terminal Units - Electric Resistance or Freeze Protection • If following the *Prescriptive Path:* Electric resistance space heating is not permitted in any space. If following the *Performance Path*: • Avoidable electric resistance heating should not be specified in apartments or common areas (top of stairwells, vestibules and other common areas). • EPA recommends that supplemental heating systems are not specified for pipe freeze protection in unconditioned spaces. If specified, their energy consumption must be modeled.	<Select compliance path on the 'Project Info' tab>	0	0					
Space Heating - Sizing• Heating loads shall be calculated, equipment capacity shall be sele		0	0					
Space Heating Distribution - Supply Fan Power • Supply fan power shall be consistent with the project specifications and Proposed Design model.		0	0					
Space Heating - Design Temperatures • Plans must specify supply and return water temperature at design conditions. • Verify installation of temperature gauges and temperature readings during inspection. • Verify return water temperature meets design for condensing boiler systems.		0	0					
Space Heating - Controls • System controls and settings shall match operating assumptions made in the Proposed Design model or meets or exceeds the requirements listed in the *Prescriptive Path*. At a minimum, controls should have the capability for outdoor reset of supply water temperature, warm weather shut down and night setback. • Verify outdoor temperature sensor is functioning properly. • Verify supply temperature is set correctly and sensor is functioning properly.		0	0					

BOILER CONFIGURATION AND HYDRONIC DISTRIBUTION						
Space Heating Central Plant - Boiler room location and venting • Verify location of heating system (e.g., cellar or roof), combustion air venting configuration (e.g., combustion air piped to boilers, boiler room air used for combustion), and venting configuration (e.g., inducer fan specified and sequence of operation verified, if required).						
Space Heating - Insulation for Piping	<Select compliance path on the 'Project Info' tab>					
Heating Distribution - Piping Configuration	• Specifications for distribution system (supply and return) piping configuration, mi					
Heating Distribution - Pump Sizing	• Calculations and assumptions for sizing circulating pumps must meet Chapter 43 of the					
Heating Distribution - Pressure Control Set-points • Although not required, EPA recommends adding a Note requiring heating circulator pressure controls to be adjusted to ensure that: (1) at terminal units furthest from the pump, sufficient GPM is achieved and (2) at terminal units closest to the pump, differential pressure across terminal unit zone valves when closed does not exceed valve manufacturer guidelines.						
Heating Terminal Units - Thermostatic Controls	• All terminal heating distribution equipment must be separated from the riser					
ALL FORCED AIR HEATING SYSTEMS (Including Heat Pumps)						
Heating Distribution - Outdoor Air Damper	• For systems designed with outdoor-air supplied to the heating distribution syster					
Heating Distribution - Flex Duct Installation	• Verify that all heating ductwork that has been specified as flex duct meets the SI					
Heating Distribution - Duct Insulation	<Select compliance path on the 'Project Info' tab>					
Heating Distribution - Duct Sealing Details	• Call out a preliminary list of duct sealing details to be integrated into the construc					
Heating System - Combustion Venting • Visual inspection of combustion venting system to verify conformance with Proposed Design model, the requirements listed in the *Prescriptive Path*, and appropriate National Fire Protection Association (NFPA) standards. This criteria also applies to heat pump units. • For gas systems reference NFPA 54 (National Fuel Gas Code). For oil systems reference NFPA 31.						
Heating System - Refrigerant Charge, Airflow and Nameplate Data • Obtain and keep documentation on file showing correct field measured refrigerant charge, field measured airflow over condenser coil, field measured airflow over heat exchanger, nameplate efficiency, and nameplate heat exchange capacity consistent with manufacturer's specifications.						
IN-UNIT FORCED AIR HEATING SYSTEMS						
Heating Distribution - In-Unit Duct Sizing	• In-unit duct systems shall be designed and installed to effectively meet the heating					
Heating Distribution - In-Unit Pressure Balancing	• Verify that bedrooms have been provided with any combination of transfer					
Heating Distribution - In-Unit Duct Leakage Testing	• Following the procedures outlined in your duct leakage tester operation					
Heating Distribution - HVAC Contractor Checklist • For improved performance, EPA recommends, but does not require compliance with all items of Version 3.0 of the *ENERGY STAR Certified Homes HVAC System Quality Installation Rater and Contractor Checklists*, where applicable to forced air heating systems.This criteria also applies to heat pump units.						
HEATING SYSTEMS MISC						
Heating Distribution - Thermostat	• Verify all terminal heating distribution equipment serving an apartment shall be controlled					
Space Heating - Training and Manuals • EPA recommends confirming that all applicable operating and specification manuals are delivered to the building staff. EPA also recommends verifying that staff members have been trained and are aware of their responsibilities to maintain and operate the systems properly. Summarize any training performed and personnel involved.						
Space Heating - Manufacturer's Product Data • Review manufacturer's cut sheets or invoice detailing system manufacturer, model, size, and location, (including all space heating systems, e.g. vestibule) and keep with the building file. All heating equipment efficiency must be verified through AHRI ratings. If not available, OEM-provided performance data must be used, in compliance with ASHRAE 90.1-2007, Section 6.4.1.4. If following the *Prescriptive Path* and ENERGY STAR certification is required, it must be verified through the ENERGY STAR website.						

Duct Leakage Summary: This section can be duplicated, copy and insert rows. If the same system provides cooling, data need only be entered in one worksheet.

Apartment #	Floor #	Unit Type (e.g. A, B, C)	# of Bedrooms	Floor Area	Design Supply CFM	Rough-in Maximum Leakage CFM25	Rough-in Tested Total Leakage CFM25	Final Maximum Leakage CFM25	Final Tested Total Leakage CFM25	% Leakage of Design CFM	Comments
						0		0		#DIV/0!	
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HVAC - COOLING - PROTOCOL 5.2, 5.4

Date:	Field Verified By:

Schedule:

1) The quality assurance and verification procedures occur during the pre-construction, construction, and post-construction phases of system installation. Refer to the appropriate standards (eg. NFPA) to determine exact timing of inspections.

2) Commissioning of the system occurs during pre-construction and construction phases of installation. Inspection, testing, and commissioning are conducted during the turn of over/acceptance phase of the installation system.

3) Training shall occur following installation of the system and completion of all quality assurance and verification procedures.

Equipment Needed

1) Mechanical Schedule, relevant floor plans and details
2) Camera

Sampling Requirements:

1) 100% of centralized primary equipment (i.e. cooling plants) shall be inspected in the quality assurance and verification process.

2) Spaces containing terminal devices (fan coils, PTHPS, VAV boxes) must be inspected following the modified RESNET sampling protocol outlined in the *How to Use this Manual* section on page 11 of the *T&V Protocols*, including at least one of each unique type.

3) ***PHOTOS REQUIRED***

-Photos of cooling system equipment and faceplates to verify proper installation and compliance with Proposed Design.

ID	DESCRIPTION	LOCATION/ SERVES	QUANTITY	MFR	Outdoor Unit Model #	Indoor Coil Model #	AHRI CERT#	CAPACITY (BTU/H)	EFFICIENCY (SEER, EER)	FAN MOTOR POWER (HP, kW/CFM)	ENERGY STAR	Outdoor Air Supply (% or CFM)	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)

PROTOCOL	PATH REQUIREMENT	PROPOSED ERM	ENERGY MODEL	PLAN REVIEW COMMENTS	LOCATION (dwg/spec)	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Compliance Statement • All cooling systems are consistent with the project specifications and Proposed Design model or meets or exceeds the requirements listed in the *Prescriptive Path*.	<Select compliance path on the 'Project Info' tab>	see below	see below					
MODELING INPUTS								
Space Cooling - Type and Efficiency • Specifications for the cooling system type, location and efficiency shall match the assumptions made in the Proposed Design model or meets or exceeds the requirements listed in the *Prescriptive Path*. • Cooling equipment efficiency must be verified through AHRI ratings. If not available, OEM-provided performance data must be used, in compliance with ASHRAE 90.1-2007, Section 6.4.1.4. If following the *Prescriptive Path* and ENERGY STAR certification is required, it must be verified through the ENERGY STAR website. • The appropriate climate zone for each building site shall be determined by ASHRAE 90.1–2007, Table B-1. Exception: The appropriate climate zone for each building site in California will be determined by Title 24. • See Table 1 for list of equipment and minimum efficiencies per ASHRAE 90.1 – 2007 Climate Zones. Part load minimum efficiencies listed are only applicable to equipment with capacity modulation. See ASHRAE 189.1-2009, Appendix C, for equipment not listed in Table 1.	<Select compliance path on the 'Project Info' tab>	0	0					
Space Cooling - Sizing• Cooling loads shall be calculated, equipment		0	0					
Space Cooling Distribution - Supply Fan Power • Supply fan power shall be consistent with the project specifications and Proposed Design model.		0	0					
Space Cooling - Controls • System controls and settings shall match operating assumptions made in the Proposed Design model or meets or exceeds the requirements listed in the *Prescriptive Path*.		0	0					

CHILLED WATER AND CONDENSER WATER SYSTEMS						
Cooling Distribution - Piping Configuration• Verification procedures must confirm that the system meet						
Cooling Distribution - Pump Sizing• Calculations and assumptions for sizing circulating pumps must m						
Cooling Distribution - Pressure Control Set-points • Although not required, EPA recommends adding a Note requiring cooling circulator pressure controls to be adjusted to ensure that: (1) at terminal units furthest from the pump, sufficient GPM is achieved and (2) at terminal units closest to the pump, differential pressure across terminal unit zone valves when closed does not exceed valve manufacturer guidelines.						
Cooling Distribution - Pipe Insulation	<Select compliance path on the 'Project Info' tab>					
Cooling Terminal Units - Thermostatic Controls• Verify all terminal cooling distribution equipment must						
Cooling Distribution - Airflow and Nameplate Data • Obtain and keep documentation on file showing correct field measured airflow over evaporator coil, nameplate efficiency, and nameplate heat exchange capacity consistent with manufacturer's specifications.						
ALL FORCED AIR COOLING SYSTEMS (Including heat pumps, split system ACs, PTACs and room ACs)						
Cooling Distribution System - In-Unit Duct Sizing• In-unit duct systems shall be designed and installed						
Cooling Distribution System - In-Unit Pressure Balancing• Verify that bedrooms have been provided w						
Cooling Distribution - Duct Insulation	<Select compliance path on the 'Project Info' tab>					
Cooling System - Outdoor Air Damper• For systems designed with outdoor-air supplied to the cooling						
Cooling Distribution - Duct Sealing Details• Call out a preliminary list of duct sealing details to be integ						
Cooling Distribution - Flex Duct Installation• Verify that all cooling ductwork that has been specified as						
Cooling Distribution - In-Unit Duct Leakage Testing• Following the procedures outlined in your duct lea						
Cooling Distribution - Refrigerant Pipe Insulation	<Select compliance path on the 'Project Info' tab>					
Cooling System - Refrigerant Charge, Airflow and Nameplate Data • Obtain and keep documentation on file showing correct field measured refrigerant charge, field measured airflow over evaporator coil, nameplate efficiency, and nameplate heat exchange capacity consistent with manufacturer's specifications.						
COOLING SYSTEMS MISC						
Cooling - A/C Sleeves• If installing sleeves for through-wall AC units, insulated covers must be provide						
Cooling Distribution - Thermostat• Verify all terminal cooling distribution equipment serving an apartme						

Cooling - Training and Manuals • EPA recommends confirming that all applicable operating and specification manuals are delivered to the building staff. EPA also recommends verifying that staff members have been trained and are aware of their responsibilities to maintain and operate the systems properly. Summarize any training performed and personnel involved.		
Cooling - Manufacturer's Product Data • Review manufacturer's cut sheets or invoice detailing system manufacturer model, size, and location (including all space cooling systems, e.g. lobby). Cooling equipment efficiency must be verified through AHRI ratings. If not available, OEM-provided performance data must be used, in compliance with ASHRAE 90.1-2007, Section 6.4.1.4. If following the *Prescriptive Path* and ENERGY STAR certification is required, it must be verified through the ENERGY STAR website.		

Duct Leakage Summary: This section can be duplicated, copy and insert rows.If the same system provides heating, data need only be entered in one worksheet.

Apartment #	Floor #	Unit Type (e.g. A, B, C)	# of Bedrooms	Floor Area	Design CFM	Rough-in Maximum Leakage CFM25	Rough-in Tested Total Leakage CFM25	Final Maximum Leakage CFM25	Final Tested Total Leakage CFM25	% Leakage of Design CFM	Comments
						0		0		#DIV/0!	
						0		0		#DIV/0!	
						0		0		#DIV/0!	
						0		0		#DIV/0!	
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LIGHTING - COMMON AREA, IN-UNIT, OUTDOOR & EMERGENCY LIGHTING - PROTOCOL 6.1-6.3

Date: | Field Verified By:

Schedule:

1) Begin lighting inspections as early in the construction process as possible. Verify make, manufacturer, ENERGY STAR certification, and rated wattage upon delivery or when lighting installations commence or during construction if earlier access (before ceiling closure) is needed to check circuiting layouts (e.g. for day lighting control). This will allow time for corrections before all of the fixtures have been installed.

2) If possible, ask to have a sample installation completed for verification and testing before the electrician proceeds with all installations.

Equipment Needed

1) Lighting Schedule (with fixture type and lamp wattage)
2) Modeler's Lighting Schedule from Performance Path Calculator
3) Floor Plans (with fixture locations)
4) Contractor Submittals
6) Camera

Sampling Requirements:

1) Inspect 100% of unique common areas (basements, lobbies) with 24/7 lighting and follow the modified RESNET sampling protocol outlined in the *How to Use this Manual* section on page 11 of the *T&V Protocols* for similar, or repetitive spaces (stairwells, corridors, trash chute rooms, etc.).

2) For all other spaces with non-24/7 lighting (apartments, storage rooms, mechanical rooms, etc.) follow the modified RESNET sampling protocol outlined in the *How to Use this Manual* section on page 11 of the *T&V Protocols*. This shall include, at a minimum, one representative apartment from each floor.

3) ***PHOTOS REQUIRED***

-Take a photo of one sample of each fixture type with ENERGY STAR certification affixed, where applicable.
- Photographs of CFLs must show if they are pin based.
- Take a photo of each type of lighting control specified for each unique space (motion sensors, timers, and daylight sensors) .
- If there are sensors in the stairwell and corridor, provide representative photo of each space and clearly label their location.
- Provide photo showing bi-level lighting is installed (half the lamps on in a fixture, or all fixtures dimmed)
- Exterior lighting with timers, provide a photo of the controls and provide lighting schedule that demonstrates hours of operation.
- To document daylight sensor performance, take one photo showing the light fixture is off during the day and another photo showing the fixture is on when the daylight sensor is covered.
- If measuring footcandles to demonstrate compliance with the Prerequisite, rather than calculating footcandles using the Performance Path Calculator, measurements should be taken in a sample of spaces, following the Sampling Protocols above. Provide photo-documentation of the light meter readings that demonstrate that IESNA light levels have been achieved.

PROTOCOL		PLAN REVIEW COMMENTS	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Lighting Power Density and Illumination Levels • Include a schedule with manufacturer, model, total wattage, bulb type, control, location, and quantity of each type of lighting fixture. • Include location of fixtures on plans. • Type and wattage of fixtures and lamps on lighting schedule, specifications, and submittals shall match modeled power density in Proposed Design. • Assemble documentation from plans, specs and submittals. • Verify assumptions in the Proposed Design model or ensure that all of the requirements listed in the *Prescriptive Path* have been met. • Determine power density of each space by calculating the luminaire wattage as indicated in ASHRAE 90.1-2007, Section 9.1.4. ASHRAE 90.1-2007, Section 9.1.4a, requires that fixture wattage be calculated using the maximum labeled wattage of the fixture. EPA will allow light fixtures to be calculated based on the installed wattage of the lamps. Ex: A fixture with a 13 W screw-in CFL can be calculated as 13 W, plus any associated ballast power. See *Appendix B* of *Performance* or *Prescriptive Path* to determine input power. • For spaces where installed light fixtures do not meet illumination requirements and occupants are expected to provide supplemental lighting (ie. bedrooms), assume the installed light fixture can illuminate at most 3 ft2 per Watt installed. • If following the *Prescriptive Path*, when calculating overall lighting power density, use 1.1 W/ft2 for spaces where lighting is not installed. • If following the *Performance Path*, verify that total installed lighting power for the combined non-apartment spaces does not exceed ASHRAE 90.1-2007 allowances for those combined spaces by more than 20%. If following the *Prescriptive Path*, verify that total installed lighting power for the combined non-apartment spaces does not exceed ASHRAE 90.1-2010 allowances for those combined spaces. Also, verify that the total specified exterior lighting power does not exceed ASHRAE 90.1-2010 allowances.Lighting controls may not be used to reduce the specified lighting power for compliance with this requirement. •If measuring footcandles to demonstrate compliance with the Prerequisite, rather than calculating footcandles, measurements shall be taken in a sample of spaces. Photo-documentation of the light-meter readings must be provided.	<Select compliance path on the 'Project Info' tab>					

LIGHT FIXTURE SCHEDULE (To be completed prior to As-Built inspections and Submittals. Not required for Proposed Design Submittal)

Copy data from Interior Lighting worksheet in Performance Path Calculator. Prescriptive Path projects must use that worksheet for LPD calculations. Insert rows as necessary

FIXTURE CODE	LUMENS/WATT	WATTS/ FIXTURE	FIXTURE TYPE	MANUFACTURER/ MODEL	GENERAL LOCATION	ENERGY STAR? (Yes/No)	Notes	QTY	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)

COMMON AREA (To be completed prior to As-Built inspections and Submittals. Not required for Proposed Design Submittal):

Copy data from Interior Lighting worksheet in Performance Path Calculator. Prescriptive Path projects must use that worksheet for LPD calculations. Insert rows as necessary

FLOOR	SQUARE FOOTAGE	ROOM NAME	ASHRAE SPACE TYPE	RCR A=1, B=4, C=7	QTY	FIXTURE CODE (A, B, C, ETC.)	AUTO-MATIC LIGHTING CONTROLS?	FIXTURE INSTALLED WATTAGE	FLOOR MULTIPLIER	TOTAL INSTALLED WATTS	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
								#N/A		#N/A				
								#N/A		#N/A				
								#N/A		#N/A				
								#N/A		#N/A				
								#N/A		#N/A				
								#N/A		#N/A				
								#N/A		#N/A				
								#N/A		#N/A				
								#N/A		#N/A				
								#N/A		#N/A				
								#N/A		#N/A				
								#N/A		#N/A				
								#N/A		#N/A				
								#N/A		#N/A				
								#N/A		#N/A				

EXTERIOR (To be completed prior to As-Built inspections and Submittals. Not required for Proposed Design Submittal):

Copy data from Exterior Lighting worksheet in Performance Path Calculator. Prescriptive Path projects must use that worksheet for LPD calculations. Insert rows as necessary

Space	LIT AREA	Linear or Square Feet?	INSTALLED QTY	FIXTURE CODE (A, B, C, ETC.)	FIXTURE INSTALLED WATTAGE	TOTAL INSTALLED WATTAGE	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
					#N/A	#N/A				
					#N/A	#N/A				
					#N/A	#N/A				
					#N/A	#N/A				
					#N/A	#N/A				
					#N/A	#N/A				

APARTMENTS (To be completed prior to As-Built inspections and Submittals. Not required for Proposed Design Submittal):

Copy data from In-Unit Lighting worksheet in Performance Path Calculator. Prescriptive Path projects must use that worksheet for LPD calculations. Insert rows as necessary

FLOOR	ROOM NAME	ROOM AREA SF	INSTALLED QUANTITY	FIXTURE CODE (A, B, C, ETC.)	FIXTURE INSTALLED WATTS	TEF	# OF ROOMS IN THE BLDG	TOTAL AREA, SF	TOTAL INSTALLED WATTAGE	ILLUMINATION (FOOTCANDLES OR LUMENS/SF)	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
					#N/A			0		0.0				
					#N/A			0	#N/A	0.0				
					#N/A			0	#N/A	0.0				
					#N/A			0	#N/A	0.0				
					#N/A			0	#N/A	0.0				
					#N/A			0	#N/A	0.0				
					#N/A			0	#N/A	0.0				
					#N/A			0	#N/A	0.0				
					#N/A			0	#N/A	0.0				
					#N/A			0	#N/A	0.0				
					#N/A			0	#N/A	0.0				
					#N/A			0	#N/A	0.0				
					#N/A			0	#N/A	0.0				
					#N/A			0	#N/A	0.0				
					#N/A			0	#N/A	0.0				

Fixture Count	TOTAL	ENERGY STAR	> 80%?
Apartment	0	0	#DIV/0!
Common Space	0	0	#DIV/0!
Exterior	0	0	#DIV/0!

PROTOCOL	PATH REQUIREMENT	PROPOSED ERM	ENERGY MODEL	PLAN REVIEW COMMENTS	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Compliance Statement • All lighting systems are consistent with the project specifications and Proposed Design model or meets or exceeds the requirements listed in the Prescriptive Path.								
Lighting Controls - Verification • Specify operational sensitivity settings (adjust so lights turn on when occupant enters controlled area, but remain off while unoccupied, i.e. unaffected by HVAC and VAV systems, etc.) and shut-off delay period (5 minutes or owner preference). • Specify power settings (as low as possible while still meeting any code requirements). • Include type and count of controls and associated fixtures in lighting schedule. • Note all locations of sensors on plans, and indicate which fixtures each sensor controls. • Check location of control types for conformance/deviation and count total number of controls in that space. • Confirm that each control type is operable: • For occupancy sensors, step in and out of the zone, check for blind spots • For timers, set timer to current time and confirm control of fixture. • For photocells, cover or black-out photocell and confirm control of fixture. • For day lighting controls, dim or black-out location to observe change in fixture light level. • For occupancy dimmers, check lower power limit and on-time settings.	<Select compliance path on the 'Project Info' tab>	0	0					
Common Area Lighting (Including Garages) - ENERGY STAR • Check quantity, locations, unit specifications for conformance/deviation with ENERGY STAR certification, where applicable. • Collect manufacturer and model data to verify lighting system is consistent with the project specifications and Proposed Design model or meets or exceeds the requirements listed in the *Prescriptive Path*. • Take a photo of one sample of each fixture type with ENERGY STAR certification affixed, where applicable. • Collect submittals/invoices for each unique fixture type showing ENERGY STAR certification (where applicable) and wattage.	<Select compliance path on the 'Project Info' tab>	0	0					
Common Area Lighting (Including Garages) - LPD • Check quantity, locations, unit specifications for conformance/deviation including types of fixtures, wattages of lamps, etc.	<Select compliance path on the 'Project Info' tab>							
Emergency Lighting - Exit Signs • All exit signs shall be specified as LED (not to exceed 5W per face) or photo-luminescent and shall conform to local building code. • Fixtures located above stairwell doors and other forms of egress shall contain a battery back-up feature.	<Select compliance path on the 'Project Info' tab>	0	0					
Exterior Lighting - Controls • Include type and count of controls and associated fixtures in lighting schedule. • Note all locations of sensors on plans, and indicate which fixtures each sensor controls. • Check location of control types for conformance/deviation. • Confirm that each control type is operable, see above for detailed instructions. • For timers, set timer to current time and confirm control of fixture. • For photocells, cover or black-out photocell and confirm control of fixture.	<Select compliance path on the 'Project Info' tab>	0	0					
Exterior Lighting - ENERGY STAR • Check quantity, locations, unit specifications for conformance/deviation with ENEGY STAR certification, where applicable. • Collect manufacturer and model data to verify lighting system is consistent with the project specifications and Proposed Design model or meets or exceeds the requirements listed in the *Prescriptive Path*. • Take a photo of one sample of each fixture type with ENERGY STAR certification affixed, where applicable. • Collect submittals/invoices for each unique fixture type showing ENERGY STAR certification (where applicable) and wattage.	<Select compliance path on the 'Project Info' tab>							
Exterior Lighting - LPD *(Prescriptive Path)* • Check quantity, locations, unit specifications for conformance/deviation including types of fixtures, wattages of lamps, etc.	<Select compliance path on the 'Project Info' tab>							

In-Unit Lighting • Check quantity, locations, unit specifications for conformance/deviation including types of fixtures, wattages of lamps, etc. • Collect manufacturer and model data to verify lighting system is consistent with the project specifications and Proposed Design model or meets or exceeds the requirements listed in the *Prescriptive Path*. • Take a photo of one sample of each fixture type with ENERGY STAR certification affixed, where applicable. • Collect submittals/invoices for each unique fixture type showing ENERGY STAR certification (where applicable) and wattage.	<Select compliance path on the 'Project Info' tab>	0	0					
Lighting - Ballasts • Fixtures specified with electronic ballasts must be confirmed in the field using an electronic ballast tester.								
Lighting - Statement of Substantial Completion - Non 24/7 Spaces • A Statement of Substantial Completion or approved proxy must be used to establish completion of the work associated in all spaces with lighting not operating 24/7 associated with this protocol. A Statement of Substantial Completion is to be completed by the installation contractor or other qualified representative on company letterhead, complete with all information, photographs, cut sheets, etc., required in this protocol and in the corresponding *T&V Worksheet.*								
Lighting - Statement of Substantial Completion - 24/7 Spaces • A Statement of Substantial Completion or approved proxy may be used to establish completion of all other work associated with this protocol. A Statement of Substantial Completion is to be completed by the installation contractor or other qualified representative on company letterhead, complete with all information, photographs, cut sheets, etc., required in this protocol and in the corresponding *T&V Worksheet.*								

ENERGY STAR

MULTIFAMILY HIGH RISE PROGRAM

heck empt

Project Name: 0

Table of Contents | ERMs | Prerequisites Checklist | Overview

HVAC - MOTORS - PROTOCOL 7.1

Date:	Field Verified By:

Schedule:

1) The developer or GC shall ensure that deliveries are inspected prior to accepting them to verify that product substitutions by the distributor or manufacturer have not resulted in motors with lower efficiencies than those in the Proposed Design.

2) Minimum of one on-site inspection required, preferably immediately after installation so that corrective action can be taken if necessary. Delivery tickets may be used to verify complete shipments but on-site inspections of a sample of installed motors is required.

3) Commissioning is conducted upon completion of the installation of the system.

4) Training shall occur following installation of the system and completion of all quality assurance and verification procedures.

Equipment Needed

1) Commissioning Report
2) Mechanical Schedule and Floor Plans
3) Camera

Sampling Requirements:

1) 100% of motors over 1 HP and all those servicing primary HVAC equipment (e.g. heating/cooling plants, domestic water heating systems, etc.) shall be inspected in the quality assurance and verification process.

2) ***PHOTOS REQUIRED***
   - Photograph faceplate; and NEMA Premium label (if applicable) of one representative motor of each size. Given the number of motors and pumps in any given building make sure to clearly identify location and use of each motor represented.

NOTES FOR DRAWINGS AND SPECIFICATIONS	PLAN REVIEW COMMENTS	LOCATION (dwg/spec)	PLAN REVIEW
• All three-phase pump motors 1 horse-power or larger shall meet or exceed efficiency standards for **NEMA Premium™** motors. Note: Motors that are packaged as an integral component of mechanical equipment, as well as motors in fire and fresh water booster pumps are exempt from this requirement. • If following the *Prescriptive Path*, Motors 5 horse-power or larger for circulating pumps serving hydronic heating or cooling systems must be specified with variable frequency drives. • Motor size, type, design, and rated efficiency shall match assumptions made in the Proposed Design model or meet or exceed the requirements listed in the *Prescriptive Path*.			

Motor Schedule:

Record manufacturer and model number of all non-ventilation motors over 1 HP (ventilation motors are covered in the ventilation section, *Protocol 8.2 - Common Area and In-Unit Ventilation (CFM), Intake Source, and Intake/Exhaust Fan Efficiency).*

ID	DESCRIPTION	LOCATION	QUANTITY	MFR	MODEL #	HORSE POWER (HP)	ENERGY STAR / NEMA PREMIUM	LOCATION (dwg/spec)	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)

PROTOCOL	PATH REQUIREMENT	PROPOSED ERM	ENERGY MODEL	PLAN REVIEW COMMENTS	LOCATION (dwg/spec)	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Heating Distribution - Motors • Confirm manufacturer and model number is **NEMA Premium*** labeled and/or complies with minimum performance criteria established by that program.	<Select compliance path on the 'Project Info' tab>	0	0					
Cooling Distribution - Motors • Confirm manufacturer and model number is **NEMA Premium*** labeled and/or complies with minimum performance criteria established by that program.	<Select compliance path on the 'Project Info' tab>	0	0					
DHW Distribution - Motors • Confirm manufacturer and model number is **NEMA Premium*** labeled and/or complies with minimum performance criteria established by that program.	<Select compliance path on the 'Project Info' tab>	0	0					
Motors- Manufacturer's Product Data • Review manufacturer's cut sheets or invoice verifying motor size and efficiency.								
Motors - Training and Manuals • EPA recommends confirming that all applicable operating and specification manuals are delivered to the building staff. EPA also recommends verifying that staff members have been trained and are aware of their responsibilities to maintain and operate the systems properly. Summarize any training performed and personnel involved.								
Statement of Substantial Completion • A Statement of Substantial Completion or approved proxy may be used to establish completion of the work associated with this protocol. A Statement of Substantial Completion is to be completed by the installation contractor or other qualified representative on company letterhead, complete with all information, photographs, cut sheets, etc., required in this protocol and in the corresponding *T&V Worksheet.*								

*Many motors are NEMA labeled and this label alone, does not ensure that a motor is energy-efficient. This requirement refers specifically to the NEMA Premium energy efficient motors program. Participating companies may be found at http://www.nema.org/Policy/Energy/Efficiency/Documents/NEMA_Premium_Partners.pdf

ENERGY STAR

MULTIFAMILY HIGH RISE PROGRAM

Project Name: 0

Check emp

Table of Contents | ERMs | Prerequisites Checklist | Overview

ENVELOPE - EXTERIOR AIR BARRIER - PROTOCOL 3.1 & 8.1	Date:	Field Verified By:

Schedule:

This process begins with the construction documentation. A minimum of 3-5 site visits are recommended to properly inspect air sealing details. Each exterior, common area and in-unit element on the air sealing checklists must be inspected at each of the following stages to ensure use of proper materials and complete seals exist for each juncture or penetration:

1) Window/Wall Mock Up Inspection (If applicable)
2) Load-bearing wall and slab-edge/rim-joist inspection: air/vapor/weather barrier prior to enclosure
3) Pre-drywall visual inspection of penetrations
4) Sample apartment inspection and blower door test
5) Post-correction testing of sample apartment
6) Final inspection and testing of apartments post completion

Equipment Needed

1) Camera
2) Measuring Tape or ruler
3) Floor Plans
4) Relevant Wall and Window Sections and Details

Sampling Requirements:

1) Each unique wall assembly shall be inspected. (For example: if the basement walls are constructed differently from the upper floors, both areas must be inspected independently; also, if insulation specifications are different for living areas vs. common areas or other special use areas, each different specification shall be inspected independently.)

2) Sampling may be used to inspect wall assemblies that are consistent throughout large sections of the building. Inspections done from the exterior shall sample at least 15% of each wall area. For inspections done from interior spaces, follow the modified RESNET sampling protocol outlined in the *How to Use this Manual* section on page 11 of the *T&V Protocols*, for each unique wall type. In addition, the sample set must include, at a minimum, all unique assemblies. If problems are found in the sample set, additional inspections must be conducted to determine the full extent of the problems and to ensure that repairs are completed in all areas of the building where they are needed.

3) For elements that provide central services to the building (i.e. entry doors, central duct chases, utility service penetrations, etc.) a minimum 50% sample shall be inspected. For elements that are repeated throughout the building or occur in every living unit (i.e. windows, wall/floor connections, air conditioner sleeves, etc.) follow RESNET sampling protocol. If problems are identified, additional units must be inspected to determine if the problems are systemic so an appropriate repair order can be issued.

4) Documentation of post-repair conditions is required for correction of problems that represent large surface areas (greater than 50 square feet) and/or systemic problems (e.g. all corner units are insulated improperly). On-site inspection to verify corrections is preferable, but if this is not possible/practical due to construction schedules, photographic documentation of repairs submitted to the responsible party by the GC are an acceptable alternative.

5) *PHOTOS REQUIRED*

Provide one representative photograph of continuous air barrier at all types of typical joints, junctions, and general coverage areas to include the following at a minimum:

5a) Inspected from the exterior: Areas with liquid-applied membranes showing appropriate thickness; AC openings; Windows, Door openings, and Door frame; Transition between wall and roof barrier; Transition between wall and foundation barrier; Plank/Slab Edge (Masonry and Steel Construction) or Rim Joist (Wood Framed Construction)
5b) Inspected from the interior: Rough openings to windows and doors, AC openings

NOTES FOR DRAWINGS AND SPECIFICATIONS	PLAN REVIEW COMMENTS	LOCATION dwg / spec	PLAN REVIEW
General Exterior Enclosure: • The construction drawings and specifications must clearly identify systems that manage the flow of rainwater (e.g. cladding, air gap and weather resistant barrier), heat (insulation) and air (air barriers) through the exterior enclosure. Continuity of these three systems must be shown in section, plan and details. Typical sections must show continuity from the center of the roof assembly, down the walls and fenestration, to the center of the foundation floor. Submittal of shop drawings detailing continuity of these systems and installer qualifications must be required in the specifications. • Exterior enclosure assemblies must be designed and constructed to prevent condensation within the assemblies during heating mode, cooling mode or both as the climate dictates. Assemblies may be drawn from published guidance documents that include hygro-thermal performance analysis. Alternatively assemblies should pass year – long, hourly hygro-thermal simulations conducted in accordance with ASHRAE 160P.			
Exterior Enclosure Air barriers: • Bid and contract documents must demonstrate a continuous, unbroken air barrier separating the conditioned space of the building from the exterior, unconditioned spaces within the building, mechanical rooms vented with conditioned air, mechanical chases opening to unconditioned spaces, elevator shafts and garages or other vehicle/equipment storage facilities. All air barrier materials must be compatible with other air barrier elements to which they connect. • Bid and contract documents must include detailed information that shows the air barrier continuity through the various conditions of the exterior enclosure (e.g., transitions between dissimilar materials and penetrations) and that serves as an index to relevant details. • Include list of elements to be sealed in construction documents. List must include all elements identified in ASHRAE 90.1-2007, Section 5.4.3.1, or applicable state code, all elements listed in the Prerequisites Checklist, and any additional site-specific elements identified during plan review that shall be addressed to ensure air leakage in the exterior building envelope is effectively controlled. Bid and contract documents must include locations to be sealed as well as acceptable methods and materials. • When feasible all air barriers membranes and accessories (transition membranes, flashing membranes, mastics, sealants, primers and tapes) will be from the same manufacturer. When products from a variety of manufacturers are used, a letter must be obtained from at least one manufacturer of the products in contact stating the materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Gaps and joints must be primed and sealed with transition membrane, tape or sealant that is rated to withstand the thermal and structural deflection calculated for the joint in question. For joints that are anticipated to have more than ½" deflection, special details are needed to allow flexibility. • Specifications could include, at the discretion of the developer, the inspection of a sample mock-up installation by the responsible party prior to installation of windows building-wide.			

WALL TYPE: This section can be duplicated, copy and insert rows	PLAN REVIEW COMMENTS	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Air Barrier Component					
Fluid applied air barrier membrane					
Self-adhering air barrier membrane					
Mechanically attached air barrier membrane					
Board stock air barrier					
Spray applied polyurethane insulation					
Gypsum board, CMU or foam board substrate					
Sealants					
Primer					
Mastic					
Transition membrane					
Tapes					

PROTOCOL	PATH REQUIREMENT	PLAN REVIEW COMMENTS	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Compliance Statement • Assembly is consistent with the project specifications and Proposed Design model or meets or exceeds the requirements listed in the *Prescriptive Path*. All air barrier materials must be compatible with other air barrier elements to which they connect. • Gaps and joints must be primed and sealed with transition membrane, tape or sealant that is rated to withstand the thermal and structural deflection calculated fort the joint in question. For joints that are anticipated to have more than ½" deflection special details are needed to allow flexibility.	<Select compliance path on the 'Project Info' tab>					
Wood-Framed Construction (RECOMMENDED, NOT A PREREQUISITE) • For wood-framed construction, Version 3.0 of the ENERGY STAR Qualified Homes Thermal Enclosure System Rater Checklist Sections 3 and 5 is recommended in addition to all applicable T&V Protocols.						
Masonry Wall Preparation • Gaps are filled, Joints struck, CMU is dry, all snags are gone.						
Gypsum Board Sheathing Wall Preperation • Gaps and joints primed and sealed with appropriate transition membrane or tape that is rated to withstand the thermal and structural deflection calculated for the joint in question • Edges of transition membrane or tape (termination seams) sealed with compatible sealant where not sealed by liquid membrane • Air barrier applied in accordance with manufacturer's instructions.						
General Coverage - Liquid Membrane • Verify proper thickness of liquid-applied membranes using a wet mil gauge; at a minimum, substrate must not be visible.						
General Coverage at Adjacent Building Conditions - Liquid Membrane • Where unable to install air barrier on the exterior of the building, a low VOC product shall be installed on the interior at full height (top of plank to bottom of plank at each floor). This shall happen before any interior framing is installed.						
General Coverage / Transition Membrane - Seams • All transition membranes should be installed and sealed before insulation is installed on top. Seams shall be sealed per manufacturer's instructions.						
Air Barrier Penetrations • Post air barrier penetrations shall be sealed per air barrier manufacturer's requirement. Transition membranes shall be used to patch as necessary with seams sealed appropriately.						
Rough Openings (Concrete Masonry Construction) - Windows and Doors • Liquid air barrier shall wrap in at masonry rough openings to be flush with inside edge of window or door frame. • Sheet membrane or metal panel enclosure can be used as alternative as long as it is clear the air barrier is continuous and any gaps are sealed per manufacturer's instructions with backer rod as necessary.						
Rough Openings (Steel Stud Construction) - Windows and Doors • Rough opening must be wrapped with sheet membrane all the way inside to be flush with inside edge.						
Rough Openings - Pipes, Conduits, Ducts, Etc. • Gaps shall be filled with backer rod as necessary and sealant compatible with all surfaces (Where smooth surfaces are present, mechanical gasket seals can be used). EPA recommends using a minimum 20 year sealant.						

Rough Openings - Cast Stone Sills • Cast stone sill shall be sealed to sill pan. EPA recommends using minimum 20 year compatible sealant where not sealed by grout.					
Rough Openings - Gap at Window Frames • Gaps between window frame (header, jambs, sill) and rough opening shall be sealed on the interior with backer rod as necessary and sealant that is compatible with all surfaces applied to. EPA recommends using a minimum 20 year sealant.					
Rough Openings - Gap at Exterior Door Frames • Gaps between door frame (header, jambs, threshold) and rough opening shall be sealed on the interior with backer rod as necessary and sealant that is compatible with all surfaces applied to. EPA recommends using a minimum 20 year sealant.					
Rough Openings - A/C Sleeves • Gaps between A/C sleeves and rough openings to be sealed on the interior with backer rod as necessary and sealant that is compatible with all surfaces applied to. EPA recommends using a minimum 20 year sealant. Insulated interior cover with air tight compressible gasket must be provided.					
Doors - Weather-stripping • When required by local building code, verify entranceways contain vestibules with weather-stripping hard-fastened to the door or frame. • Weather-stripping is mandatory at doors between conditioned spaces and the exterior; unconditioned spaces; and spaces vented to the outside. • Weather-stripping is recommended, but not required, at doors between corridors and stairwells; between apartments and corridors; and doors leading to mechanical rooms. • Weather-stripping at mandatory locations shall be installed with a rigid fastener and replaceable foam gasket specified for durability and less maintenance.					
Plank Edges (Steel Stud Construction) - At plank / exterior sheathing joint • Transition Membrane must be installed over top spanning the sheathing / plank edge joint creating a bellows with backer rod • All termination seams must be sealed with compatible sealant. EPA recommends using a minimum 20 year sealant.					
Plank Edges (Concrete Masonry Construction) - At plank / CMU joint • Option 1 - If gap is greater than 1/4", Transition Membrane must be used to seal the gap with minimum 3" overlap • Option 2 - If gap is less than 1/4", Liquid Membrane can be used to seal the gap • Option 3 - When shelf angles are to be installed, through wall flashing must be draped from above to completely cover the joints at top and bottom edges of the plank and sealed to the shelf angle. The Liquid Membrane shall be applied up to and continuing on the underside of the shelf angle to achieve continuity.					
Plank Edges - At plank / steel girder joint • Through wall flashing must be draped from above to completely cover this joint and the entire face of the girder and sealed to the shelf angle. • This can be sealed with a transition membrane from the interior underside of the plank if the girder is solid and is allowed by local code.					
Steel Columns - Steel / CMU / Exterior Sheathing Joints • If allowed by local code, EPA suggests gaps shall be filled with backer rod as necessary and minimum 20 year sealant that is compatible with all surfaces applied to. Alternatively a transition membrane can be installed over top spanning the entire steel column, extending 3" beyond each edge of the column and adhered to the substrate per manufacturer's recommendations.					
Wall to Roof Connections • Liquid air barrier must be brought up over grout edge part of roof plank and shall be sealed over the plank / grout joint					
Transition between foundations and walls • Through wall flashing must be draped from above to completely cover this joint and adhered to the face of the foundation wall. • This can be sealed with a transition membrane from the interior underside of the plank if the girder is solid and is allowed by local code.					
Transition between one wall type and another • Gaps and joints primed and sealed with appropriate transition membrane or tape that is rated to withstand the thermal and structural deflection calculated for the joint in question • Edges of transition membrane or tape (termination seams) sealed with compatible sealant where not sealed by liquid membrane • All termination seams must be sealed with minimum 20-year compatible sealant.					

Transition at inside and outside corners • Gaps and joints primed and sealed with appropriate transition membrane or tape that is rated to withstand the thermal and structural deflection calculated for the joint in question • Edges of transition membrane or tape (termination seams) sealed with compatible sealant where not sealed by liquid membrane • All termination seams must be sealed with minimum 20-year compatible sealant.					
Transition between exterior enclosure and interior walls, floors and ceilings that bound non-conditioned spaces (e.g. garages, some mechanical rooms, vented attics, vented crawlspaces) • At these transitions the rain water control elements remain as part of the exterior enclosure while the insulation, air barrier and condensation control functions connect to the interior walls, floors and ceilings.					
Other • Use this worksheet to identify areas to be inspected based on building geometry, construction, location of mechanicals and building utilities, etc. The list is not exhaustive and the responsible party must still review building plans and field conditions to identify additional leakage sources to be sealed.					

ENERGY STAR

MULTIFAMILY HIGH RISE PROGRAM

Project Name: 0

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INFILTRATION - COMPARTMENTALIZATION - PROTOCOL 8.1

Date:	Field Verified By:

Schedule:

This process begins with the construction documentation. A minimum of 3-5 site visits are recommended to properly inspect air sealing details. Each exterior, common area and in-unit element on the air sealing checklists must be inspected at each of the following stages to ensure use of proper materials and complete seals exist for each juncture or penetration:

1) Window/Wall Mock Up Inspection (If applicable)
2) Load-bearing wall and slab-edge/rim-joist inspection: air/vapor/weather barrier prior to enclosure
3) Pre-drywall visual inspection of penetrations
4) Sample apartment inspection and blower door test
5) Post-correction testing of sample apartment
6) Final inspection and testing of apartments post completion

Equipment Needed

1) Camera
2) Measuring Tape or ruler
3) Floor Plans and Relevant Details

Sampling Requirements:

1) For elements that provide central services to the building (i.e. entry doors, central duct chases, utility service penetrations, etc.) a minimum 50% sample shall be inspected. For elements that are repeated throughout the building or occur in every living unit (i.e. windows, wall/floor connections, air conditioner sleeves, etc.) follow RESNET sampling protocol. If problems are identified, additional units must be inspected to determine if the problems are systemic so an appropriate repair order can be issued.

2) One sample apartment will be inspected and tested to ensure air sealing details are correct before building-wide installations continue.

3) During construction, apartment units must be visually inspected prior to drywall and upon final completion following RESNET sampling protocol. The sample set shall be representative of the variety of apartment types in the building, including: end/corner units and inside units; top-floor, middle-floor, bottom-floor units; and at least one unit of each size/type (i.e., studios, 1-bed, 2-bed, etc.).

4) *PHOTOS REQUIRED*

Provide one representative photograph of continuous air barrier at all types of typical joints, junctions, and general coverage areas. Include the following at a minimum:

5a) Inspected from the interior: Window to interior gypsum board, Air conditioner sleeve sealed to drywall (cover is installed if ACs provided by building), Outlet/Electrical Box - Exterior and Demising Walls, Heating pipe penetrations through exterior walls, Heating pipe penetrations through interior partitions, Plumbing / Sprinkler Pipe Penetrations, Range Gas Line Penetration, Gypsum board to concrete ceiling plank connection - Exterior walls and all interior partition walls, Gap between take off duct and gypsum board, Electrical Panel, HVAC Access Doors, Thermostats, Intercoms, Lighting Fixtures, Door Latch Hole, Medicine Cabinet

NOTES FOR DRAWINGS AND SPECIFICATIONS	PLAN REVIEW COMMENTS	LOCATION dwg / spec	PLAN REVIEW
• Walls, ceilings and floors that separate each apartment from neighboring apartments, corridors, common space, trash chutes, utility chases and trenches, upper floor, lower floors, stairwells and elevator shafts must be air sealed to form a continuous air barrier surrounding the apartment and connecting to the exterior enclosure air barrier system. • As with the exterior air barrier, the compartmentalization air barrier bid and contract documents shall demonstrate a continuous, unbroken air barrier separating each apartment from surrounding spaces. Air barrier materials and accessories shall be clearly identified in section, plan and details.			

PROTOCOL	PLAN REVIEW COMMENTS	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Compliance Statement • Assembly is consistent with the project specifications and Proposed Design model or meets or exceeds the requirements listed in the *Prescriptive Path.*					
Sample Unit - Visual Inspection • The developer shall set up at least two sample units with both exterior enclosure and apartment compartmentalization air sealing details completed for initial inspection. The units shall include a corner unit and a middle unit. All air sealing details must be open for inspection – visible from the interior or exterior of the building. The sample unit inspection will be used to identify problems with the exterior enclosure air sealing approach and apartment compartmentalization before building-wide construction and air sealing of apartments is completed. The inspection may be spread over more than a single visit to accommodate schedules but all air sealing details should be inspected. The sample units should also be used for Preliminary Fan Pressure Testing if applicable.					
Inspect framing layout for interior demising (common) walls and interior partitions to ensure: • Demising wall air barrier (e.g. sealed gypsum board or coated CMU) extends completely to all adjacent walls and is connected in an air tight way to the exterior enclosure air barriers. • Demising wall air barrier (e.g. sealed gypsum board or coated CMU) extends completely to ceiling plank (or other solid ceiling material) where drop ceilings are present.					
Gypsum board to concrete ceiling plank connection • Exterior walls and all interior partition walls					
Gypsum board to concrete floor plank connection • Exterior walls and all interior partition walls					
A/C Sleeve Cover (if A/Cs provided by building) • Verify that insulated covers for through-wall AC units have been provided by the building for use during heating season and when AC units are not installed. Ensure the cover is equipped with a gasket so when installed it will have an airtight seal against the drywall. As an alternative to a gasket, sealant may be used but will have to be resealed each time it is installed.					
Window to interior gypsum board					
Air conditioner sleeve sealed to drywall					
Outlet/Electrical Box - Exterior and Demising Walls					
Heating pipe penetrations through exterior walls					
Heating pipe penetrations through interior partitions					
Plumbing / Sprinkler Pipe Penetrations					
Range Gas Line Penetration					
Gap between take off duct and gypsum board					
Electrical Panel					
HVAC Access Doors					
Thermostats					
Intercoms					
Lighting Fixtures					
Door Latch Hole					
Medicine Cabinet					
Other • Use this worksheet to identify areas to be inspected based on building geometry, construction, location of mechanicals and building utilities, etc. The list is not exhaustive and the responsible party must still review building plans and field conditions to identify additional leakage sources to be sealed.					

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Project Name: 0

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INFILTRATION - BLOWER DOOR TEST - PROTOCOL 8.1	Date:	Field Verified By:

Schedule:

This process begins with the construction documentation. A minimum of 3-5 site visits are recommended to properly inspect air sealing details. Each exterior, common area and in-unit element on the air sealing checklists must be inspected at each of the following stages to ensure use of proper materials and complete seals exist for each juncture or penetration. Fan pressure testing shall be conducted for two purposes: Preliminary testing should be conducted on an initial set of apartments to verify the performance of the air barrier detailing and installation and Final verification testing shall be conducted on a subset of the remaining apartments for quality assurance.

1) Sample apartment inspection and blower door test
2) Post-correction testing of sample apartment
3) Final inspection and testing of apartments post completion

Equipment Needed

1) Camera
2) Measuring Tape or ruler
3) Knife
4) Screwdrivers (Hex, Phillips, Flat)
5) Duct Mask
6) Blue Painter's Tape
7) Metal Tape
8) Floor Plans
9) Riser Diagrams
10) Duct Blaster
11) Manometer

Sampling Requirements:

1) Post-construction, single point blower door testing of apartment units must be conducted following RESNET sampling protocol. The tested units shall be representative of the variety of apartment types in the building, including: end/corner units and inside units; top-floor, middle-floor, bottom-floor units; and at least one unit of each size/type (i.e., studios, 1-bed, 2-bed, etc.). Any apartment that exceeds the allowed leakage rate (0.30 CFM50 per square foot of enclosure), must confirm that all items below have been properly sealed prior to retesting. Per RESNET Section 603.7.8, until the failure is corrected in all identified (failed) apartments in the sample set, none of the apartments shall be deemed to meet the threshold or labeling criteria.

NOTES FOR DRAWINGS AND SPECIFICATIONS	PLAN REVIEW COMMENTS	LOCATION dwg / spec	PLAN REVIEW
• Enclosed apartments must be fan pressure tested as an independent unit in accordance with either ASTM E779 2010 or ASTM E1827. The target maximum air leakage rate is 0.3 CFM per square foot of the enclosure bounding the apartment at an induced pressure difference of 50 pascals. E{A recommends at least two sample apartments are fan pressure tested as soon as they can be scheduled. A subset of the remaining apartments shall be fan pressure tested for quality assurance purposes. See the section on Fan Pressure Testing for details.			

PROTOCOL	PATH REQUIREMENT	PLAN REVIEW COMMENTS	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Compliance Statement • Assembly is consistent with the project specifications and Proposed Design model or meets or exceeds the requirements listed in the *Prescriptive Path.*	<Select compliance path on the 'Project Info' tab>					

Preliminary Testing (Recommended) • The initial set of tested apartments should include at least one corner unit and one middle unit. • The preliminary testing should be conducted at the earliest time in the construction process possible before building-wide air sealing of apartments is completed. • Before an apartment can be tested, the air barrier systems for both the exterior enclosure and the interior compartmentalization should be installed and inspected. • The apartments selected for preliminary testing shall be tested using the methods described below. If the units meet or beat the air leakage target of 0.30 CFM per square foot of enclosure at 50 pascals, the inspections described above continue to ensure air barrier integrity of the exterior enclosure and apartment compartmentalization continues at the same quality. • If an apartment fails to meet or beat the target air leakage rate, then deficiencies in the air barriers should be identified and corrected until all apartments in the preliminary test set have passed. Use the results of these tests to develop a punch list of details to be modified as construction continues. The inspection checklist should be modified to incorporate the lessons learned from the preliminary tests and the modified inspections should proceed to ensure air barrier integrity of the exterior enclosure and for apartment compartmentalization continues at the newly identified quality. • Send a summary of the preliminary tests, results and any recommendations to the project team to reduce apartment infiltration moving forward.		
Final Verification Testing • When seven apartments are ready for final testing, each apartment must be tested and pass in order to begin sampling. Once sampling begins, one apartment shall be selected at random from a group of seven apartments. More than one group of seven may be available for testing at the same time, but they must be divided into identified groups of seven or less. The logic for responding to units that pass or fail then follows the RESNET 2006 Mortgage Industry National Home Energy Rating Systems Standard sampling protocol. • If the randomly selected test apartment passes, then all apartments in that set are deemed to pass. • If the randomly selected test unit fails, then an additional 2 units in that group of seven must be tested. If either of those two units fail, then the remaining 4 units must be tested. Any unit that fails must have the air barrier deficiencies corrected until it meets or beats the air leakage target of 0.30 CFM at 50 pascals induced pressure difference. See the Sampling Requirements section of this protocol for more details. • Continue this process until all apartments have been included in a group of seven.		
Fan Pressure Testing Method • Prior to testing follow Residential Energy Services Network (RESNET) Mortgage Industry's National Home Energy Rating Systems Section 802.2 Protocol for Preparing the Building Enclosure for Testing. • Measure the air leakage rate of a test apartment using fan pressurization techniques following either ASTM E779 2010 or ASTM E1827. If using ASTM E1827, a one-point test at 50 Pascal using the average CFM50 measured under depressurization is acceptable for this measurement. • When performing this test, the calibrated blower door fan shall be located in the entry door, balcony/patio door or window of the apartment. Windows in adjacent apartments shall be open during the test. Alternatively, the pressure difference between the test unit and the neighboring units can be measured when the test unit is depressurized 50 pascals relative to outdoor air. Windows do not need to be opened in a neighboring unit if the pressure difference between it and the test unit is greater than or equal to 45 pascals. If the apartment entry door opens to a corridor or other enclosed space, that space shall be well open to the outside during the test (e.g., opening the windows and corridor doors in neighboring units achieves both ends). • Conduct any QA procedures on test equipment and set-up recommended by the blower door manufacturer (e.g., ensure that the fan flow is in the proper direction for flow measurement to be accurate). Check the tubing connections to the flow sensing element and that the flow sensing element is properly positioned. • Conduct test to see whether or not the apartment air leakage rate is less than or equal to 0.30 CFM50 per square foot of enclosure (e.g., all surfaces enclosing the apartment, including exterior and party walls, floors, ceiling). Use the guidance in the Preliminary or Final Verification Testing sections above to determine the next action (e.g., test more apartments, make repairs or write report). • *Note: This test does not distinguish between leakage from the apartment to outside and leakage from the apartment to other interior and/or interstitial spaces. The allowable limit for measured leakage is for the total enclosure of the apartment unit.*		

Apartment Tightness Summary: This section can be duplicated, copy and insert rows

Apt #	Floor #	Unit Type (e.g. A, B, C)	# of Bedrooms	Floor Area (FA)	Perimeter Wall Length (PWL)	Ceiling Height (CH)	Enclosure Area (2* FA) + (PWL*CH)	Maximum CFM50 allowed	Tested CFM50	Tested CFM50/SF (Criteria is <=.30)	Comments
							0	0		#DIV/0!	
							0	0		#DIV/0!	
							0	0		#DIV/0!	
							0	0		#DIV/0!	
							0	0		#DIV/0!	
							0	0		#DIV/0!	
							0	0		#DIV/0!	
							0	0		#DIV/0!	
							0	0		#DIV/0!	

ENERGY STAR

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VENTILATION - SCHEDULE AND OPERATION - PROTOCOL 8.2

Date:	Field Verified By:

Schedule:

1) The developer or GC shall ensure that deliveries are inspected prior to accepting them to verify that product substitutions by the distributor or manufacturer have not resulted in non-ENERGY STAR certified exhaust fans for in-unit ventilation systems.

2) Minimum of one on-site inspection required, preferably immediately after installation so that corrective action can be taken if necessary. Delivery tickets may be used to verify complete shipments but on-site inspections of a sample of installed appliances is required.

3) Flow measurements cannot be verified until interior drywall and registers are installed.

Equipment Needed:

1) Camera
2) Measuring Tape or ruler
3) Screwdrivers (Hex, Phillips, Flat)
4) Floor Plans (preferably with mechanicals)
5) Roof Plans (preferably with mechanicals)
6) Mechanical Schedule
7) Cut Sheets from Contractor Submittals
8) Pressure Pan
9) Manometer
10) Quantified CO release (if applicable)

Sampling Requirements:

1) 100% of ventilation equipment serving common spaces must be inspected and verified for system performance (ie. fan efficiency, controls). Ventilation performance (CFM) at the delivery location (register) can be sampled at every other floor. The overall sample shall include at least one riser for each type/size of fan installed in the building serving common space.

2) 100% of central ventilation equipment serving apartments must be inspected and verified for system performance (ie. fan efficiency, controls). Ventilation performance (CFM) at the delivery location (register) can be sampled following the modified RESNET sampling protocol outlined in the *How to Use this Manual* section on page 11 of the T&V Protocols. The overall sample shall include at least one riser for each type/size of fan installed in the building serving apartments. For each ventilation riser tested, take measurements at every other floor to obtain a representative profile.

3) Verification of in-unit ventilation equipment performance (ie. fan efficiency, controls) and in-unit ventilation performance (CFM) at the delivery location (register) can be sampled following the modified RESNET sampling protocol outlined in the *How to Use this Manual* section of the T&V Protocols.

4) *PHOTOS REQUIRED*

- Photo of fan installation and nameplates
- For through-wall kitchen exhaust ventilation, photo of kitchen exhaust venting to outside
- If applicable, photograph location of CO/NO2 sensors and air intake point.

NOTES FOR DRAWINGS AND SPECIFICATIONS	PLAN REVIEW COMMENTS	LOCATION dwg / spec	PLAN REVIEW
Construction documents must include performance criteria for central and in-unit ventilation systems including: • Apartment in-line and ceiling exhaust fans must be ENERGY STAR certified.			
Construction documents must also include the following criteria apply to projects using the *Prescriptive Path*: • Central exhaust and in-line exhaust systems serving apartments must have self-balancing dampers at each grill. • Central exhaust fans 1/16 HP and less must be direct-drive and have variable speed controllers. • Central exhaust fans greater than 1/16 HP and less than 1 HP must be direct-drive with ECM motors and variable speed controllers. • Central exhaust fans 1 HP and larger must have NEMA Premium efficient motors. • In addition to requirements above, powered common laundry ventilation must be installed with automatic demand control to turn off ventilation fans when no dryers are operating.			
Construction documents must include performance criteria for buildings with garages including: • If following the *Prescriptive Path*, when garage exhaust is required by code, CO/NO2 sensors must be installed that control exhaust fan operation. • Include threshold criteria for CO/NO2 concentration which activates sensors. • Include a schedule of CO/NO2 controls with make, model, location and count. • Include locations, powering of sensors, and connecting wiring on plans. • Include fan size (CFM capacity) in ventilation schedule and air intake points on plans to properly ventilate throughout garage area.			

ID	DESCRIPTION	LOCATION	QUANTITY	MFR	MODEL #	DESIGN CFM	DESIGN PRESSURE (Pa)	FAN POWER (HP, BHP, kW, Watts)	ENERGY STAR / NEMA PREMIUM?	ECM?	DIRECT-DRIVE?	VARIABLE SPEED CONTROLLERS?	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)

PROTOCOL	PATH REQUIREMENT	PROPOSED ERM	ENERGY MODEL	PLAN REVIEW COMMENTS	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
COMPLIANCE STATEMENT								
Compliance Statement • All ventilation systems are consistent with the project specifications and Proposed Design model or meets or exceeds the requirements listed in the *Prescriptive Path*.								
MODELING INPUTS - SIZING & BALANCING								
Non - Apartment Fan Efficiency • Design specifications shall include fan energy efficiency criteria (BHP and motor efficiency) for the fans themselves.	<Select compliance path on the 'Project Info' tab>	0	0					
Apartment Fan Efficiency (Roof) • Specifications shall include fan energy efficiency criteria (BHP and motor efficiency) for the fans themselves.	<Select compliance path on the 'Project Info' tab>	0	0					
Apartment Fan Efficiency (In-Unit) • Specifications shall also include fan energy efficiency criteria (Watts/CFM) for the fans themselves.	<Select compliance path on the 'Project Info' tab>	0	0					
All Ventilation Systems - Capacity, Testing and Balancing • The developer may choose to hire a Test and Balance (TAB) contractor to commission the system or any part thereof. Either the TAB contractor or the responsible party shall provide a balancing report for each shaft with operating pressures at the grill furthest from the fan and with airflow (CFM) measurements at apartment and common area grills following RESNET sampling protocol described below. Airflow shall be measured with equipment that fully enclose grills and is able to measure as low as 20 CFM ± 5 CFM. Air intake point shall also be inspected. • For kitchen exhaust fans, prescriptive duct sizing requirements described at www.energystar.gov/newhomesresources may be used in lieu of measuring the actual air flow rate. • Average supply and exhaust CFM measurement shall be updated in the As-Built model where applicable. • If following the *Prescriptive Path*, common area ventilation systems cannot exceed ASHRAE 62.1-2007 by more than 50%. Apartment ventilation systems cannot exceed ASHRAE 62.2-2007 by more than 50%.	<Select compliance path on the 'Project Info' tab>	0	0					
	<Select compliance path on the 'Project Info' tab>	0	0					
Demand Controls • Verify control systems including timing devices, demand control sensors, or other devices match project specifications and Proposed Design model or meets or exceeds the requirements listed in the *Prescriptive Path*. EPA suggests including the following in the design where applicable: • Controls to allow for intermittent (ON/OFF) operation of central exhaust fans are not permitted. • Public/Office Bathroom Exhaust Configuration and Control: • If vented to the roof with a central fan: Motorized damper controlled by light switch to open when occupied (normally tightly closed). • If vented thru-wall: ENERGY STAR certified fan vented through-wall controlled by light switch to activate when occupied.	<Select compliance path on the 'Project Info' tab>	0	0					
Heat or Energy Recovery • Consider heat or energy recovery for 100% of corridor supply air. Capacity of heat recovery unit should match the design corridor ventilation rates.	NA	0	0					

GARAGE VENTILATION

Garage Exhaust Fan CFM and Efficiency ▪ Equipment is consistent with the project specifications and Proposed Design model or meets or exceeds the requirements listed in the *Prescriptive Path*. ▪ Provide Testing and balancing (TAB) report showing fan's performance and balance at intake points. TAB to be provided by the installing contractor, responsible party or commissioning agent.	NA	0	0					
Test Sensor Operation ▪ If following the *Prescriptive Path*, when garage exhaust is required by code, CO/NO2 sensors must be installed that control exhaust fan operation. ▪ Using quantified CO tracer gas release (obtain specifications from chemical test suppliers), confirm performance of sensor and activation of fans. ▪ A Statement of Substantial Completion or approved proxy may be submitted to establish completion of the work associated with this protocol. A Statement of Substantial Completion is to be completed by the installation contractor or other qualified representative on company letter head and attached to all relevant *T&V Worksheets* complete with all required information, photographs, cut sheets, etc.								
CO/NO2 Sensor Locations ▪ Record sensor locations and confirm conformance with plans.								
Garage Fan and CO/NO2 Sensor - Manufacturer's Product Data ▪ Include cut sheet showing fan and sensor specifications such as CFM and CO/NO2 concentration threshold.								

VENTILATION MISC

Toilet, Kitchen, General Exhaust Grills and Corridor Supply Ventilation Grills ▪ EPA recommends that each exhaust and supply grill assembly be equipped with a self-balancing damper that responds to changes in duct pressure to allow a constant airflow (+/- 20%) over a range of operating pressures from 0.2 in WC to the greater of: 0.5 in WC or the maximum system operating pressure at the particular exhaust register/grill. This is critical to helping ensure the system performs according to project specifications and Proposed Design model. ▪ If following the *Prescriptive Path* Central exhaust and in-line exhaust systems serving apartments must have self-balancing dampers at each grill. ▪ Adjustable register assemblies that allow for the free area to be manually adjusted in the field should not be used to meet this requirement. Self balancing dampers shall be designed and installed in any situation where more than one exhaust point is connected to a fan so that they may be easily removed for cleaning or replacement. ▪ For inspection: Self balancing dampers have been installed in correct position and are functioning properly. For through-wall kitchen exhaust systems, photo-document the exhaust outlet at the exterior to confirm that they are vented to the outside.								
Common Area Supply Ventilation - Outdoor Air Damper▪ For systems designed with outdoor-air supplied to the ventilation distribu								
Fresh Air Intake Systems - Operating Sequence ▪ For both active and passive intake systems, design specifications must indicate operation sequence as it relates to controls, sensors, fans, dampers, etc.								
Fresh Air Intakes are Properly Located ▪ For all make-up air systems, a visual inspection of the supply air source shall be conducted to ensure pollutants are not being drawn into the building unintentionally.								
Smoke Vents ▪ If allowed by local code, stairwell bulkhead and elevator hoist way smoke vents must be normally closed and interlocked with motorized damper and smoke detector/fire alarm system per ASHRAE 90.1-2007, Section 6.4.3.4.								
Passive Intake Systems (Trickle Vents) ▪ In passive intake systems (i.e., trickle vents), EPA recommends, but does not require, that airflow measurements be taken to verify flow rates are within design specifications under the range of conditions anticipated for system operation. If airflow cannot be directly measured, pressure measurements can be used to estimate airflow based on manufacturer's data for different pressure levels.								
Ventilation - Manufacturer's Product Data ▪ Review manufacturer's cut sheets or invoice detailing system manufacturer, model, HP and CFM.								
Ventilation - Training and Manuals ▪ EPA recommends confirming that all applicable operating and specification manuals are delivered to the building staff. EPA also recommends verifying that staff members have been trained and are aware of their responsibilities to maintain and operate the systems properly. Summarize any training performed and personnel involved.								

All ventilation fans installed and listed above should be listed here to document tested ventilation rates. Insert rows to meet sampling protocol.

Fan/Shaft ID	0			0			0			0			0			0		
Total Design CFM																		
Floor	Apt # or Space	Design CFM	Tested CFM	Apt # or Space	Design CFM	Tested CFM	Apt # or Space	Design CFM	Tested CFM	Apt # or Space	Design CFM	Tested CFM	Apt # or Space	Design CFM	Tested CFM	Apt # or Space	Design CFM	Tested CFM
Bottom Floor Pressure (Pa), if applicable																		

Calculator for Non Apartment Spaces (ASHRAE 62.1 - 2007)

Space Name	Number of Floors	Space Type	CFM/Person	CFM/SF	Occupant Density/1000 SF	Occupants per room (optional)	Floor Area (SF)	Ventilation Design (CFM)	Ventilation Requirements (CFM) *based on space type*	Ventilation Requirements (CFM) *based on occ. density*	Ventilation Requirements (CFM) % above or below vent. req't	Comments
			#N/A	#N/A	#N/A				#N/A	#N/A	**#N/A**	
			#N/A	#N/A	#N/A				#N/A	#N/A	**#N/A**	
			#N/A	#N/A	#N/A				#N/A	#N/A	**#N/A**	
			#N/A	#N/A	#N/A				#N/A	#N/A	**#N/A**	
			#N/A	#N/A	#N/A				#N/A	#N/A	**#N/A**	
							Total	**0**	#N/A	#N/A		

Calculator for Apartment Spaces (ASHRAE 62.2 - 2007)

Whole Unit Ventilation

Number of Bedrooms (studios are to be entered with (1) bedroom)	Typical Floor Area (SF)	Ventilation Design (CFM)	Calculated Ventilation Requirement (CFM)	Table 4.1a Ventilation Requirement (CFM)	% above min baseline (Must be at least 0%)	% above max baseline (*Prescriptive Path* projects cannot Exceed 50%)
			-	-	#VALUE!	#VALUE!
			-	-	#VALUE!	#VALUE!
			-	-	#VALUE!	#VALUE!
			-	-	#VALUE!	#VALUE!
			-	-	#VALUE!	#VALUE!
			-	-	#VALUE!	#VALUE!
			-	-	#VALUE!	#VALUE!
			-	-	#VALUE!	#VALUE!
			-	-	#VALUE!	#VALUE!
	Total	**0**	**0**			

Local Exhaust Ventilation - Continuous

Kitchen Type	Volume (CF)	Ventilation Design (CFM)	Ventilation Requirement (CFM)	% above baseline (Must be at least 0% and *Prescriptive Path* projects cannot exceed 50%)
			0	#DIV/0!
			0	#DIV/0!
			0	#DIV/0!
			0	#DIV/0!
			0	#DIV/0!
			0	#DIV/0!

Bathroom Type	Ventilation Design (CFM)	Total Ventilation Requirement (CFM)	% above baseline (Must be at least 0% and *Prescriptive Path* projects cannot exceed 50%)
		20	-100%
		20	-100%
		20	-100%
		20	-100%
		20	-100%

Local Exhaust Ventilation - Intermittent

Space Type	Ventilation Design (CFM)	Ventilation Requirement (CFM)	% above baseline (Must be at least 0% and *Prescriptive Path* projects cannot exceed 50%)
		#N/A	#N/A
		#N/A	#N/A

ASHRAE 62.2 - 2007 Table 4.1a - Ventilation Air Requirements, CFM

	Bedrooms										
Max Floor Area	0	1	2	3	4	5	6	7	8	9	10
1500	30	30	45	45	60	60	75	75	90	90	90
3000	45	45	60	60	75	75	90	90	105	105	105
4500	60	60	75	75	90	90	105	105	120	120	120
6000	75	75	90	90	105	105	120	120	135	135	135
7500	90	90	105	105	120	120	135	135	150	150	150
999999	105	105	120	120	135	135	150	150	165	165	165

ASHRAE 62.1 - 2007 Table 6-1

Space Type	CFM/Person	CFM/SF	Occupant Density	Combined Outdoor Air Rate	Air Class
Conference/ Meeting Room	5	0.06	50	6	1
Corridors	0	0.06	0	0	1
Storage Rooms	0	0.12	0	0	1
Laundry rooms, central	5	0.12	10	17	2
Lobbies	7.5	0.06	30	10	1
Multipurpose assembly	5	0.06	120	6	1
Office space	5	0.06	5	17	1
Reception areas	5	0.06	30	7	1
Main entry lobbies (office only)	5	0.06	10	11	1
Computer (not printing)	5	0.06	4	20	1
Electrical Equipment Rooms	0	0.06	0	0	1
Elevator Machine Rooms	0	0.12	0	0	1

ASHRAE 62.2 - 2007 Table 5.1 & 5.2

Ventilation Type	Intermittent	Units	Continuous	Units
Kitchen	100	CFM	5	ACH
Bath	50	CFM	20	CFM

ENERGY STAR

MULTIFAMILY HIGH RISE PROGRAM

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Project Name: 0

Table of Contents | ERMs | Prerequisites Checklist | Overview

VENTILATION - DUCT TIGHTNESS TEST - PROTOCOL 8.2	Date:	Field Verified By:

Schedule:

1) Inspect and test duct systems for leakage upon installation including all take offs and branches and prior to enclosure with drywall. The intent is to test the duct system before drywall and grills are installed so corrections can be made if duct leakage is excessive, however all take offs branch duct work, bottom caps and permanent roof curbs must be installed prior to testing. Takeoffs are typically installed floor by floor.

Equipment Needed

1) Camera
2) Measuring Tape or ruler
3) Knife
4) Screwdrivers (Hex, Phillips, Flat)
5) Duct Mask
6) Foam Blocks (***If dry wall has started)
7) Metal Tape
8) Floor and Roof Plans (preferably with mechanicals)
9) Riser Diagrams
10) Duct Blaster
11) Manometer

Sampling Requirements:

1) Apartment ventilation risers must be inspected and verified for system performance following the modified RESNET sampling protocol outlined in the *How to Use this Manual* section on page 11 of the *T&V Protocols*. For each ventilation riser in the sample set, conduct inspections at every other floor to obtain a representative profile. The sample shall include at least one riser for each type/size of fan installed in the building.

2) *PHOTOS REQUIRED*

- One representative photo of each duct sealing detail outlined below

NOTES FOR DRAWINGS AND SPECIFICATIONS	PLAN REVIEW COMMENTS	LOCATION dwg / spec	PLAN REVIEW
Construction documents must include performance criteria for central and in-unit ventilation systems including: For central ventilation systems: • Roof curb and or wall penetrations has been sealed • Mastic or other UL-181 compliant material shall be applied within temperature range and according to all other manufacturer's requirements at ALL transverse joints and take offs. • All duct transitional junctions have been sealed with mastic or other UL-181 compliant material. • All connections between gypsum board and ductwork must be sealed. • Total exhaust shaft leakage shall not exceed the sum of 5 CFM50 per register per shaft plus 5 CFM50 floor per shaft at a pressure of 0.2 in WC (2.5 CFM50 if following the *Prescriptive Path*) • Contractor shall adjust roof fan to provide a pressure of 0.2 – 0.3 inches WC at the grill farthest from the fan. For in-line fan exhaust systems: • Mastic or other UL-181 compliant material shall be applied within temperature range and according to all other manufacturer's requirements at ALL transverse joints and take offs. • All duct transitional junctions have been sealed with mastic or other UL-181 compliant material. • All connections between gypsum board and ductwork must be sealed. • If plank core is to be used as duct, ceiling plank penetration has been sealed. • If plank core is to be used as duct, plank core has been effectively connected to exterior of the building. • The appropriate plank core was selected that aligns with exterior louver.			

PROTOCOL	PATH REQUIREMENT	PROPOSED ERM	ENERGY MODEL	PLAN REVIEW COMMENTS	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Compliance Statement • Assembly is consistent with the project specifications and Proposed Design. Central exhaust systems serving apartments must be tested for duct leakage, which cannot exceed the sum of 5 CFM50 per register per shaft plus 5 CFM50 per floor per shaft. For projects using the *Prescriptive Path*, leakage cannot exceed the sum of 2.5 CFM50 per register per shaft plus 2.5 CFM50 per floor per shaft.	<Select compliance path on the 'Project Info' tab>	0	0					
	<Select compliance path on the 'Project Info' tab>							
Duct Leakage Testing (Central Exhaust Serving Apartments) • Following the procedures outlined in your duct leakage tester operation manual, a single or five-point test for total duct leakage in the main duct shaft using a calibrated fan between -50 and -100 Pascal measured under depressurization or 50 and 100 Pascal under pressurization is acceptable for this measurement. • When conducting a duct leakage depressurization test, the flow conditioner and one of the flow rings must always be installed. • EPA does not require the duct tester to be connected to a specific location in the shaft, however typically central exhaust duct tightness tests are conducted from the roof with the duct tester connected to the roof curb. Often a transition plate is needed to effectively seal the duct tester to the roof curb opening. Cardboard is usually a readily accessible material on construction sites and can be easily adapted into such a transition plate (precut plastic, acrylic glass and or rubber sheets could also be used). • The pressure probe should be installed approximately 5' downstream of the connection between the duct and the duct tester, with the probe configured so it's openings face perpendicular to the direction of flow and only static pressure is measured, not velocity pressure. When connecting the duct tester to the roof curb, poke a hole in the transition sheet and run the tubing and pressure probe inside of the shaft before connecting the transition sheet. Often static pressure probes come with a magnet to help configure the probe in the right direction, but if the inside surface of the duct is not magnetic, a weighted pressure hose could be used with holes cut out of the sides to prevent velocity pressure from being measured. • For five-point tests, use the Linear Regression Assistant below to find the CFM50 leakage. • If credit is being taken for improved energy efficiency of the ventilation duct system, adjust As-Built energy model based on actual duct leakage rates as described in the *Simulation Guidelines*. Provide a summary of results of any duct leakage or ventilation performance testing; a sample table is provided in the *T&V Worksheets*.							
Roof Curb/Wall Penetration (Central) • Roof curb and or wall penetration sealing.								
Transverse Joints (Central and Through Wall) • All transverse joints sealed air-tight with mastic applied according to manufacturers requirements (i.e. application temperature). This includes verifying through visual inspection that joints and gaps between all exhaust and supply ducts and sheetrock at the grills have been sealed.								
Transitions (Central and Through Wall) • All duct transitional junctions have been sealed with mastic.								
Pinned Ducts (Central and Through Wall) • All joints have been completely sealed around the entire perimeter including those tight against a wall or ceiling. Before connecting ductwork at this condition, ample mastic needs to be applied to both sections and then connected while the mastic is still wet to achieve the seal.								
Elbow Joints (Round Duct Work) • All elbow joints have been effectively sealed with mastic.								
Exterior Wall Connection (Through Wall) • Ductwork connection with exterior grill termination has been sealed air-tight.								

Duct Leakage Summary (Single-Point tests): This section can be expanded, copy and insert rows as needed.

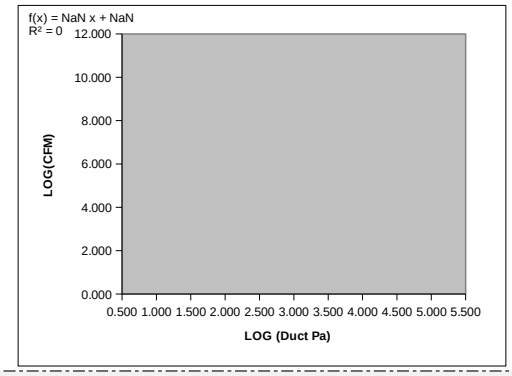
Fan/Shaft ID	# Registers Served	# floors	Design Exhaust CFM	CFM50 Leakage from Single-Point Test	% Leakage of Design CFM	MAX CFM50	Comments
					#DIV/0!		
					#DIV/0!		
					#DIV/0!		
					#DIV/0!		
					#DIV/0!		
					#DIV/0!		
					#DIV/0!		
					#DIV/0!		
					#DIV/0!		

Linear Regression Assistant: This section can be used for multi-point testing and can be duplicated by copying/inserting rows.

Fan/Shaft ID		
	Approximate Indoor Temp (F):	
	Approximate Outdoor Temp (F):	
	Baseline Pressure (Pa):	

Shaft Pressure	Fan Pressure (Pa)	Plate Position	Flow Rate (cfm)	Temp Corc Flow (cfm)	Log (Duct Curb Press)	Log (Flowrate)
			Enter Plate Position	#VALUE!	Err:502	#VALUE!
			Enter Plate Position	#VALUE!	Err:502	#VALUE!
			Enter Plate Position	#VALUE!	Err:502	#VALUE!
			Enter Plate Position	#VALUE!	Err:502	#VALUE!
			Enter Plate Position	#VALUE!	Err:502	#VALUE!

Slope:	#VALUE!
Intercept:	#VALUE!
C:	#VALUE!
n:	#VALUE!
R:	#VALUE!
From Regression:	
CFM_{50}	#VALUE!



ENERGY STAR

MULTIFAMILY HIGH RISE PROGRAM

Project Name: 0

METERS - CONFIGURATION - PROTOCOL 9.1

Date:	Field Verified By:

Schedule:
1) After piping and wiring are complete
2) After installation, hook-up, and activation of meters.

Equipment Needed
1) Camera
2) Plans and Specifications

Sampling Requirements:
1) Where metering is in basement or central location, check all meter banks. Where metering is distributed in common areas, such as hallway utility closets or is inside individual apartments, follow the modified RESNET sampling protocol outlined in the *How to Use this Manual* section on page 11 of the *T&V Protocols* to include, at a minimum, one apartment from each line.

2) *PHOTOS REQUIRED*
- Provide photographs of all types of meters (electrical, gas, water) for building. Be sure to properly label location and type of meter represented.

METER TYPE:	Electric	Gas	Fuel Oil	Water	Steam	Hot Water	PLAN REVIEW COMMENTS	LOCATION dwg / spec	PLAN REVIEW
Location									
Utility Company *(National Grid)*									
Configuration *(Direct, Master, Sub)*									
# of Meters									
Areas Served *(Common, Apts, Retail)*									

PROTOCOL	PLAN REVIEW COMMENTS	LOCATION dwg / spec	PLAN REVIEW	INSPECTION	INSPECTION COMMENTS (Use this field to note problems, specific inspection details, or changes in As-Built compared to Design, like model numbers. If installed as designed, please state "Same as Design". If make/model numbers have changed, list them here.)
Location - Residential • Confirm location and existence of electric, gas, and water meters and observe configurations (areas served) in relation to plans and specifications.					
Location - Nonresidential• Post-construction, the utility consumption of the residential-associated spaces must be capable of evaluation inde					
Type • Check meter types against specifications (and/or utility correspondence).					
Configuration • Confirm metering configuration: master meter, submetered, direct metered.					
Utility Release Forms• For buildings that are direct-metered for utilities to the apartments, the building owner must secure signed releases from individual apartment occupants to allow for					
Statement of Substantial Completion • A Statement of Substantial Completion or approved proxy may be used to establish completion of the work associated with this protocol. A Statement of Substantial Completion is to be completed by the installation contractor or other qualified representative on company letterhead, complete with all information, photographs, cut sheets, etc., required in this protocol and in the corresponding *T&V Worksheet.*					