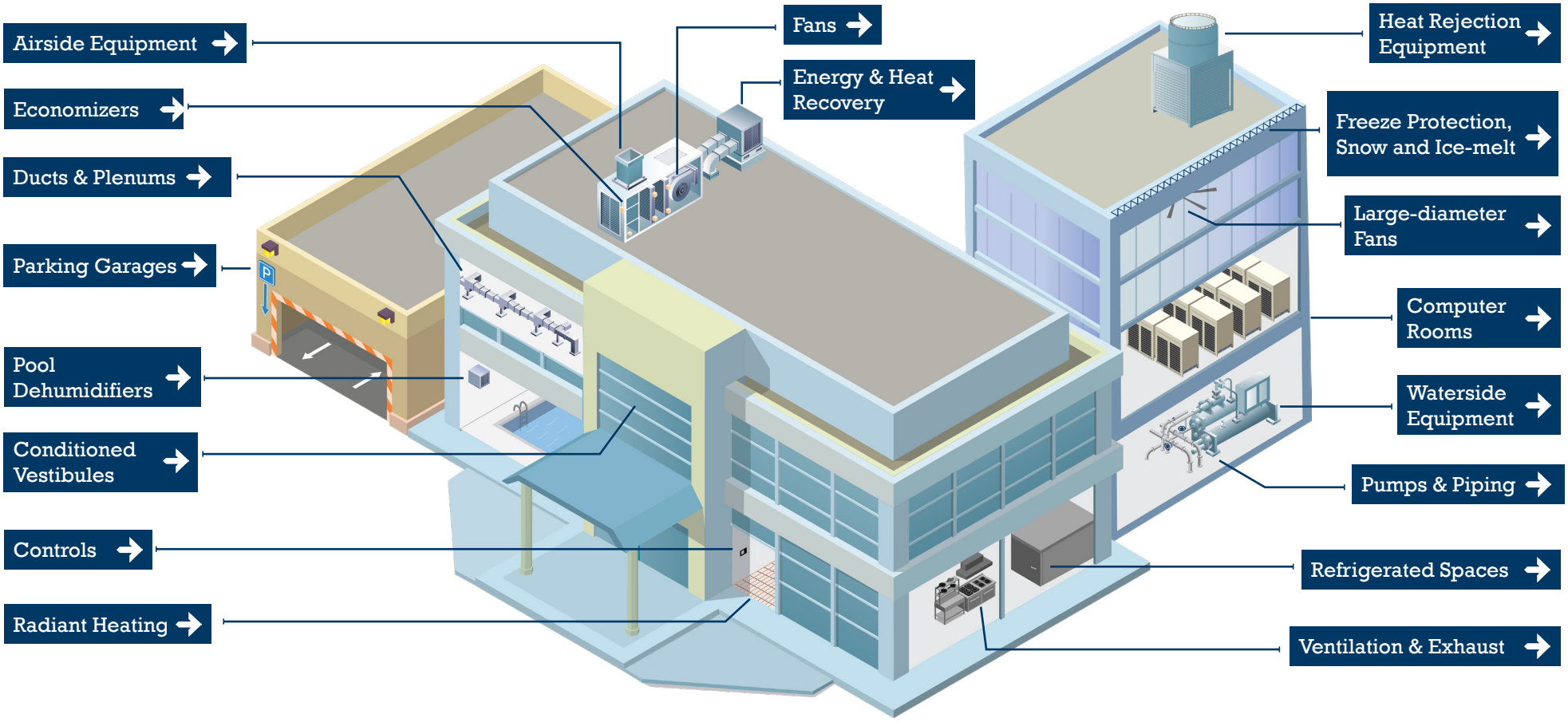
Minnesota Commercial Energy Code

Mechanical Application Guide

BuildUp MN
Supporting Energy Codes in Minnesota

This Application Guide supports the Minnesota Commercial Energy Code mechanical requirements for commercial building projects that are new construction, additions, and alterations.

Click on any of the topics in this interactive infographic for detailed information about requirements, key decisions, roles and responsibilities, and compliance documentation.



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Application Guides

This Application Guide is meant to provide guidance to industry practitioners and code enforcement officials on the intent and application of Minnesota's 2024 Commercial Energy Code (Energy Code).

A suite of Guides will be published covering the building systems which are regulated in the Energy Code.

Envelope – Envelope system components such as roof, walls, windows, floors, doors, etc. ***COMING SOON!***

Mechanical - Space conditioning, ventilation and refrigeration system components such as fans, ductwork, controls, heat rejection equipment, etc.

Lighting & Electrical – Indoor and outdoor lighting and electrical system components such as luminaires, controls, receptacles, metering, etc.

Plumbing – Domestic water heating system components such as water heaters, piping, controls, etc. ***COMING SOON!***

Contributors:

NORESCO

CEE Center for Energy and Environment

This Application Guide was developed by BuildUp MN, a program implemented by the MN Advanced Energy Codes Partnership with the goal of improving energy code compliance across Minnesota and developing the workforce for the next generation of buildings. This material is based on work supported by the US Department of Energy's Energy Efficiency & Renewable Energy Office (EERE) under Award Number DE-EE0010933.

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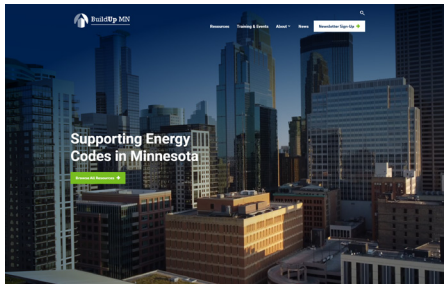
BuildUp MN
Supporting Energy Codes in Minnesota

BuildUp MN offers training, tools and resources to support energy code compliance with the MN Commercial Energy Code.

Visit our website: https://buildupmn.org



Using This Guide

Look for these color-coded call out boxes with helpful context, additional information and calculation support.

Important Information

Additional Resources

Example Calculation

Importance of Energy Efficient HVACR Systems

Because of Minnesota's climate extremes, heating and cooling loads calculated to keep indoor environments comfortable for building occupants are relatively significant. Space conditioning often makes up a considerable portion of a commercial building's energy consumption. As a result, energy efficient heating, ventilation, and air conditioning systems can have a sizable contribution towards efficient building operation, and at a statewide scale, a sizable contribution to meeting Minnesota's energy efficiency goals. For commercial buildings that include refrigeration, these systems are often a significant portion of the building's energy consumption profile and therefore including controls and efficient system components can produce notable savings.

HVACR systems in particular produce energy and cost savings based on how they operate over time. To realize these operational cost savings over the life of the equipment, efficient systems must be included in the building design, and installed and maintained as intended. This accounts for the emphasis in the 2024 MN Commercial Energy Code (Energy Code), and in this Guide, on controls and commissioning. In addition, system selection and inclusion of technologies such as thermal energy storage could produce operational cost savings by shifting the timing of peak loads to take advantage of utility rate structures.

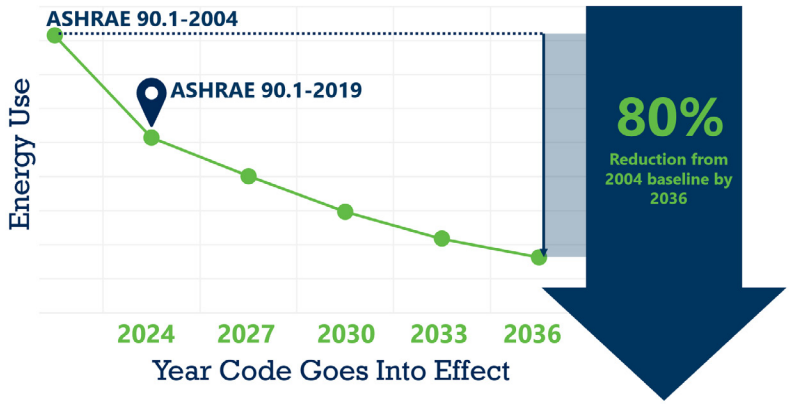
Health indicators such as indoor air quality are also impacted by the design, installation and maintenance of HVACR systems. Energy Code requirements such as minimum ventilation rates promote healthy environments as minimum performance standards for all buildings, not just those with adequate project budgets. Automated control systems and monitoring can also contribute to recovery from disruptive events such as power outages to get buildings back online supporting local businesses and service operations.

MINNESOTA'S ENERGY EFFICIENCY GOALS

Minnesota's Climate Action Framework calls for new commercial and multifamily buildings to reach net zero by 2036 and achieve significant energy and emissions reductions in existing buildings. To meet energy reduction goals and ensure our next generation of buildings are ready for the changing climate, Minnesota has committed to advancing energy codes for commercial and multifamily buildings.

Recent legislation has enshrined in statute aggressive energy efficiency improvement goals for the commercial energy code. Beginning in 2024, Minnesota must adopt a new energy code each time a new model code is released at the national level —approximately every three years— with an 80% efficiency improvement over a 2004 baseline by 2036.

Read more here: https://climate.state.mn.us/minnesotas-climate-action-framework



What's New in the 2024 MN Commercial Energy Code

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The 2020 MN Commercial Energy Code incorporated the 2018 International Energy Conservation Code (IECC) and ANSI/ASHRAE/IES Standard 90.1-2016 with Minnesota-specific amendments made by the State. For the 2024 MN Commercial Energy Code update, incorporation of the IECC provisions has been removed and the requirements are based on ANSI/ASHRAE/IES Standard 90.1-2019 with Minnesota amendments per Section 1323.0010.

In addition, the following significant building HVACR requirements have been added or changed in the 2024 Energy Code:

Energy Recovery Ventilators in Large Dwelling Units

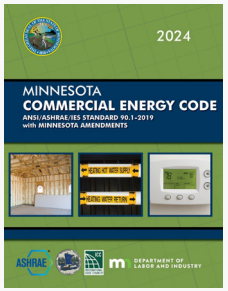
Dwelling units 750 ft^2 and larger are now required to include outdoor air energy recovery ventilation (ERV) systems when following the Prescriptive compliance path. Exceptions were modified to include climate zone 6A along with 7, therefore no Minnesota climate zones require the enthalpy recovery ratio be met at cooling design conditions, only heating design conditions must be met. Additional changes to ERV requirements are shown in Section 6.5.6.1.

High-Capacity Space-Heating Gas Boiler Systems

Section 6.5.4.8 includes new requirements for gas hot-water boiler systems for space heating with a total system input rate from 1,000,000 Btu/h to 10,000,000 Btu/h. The new requirements include a minimum boiler thermal efficiency of 90%, and that the system be designed to operate with boiler return water temperature at 120 °F or below at design conditions and all operating conditions (or that no more than 20% of the system flow bypass the heat emitters.) Additional detail in Section 6.5.4.8.

Additional Resources

2024 MN COMMERCIAL ENERGY CODE



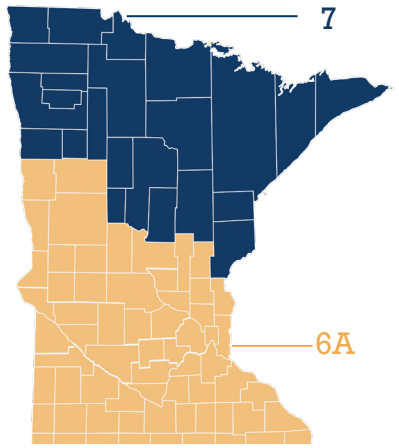
Minnesota's 2024 Energy Code went into effect on January 5, 2024. The Energy Code includes Minnesota amendments to ANSI/ASHRAE/IES Standard 90.1-2019. The complete Energy Code, including the Minnesota amendments, is available from the International Code Council (ICC) online or via hard copy code books.

Online: https://codes.iccsafe.org/content/MNEC2024P1/2024-minnesota-commercial-energy-code

Code Books: https://shop.iccsafe.org/custom-codes/state-codes/minnesota.html

Climate Zones

Minnesota has two climate zones which impact requirements such as economizer design parameters in Section 6.5.1. Section 5.1.4 includes a list of counties that are in Climate Zone 7, all other counties are in Climate Zone 6A. When reviewing requirements in the Energy Code, be sure to understand which Climate Zone the project site is in and look for any requirements that differ by Climate Zone.



Commissioning for Smaller Buildings and Verification Required Prior to Occupancy

Commissioning is now required for buildings with 10,000 ft² or greater of conditioned floor area, where the 2020 Energy Code triggered commissioning at 50,000 ft². It is also made clear that prior to occupancy the building official must either directly receive a preliminary commissioning report (or verification and functional performance testing documentation for projects smaller than 10,000 ft²) or receive a letter of transmittal from the owner documenting receipt and acceptance of the required report. Page 14 of this Guide includes more explanation of verification, testing and commissioning requirements based on building size and other factors, and additional detail is included in Section 4.2.5 and Informative Appendix H of the Energy Code.

Occupied-Standby Controls for Ventilation

New Section 6.5.3.9 requires occupied-standby controls for zones serving only rooms that are required to have automatic partial-off or full-off lighting controls per Section 9.4.1.1 and where ASHRAE Standard 62.1 permits ventilation to be reduced to zero and where the Ventilation Rate Procedure is being used. Multiple zone systems without automatic zone flow control dampers are exempt. Additional detail in Section 6.5.3.9.

New Equipment Efficiency Tables

New minimum efficiency tables have been added to Section 6.8.1 to regulate heat pump and heat recovery chillers (T6.8.1-16), ceiling-mounted Computer Room Air-Conditioning (CRAC) units (T6.8.1-17), cooler and freezer display doors (T6.8.1-18 & T6.8.1-19) and walk-in cooler and freezers (T6.8.1-20).

Large-diameter Ceiling Fan Efficiency

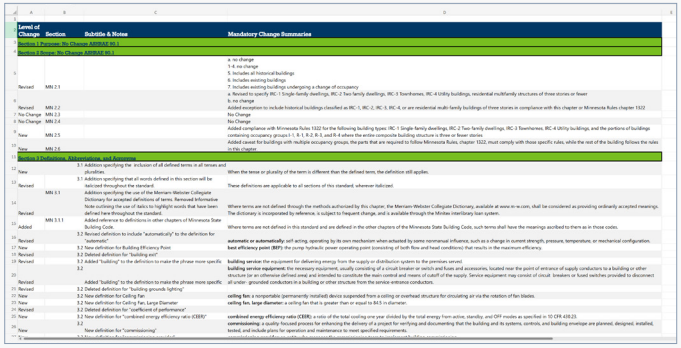
New requirements have been added in Section 6.4.1.3 regarding airflow and power consumption of large-diameter ceiling fans.

Additional Resources

WHAT'S CHANGED FROM 2020 TO 2024 ENERGY CODE

BuildUp MN has created a spreadsheet noting significant changes between the 2020 MN Commercial Energy Code and the 2024 MN Commercial Energy Code. Both new requirements and revisions to previous requirements are noted. The tables also note which changes are Minnesota Amendments to ASHRAE 90.1-2019.

Find the What's Changed spreadsheet online: https://www.buildupmn.org/all-resources



Level of Change	Section	Subtitle & Notes	Mandatory Change Summaries
Section 1 Purpose: No Changes ASHRAE 90.1			
Section 2 Scope: No Changes ASHRAE 90.1			
			a. no change 1-4. no change 5. Includes all historical buildings 6. Includes existing buildings 7. Includes existing buildings undergoing a change of occupancy.
Revised	MN 2.1		a. Revised to specify IRC-1 Single-family dwellings, IRC-2 Two family dwellings, IRC-3 Townhomes, IRC-4 Utility buildings, residential multifamily structures of three stories or fewer b. no change
Revised	MN 2.2		Added exception to include historical buildings classified as IRC-1, IRC-2, IRC-3, IRC-4, or are residential multi-family buildings of three stories in compliance with this chapter or Minnesota Rules chapter 1322 .
No Change	MN 2.3		No Change
No Change	MN 2.4		No Change
New	MN 2.5		Added compliance with Minnesota Rules 1322 for the following building types: IRC-1 Single family dwellings, IRC-2 Two family dwellings, IRC-3 Townhomes, IRC-4 Utility buildings, and the portions of buildings containing occupancy groups I-1, R-1, R-2, R-3, and R-4 where the entire composite building structure is three or fewer stories.
New	MN 2.6		Added caveat for buildings with multiple occupancy groups, the parts that are required to follow Minnesota Rules, chapter 1322, must comply with those specific rules, while the rest of the building follows the rules in this chapter.
Section 3 Definitions, Abbreviations, and Acronyms			
New		3.1 Addition specifying the inclusion of all defined terms in all verses and definitions	When the tense or plurality of the term is different than the defined term, the definition still applies.
Revised		3.1 Addition specifying that all words defined in this section will be capitalized throughout the standard	These definitions are applicable to all sections of this standard, wherever italicized.
	MN 3.1	Addition specifying the use of the Merriam-Webster Collegiate Dictionary for accepted definitions of terms. Removed Informative Note outlining the use of italics to highlight words that have been defined here throughout the standard.	Where terms are not defined through the methods authorized by this chapter, the Merriam-Webster Collegiate Dictionary, available at www.m-w.com, shall be considered as providing ordinarily accepted meanings. The dictionary is incorporated by reference, is subject to frequent change, and is available through the Minitex interlibrary loan system.
Added	MN 3.1.1	Added reference to definitions in other chapters of Minnesota State Building Code.	Where terms are not defined in this standard and are defined in the other chapters of the Minnesota State Building Code, such terms shall have the meanings ascribed to them as in those codes.
Revised		3.2 Revised definition to include "automatically" to the definition for "automatic"	**automatic or automatically:** self-acting, operating by its own mechanism when actuated by some nonmanual influence, such as a change in current strength, pressure, temperature, or mechanical configuration.
New		3.2 New definition for Building Efficiency Point	**base efficiency point (BEP):** the pump hydraulic power-operating point (consisting of both flow and head conditions) that results in the maximum efficiency.
Revised		3.2 Deleted definition for "building exit"	
Revised		3.2 Added "building" to the definition to make the phrase more specific	**building service** the equipment for delivering energy from the supply or distribution system to the premises served
		3.2	**building service equipment:** the necessary equipment, usually consisting of a circuit breaker or switch and fuses and accessories, located near the point of entrance of supply conductors to a building or other structure (or an otherwise defined area) and intended to constitute the main control and means of cutoff of the supply. Service equipment may consist of circuit breakers or fused switches provided to disconnect all under - grounded conductors in a building or other structure from the service-entrance conductors.
Revised		Added "building" to the definition to make the phrase more specific	
Revised		3.2 Deleted definition for "building grounds lighting"	
New		3.2 New definition for Ceiling Fan	**ceiling fan:** a nonportable (permanently installed) device suspended from a ceiling or overhead structure for circulating air via the rotation of fan blades.
New		3.2 New definition for Ceiling Fan, Large Diameter	**ceiling fan, large diameter:** a ceiling fan that is greater than or equal to 84.5 in diameter.
Revised		3.2 Deleted definition for "coefficient of performance"	
New		3.2 New definition for "combined energy efficiency ratio (CEER)"	**combined energy efficiency ratio (CEER):** a ratio of the total cooling one year divided by the total energy from active, standby, and OFF modes as specified in 10 CFR 430.23.
New		3.2	**commissioning:** a quality focused process for enhancing the delivery of a project for verifying and documenting that the building and its systems, controls, and building envelope are planned, designed, installed, tested, and include plans for operation and maintenance to meet specified requirements.
New		New definition for "commissioning"	

ENERGY CODE TRAINING

Training will be offered in several modalities including in-person and online options. Visit BuildUp MN's website to see upcoming and recorded training offerings!

Available training on the BuildUp MN website: https://www.buildupmn.org/training-events

Compliance Pathways

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The 2024 Energy Code utilizes ASHRAE 90.1-2019 and therefore includes Prescriptive and Performance compliance pathways, and for HVACR systems, also includes a Simplified Approach pathway. Within the Performance pathway there are two options, as shown in Figure 1 below. The Energy Code requires the entire project to follow the same compliance path, either Prescriptive or Performance. This means if HVACR is pursuing the Simplified HVACR Approach under the Prescriptive Path, other building systems such as lighting, envelope, water heating, etc. must also comply prescriptively.

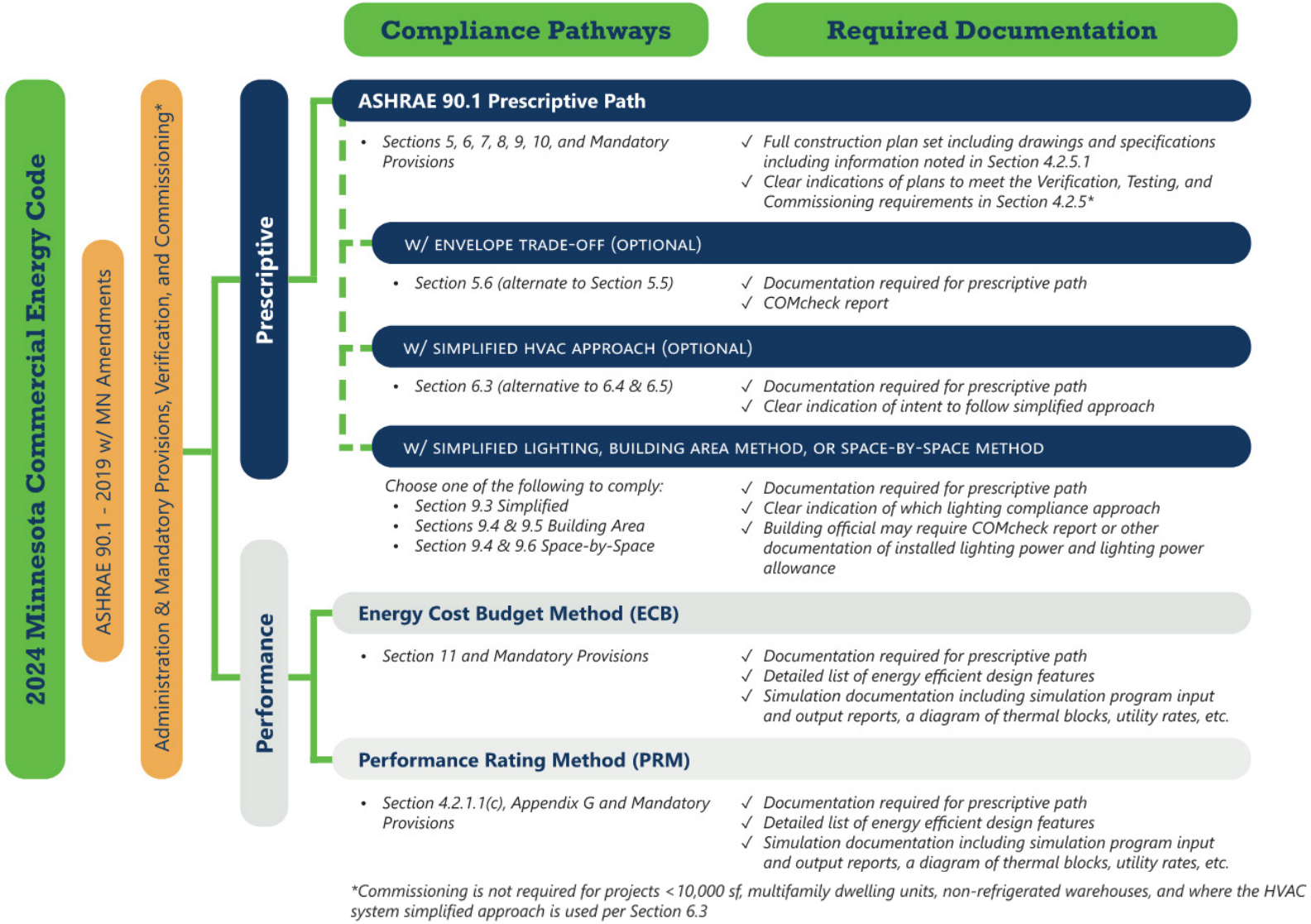


Figure 1: Compliance Pathways Available in the 2024 MN Commercial Energy Code

HVACR Requirements for All Compliance Paths

The following sections apply to HVACR systems for all projects, regardless of the compliance path chosen:

- Section 4.2.5 Verification, Testing, and Commissioning
- Section 6.1 General
- Section 6.7 Submittals
- Section 6.8 Minimum Equipment Efficiency Tables

ASHRAE 90.1 Simplified Approach Path

The Simplified Approach can be used for buildings up to two stories and less than 25,000 ft^2 that use simple HVACR systems. Simple HVACR systems are those which meet the criteria outlined in Section 6.3.2, such as being single-zone with basic control capabilities. When complying using the Simplified Approach, Mandatory provisions in Section 6.4 do not need to be met. The intention of this compliance pathway is to gather Mandatory and Prescriptive requirements that apply to simple HVACR systems for small buildings in one section so designers, plans examiners and installers can avoid digging through requirements that don't apply to simple systems and quickly find those that do. Documenting and verifying both the applicability and compliance with the Simplified Approach is relatively straight forward as the list of requirements in Section 6.3.2 are generally "yes/no" criteria and don't require complex calculations.

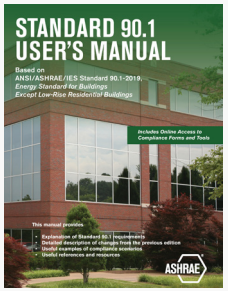
ASHRAE 90.1 Prescriptive Path

Note: All Mandatory Provisions still apply

More complex HVACR systems such as multi-zone, central plants, etc. which cannot use the Simplified Approach but would still like to comply prescriptively must meet all Mandatory requirements in Section 6.4 and Prescriptive HVACR requirements in Section 6.5. If the project scope "triggers" the requirement and does not meet any listed exception criteria, then the requirement must be met when using the Prescriptive Path. If the project team cannot or desires not to meet a Prescriptive requirement, the Performance Path must be used to "trade-off" that requirement and still demonstrate compliance. For HVACR systems serving only computer rooms with an IT equipment load greater than 10kW, the project team can elect to comply with ASHRAE Standard 90.4, Energy Standard for Data Centers instead of Prescriptive requirements under the Alternate Compliance requirements in Section 6.6 for that system only. Computer room IT systems using the Alternate Compliance requirements still must meet Mandatory requirements in Section 6.4.

Additional Resources

ASHRAE/IES 90.1-2019 USER'S MANUAL AND COMPLIANCE FORMS



Guidance and compliance forms are published in the ASHRAE/IES 90.1-2019 User's Manual to assist in understanding and documenting compliance. The guidance and forms do not include Minnesota's amendments to ASHRAE/IES 90.1-2019 that together make up the 2024 Minnesota Energy Code. However, these could be used for instruction, and in some cases, such as for the HVACR Simplified Approach compliance path, would only need minor modifications to reflect Minnesota's amendments.

Find the ASHRAE/IES 90.1-2019 Compliance forms on the ASHRAE website: https://www.ashrae.org/technical-resources/bookstore/supplemental-files/supplemental-files-for-the-standard-90-1-2019-users-manual

Compliance with many Mandatory and Prescriptive requirements can be documented using a COM*check*™ report submitted with the permit application. Consider completing a preliminary COM*check*™ analysis during Design Development to ensure compliance will be achieved before final construction documents are completed. Also note all inputs into the COM*check*™ tool must be shown on final construction documents to be verified during plan check. Keep in mind that while COM*check*™ reports are useful tools to demonstrate how HVACR systems are complying with the Energy Code requirements—especially for complex items like fan power limits in Section 6.5.3.1.1—they are generally not part of the contract documents that the contractor is being held to fulfill.

ASHRAE 90.1 Energy Cost Budget Method

Note: All Mandatory Provisions still apply

One of the two options to demonstrate compliance via a Performance Path is to use the Energy Cost Budget Method outlined in Section 11. Performance Path projects must be modeled using energy simulation software that meets detailed requirements and is tested according to ASHRAE Standard 140, such as IESVE, eQUEST, Trane TRACE® and EnergyPlus™. These programs model all building systems and calculate the impact of "trade-offs" between certain building features. For example, if a building design has more window area than is allowed via the Prescriptive Path, a lighting or HVACR design that is more efficient than prescriptively required could be used as a "trade-off" to bring the building as a whole into compliance. Section 11 requires compliance with Mandatory HVACR provisions in Section 6.4 and those cannot be traded-off.

When using the Energy Cost Budget Method, the energy simulation software program applies building science physics principles, such as heat transfer, to the representative building

Additional Resources

COM*CHECK*™ WEB TOOL

COM*check*™ is supported by the U.S. Department of Energy to assist builders, designers, and contractors in demonstrating energy code compliance with the Prescriptive Path and create compliance reports for code officials on project inputs. Select the MN Commercial Energy Code for the tool to reflect Minnesota amendments. DOE also maintains a recorded video called COM*check*™ Basics that includes an overview of the basic functions of the COM*check*™ software, how to identify the construction specifications needed to complete a compliance calculation and how to enter the building thermal envelope components, lighting and mechanical systems into the software.

Access the COM*check*™ web tool at https://energycode.pnl.gov/COMcheckWeb/

Watch the COM*check*™ Basics video at https://training.energycodes.gov/ui/course/1884/preview/true

GUIDANCE ON PLAN CHECKING COM*CHECK*™ REPORTS

The Minnesota Energy Code Support Program has produced four Commercial Energy Compliance Certificate Technical Documents that review how to read COM*check*™ reports for thermal envelope, HVAC, indoor lighting and outdoor lighting. Training is also offered to review the COM*check*™ tool, its inputs, and walking through the reports.

Find the Technical Documents and the Training on the Program website: www.minnesotaenergycodesupport.org

models built by the energy modeler. The energy modeler must follow the modeling rules per Section 11 while building the models. Two models are created, one representing the building as designed and the other representing a baseline building that just meets the Prescriptive Path code requirements across all disciplines. To determine compliance with the Energy Cost Budget Method, the simulation program calculates an annual energy cost associated with the building as designed (design energy cost) and an annual energy cost associated with the baseline building that sets a compliant energy budget (energy cost budget). To comply, the design energy cost must be equal to or less than the energy cost budget.

The energy simulation software produces results via output reports, which are reviewed for accuracy and compliance by the energy modeler and are summarized for permit application in clear summary tables. Accurately documenting compliance using a whole building energy model requires modeler proficiency with the chosen energy simulation program and knowledge of how to apply the rules of the Energy Cost Budget Method in Section 11.

Even though an exhaustive plan review of the simulation models also requires a deep level of knowledge of simulation software and the modeling rules in Section 11, there are many valuable reality checks that plan reviewers can make without having energy modeling expertise. As with the review of COM*check*™ reports, verifying key inputs (that are usually clearly summarized in a table) against the construction documents is a critical step in the review. Additionally, verification of baseline model inputs against the Section 11 rules and simple comparisons of some key simulation outputs frequently uncover any important discrepancies.

It's worth noting that Minnesota has amended Section 11.5.2 for how fan system efficiency is modeled when the proposed design includes energy recovery, but it is not required for the budget building design. The intention of this amendment is to limit the fan power of the budget building design in those cases where the proposed design both includes heat recovery where it is not required per 11.5.2(d) and has fan power that exceeds the Prescriptive limit set in Section 6.5.3.1. The exception applies only when the proposed design includes energy recovery that is not required in the budget building, as determined using 11.5.2(d). In this case, the fan power in the budget design is still set equal to that of the proposed design up to the limit set in Section 6.5.3.1 without including the additional static pressure of the "energy recovery device, other than coil runaround loop" and "coil runaround loop" that would otherwise apply.

Additional Resources

Energy Cost Budget Method (ECB) vs. Performance Rating Method (PRM)

U.S. Department of Energy's Building Energy Codes Program maintains a webpage with information comparing the ECB versus the PRM Methods for Performance Path compliance. The information includes a basic overview of the two methods as well as links to a spreadsheet-based compliance form that can be used for either method, a companion tool for additional calculations, and a review manual to guide plans examiners through reviewing Performance Path permit applications.

Find the DOE Performance Path Resources at https://www.energycodes.gov/performance_based_compliance

ASHRAE 90.1 Performance Rating Method (Appendix G)

Note: All Mandatory Provisions still apply

The other option to demonstrate compliance via a Performance Path is to use the Performance Rating Method in Appendix G. Just like the Energy Cost Budget Method, whole building energy models are created using energy simulation software that evaluates the impact of trade-offs between building systems. Also like the Energy Cost Budget Method, Mandatory requirements from Section 6.4 must be met and cannot be traded-off.

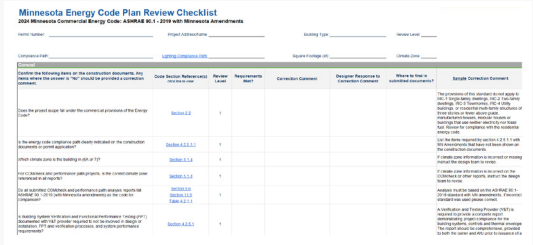
Similar to the Energy Cost Budget Method, two energy models are created by the energy modeler and building physics are applied by the software to simulate performance during building operation. The energy cost results from the two models are compared to determine compliance with the rules outlined in Appendix G. The primary difference from the Energy Cost Budget method is that the baseline model for the Performance Rating Method is based on a level of performance that roughly matches the 2004 version of ASHRAE Standard 90.1 and does not change with each iteration of the energy code. What does change with each code cycle are the Building Performance Factors in Table 4.2.1.1 that scale the regulated portion of baseline building energy as part of a formula in Section 4.2.1.1 that is used to calculate a Performance Cost Index Target that the proposed design model must match or be better than (i.e. lower). Simulation output reports are reviewed by the modeler to evaluate accuracy of the models and to evaluate compliance. The compliance results should be summarized and included in the permit application. As with the Energy Cost Budget Method, modeling to demonstrate compliance with the Performance Rating Method necessitates some level of expertise with the Appendix G modeling methodology and use of the energy simulation program.

Additional Resources

PLANS EXAMINER CHECKLISTS

BuildUp MN has developed a checklist resources tailored for Plan Examiners to streamline the review process for energy code compliance. This checklist focuses on the most impactful measures, including Mandatory provisions, building envelope, mechanical systems, and lighting components. It also features direct links to applicable code references and helpful sample correction comments to support consistent enforcement. Additionally, the checklist serves as a valuable tool for designers, providing insights to enhance their understanding of Energy Code requirements and improve compliance in their designs.

Find the checklists on the BuildUp MN website: https://www.buildupmn.org/all-resources


Minnesota Energy Code Plan Review Checklist

2004 Minnesota Commercial Energy Code: ASHRAE 90.1 - 2019 with Minnesota Amendments

Even though an exhaustive plan review of the simulation models also requires a deep level of knowledge of simulation software and the modeling rules in Appendix G, there are many valuable reality checks that plan reviewers can make without having energy modeling expertise. As with the review of COM*check*™ reports, verifying key inputs (that are usually clearly summarized in a table) against the construction documents is a critical step in the review. Additionally, verification of baseline model inputs against the Appendix G rules and simple comparisons of some key simulation outputs frequently uncover any important discrepancies.

For the Performance Rating Method compliance path, Minnesota has amended the language describing the number and type of chillers modeled for baseline systems in Appendix G3.1.3.7. The intent of this amendment is not to modify the requirement, but rather to use more precise language. Minnesota has changed the language from, "as a function of building peak cooling load" to "based on the peak coincident cooling load of baseline HVACR systems using chilled water." It specifies that the peak load is that of only the systems using chilled water, specifically excluding any systems using direct expansion (DX) or other types of cooling. It also specifies that the peak cooling load is the coincident load (rather than the higher non-coincident load). Use of the coincident load is already required in Section G3.1.2.2, Equipment Capacities, which includes the sentence, "Plant capacities shall be based on coincident loads."

Documenting Compliance within Construction Documents

After determining the building HVACR features that will result in Energy Code compliance, regardless of compliance path chosen, it's important to ensure they are properly documented within the construction documents. HVACR plan pages, details, schedules, specifications, and control sequences, etc. all need to reflect the equipment performance and control requirements necessary to comply. This will require coordination with the energy modeler (if the Performance Path is used) or project team member who has evaluated compliance to ensure all inputs into the energy simulation program are properly reflected. If inputs are not reflected in the construction documents, plans examiners will not be able to verify compliance and may issue correction comments, and installers won't be able to include compliant products and envelope features within their bids. The table starting on page 17 of this Guide suggests how Energy Code measures should be reflected in the construction documents and provides some examples.

Important Information

"EQUAL OR BETTER" INSTALLATIONS

Whether using the Prescriptive or Performance Path, it's important that installations are "equal or better" than what was documented for Energy Code compliance for plan check. Field changes and substitutions for building equipment and systems that impact energy consumption might result in the project becoming non-compliant. If the project used the Prescriptive Path, it is easy to determine if a substitution still meets or exceeds a Prescriptive requirement. If the project used the Performance Path, it might be necessary to rerun the energy simulation to determine if the substitution still complies. For that reason, it could be easier for installers to stick to "equal or better" when making substitutions or other field changes.

The possibilities of field substitutions makes it inadequate to simply list a make and model of equipment that has compliant performance. It is critical that the CDs also note the minimum performance related to key energy performance parameters within the mechanical schedules, drawing notes, and/or specifications to ensure that any 'equal or better" substitution can be compared against clearly defined requirements.

Additions and Alterations

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A subset of requirements applies to existing buildings undergoing additions or alterations depending on the building systems included in the permit application. Note the definitions of both addition and alteration in Section 3 to first determine if the Energy Code provisions apply to the scope of the project. All building systems being installed as part of an addition must comply with Mandatory, and Prescriptive or Performance requirements just as new buildings must. If an addition can't comply itself, directions are provided in Section 4.2.1.2.1 regarding how existing building components can be incorporated into the project to comply.

Altered building systems and components also must comply with Mandatory, and Prescriptive or Performance requirements that apply to the systems/components being altered as part of the project scope. Because alterations often involve fewer building systems, and sometimes only one, compliance is often demonstrated via the Prescriptive compliance path. Minnesota has added an exception to Section 4.2.1.3 for features and elements that have been designated historic by the historic authority having jurisdiction (AHJ). The historic AHJ might be the jurisdiction's historic preservation commission or board, or the Minnesota State Historical Preservation Office (SHPO); if you are unsure who serves as the historic AHJ but believe your existing building might qualify, check with the permitting office at the AHJ.

Guidance on the intent and application of the Energy Code for common addition and alteration scenarios is included below.

Equipment Replacements

Section 6.1.1.3.1 lists specific Energy Code provisions that are required for new HVACR equipment that is being installed as a direct replacement of existing HVACR equipment when the provision is applicable for the equipment being replaced. See the table starting on page 17 of this Guide to determine whether the provision is applicable and then reference the Energy Code for the full requirement details.

An additional requirement regarding alterations to existing cooling systems is included in Section 6.1.1.3.3 stating alterations shall not decrease economizer capability unless the system complies with Section 6.5.1, which are the Prescriptive requirements for air and fluid economizers.

The following exceptions to Section 6.1.1.3 indicate alterations which do not trigger Energy Code requirements:

- For equipment that is being modified or repaired but not replaced, provided that such modifications and/or repairs will not result in an increase in the annual energy consumption of the equipment using the same energy type;
- Where a replacement or alteration of equipment requires extensive revisions to other systems, equipment, or elements of a building, and such replaced or altered equipment is a like-for-like replacement;
- For a refrigerant change of existing equipment;
- For the relocation of existing equipment.

Duct and Piping Replacements

Section 6.1.1.3.4 requires new and replacement ductwork to comply with Mandatory duct and plenum insulation requirements found in Section 6.4.4.1 and Mandatory duct sealing and leakage requirements found in Section 6.4.4.2. New and replacement piping must also comply with Mandatory insulation requirements in Section 6.4.4.1 as provisioned in Section 6.1.1.3.5. Ducts and piping where there is insufficient space or access to meet these requirements is excepted under Section 6.1.1.3. Though both ductwork and piping insulation requirements have additional listed exceptions in Section 6.4.4.1, none are specific to alteration scopes.

Change of Occupancy/ Unconditioned to Conditioned Space

Section 4.2.1.4 outlines how the Energy Code should be applied to existing buildings and spaces that are undergoing a renovation that changes occupancy type.

Section 6.1.1.3.2 requires that new cooling systems installed to serve previously uncooled spaces shall comply with the full Section 6 for systems, using the Compliance Path options outlined above in this Guide and in Section 6.2 of the Energy Code.

Additions That Use New Systems vs. Tie Into Existing Systems

Additions that use new mechanical or refrigeration systems must comply with the HVACR requirements in Section 6 just like a new building. When additions tie into existing HVACR systems, the existing systems are not required to comply unless part of the system is being altered as part of the addition project, in which case that equipment or system component must comply with the specific requirements applicable. Note that the Energy Cost Budget Method in Section 11 and the Performance Rating Method in Appendix G can not be used for Performance Path compliance if the proposed design does not include a mechanical system. See Section 4.2.1.2.1 regarding how existing building components can be incorporated into the project to comply if necessary.

Additional Resources

Minnesota State Historical Preservation Office (SHPO)

The National Historic Preservation Act of 1966 provided for a network of historic preservation offices in every state to spearhead state preservation initiatives and help carry out the nation's historic preservation program. Minnesota's SHPO was created by state statute in 1969 to provide statewide leadership. The SHPO website includes a statewide inventory of Minnesota's historic resources, historic reports, and archaeological reports, 1,750 Minnesota listings, encompassing over 6,000 properties from all counties in the state found on the National Register of Historic Places, links to the federal and state laws that protect historic and archaeological properties, as well as the project review process in Minnesota, and many more resources.

Find information on Minnesota's historic preservation efforts on the SHPO website: https://mn.gov/admin/shpo/

Additional Resources

ENERGY CODE HELPLINE

MINNESOTA ENERGY CODE SUPPORT PROGRAM

The Minnesota Energy Code Support Program offers a helpline to ask Energy Code experts questions. Frequently asked questions will be posted on their website to increase access to the answers. Questions will also inform training topics and other support offered by the Program.

Submit an Energy Code question on the Program's website: www.minnesotaenergycodesupport.org/helpline

The intent of commissioning is not necessarily focused on code compliance, but rather to deliver a building project meeting the design requirements of the owner and initial operations based on the design. However, the required submissions for documentation of field testing and a preliminary commissioning report can be leveraged by code officials to be informed by a third-party verification—especially for numerous HVACR control requirements that are complex to verify, such as those implemented via a building automation system. Additionally, commissioning has been incorporated into the Energy Code because energy efficient operations depend upon following design intent, quality installation, equipment start-up and functional performance testing, and training building maintenance staff on systems operation, which are all part of the commissioning process. Owners and tenants reap operational benefits intended by the Energy Code when efficiency features are installed and properly function, facilitated by building commissioning. The more complex building mechanical systems and controls, the more likely benefits will come from commissioning.

Commissioning During Design and Construction

Section 4.5.2 requires that detailed instructions for commissioning HVACR systems be included in the construction documents, which typically takes the form of commissioning specifications in the project manual or a draft commissioning plan. The commissioning plan often includes content such as goals of the commissioning process, building systems to be included in the commissioning scope, original design intent for those systems, test procedures and conditions for functions to be tested, and acceptance criteria. Project management content such as roles for involved team members, schedule, and deliverables is also commonly included. Section 4.2.5.1.1 lists information to be included in the permit application, which reasonably aligns with content typical in commissioning plans. Drafting this plan during design and before permitting requires that a commissioning provider be designated during the design phase, not at the start of construction.

Building projects which do not meet the exceptions for Section 4.2.5.2 (less than 10,000 ft^2 of area, not counting multifamily dwelling units, etc.) are required to meet additional commissioning requirements including a design review conducted by the commissioning provider. The design review must document how the design meets the owner requirements documented during programming in the Owner's Project Requirements (OPR) document and summarize how the project design meets the Energy Code. Informative Appendix H includes Table H-3 listing specific items to check during the design review related to Energy Code compliance verification.

DEFINED ROLES FOR COMMISSIONING

Commissioning Provider: Section 3 defines the commissioning provider as an entity who manages the commissioning team to implement building commissioning. Section 4.2.5.2 has additional requirements for the commissioning provider when the listed exceptions don't apply: The commissioning provider shall be (a) a third-party entity not associated with the building project, (b) owner's qualified employees, or (c) an individual associated with the design firm or contractor but not directly associated with design or installation of the building systems, controls, or building envelope being commissioned.

Verification and Testing Provider (V&T Provider): Also per Section 3, a verification and testing provider is an entity who completes the activities needed to implement the building functional performance testing (FPT) activities or verify that elements of the building project meet stated requirements. Per Section 4.2.5.1 Verification and Testing (V&T) Providers can't test equipment or systems where they served as the designer or installer. V&T Providers must be identified within the construction documents, most logically within the draft commissioning plan.

During construction, functional performance testing (FPT) and verification should occur based on the schedule outlined in the commissioning plan. As construction schedules often change, the commissioning provider and others involved should be kept up to date so the FPT happens at the right time and does not delay or interfere with ongoing construction activities. Results from testing and verification are required to be provided to the building owner along with a plan to conduct any future testing that requires seasonal weather conditions, etc. Unless the project meets a listed exception to Section 4.2.5.2, these preliminary results must be included in a draft commissioning report, created by the commissioning provider, along with the other required content listed in Section 4.2.5.2.2(c). Because commissioning continues after the building is occupied, the final commissioning report isn't required to be submitted to the owner until the contractor's general warranty period expires.

Commissioning and the Permitting and Inspection Process

Although the commissioning process is parallel to permitting and inspection processes, there are specific Energy Code requirements that should be verified during plan check and inspection. During plan check, the existence of commissioning specifications within the project manual should be confirmed. Unless the project meets one of the exceptions listed in Section 4.2.5.2, a draft commissioning plan should also be included in the permit application.

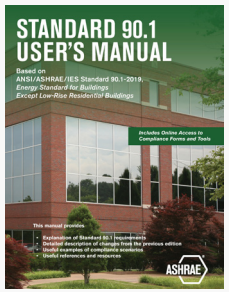
During inspection, a letter from the building owner must be submitted stating that functional performance testing and field verification results and an issues and resolution log have been provided to the owner. Unless the project meets a listed exception to Section 4.2.5.2, a preliminary commissioning report must also be provided to the owner before occupancy and documented as received in the owner's letter to the inspector. Section 4.2.5.3(c) gives the AHJ authority to ask for a copy of these reports in addition to the owner's letter. Note the final commissioning report will not be completed until after building occupancy, but a preliminary report should be available if requested by the AHJ.

Commissioning-related HVACR Submittals Required by the Energy Code

Section 6.7 of the Energy Code requires several HVACR submittals that relate the commissioning process to other construction processes such as testing and balancing (TAB). System balancing is required by Section 6.7.3.3 and would typically be verified by the commissioning provider during construction. Commissioning also typically includes verification that training has been provided to building facility managers along with operation and maintenance (O&M) manuals, which are required in Section 6.7.3.2.

Additional Resources

ASHRAE/IES STANDARD 202 THE COMMISSIONING PROCESS REQUIREMENTS FOR NEW BUILDINGS AND NEW SYSTEMS



Section 4.2.5.2 requires using ASHRAE/IES Standard 202 or other generally accepted engineering standards approved by the building official for building projects equal or greater than 10,000 ft² of conditioned floor area and with combined heating, cooling and service water heating equipment with total capacity 960 kBtu/h or greater. Other exceptions are listed in Section 4.2.5.2.

Find Standard 202 and other commissioning resources on the ASHRAE website: https://www.ashrae.org/technical-resources/bookstore/commissioning

Verification, Testing and Commissioning Activities Timeline

4.2.5.1 TESTING & VERIFICATION: All projects must comply with section 4.2.5.1 Verification and Testing requirements.

4.2.5.2 COMMISSIONING: Most projects must also comply with section 4.2.5.2 for Commissioning, with these exceptions:

- Buildings, additions or alterations with <10,000 ft^2 of conditioned space AND with combined heating, cooling and service water heating equipment totaling <96 kBtu/h in capacity OR
- Buildings or portions of buildings using the Simplified Approach compliance path OR
- Dwelling units OR
- Nonrefrigerated warehouses

	4.2.5.1 TESTING & VERIFICATION	4.2.5.2 COMMISSIONING
Design	Include information listed in Section 4.2.5.1.1 in construction documents prior to permit application.	Select Commissioning Provider per Section 4.2.5.2 and identify in construction documents. Commissioning Provider performs design review & submits report to owner. Identify construction phase commissioning requirements in specifications and/ or draft commissioning plan. (4.2.5.2.1)
Permitting		Include information listed in Section 4.2.5.1.1 in draft commissioning plan. Copy may be requested by plans examiner. (4.2.5.2.1)
Construction	V&T Provider performs verification/ FPT to confirm compliance. (4.2.5.1)	Commissioning Provider finalizes commissioning plan and provides to owner and project team (4.2.5.2.2) Commissioning Provider performs verification/ FPT to confirm compliance. Performs commissioning per ASHRAE/IES Standard 202. (4.2.5.2)
Occupancy	Results of verification/FPT provided to owner by V&T Provider with plan to complete any deferred FPT. Copy may be requested by inspector or letter from owner confirming receipt required. (4.2.5.1.2/ 4.2.5.3)	Commissioning Provider provides preliminary commissioning report to owner prior to occupancy. Copy may be requested by inspector or letter from owner confirming receipt required. Provides final report to owner before warranty period expiration. (4.2.5.2.2/ 4.2.5.3)

HVACR Energy Code Measures

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The following table lists Mandatory, Prescriptive and Performance measures based on the 2024 Energy Code along with what project features "trigger" the code requirement and where the measure should be documented within the construction documents. Where available, examples are linked of what the measure might look like in the floor plans, equipment schedules, specifications, and other design documents.

This table is not meant to replace Energy Code language and does not include details of the requirements. It can be used as a reference to understand what measures are regulated and applicable to each compliance path, what triggers each measure, and includes hyperlinks to the code section so the full Energy Code requirements can be accessed.

Icons are used throughout the table to label compliance paths, Minnesota Amendments, and compliance documentation examples.

KEY

Denotes compliance paths for which section is required.

- → Simplified
- ☑ Prescriptive
- Performance

mn Denotes sections with MN Amendments to ASHRAE 90.1-2019

Denotes section with compliance example available.

AIRSIDE EQUIPMENT

Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: → Simplified ☑ Prescriptive Performance	mn 6.1.1.3.6	**Rooftop HVACR Insulated Curbs** New insulated curbs that comply with Section 5.5.3.1 are required for new and replacement rooftop equipment. ***Intention of Requirements:*** These requirements both set a minimum performance standard for curb insulation and a curb height to support roof covering replacements with code-compliant insulation depth and sufficient freeboard to facilitate positive drainage.	New and replacement rooftop equipment unless technically infeasible. Technical infeasibility due to structural capacity of the existing roof will need to be demonstrated and certified by a licensed structural engineer for that roof portion which establishes curb height for the rooftop mechanical equipment being replaced.	Curbs should be included in plan notes on mechanical roof plan sheet. Also include a note in the mechanical schedule for rooftop units and fans. Contractors should provide a roof curb submittal with data for insulation, acoustical performance, and vibration. **See Compliance Example**

AIRSIDE EQUIPMENT				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: → Simplified ☑ Prescriptive Performance	6.4.1.1	**Minimum Equipment Efficiencies** Section 6.4.1.1 requires equipment to meet minimum efficiencies prescribed in Tables in Section 6.8.1. ***Intention of Requirements:*** These minimum equipment efficiencies meet federal regulations set by DOE to reduce energy demand, lower GHG emissions and other pollutants, and save consumers money.	All equipment included in the Tables in Section 6.8.1.	Minimum performance requirements for all HVACR equipment should be shown on the equipment schedules in the plans with the same units used in the tables in Section 6.8.1. For alterations that don't include plans, equipment cut sheets or purchase orders should be submitted with the permit application.
Mandatory when using: → Simplified ☑ Prescriptive Performance	mn 6.4.2.1	**Load Calculations** Heating and cooling system design loads for the purpose of sizing systems and equipment shall be determined in accordance with ASHRAE/ACCA Standard 183. Table 6.4.2.1 includes climate design conditions for Minnesota. ***Intention of Requirements:*** Calculating design loads based on industry standards and not "rule-of-thumb" ensures equipment is right-sized, impacting equipment first-cost and operating performance.	All projects which include space conditioning equipment within the scope.	Equipment sizes and capacity based on calculated heating and cooling load should be included in mechanical equipment schedules.

mn denotes sections with MN Amendments to ASHRAE 90.1-2019

AIRSIDE EQUIPMENT				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
→ Simplified	mn 6.3.2	**Simplified Approach** Several measures listed in Section 6.3.2 pertain to airside equipment. See code section for the full list, but a few examples are: the system is single zone, variable flow per 6.5.3.2.1, cooling provided by unitary packaged or split-system AC, heating and cooling meet minimum efficiencies, etc. ***Intention of Requirements:*** The Simplified Approach gathers relevant Mandatory and Prescriptive requirements into one section for simple HVACR systems serving small buildings. Review each relevant Mandatory and Prescriptive requirement in this table for its intent.	Projects electing to use Simplified Approach Compliance Path and which meet eligibility criteria including buildings two stories or fewer and less than 25,000 ft^2 gross.	Measures listed in Section 6.3.2 for all airside equipment should be shown on the equipment schedules in the plans. Air balancing should be included in the project manual. For alterations that don't include plans, equipment cut sheets or purchase orders should be submitted with the permit application.

mn denotes sections with MN Amendments to ASHRAE 90.1-2019

AIRSIDE EQUIPMENT				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
☑ Prescriptive	6.5.9	**Hot Gas Bypass** Cooling systems shall not use hot-gas bypass or other evaporator pressure control systems unless the system is designed with multiple steps of unloading or continuous capacity modulation. The capacity of the hot-gas bypass shall be limited as indicated in Table 6.5.9 for VAV units and single-zone VAV units. Hot-gas bypass shall not be used on constant-volume units. ***Intention of Requirements:*** Hot Gas Bypass provides an artificial load on the compressor to avoid low load operation and refrigerant slugging, but increases energy consumption in the process. Limitations on use of hot gas bypass require use of other widely available methods to ensure reliable compressor operation.	Cooling systems using refrigerants.	Mechanical schedules must show VAV systems with capacity modulation (such as VFD) to be eligible for hot-gas bypass. If hot-gas bypass is included, it should be noted, with it's capacity, on the mechanical equipment schedules.

mn denotes sections with MN Amendments to ASHRAE 90.1-2019

AIRSIDE EQUIPMENT				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Energy Cost Budget)	11.5	**Energy Cost Budget Method** Table 11.5.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Energy Cost Budget Method for Performance Path compliance. The budget building simulation's representation of the HVACR systems must be based on a combination of the proposed design and Prescriptive Path HVACR requirements as detailed in Section 11.5.2 and Table 11.5.1. ***Intention of Requirements:*** The Energy Cost Budget Method provides design teams the ability to trade-off energy efficiency in different areas of the design to achieve a building meeting the overall energy efficiency goals of the code. This may allow design teams the ability to provide a more economical design without compromising energy efficiency.	Projects using the Energy Cost Budget Method for Performance Path compliance.	Section 11.7.2 includes a list of information that must be submitted with the permit application when using Energy Cost Budget Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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AIRSIDE EQUIPMENT				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Performance Rating Method)	mn Appendix G	**Performance Rating Method** Table G3.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Performance Rating Method for Performance Path compliance. The baseline model's representation of the HVACR systems must generally be consistent with Section G3.1.1 through G3.1.3, Table G3.1, and numerous tables at the end of Appendix G. ***Intention of Requirements:*** The Performance Rating Method (PRM) provides design teams the ability to trade-off energy efficiency in different areas of the design to achieve a building meeting the overall energy efficiency goals of the code. It also provides a measure for relative energy performance of a design, such as a percentage better than code. The PRM is widely used in incentive programs such as LEED.	Projects using the Performance Rating Method for Performance Path compliance.	Section G1.3.2 includes a list of information that must be submitted with the permit application when using Performance Rating Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

mn denotes sections with MN Amendments to ASHRAE 90.1-2019

FANS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
☑ Prescriptive	6.5.3.1	**Fan Power and Efficiency** Table 6.5.3.1-1 includes fan power limitations for the sum of supply fans, return/relief fans, exhaust fans, and fan-powered terminal units. Requirements around fan motor selection and fan efficiency (using Fan Efficiency Index or FEI) are also included in Section 6.5.3.1. ***Intention of Requirements:*** These requirements set minimum requirements on fans and motors to avoid inefficient designs that would waste energy.	HVACR systems having a total fan system motor nameplate horsepower exceeding 5 hp at design conditions. Hospital, vivarium, and laboratory systems that use flow control devices and individual exhaust fans 1 hp or less are exempt.	Mechanical schedules must include motor brake horsepowers for all motors in systems with total nominal motor horsepower of 5 hp or greater. The mechanical equipment schedule should indicate fan efficiency or motors that are premium efficiency.

Additional Resources

ENERGY CODE HELPLINE

MINNESOTA ENERGY CODE SUPPORT PROGRAM

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FANS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
→ Simplified (6.5.3.2.1 only) ☑ Prescriptive	6.5.3.2	**Fan Controls** Section 6.5.3.2 includes requirements for controlling supply fan airflow, where VAV fan static pressure sensors can be located, multizone VAV system static pressure set point reset controls, and return and relief fan controls. ***Intention of Requirements:*** VAV operation is an efficient method of controlling temperature and these requirements ensure the system can do so effectively.	DX cooling systems at least 65 kBtu/h and chilled water/ evaporative cooling systems with fan motors at least 0.25 hp must comply with supply fan airflow requirements, exceptions listed in Section 6.5.3.2.1. VAV fans must comply with static pressure sensor location requirements unless complying with multizone VAV static pressure controls in Section 6.5.3.2.3. Section 6.5.3.2.3 is only required for fan systems exceeding 5 hp with DDC of individual zones reporting to the central control panel. Return/ relief fans for removing excess outdoor air during economizer operation must meet Section 6.5.3.2.4 unless they are 0.5 hp or less or staged relief fans with a minimum of four stages.	Mechanical drawing control schematic and the Sequence of Operation (SOP) or Automatic Temperature Controls (ATC) specification sections should indicate the fan controls sequence. Duct plans should indicate location to install duct static pressure sensor. The controls contractor should furnish the static pressure sensor and install the sensor in the supply duct at the location indicated on ductwork plans. The balancer should determine the static pressure setpoint to satisfy airflow at the furthest diffuser. See Compliance Example

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FANS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
☑ Prescriptive	6.5.3.6	**Fractional Horsepower Fan Motors** Section 6.5.3.6 requires electronically commutated motors or a minimum motor efficiency of 70%. Motors shall also have the means to adjust motor speed for either balancing or remote control. Belt-driven fans may use sheave adjustments for airflow balancing in lieu of a varying motor speed. ***Intention of Requirements:*** Electronically commutated motors provide an energy efficient method of speed control, while the 70% efficiency requirement allows other methods to be used if they provide similar efficiency.	Motors for fans that are 1/12 hp or greater and less than 1 hp. Motors in the airstream within fan-coils and terminal units that operate only when providing heating to the space served are exempt. Also exempt are motors installed in space conditioning equipment certified under Section 6.4.1 and motors covered by Table 10.8-3 (Polyphase Small Electric Motors) or Table 10.8-4 (Capacitor-Start Capacitor-Run and Capacitor-Start Induction-Run Small Electric Motors).	The mechanical schedule should indicate if fan speed is controlled by ECM motor or VFD.
☑ Prescriptive	mn 6.5.3.7	**Low Power Fans** Table 6.5.3.7 includes fan efficacy requirements for exhaust air energy recovery, transfer and exhaust fans. ***Intention of Requirements:*** Ensures that even small fans meet minimum efficiency levels.	Fans that are not covered by Section 6.5.3.6 and having a fan nameplate electrical input power of less than 180 W, or having a motor nameplate horsepower less than 1/12 hp. Exceptions such as fans within domestic range hoods and radon mitigation systems are listed in Section 6.5.3.7.	The fan section of the mechanical schedules should include a note to select fans that meet the efficacy requirement. The project manual should include Table 6.5.3.7 (minimum fan efficacy for low power fans) in the fan section under part-1 quality assurance. **See Compliance Example**

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FANS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Energy Cost Budget)	11.5	**Energy Cost Budget Method** Schedules for HVACR fans that provide outdoor air for ventilation shall run continuously whenever spaces are occupied and shall be cycled ON and OFF to meet heating and cooling loads during unoccupied hours when simulated for Performance Path compliance using the Energy Cost Budget Method. Several exceptions are listed in Table 11.5.1 regarding fan schedules. The budget building simulation's representation of the HVACR systems must be based on a combination of the proposed design and prescriptive path HVACR requirements as detailed in Section 11.5.2 and Table 11.5.1. ***Intention of Requirements:*** The budget building design is specified to represent the performance of a building that complies with prescriptive requirements. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the budget design, except where specifically directed otherwise.	Projects using the Energy Cost Budget Method for Performance Path compliance.	Section 11.7.2 includes a list of information that must be submitted with the permit application when using Energy Cost Budget Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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FANS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Performance Rating Method)	mn Appendix G	**Performance Rating Method** Table G3.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Performance Rating Method for Performance Path compliance. The baseline model's representation of the HVACR systems must generally be consistent with Section G3.1.1 through G3.1.3, Table G3.1, and numerous tables at the end of Appendix G. ***Intention of Requirements:*** The baseline building modeled in the Performance Rating Method differs from the budget design in the Energy Cost Budget Method. The baseline building is intended to be minimally compliant with the code, but the HVACR system represents a "typical" design for the building type. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the baseline, except where specifically directed otherwise.	Projects using the Performance Rating Method for Performance Path compliance.	Section G1.3.2 includes a list of information that must be submitted with the permit application when using Performance Rating Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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ECONOMIZERS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: → Simplified ☑ Prescriptive Performance	6.4.3.12	**Economizer Fault Detection Diagnostics (FDD)** A fault detection diagnostic system must be installed capable of monitoring outdoor, supply and return air temperatures, displaying the value of each sensor, providing system status, manually initiating each operating mode to enable testing, and detecting and reporting faults such as the damper not modulating. ***Intention of Requirements:*** Economizer systems offer significant energy savings. Unfortunately, economizers are subject to a variety of failure modes which reduce or eliminate the energy savings. Adding capabilities to detect such faults allows building operators to continue the expected energy benefits.	Air-cooled direct-expansion cooling units listed in Tables 6.8.1-1 and 6.8.1-2, with an air economizer.	The mechanical drawings should include control schematics and sequence of operation. The sequence of operation in the Project Manual should include economizer fault detection. See Compliance Example
→ Simplified	mn 6.3.2	**Simplified Approach** Air economizers meeting the requirements of Sections 6.5.1 (economizer design and control requirements) and 6.4.3.1.12 (economizer FDD) are required. ***Intention of Requirements:*** The Simplified Path provides all the requirements for the HVACR system in a relatively concise form but is only applicable to smaller buildings. The requirements for HVACR systems using the Simplified Path includes compliance with two sections of requirements for economizers.	Projects electing to use Simplified Approach Compliance Path and which meet eligibility criteria including buildings two stories or fewer and less than 25,000 ft^2 gross.	Economizers should be specified on the mechanical equipment schedule. The sequence of operation in the Project Manual should include economizer fault detection. See Compliance Example

ECONOMIZERS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
→ Simplified ☑ Prescriptive	mn 6.5.1.1	**Air Economizers** Each cooling system shall include either an air economizer or fluid economizer meeting the requirements of Sections 6.5.1.1 through 6.5.1.5. Air economizer requirements in Section 6.5.1.1.1 regulate design capacity, while Sections 6.5.1.4 and 6.5.1.5 require that economizer operation does not increase the building heating energy use and that systems with hydronic cooling and humidification systems designed to maintain inside humidity use a fluid economizer instead of an air economizer. ***Intention of Requirements:*** Economizers rely on using cool outdoor conditions to reduce or avoid the use of mechanical or other types of cooling. This section specifies design parameters to maximize benefits and avoid operation during unfavorable conditions.	Section 6.5.1 includes a long list of exceptions such as small FCUs, systems that include nonparticulate air treatment, systems expected to operate fewer than 20 hrs per week, etc.	Economizers should be shown on mechanical equipment schedules.

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ECONOMIZERS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
→ Simplified ☑ Prescriptive	mn 6.5.1.1	**Air Economizer Controls** Air economizer control requirements in Section 6.5.1.1 include control signals and high limit shut-off, damper requirements, excess outdoor air relief, and accuracy for sensors. ***Intention of Requirements:*** Economizers rely on using cool outdoor conditions to reduce or avoid the use of mechanical or other types of cooling. This section specifies design parameters to maximize benefits and avoid operation during unfavorable conditions.	Section 6.5.1 includes a long list of exceptions such as small FCUs, systems that include nonparticulate air treatment, systems expected to operate fewer than 20 hrs per week, etc.	The mechanical drawings should include control schematics and sequence of operation. The sequence of operation in the Project Manual should include air economizer controls and setpoints. Deadband controls should be shown on the control setpoint schedule or where thermostatic controls are specified. See Compliance Example

Additional Resources

ENERGY CODE HELPLINE

MINNESOTA ENERGY CODE SUPPORT PROGRAM

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Submit an Energy Code question on the Program's website: www.minnesotaenergycodesupport.org/helpline

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ECONOMIZERS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
→ Simplified ☑ Prescriptive	6.5.1.2	**Fluid Economizers** Each cooling system shall include either an air economizer or fluid economizer meeting the requirements of Sections 6.5.1.1 through 6.5.1.5. Fluid economizer requirements in Section 6.5.1.2.1 regulate design capacity, while Sections 6.5.1.4 and 6.5.1.5 require that economizer operation does not increase the building heating energy use and that systems with hydronic cooling and humidification systems designed to maintain inside humidity use a fluid economizer. ***Intention of Requirements:*** Economizers rely on using cool outdoor conditions to reduce or avoid the use of mechanical or other types of cooling. This section specifies design parameters to maximize benefits and avoid excess pumping energy.	Section 6.5.1 includes a long list of exceptions such as small FCUs, systems that include nonparticulate air treatment, systems expected to operate fewer than 20 hrs per week, etc.	Economizers should be shown on mechanical equipment schedules.
→ Simplified ☑ Prescriptive	6.5.1.2	**Fluid Economizer Controls** Fluid economizer control requirements in Section 6.5.1.2 include maximum hydronic pressure drop and integrated controls. ***Intention of Requirements:*** Economizers rely on using cool outdoor conditions to reduce or avoid the use of mechanical or other types of cooling. This section specifies design parameters to maximize benefits and avoid excess pumping energy.	Section 6.5.1 includes a long list of exceptions such as small FCUs, systems that include nonparticulate air treatment, systems expected to operate fewer than 20 hrs per week, etc.	The mechanical drawings should include control schematics and sequence of operation. The sequence of operation in the Project Manual should include fluid economizer controls and setpoints. **See Compliance Example**

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ECONOMIZERS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performvance (Energy Cost Budget)	11.5	**Energy Cost Budget Method** Table 11.5.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Energy Cost Budget Method for Performance Path compliance. The budget building simulation's representation of the HVACR systems must be based on a combination of the proposed design and prescriptive path HVACR requirements as detailed in Section 11.5.2 and Table 11.5.1. ***Intention of Requirements:*** The budget building design is specified to represent the performance of a building that complies with prescriptive requirements. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the budget design, except where specifically directed otherwise.	Projects using the Energy Cost Budget Method for Performance Path compliance.	Section 11.7.2 includes a list of information that must be submitted with the permit application when using Energy Cost Budget Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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ECONOMIZERS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Performance Rating Method)	mn Appendix G	**Performance Rating Method** Table G3.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Performance Rating Method for Performance Path compliance. The baseline model's representation of the HVACR systems must generally be consistent with Section G3.1.1 through G3.1.3, Table G3.1, and numerous tables at the end of Appendix G. ***Intention of Requirements:*** The baseline building modeled in the Performance Rating Method differs from the budget design in the Energy Cost Budget Method. The baseline building is intended to be minimally compliant with the code, but the HVACR system represents a "typical" design for the building type. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the baseline, except where specifically directed otherwise.	Projects using the Performance Rating Method for Performance Path compliance.	Section G1.3.2 includes a list of information that must be submitted with the permit application when using Performance Rating Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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ENERGY & HEAT RECOVERY				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
→ Simplified	mn 6.3.2	**Simplified Approach** Exhaust air energy recovery meeting the requirements of Section 6.5.6.1 (enthalpy recovery ratios, etc.) is required. ***Intention of Requirements:*** The Simplified Path provides all the requirements for the HVACR system in a relatively concise form but is only applicable to smaller buildings. The requirements for HVACR systems using the Simplified Path includes compliance with requirements for exhaust air energy recovery.	Projects electing to use Simplified Approach Compliance Path and which meet eligibility criteria including buildings two stories or fewer and less than 25,000 ft² gross.	The mechanical schedule should indicate a system with energy recovery functionality including a note to see the mechanical specification for energy recovery units. The Project Manual should include a section for the energy recovery unit that requires performance per the Energy Code requirements. See Compliance Example

Additional Resources

ENERGY CODE HELPLINE

MINNESOTA ENERGY CODE SUPPORT PROGRAM

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ENERGY & HEAT RECOVERY				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
→ Simplified ☑ Prescriptive	mn 6.5.6.1.1	**Exhaust Air Energy Recovery - Nontransient Dwelling Units** Outdoor air energy recovery ventilation systems are required that result in an Enthalpy Recovery Ratio of at least 60% at heating design condition. Climate zones 6A and 7 are excepted from cooling design condition requirements. The Energy Recovery Ratio is defined in Section 3.2 and the ASHRAE 90.1 User's Manual includes more explanation of how to calculate it. The effectiveness value listed by the manufacturer is not the same as the Enthalpy Recovery Ratio. ***Intention of Requirements:*** Ventilation with outdoor air is necessary to assure healthy air quality, but the process requires exhaust of conditioned indoor air and replacement with outdoor air that must be conditioned. If the difference in temperature or enthalpy between the incoming outdoor air and the exhausted indoor air is large enough, energy recovery systems can significantly reduce the energy needed to condition the entering outdoor air.	Nontransient dwelling units more than 750 ft^2 of conditioned floor area.	The mechanical schedule should indicate a system with energy recovery functionality such as an energy recovery ventilator (ERV). Schedules should also include Enthalpy Recovery Ratio values or show enough of entering and exiting conditions at heating and cooling design conditions for their calculation.

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ENERGY & HEAT RECOVERY				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
→ Simplified ☑ Prescriptive	m 6.5.6.1.2	**Exhaust Air Energy Recovery- Spaces Not Nontransient Dwelling Units** Energy recovery systems where the design supply fan airflow rate exceeds the value listed in Table 6.5.6.1.2 are required for spaces other than nontransient dwelling units. Energy recovery systems required by this section shall result in an Enthalpy Recovery Ratio of at least 50 percent. The Energy Recovery Ratio is defined in Section 3.2 and the ASHRAE 90.1 User's Manual includes more explanation of how to calculate it. The effectiveness value listed by the manufacturer is not the same as the Enthalpy Recovery Ratio. Additional provisions apply to enable economizer operation. ***Intention of Requirements:*** Ventilation with outdoor air is necessary to assure healthy air quality, but the process requires exhaust of conditioned indoor air and replacement with outdoor air that must be conditioned. If the difference in temperature or enthalpy between the incoming outdoor air and the exhausted indoor air is large enough, energy recovery systems can significantly reduce the energy needed to condition the entering outdoor air. Requirements are based on climate zone and outdoor airflow as a percentage of the design supply airflow because the benefits of these systems increases in colder climate zones and with higher outdoor air percentages. The various exceptions apply to cases where energy recovery systems may create safety issues or where the benefits may not be large enough.	Fan systems not serving nontransient dwelling units. Several exceptions are listed in Section 6.5.6.1.2 including laboratory systems, when outdoor air heating energy is provided from site-recovered energy or site-solar energy, etc. Note that projects in Climate Zone 7 are also exempt from this requirement.	The mechanical schedule should indicate a system with energy recovery functionality such as an energy recovery ventilator (ERV).

ENERGY & HEAT RECOVERY				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
☑ Prescriptive	6.5.6.2	**Service Water Heating Heat Recovery** Condenser heat recovery systems are required for heating or preheating of service hot water. The required heat recovery system shall have the capacity to provide the smaller of 60% of the peak heat-rejection load at design conditions or preheat of the peak service hot-water draw to 85°F. ***Intention of Requirements:*** Buildings with large cooling systems and large water heating loads that operate 24 hours per day must reject large amounts of heat from the cooling systems. In these buildings, systems to use that heat for heating service hot water will often be cost effective.	Systems heating or preheating service hot water where the facility operates 24 hours a day, the total installed heat-rejection capacity of the water-cooled systems exceeds 6 MMBtu/h of heat rejection and the design service water-heating load exceeds 1 MMBtu/h. Exceptions to capacity requirement listed in Section 6.5.6.2.2.	The mechanical schedule should indicate a system with heat recovery functionality such as a heat exchanger or coil. The controls sequence within the mechanical plans should show the heat recovery system off line when there is no opportunity for heat recovery. The sequence should show pump stops and isolation valves modulating close. The Project Manual should include performance specifications for the heat recovery unit.
☑ Prescriptive	6.5.6.3	**Space Conditioning Heat Recovery** The heat recovery system is required to have a cooling capacity that is at least 7% of the total design chilled-water capacity of the acute inpatient hospital at peak design conditions. ***Intention of Requirements:*** Portions of in-patient hospitals that operate 24 hours per day and have significant periods of simultaneous heating and cooling can save heating energy by recovering heat from the cooling systems.	Where heating water is used for space heating and the building is an acute inpatient hospital in Climate Zone 6A, used on a 24-hour basis, the total design chilled-water capacity required at cooling design conditions exceeds 3,600,000 Btu/h of cooling, and where simultaneous heating and cooling occurs above 60°F outdoor air temperature. Buildings that provide at least 60% of their reheat energy from on-site renewable energy or site recovered energy are exempt.	The mechanical schedule should indicate a system with heat recovery functionality such as a heat recovery ventilator (HRV). The Project Manual should include performance specifications per the Energy Code in the heat recovery unit section under Part 1 General - quality assurance.

ENERGY & HEAT RECOVERY				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Energy Cost Budget)	11.5	**Energy Cost Budget Method** Table 11.5.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Energy Cost Budget Method for Performance Path compliance. The budget building simulation's representation of the HVACR systems must be based on a combination of the proposed design and prescriptive path HVACR requirements as detailed in Section 11.5.2 and Table 11.5.1. ***Intention of Requirements:*** The budget building design is specified to represent the performance of a building that complies with prescriptive requirements. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the budget design, except where specifically directed otherwise.	Projects using the Energy Cost Budget Method for Performance Path compliance.	Section 11.7.2 includes a list of information that must be submitted with the permit application when using Energy Cost Budget Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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ENERGY & HEAT RECOVERY				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Performance Rating Method)	mn Appendix G	**Performance Rating Method** Table G3.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Performance Rating Method for Performance Path compliance. The baseline model's representation of the HVACR systems must generally be consistent with Section G3.1.1 through G3.1.3, Table G3.1, and numerous tables at the end of Appendix G. ***Intention of Requirements:*** The baseline building modeled in the Performance Rating Method differs from the budget design in the Energy Cost Budget Method. The baseline building is intended to be minimally compliant with the code, but the HVACR system represents a "typical" design for the building type. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the baseline, except where specifically directed otherwise.	Projects using the Performance Rating Method for Performance Path compliance.	Section G1.3.2 includes a list of information that must be submitted with the permit application when using Performance Rating Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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HEAT REJECTION EQUIPMENT

Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: ☑ Prescriptive Performance	6.4.1.1	**Minimum Equipment Efficiencies** Section 6.4.1.1 requires equipment to meet minimum efficiencies prescribed in Tables in Section 6.8.1. ***Intention of Requirements:*** Minimum efficiency levels have been set by comparing the costs of increased efficiency to the energy cost savings and showing that the savings justify the costs in most applications.	All equipment included in the Tables in Section 6.8.1.	Minimum performance requirements for all HVACR equipment should be shown on the equipment schedules in the plans with the same units used in the tables in Section 6.8.1. For alterations that don't include plans, equipment cut sheets or purchase orders should be submitted with the permit application.
☑ Prescriptive	6.5.5.2	**Fan Speed Control** Section 6.5.5.2 requires controls that result in fan motor demand of ≤ 30% of design wattage at 50% of the design airflow and that automatically modulate the fan speed to control the leaving fluid temperature or condensing temperature/ pressure of the heat-rejection device. Multicell heat-rejection equipment with variable-speed fan drives must operate the maximum number of fans allowed that comply with the manufacturer's requirements and control all fans to the same fan speed required for the instantaneous cooling duty, as opposed to staged (on/off) operation. Minimum fan speed shall comply with the minimum allowable speed of the fan drive system per manufacturer's recommendations. ***Intention of Requirements:*** This requirement ensures that fans slow down to reduce energy consumption to only the level needed to provide the needed heat rejection.	Heat-rejection equipment used in comfort cooling systems with fan system motors totaling 5 hp or more. Heat-rejection devices whose energy use is included in the equipment efficiency ratings listed in Tables 1-4, 8-14, 16, 17, and 20 in Section 6.8.1 are exempt. Condenser fans serving multiple refrigerant or fluid cooling circuits and condenser fans serving flooded condensers are exempt from fan motor demand controls.	Fan speed controls should be reflected in the sequence of operation (SOP) or automatic temperature control (ATC) sections in the Project Manual. The mechanical drawings should indicate fan speed controls in the controls schematic and sequence operation as well.

HEAT REJECTION EQUIPMENT

Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
☑ Prescriptive ☑	6.5.5.3	**Centrifugal Fan Open-Circuit Cooling Towers** Section 6.5.5.3 requires centrifugal fan open-circuit cooling towers to meet the energy efficiency requirement for axial fan open-circuit cooling towers listed in Table 6.8.1-7 ***Intention of Requirements:*** Axial fans are typically used for cooling towers. If centrifugal fans are used instead, they must meet the efficiency requirements for axial fans of the same capacity. The exception for ducting is because ducting will increase the fan power needed to provide an equal airflow.	Centrifugal fan open-circuit cooling towers with a combined rated capacity of 1100 gpm or greater at 95°F condenser water return, 85°F condenser water supply, and 75°F outdoor air wet-bulb temperature. Centrifugal open-circuit cooling towers that are ducted (inlet or discharge) or require external sound attenuation are exempt.	A note within the cooling tower schedule should refer to the mechanical specification section for cooling towers for additional information and requirements. The Project Manual should require cooling towers have capacity that meet the Energy Code 6.5.5.3 centrifugal fan open-circuit cooling tower requirements. The specifications should refer to or include Table 6.8.1-7 - Performance Requirement for heat rejection. See Compliance Example
Prescriptive	6.5.5.4	**Tower Flow Turndown** Section 6.5.5.4 requires open-circuit cooling towers be designed so that all open-circuit cooling tower cells can be run in parallel with the larger of the flow that is produced by the smallest pump at its minimum expected flow rate or 50% of the design flow for the cell. ***Intention of Requirements:*** In condenser water systems that can reduce the water flow at lower loads, distributing that flow over all available cooling towers increases the effectiveness of the cooling provided by maintaining a large area of heat exchange.	Open-circuit cooling towers used on water-cooled chiller systems that are configured with multiple- or variable-speed condenser water pumps.	The mechanical control schematic should include a sequence for cooling towers to run in parallel operation. The Project Manual should include a sequence of operation (SOP) for cooling towers and specify that cooling tower cells must be designed for parallel operation. The mechanical plans should show a piping layout for condenser water system that consists of two or more cooling tower cells.

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HEAT REJECTION EQUIPMENT				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Energy Cost Budget)	11.5	**Energy Cost Budget Method** Table 11.5.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Energy Cost Budget Method for Performance Path compliance. The budget building simulation's representation of the HVACR systems must be based on a combination of the proposed design and prescriptive path HVACR requirements as detailed in Section 11.5.2 and Table 11.5.1. ***Intention of Requirements:*** The budget building design is specified to represent the performance of a building that complies with prescriptive requirements. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the budget design, except where specifically directed otherwise.	Projects using the Energy Cost Budget Method for Performance Path compliance.	Section 11.7.2 includes a list of information that must be submitted with the permit application when using Energy Cost Budget Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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HEAT REJECTION EQUIPMENT

Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Performance Rating Method)	mn Appendix G	**Performance Rating Method** Table G3.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Performance Rating Method for Performance Path compliance. The baseline model's representation of the HVACR systems must generally be consistent with Section G3.1.1 through G3.1.3, Table G3.1, and numerous tables at the end of Appendix G. ***Intention of Requirements:*** The baseline building modeled in the Performance Rating Method differs from the budget design in the Energy Cost Budget Method. The baseline building is intended to be minimally compliant with the code, but the HVACR system represents a "typical" design for the building type. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the baseline, except where specifically directed otherwise.	Projects using the Performance Rating Method for Performance Path compliance.	Section G1.3.2 includes a list of information that must be submitted with the permit application when using Performance Rating Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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WATERSIDE EQUIPMENT				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: ☑ Prescriptive Performance	6.4.1.1	**Minimum Equipment Efficiencies** Section 6.4.1.1 requires equipment to meet minimum efficiencies prescribed in Tables in Section 6.8.1. If water-cooled centrifugal chillers or positive displacement chillers are designed for nonstandard conditions, calculations required by Section 6.4.1.2 must be used. ***Intention of Requirements:*** Minimum efficiency levels have been set by comparing the costs of increased efficiency to the energy cost savings and showing that the savings justify the costs in most applications.	All equipment included in the Tables in Section 6.8.1.	Minimum performance requirements for all HVACR equipment should be shown on the equipment schedules in the plans with the same units used in the tables in Section 6.8.1. For alterations that don't include plans, equipment cut sheets or purchase orders should be submitted with the permit application.
Mandatory when using: ☑ Prescriptive Performance	6.4.7	**Liquid-to-Liquid Heat Exchangers** Plate-type liquid-to-liquid heat exchangers shall be rated in accordance with AHRI 400-2015. ***Intention of Requirements:*** This requirement ensures that installed plate-type liquid-to-liquid heat exchangers are rated in a consistent manner.	Plate-type liquid-to-liquid heat exchangers.	Both the mechanical schedules and specifications within the Project Manual should include rating requirements for heat exchangers.

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WATERSIDE EQUIPMENT				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
→ Simplified	mn 6.3.2	**Simplified Approach** Boilers supplying baseboard heating systems must meet the applicable efficiency requirements shown in Table 6.8.1-6. ***Intention of Requirements:*** The Simplified Path provides all th requirements for the HVACR system in a relatively concise form but is only applicable to smaller buildings. The requirements for HVACR systems using the Simplified Path allows use of any of four heating system types, one of which is a baseboard system served by a boiler.	Projects electing to use Simplified Approach Compliance Path and which meet eligibility criteria including buildings two stories or fewer and less than 25,000 ft^2 gross.	Minimum performance for boilers should be shown on the equipment schedule in the plans. For alterations that don't include plans, equipment cut sheets or purchase orders should be submitted with the permit application.
☑ Prescriptive	6.5.4.5	**Hydronic Heat Pumps and Water-Cooled Unitary Air Conditioners** Each hydronic heat pump and water-cooled unitary air conditioner shall have a two-position automatic valve interlocked to shut off water flow when the compressor is off. This section also requires controls that will result in pump motor demand of ≤ 30% of design wattage at 50% of design water flow. ***Intention of Requirements:*** These systems exchange heat with a water loop. This section requires a valve to shut off water flow when the compressor is not operating, allowing a reduction in pump energy. Pump efficiency requirements ensure that as the water flow is reduced, adequate pump energy reductions are provided.	Hydronic heat pumps and water-cooled unitary air conditioners. Units employing a fluid economizers are exempt from two-position valve requirement and units having a total pump system power 5 hp or less are exempt from the demand control requirement.	The mechanical schedules should include a note referring to the heat pump section in the Project Manual. Controls requirements meeting the Energy Code should be included in the heat pump specifications.

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WATERSIDE EQUIPMENT				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
☑ Prescriptive	6.5.4.7	**Chilled-Water Coil Selection** Chilled-water cooling coils shall be selected to provide a 15°F or higher temperature difference between leaving and entering water temperatures and a minimum of 57°F leaving water temperature at design conditions. ***Intention of Requirements:*** Larger coils allow more heat transfer from the chilled water to the air, so cooling loads can be met with a lower water flow rate. This ensures that cooling loads are met without excess pumping energy consumption. Increased temperature difference between water entering and leaving the chiller can also improve chiller efficiency. The requirement for the boiler system to have return water temperature of 120°F or less ensures that the return water is cool enough to achieve the design efficiency.	All chilled-water cooling coils unless equipment meets one of the listed exceptions in Section 6.5.4.7 such as constant air volume systems, FCUs with supply airflow rate 5000 cfm and less, etc.	The equipment or zone reheat coil within the mechanical schedules, and the coil selection specification within the Project Manual should reflect requirements.

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WATERSIDE EQUIPMENT				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
☑ Prescriptive	6.5.4.8	**High-Capacity Space-Heating Gas Boiler Systems** A minimum thermal efficiency (Et) of 90% is required for gas hot-water boilers. Systems with multiple boilers are allowed to provide an input capacity-weighted average thermal efficiency of at least 90%. ***Intention of Requirements:*** Boilers with an efficiency 90% or more are called condensing boilers and they extract enough extra heat from the boiler flue gas that the water vapor in the flue gas is condensed. This extra heat extraction increases efficiency and is achieved by adding extra water tubes in the boiler which are cooled by the return boiler water (heating the water at the same time). The requirement for the boiler system to have return water temperature of 120°F or less ensures that the return water is cool enough to achieve the design efficiency.	New buildings with gas hot-water boiler systems for space heating with a total system input of at least 1,000,000 Btu/h but not more than 10,000,000 Btu/h. Several exceptions are listed in Section 6.5.4.8.	The mechanical schedules should indicate efficiency requirements meeting the required minimums. The boiler section in the Project Manual should indicate performance requirements around return water temperatures.

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WATERSIDE EQUIPMENT				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Energy Cost Budget)	11.5	**Energy Cost Budget Method** Table 11.5.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Energy Cost Budget Method for Performance Path compliance. The budget building simulation's representation of the HVACR systems must be based on a combination of the proposed design and prescriptive path HVACR requirements as detailed in Section 11.5.2 and Table 11.5.1. ***Intention of Requirements:*** The budget building design is specified to represent the performance of a building that complies with prescriptive requirements. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the budget design, except where specifically directed otherwise.	Projects using the Energy Cost Budget Method for Performance Path compliance.	Section 11.7.2 includes a list of information that must be submitted with the permit application when using Energy Cost Budget Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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WATERSIDE EQUIPMENT				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Performance Rating Method)	mn Appendix G	**Performance Rating Method** Table G3.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Performance Rating Method for Performance Path compliance. The baseline model's representation of the HVACR systems must generally be consistent with Section G3.1.1 through G3.1.3, Table G3.1, and numerous tables at the end of Appendix G. ***Intention of Requirements:*** The baseline building modeled in the Performance Rating Method differs from the budget design in the Energy Cost Budget Method. The baseline building is intended to be minimally compliant with the code, but the HVACR system represents a "typical" design for the building type. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the baseline, except where specifically directed otherwise.	Projects using the Performance Rating Method for Performance Path compliance.	Section G1.3.2 includes a list of information that must be submitted with the permit application when using Performance Rating Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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PUMPS AND PIPING				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: ☑ Prescriptive Performance	6.4.2.2	**Pump Head** Pump differential pressure for the purpose of sizing pumps shall be determined in accordance with generally accepted engineering standards and handbooks acceptable to the adopting authority. The pressure drop through each device and pipe segment in the critical circuit at design conditions shall be calculated. ***Intention of Requirements:*** This requirement assures that pumps are selected that can provide the design flow against the head that the piping will impose.	Pumps included in the project scope.	Pump capacity as determined by the designer of record should be included on the mechanical pump schedule.
Mandatory when using: ☑ Prescriptive Performance	6.4.4.1.3	**Insulation** Piping shall be insulated in accordance with Tables 6.8.3-1 and 6.8.3-2. In piping 1 in. or less, insulation is not required for strainers, control valves, and balancing valves. ***Intention of Requirements:*** Insulation added to piping reduces energy loss from the piping system.	All piping that is not factory-installed within HVACR equipment tested and rated in accordance with Section 6.4.1, or that conveys fluids having a design operating temperature range between 60°F and 105°F, or that conveys fluids that have not been heated or cooled through the use of fossil fuels or electricity, or where heat gain or heat loss will not increase energy use.	The Project Manual should include Tables 6.8.3-1 and 6.8.3-2 or a pipe insulation schedule compliant with the Energy Code.

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PUMPS AND PIPING				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: ☑ Prescriptive Performance	6.4.4.1.4	**Sensible Heating Panel Insulation** All thermally ineffective panel surfaces of sensible heating panels shall be insulated with a minimum of R-3.5. Adjacent building envelope insulation counts toward this requirement. ***Intention of Requirements:*** Some portions of sensible heating panels don't contribute to providing desired heat. These portions must be insulated to minimize heat loss to undesirable locations.	All thermally ineffective panel surfaces of sensible heating panels, including U-bends and headers.	The Project Manual should reflect minimum insulation requirements for sensible heating panels.
→ Simplified	mn 6.3.2	**Simplified Approach** Piping must be insulated in accordance with Tables 6.8.3-1 and 6.8.3-2 and insulation exposed to weather must be suitably protected. ***Intention of Requirements:*** The Simplified Path provides all the requirements for the HVACR system in a relatively concise form but is only applicable to smaller buildings. The requirements for HVACR systems using the Simplified Path includes compliance with requirements for pipe insulation.	Projects electing to use Simplified Approach Compliance Path and which meet eligibility criteria including buildings two stories or fewer and less than 25,000 ft² gross.	The Project Manual should include Tables 6.8.3-1 and 6.8.3-2 or a pipe insulation schedule compliant with the Energy Code.

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PUMPS AND PIPING				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
☑ Prescriptive	6.5.4.2	**Hydronic Variable Flow Systems** Section 6.5.4.2 requires distribution systems be designed for variable fluid flow and configured to reduce pump flow rates. Control and differential pressure setpoints also have requirements in this section. ***Intention of Requirements:*** Reducing the flow rate of the chilled water loop or hot water loop as load is decreased reduces pumping energy.	Chilled- and hot-water distribution systems that include three or more control valves designed to modulate or step open and close as a function of load. Several exceptions are listed in Section 6.5.4.2.	Both the mechanical control schematic and the sequence of operation (SOP) section for variable flow in the Project Manual should require pump speed to modulate to maintain the differential pressure setpoint.
☑ Prescriptive	6.5.4.6	**Pipe Sizing** The design flow rate in each piping segment shall not exceed the values listed in Table 6.5.4.6 for the appropriate total annual hours of operation. Design flow rates exceeding the values in Table 6.5.4.6 are allowed in specific sections of piping if the piping in question is not in the critical circuit at design conditions and is not predicted to be in the critical circuit during more than 30% of operating hours. ***Intention of Requirements:*** Increasing the size of piping carrying a given flow rate reduces the pump energy. Table 6.5.4.6 specifies minimum pipe sizing based on pumping type (variable speed or not), and the number of operating hours per year. These distinctions are because variable speed pumping systems will often operate at much less than design flow, decreasing the benefit from larger piping. More operating hours per year increase the benefits of larger piping.	All chilled-water and condenser-water piping. Piping systems that have equivalent or lower total pressure drop than the same system constructed with standard weight steel pipe with piping and fittings sized per Table 6.5.4.6 are exempt.	The Project Manual should include a pipe system table that meet flowrate requirements of the Energy Code.

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PUMPS AND PIPING				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
☑ Prescriptive	6.5.4.8	**High-Capacity Space-Heating Gas Boiler System Distribution** Coils and other heat exchangers shall be selected so that at design conditions the hot water return temperature entering the boilers is 120°F or less. Under all operating conditions, the water temperature entering the boiler is 120°F or less, or the flow rate of supply hot water that recirculates directly into the return system, such as by three-way valves or minimum flow bypass controls, shall be no greater than 20% of the design flow of the operating boilers. ***Intention of Requirements:*** Boilers with an efficiency 90% or more are called condensing boilers and they extract enough extra heat from the boiler flue gas that the water vapor in the flue gas is condensed. This extra heat extraction increases efficiency and is achieved by adding extra water tubes in the boiler which are cooled by the return boiler water (heating the water at the same time). The requirement for the boiler system to have return water temperature of 120°F or less ensures that the return water is cool enough to achieve the design efficiency.	New buildings with gas hot-water boiler systems for space heating with a total system input of at least 1,000,000 Btu/h but not more than 10,000,000 Btu/h. Several exceptions are listed in Section 6.5.4.8.	Boiler efficiencies must be listed on the equipment schedule. The Project Manual should include a requirement to comply with Energy Code 6.5.4.8. in the boiler specification Part-1, quality assurance and performance.

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PUMPS AND PIPING				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Energy Cost Budget)	11.5	**Energy Cost Budget Method** Table 11.5.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Energy Cost Budget Method for Performance Path compliance. The budget building simulation's representation of the HVACR systems must be based on a combination of the proposed design and prescriptive path HVACR requirements as detailed in Section 11.5.2 and Table 11.5.1. ***Intention of Requirements:*** The budget building design is specified to represent the performance of a building that complies with prescriptive requirements. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the budget design, except where specifically directed otherwise.	Projects using the Energy Cost Budget Method for Performance Path compliance.	Section 11.7.2 includes a list of information that must be submitted with the permit application when using Energy Cost Budget Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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PUMPS AND PIPING				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Performance Rating Method)	mn Appendix G	**Performance Rating Method** Table G3.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Performance Rating Method for Performance Path compliance. The baseline model's representation of the HVACR systems must generally be consistent with Section G3.1.1 through G3.1.3, Table G3.1, and numerous tables at the end of Appendix G. ***Intention of Requirements:*** The baseline building modeled in the Performance Rating Method differs from the budget design in the Energy Cost Budget Method. The baseline building is intended to be minimally compliant with the code, but the HVACR system represents a "typical" design for the building type. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the baseline, except where specifically directed otherwise.	Projects using the Performance Rating Method for Performance Path compliance.	Section G1.3.2 includes a list of information that must be submitted with the permit application when using Performance Rating Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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LARGE-DIAMETER FANS				
Compliance Path (See page X for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: ☑ Prescriptive Performance	6.4.1.3	**Rated Airflow and Power Consumption** Ceiling fans greater than or equal to 84.5 in. in diameter (large-diameter) must document blade span (blade tip diameter) and rated airflow and power consumption at the maximum speed. ***Intention of Requirements:*** This requirement assures that these large-diameter ceiling fans are rated consistently and that specific parameters are provided.	Ceiling fans covered in the scope of 10 CFR Part 430 that are greater than or equal to 84.5 in. in diameter.	Blade span, airflow and power consumption should be included in the equipment schedule.

Additional Resources

ENERGY CODE HELPLINE

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DUCTS AND PLENUMS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: ☑ Prescriptive Performance	mn 6.4.4.1.2	**Insulation** All supply and return ducts and plenums installed as part of an HVACR air distribution system shall be thermally insulated in accordance with Table 6.8.2. For runouts less than 10 ft in length to air terminals or air outlets, the rated R-value of insulation need not exceed R-3.5. Backs of air outlets and outlet plenums exposed to unconditioned space or indirectly conditioned space with face areas exceeding 5 ft^2 need not exceed R-2; those 5 ft^2 or smaller need not be insulated. ***Intention of Requirements:*** Duct insulation minimizes energy losses from the ducts.	All ducts and plenums that are not factory-installed-and-furnished as a part of HVACR equipment tested and rated in accordance with Section 6.4.1.	The Project Manual should include Table 6.8.2 or an insulation table that meets Energy Code requirements for ducts and plenums.
Mandatory when using: → Simplified ☑ Prescriptive Performance	6.4.4.2	**Duct Sealing and Leakage Testing** Ductwork and all plenums with pressure class ratings shall be constructed to Seal Class A. Specific requirements for sealing devices and tapes are included in Section 6.4.4.2.1. Representative sections totaling no less than 25% of the total installed duct area for the designated pressure class shall be tested and pass criteria is calculated by the equation in Section 6.4.4.2.2. ***Intention of Requirements:*** Air leaks from ductwork can waste large amounts of energy. Duct sealing reduces this waste and leakage testing ensures that the duct sealing is done properly.	All ductwork must be sealed. Leakage testing is not required for indoor ductwork that is designed to operate at static pressures less than or equal to 3 in. of water. Leakage testing also not required for projects complying via the Simplified Path.	The Project Manual should include compliant sealant and caulking specifications and indicate leakage testing requirements when applicable.

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DUCTS AND PLENUMS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
→ Simplified	mn 6.3.2	**Simplified Approach** Ducts and plenums must be insulated in accordance with Table 6.8.2 and sealed in accordance with Section 6.4.4.2.1. Duct systems must be air balanced in accordance with industry accepted procedures. ***Intention of Requirements:*** The Simplified Path provides all the requirements for the HVACR system in a relatively concise form but is only applicable to smaller buildings. The requirements for HVACR systems using the Simplified Path includes compliance with requirements for duct insulation.	Projects electing to use Simplified Approach Compliance Path and which meet eligibility criteria including buildings two stories or fewer and less than 25,000 ft^2 gross.	The Project Manual should include Table 6.8.2 or an insulation table that meets Energy Code requirements for ducts and plenums.

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DUCTS AND PLENUMS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Energy Cost Budget)	11.5	**Energy Cost Budget Method** Table 11.5.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Energy Cost Budget Method for Performance Path compliance. The budget building simulation's representation of the HVACR systems must be based on a combination of the proposed design and prescriptive path HVACR requirements as detailed in Section 11.5.2 and Table 11.5.1. ***Intention of Requirements:*** The budget building design is specified to represent the performance of a building that complies with prescriptive requirements. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the budget design, except where specifically directed otherwise.	Projects using the Energy Cost Budget Method for Performance Path compliance.	Section 11.7.2 includes a list of information that must be submitted with the permit application when using Energy Cost Budget Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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DUCTS AND PLENUMS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Performance Rating Method)	mn Appendix G	**Performance Rating Method** Table G3.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Performance Rating Method for Performance Path compliance. The baseline model's representation of the HVACR systems must generally be consistent with Section G3.1.1 through G3.1.3, Table G3.1, and numerous tables at the end of Appendix G. ***Intention of Requirements:*** The baseline building modeled in the Performance Rating Method differs from the budget design in the Energy Cost Budget Method. The baseline building is intended to be minimally compliant with the code, but the HVACR system represents a "typical" design for the building type. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the baseline, except where specifically directed otherwise.	Projects using the Performance Rating Method for Performance Path compliance.	Section G1.3.2 includes a list of information that must be submitted with the permit application when using Performance Rating Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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CONTROLS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: ☑ Prescriptive Performance	6.4.3.1	**Zone Thermostats** Each zone shall be individually controlled by thermostatic controls responding to temperature within the zone. Thermostatic controls also need to be deadband capable. ***Intention of Requirements:*** Controlling the temperature of each zone individually helps ensure that each zone is maintained at desired temperatures. Energy is saved by avoiding excess heating or cooling of a zone without a thermostat based on loads in another zone.	All space heating and cooling systems. Note exception to zonal control for independent perimeter systems that are designed to offset only building envelope loads in Section 6.4.3.1.1.	Mechanical floor plans should indicate room location for thermostatic controls while architectural drawings may indicate elevation. The mechanical control schematic and sequence of operation section of the Project Manual should include control capabilities.
Mandatory when using: ☑ Prescriptive Performance	6.4.3.2	**Setpoint Overlap Restriction** Separate heating and cooling thermostatic controls within the same zone must prevent the heating set point from exceeding the cooling set point, minus any applicable proportional band. ***Intention of Requirements:*** It is extremely important that the heating setpoint be kept below the cooling setpoint in a zone. If the heating setpoint is at or above the cooling setpoint, the HVACR system may fight itself by providing cooling and heating at the same time with potentially massive amounts of wasted energy.	All space heating and cooling systems.	The mechanical control schematic and sequence of operation section of the Project Manual should include control capabilities.

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CONTROLS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: → Simplified ☑ Prescriptive Performance	mn 6.4.3.3	**Off-hour Controls** Section 6.4.3.3 requires several controls capabilities such as automatic shutdown, setback, optimum start, zone isolation, and hotel/motel guest room temperature and ventilation. ***Intention of Requirements:*** Most spaces have periods of time when they are not in use. Maintaining normal heating or cooling temperatures during such periods is of little value. Controls that reduce heating setpoints, increase cooling setpoints and turn systems off when heating or cooling are not needed save energy and wear on the systems.	All space heating and cooling systems that do not meet the several exceptions listed in Section 6.4.3.3. Zone isolation controls not required for projects complying via the Simplified Path.	The mechanical control schematic and sequence of operation section of the Project Manual should include control capabilities.

Additional Resources

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CONTROLS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: ☑ Prescriptive Performance	6.4.3.5	**Heat-pump Auxiliary Heat Control** Heat pumps with internal electric resistance heaters shall have controls that prevent supplemental heater operation when the heating load can be met by the heat pump alone during both steady-state operation and setback recovery. Supplemental heater operation is permitted during defrost cycles. ***Intention of Requirements:*** Heat pumps provide heat through the use of a refrigerant cycle, like air conditioning in reverse. As the outdoor air temperature decreases, the heating capacity and efficiency of the heat pump decrease. Most heat pumps have supplemental heating, usually electric resistance coils, to ensure that the heating loads can be met at cold outdoor temperatures. The efficiency of the electric resistance heat, however, is significantly lower than the heat pump efficiency. The controls required by this section ensure that the heating load is met in the most efficient manner, by using the heat pump when it can meet the load.	Heat pumps with minimum efficiency not regulated by NAECA, and including electric resistance heating don't meet the minimum efficiency requirements in Table 6.8.1-2.	The mechanical control schematic and sequence of operation section of the Project Manual should include control capabilities.

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CONTROLS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: ☑ Prescriptive Performance	6.4.3.6	**Humidification and Dehumidification Control** Limitations on reducing humidity using mechanical cooling and increasing humidity using fossil fuel or electric systems are included in Section 6.4.3.6. Control interlock is required when zones include both humidification and dehumidification systems to prevent simultaneous operation. ***Intention of Requirements:*** The dehumidification controls avoid operating the cooling system solely for dehumidification below a certain point. Dehumidification is sometimes necessary for comfort and to avoid microbial growth that can occur in damp spaces. However, the 60% relative humidity or 55°F dewpoint limits are low enough to avoid these problems in normal occupied spaces. Similarly, humidification may be desired to improve occupant comfort during the heating season, but 30% relative humidity has been shown to avoid discomfort due to dryness. Interlock controls avoid simultaneous humidification and dehumidification, particularly humidification while cooling systems are operating.	Systems using humidistatic controls.	The mechanical control schematic and sequence of operation section of the Project Manual should include control capabilities.

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CONTROLS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: ☑ Prescriptive Performance	6.4.3.10	**Direct Digital Controls (DDC)** Section 6.4.3.10 includes DDC capability requirements such as monitoring demand for pump pressure, trending and graphically displaying input and output points, etc. ***Intention of Requirements:*** DDC controls offer many improved control capabilities with better system monitoring and fault diagnostics. DDC systems are particularly beneficial for larger, more complex buildings, which is why buildings that qualify for and use the Simplified Approach are not required to use DDC.	Table 6.4.3.10.1 lists the applications where DDC controls are required.	The mechanical control schematic and sequence of operation section of the Project Manual should include control capabilities.
Mandatory when using: ☑ Prescriptive Performance	6.4.3.11	**Chilled Water Plant Monitoring** Measurement devices shall measure the electric energy use and efficiency of the chilled-water plant. The electrical energy use efficiency shall be trended every 15 minutes and graphically displayed and include hourly, daily, monthly, and annual data. The system shall maintain all data collected for a minimum of 36 months. ***Intention of Requirements:*** The energy consumption of the chiller plant used to cool a building will often be the large load in a single place in the building. Systems to monitor the energy consumption and efficiency of the chillers and to display that for the building operators allow any problems to be quickly identified and addressed, minimizing periods where the chillers might operate inefficiently and waste energy.	New electric-motor-driven chilled-water plants which are either water-cooled plants larger than 1500 tons peak cooling capacity or air-cooled plants larger than 860 tons peak cooling capacity.	The mechanical control schematic and sequence of operation section of the Project Manual should include control capabilities.

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CONTROLS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
→ Simplified	mn 6.3.2	**Simplified Approach** Several criteria required to comply involve controls such as manual changeover or dual set-point thermostat, heat pump auxiliary heat setpoints, reheat and simultaneous heating/ cooling controls, etc. See list in Section 6.3.2 for all control requirements. ***Intention of Requirements:*** The Simplified Path provides all the requirements for the HVACR system in a relatively concise form but is only applicable to smaller buildings. The requirements for HVACR systems using the Simplified Path includes compliance with requirements for installation of multiple control capabilities.	Projects electing to use Simplified Approach Compliance Path and which meet eligibility criteria including buildings two stories or fewer and less than 25,000 ft^2 gross.	The mechanical control schematic and sequence of operation section of the Project Manual should include control capabilities.

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CONTROLS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
☑ Prescriptive	6.5.2	**Simultaneous Heat/ Cool Limitation** Section 6.5.2 includes a list of controls required to prevent systems from simultaneous heating and cooling the same zone. Controls include zone thermostats, supply air temperature reheat limits, hydronic system controls, prevention of three-pipe hydronic systems, requirements for two-pipe changeover systems, controls for hydronic heat pump systems, dehumidification and humidification system controls, preheat coil controls, and ventilation air heating controls. ***Intention of Requirements:*** Simultaneously heating and cooling a space or the air being supplied to the space is a waste of energy. However, modern HVACR systems must meet many objectives simultaneously, so some amount of simultaneous heating and cooling is often unavoidable. The requirements of this section specify controls aimed at minimizing simultaneous heating and cooling while allowing the system to provide ventilation, temperature control, humidity control, and freeze protection for the equipment.	Section 6.5.2 applies to all systems complying prescriptively though there are exceptions listed in Section 6.5.2.1 for zonal controls, in Section 6.5.2.1.1 for supply air temperature reheat, Section 6.5.2.2.3 for hydronic heat pumps, and Sections 6.5.2.3 and 6.5.2.4 for humidity control systems.	The mechanical control schematic and sequence of operation section of the Project Manual should include control capabilities.

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CONTROLS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
☑ Prescriptive	6.5.3.3	**Multi-zone VAV System Ventilation Control** Automatic reduction of outdoor air intake flow below design rates in response to changes in system ventilation efficiency as defined by Appendix A of ASHRAE Standard 62.1. ***Intention of Requirements:*** System ventilation efficiency is a measure of how well outdoor air brought into a multizone system is distributed to the different zones when the desired zone outdoor air fraction differs from the system outdoor air fraction. System ventilation efficiency varies as the system and zone supply air volume varies and sometimes based on demand control ventilation. This section requires that the volume of outdoor air taken in by the system be reduced when changes in the system result in improved system ventilation efficiency. Reducing the outdoor air volume saves energy due to reduced heating or cooling of the outdoor air.	Multiple-zone VAV systems with DDC of individual zone boxes reporting to a central control panel. Systems with zonal transfer fans, dual-duct dual-fan systems, fan-powered terminal units, and systems where total design exhaust airflow is more than 70% of total design outdoor air intake flow are exempt.	The mechanical control schematic and sequence of operation section of the Project Manual should include control capabilities.

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CONTROLS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
☑ Prescriptive	6.5.3.4	**Parallel-Flow Fan-Powered VAV Air Terminal Control** Automatic controls configured to turn on and off the terminal fan based on heating and ventilation requirements, and either operate the terminal fan and heating coil without primary air or reverse the terminal damper logic and provide heating from the central air handler during warm-up or setback temperature control are required. ***Intention of Requirements:*** Parallel-flow fan-powered VAV terminal units have a fan that can pull air from the return plenum that is usually warm from interior zone return air. Using this warm air to heat perimeter zones without using the heating coil is an obvious way to save energy. Similarly, when such heating is not needed, turning the fan off is appropriate. When the space is unoccupied, heating the space without running the overall VAV system (which provides primary air) is an efficient option. In some situations, where many zones need heat and interior zones that normally need cooling are unoccupied and do not need ventilation air, running the VAV system to supply warm primary air to the perimeter zones is also an option.	Parallel-flow fan-powered VAV air terminals.	The mechanical control schematic and sequence of operation section of the Project Manual should include control capabilities.

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CONTROLS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
☑ Prescriptive	6.5.3.5	**Supply Air Temperature Reset** Controls to automatically reset the supply air temperature in response to representative building loads, or to outdoor air temperature are required. Controls that adjust the reset based on zone humidity are allowed. HVACR zones that are expected to experience relatively constant loads shall have maximum airflow designed to accommodate the fully reset supply air temperature. ***Intention of Requirements:*** Multiple zone HVACR systems, particularly VAV systems, will be designed with a supply air temperature which is cool enough to meet the peak cooling loads in the zones served. Most of the time, however, the zones will be operating at lower cooling loads. The VAV terminal units in each zone will reduce the flow of cool air as needed for the reduced cooling load. Becasue the system must also provide ventilation air, flow cannot be reduced to a zone below a certain point, and then reheat must be used to avoid overcooling the space. When all the zones are operating at reduced airflow, it is desirable to increase the supply air temperature, allowing the VAV terminal units to increase their flow. This minimizes reheat, allows the cooling equipment to operate more efficiently and usually allows the terminal units to control temperatures more accurately. The amount that the supply air temperature can be reset, however, is usually limited because a warmer supply air temperature means that less dehumidification will be provided.	Multi-zone HVACR systems. Systems that prevent reheating, recooling, or mixing of heated and cooled supply air and those in which at least 75% of the energy for reheating is from site recovered/solar energy are exempt.	The mechanical control schematic and sequence of operation section of the Project Manual should include control capabilities.

CONTROLS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
→ Simplified ☑ Prescriptive	mn 6.5.3.9	**Occupied-Standby Mode** Section 6.5.3.9 requires controls to setback both the heating and cooling set points at least 1°F, and shut off airflow supplied to the zone whenever the space temperature is between the active heating and cooling set points within 5 minutes of all rooms in that zone entering occupied-standby mode. ***Intention of Requirements:*** Zones are required to be ventilated when occupants are present. The ventilation standards have different requirements for occupied and unoccupied modes, but during occupied modes when sensors detect that a zone is not occupied, it is said to be in occupied-standby mode. When certain space types are in this mode for five minutes or more, then the heating and cooling setpoint temperatures are setback/setup and the airflow to the space can be shut off when heating or cooling is not needed. These steps save energy by reducing cooling and heating and by saving fan energy.	Zones serving only rooms that are required to have automatic partial/full OFF lighting controls per Section 9.4.1.1, where ASHRAE Standard 62.1 permits ventilation air to be reduced to zero when the space is in occupied-standby mode, and when using the Ventilation Rate Procedure. Multi-zone systems without automatic zone flow control dampers are exempt.	The mechanical control schematic and sequence of operation section of the Project Manual should include control capabilities.

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CONTROLS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
☑ Prescriptive	6.5.4.1	**Boiler Turndown** Table 6.5.4.1 specifies the required minimum turndown ratio for large boiler systems. The section also requires boilers meet the minimum efficiency requirements in Table 6.8.1-6. This can be met with multiple single-input boilers or modulating boilers. ***Intention of Requirements***: Large boilers must be able to reduce the energy input to the boiler system as the load on the system decreases. This saves energy by avoiding full firing of the boiler when the heat is not needed.	Boiler systems with design input of at least 1,000,000 Btu/h.	The mechanical control schematic and sequence of operation section of the Project Manual should include control capabilities.
☑ Prescriptive	6.5.4.3	**Chiller and Boiler Isolation** Section 6.5.4.3 requires all fluid flow through a chiller is automatically shut off when the chiller is shut down, and where constant-speed chilled-water or condenser water pumps are used to serve multiple chillers, the number of pumps be no less than the number of chillers and staged on and off with the chillers. The same shut-off and pump number requirements also apply to boilers. ***Intention of Requirements:*** When a chiller or boiler plant includes multiple chillers or boilers, the system must be able to operate with only the number of chillers or boilers needed to meet the load. The pumps serving the system must be able to reduce flow to match that needed by the operating units only.	Chilled-water plants that include more than one chiller (chillers piped in series for the purpose of increased temperature differential shall be considered as one chiller). Boiler plants that include more than one boiler.	The mechanical control schematic and sequence of operation section of the Project Manual should include control capabilities.

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CONTROLS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
☑ Prescriptive	6.5.4.4	**Chilled- and Hot-Water Temperature Reset Controls** Section 6.5.4.4 requires controls that automatically reset supply water temperatures by representative building loads (including return water temperature) or by outdoor air temperature. ***Intention of Requirements:*** Chilled water and hot water loops are designed with water temperature and flow necessary to meet peak loads. Most of the time, the loads will be less than peak, and valves in the system will reduce flow as needed to just meet load. When all the valves in the system are at less than full flow, adjusting supply water temperature can save energy by increasing the efficiency of the chillers or boilers. It may also allow the valves at individual zones to more accurately meet loads.	Chilled- and hot-water systems with a design capacity exceeding 300,000 Btu/h supplying chilled or heated water to comfort conditioning systems. Several exceptions are listed in Section 6.5.4.4.	The mechanical control schematic and sequence of operation section of the Project Manual should include control capabilities.

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CONTROLS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
→ Simplified ☑ Prescriptive	6.5.10	**Door Switches** Controls are required that disable mechanical heating or reset the heating set point to 55°F or lower within five minutes of the door opening and disable mechanical cooling or reset the cooling set point to 90°F or greater within five minutes of the door opening. Mechanical cooling may remain enabled if outdoor air temperature is below space temperature. ***Intention of Requirements:*** Doors in conditioned spaces that are left open to the outdoors are an obvious waste of energy. This section requires controls to reduce the heating or cooling provided to such a space when doors are left open.	Any conditioned space with a door, including doors with more than one-half glass, opening to the outdoors. Building entries with automatic closing devices, any space without a thermostat, alterations to existing buildings and loading docks are exempt.	The mechanical control schematic and sequence of operation section of the Project Manual should include control capabilities.

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CONTROLS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Energy Cost Budget)	11.5	**Energy Cost Budget Method** Temperature and humidity control set points and schedules, as well as temperature control throttling range, must be the same for proposed design and baseline building design when simulated. Table 11.5.1 also has direction around defining thermal blocks based on similar internal load densities, occupancy, lighting, thermal and space temperature schedules. The budget building simulation's representation of the HVACR systems must be based on a combination of the proposed design and prescriptive path HVACR requirements as detailed in Section 11.5.2 and Table 11.5.1. ***Intention of Requirements:*** The budget building design is specified to represent the performance of a building that complies with prescriptive requirements. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the budget design, except where specifically directed otherwise.	Projects using the Energy Cost Budget Method for Performance Path compliance.	Section 11.7.2 includes a list of information that must be submitted with the permit application when using Energy Cost Budget Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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CONTROLS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Performance Rating Method)	mn Appendix G	**Performance Rating Method** Table G3.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Performance Rating Method for Performance Path compliance. The baseline model's representation of the HVACR systems must generally be consistent with Section G3.1.1 through G3.1.3, Table G3.1, and numerous tables at the end of Appendix G. ***Intention of Requirements:*** The baseline building modeled in the Performance Rating Method differs from the budget design in the Energy Cost Budget Method. The baseline building is intended to be minimally compliant with the code, but the HVACR system represents a "typical" design for the building type. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the baseline, except where specifically directed otherwise.	Projects using the Performance Rating Method for Performance Path compliance.	Section G1.3.2 includes a list of information that must be submitted with the permit application when using Performance Rating Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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FREEZE PROTECTION/ SNOW/ ICE-MELT				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: ☑ Prescriptive Performance	6.4.3.7	**Controls** Automatic controls are required for freeze protection systems to shut off when outdoor air temperatures are above 40°F or when the conditions of the protected fluid will prevent freezing. Automatic controls are required for snow and ice melting systems to shut off when the pavement temperature is above 50°F and no precipitation is falling. Additional automatic or manual controls are required for snow and ice melting systems to shutoff when the outdoor temperature is above 40°F. ***Intention of Requirements:*** Providing heat to freeze protection systems when temperatures are above freezing is a waste of energy. This section requires controls to shut off such systems at temperatures above 40°F, or lower if the fluid has a lower freezing temperature. Snow and ice melt systems must similarly shut off when the outdoor temperature is above 40°F and also when the pavement temperature is above 50°F and no precipitation is falling. This allows the snow/ice melt system to come on when there has been rapid weather change where the air temperature has dropped and rain or snow is falling, but the pavement is still warm.	All freeze protection, snow and ice-melting systems included in the scope of the project.	The mechanical control schematic and sequence of operation section of the Project Manual should include control capabilities.

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FREEZE PROTECTION/ SNOW/ ICE-MELT				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Energy Cost Budget)	11.5	**Energy Cost Budget Method** Table 11.5.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Energy Cost Budget Method for Performance Path compliance. The budget building simulation's representation of the HVACR systems must be based on a combination of the proposed design and prescriptive path HVACR requirements as detailed in Section 11.5.2 and Table 11.5.1. ***Intention of Requirements:*** The budget building design is specified to represent the performance of a building that complies with prescriptive requirements. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the budget design, except where specifically directed otherwise.	Projects using the Energy Cost Budget Method for Performance Path compliance.	Section 11.7.2 includes a list of information that must be submitted with the permit application when using Energy Cost Budget Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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FREEZE PROTECTION/ SNOW/ ICE-MELT				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Performance Rating Method)	mn Appendix G	**Performance Rating Method** Table G3.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Performance Rating Method for Performance Path compliance. The baseline model's representation of the HVACR systems must generally be consistent with Section G3.1.1 through G3.1.3, Table G3.1, and numerous tables at the end of Appendix G. ***Intention of Requirements:*** The baseline building modeled in the Performance Rating Method differs from the budget design in the Energy Cost Budget Method. The baseline building is intended to be minimally compliant with the code, but the HVACR system represents a "typical" design for the building type. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the baseline, except where specifically directed otherwise.	Projects using the Performance Rating Method for Performance Path compliance.	Section G1.3.2 includes a list of information that must be submitted with the permit application when using Performance Rating Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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CONDITIONED VESTIBULES				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: ☑ Prescriptive Performance	6.4.3.9	**Controls** Controls configured to shut off heating systems when outdoor air temperatures are above 45°F are required for heated vestibules and air curtains. Thermostats must be located in the vestibule configured to limit heating to a maximum of 60°F and cooling to a minimum of 85°F. ***Intention of Requirements:*** Vestibules and air curtains are presumed to have significant traffic bringing in large amounts of outdoor air. Limiting the heating and cooling supplied saves energy and makes sense since people are not expected to spend much time in a vestibule.	Heated or cooled vestibules or air curtains where conditioning is not provided by site-recovered energy or by transfer air that would otherwise be exhausted.	The mechanical control schematic and sequence of operation section of the Project Manual should include control capabilities.

Additional Resources

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CONDITIONED VESTIBULES				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Energy Cost Budget)	11.5	**Energy Cost Budget Method** Table 11.5.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Energy Cost Budget Method for Performance Path compliance. The budget building simulation's representation of the HVACR systems must be based on a combination of the proposed design and prescriptive path HVACR requirements as detailed in Section 11.5.2 and Table 11.5.1. ***Intention of Requirements:*** The budget building design is specified to represent the performance of a building that complies with prescriptive requirements. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the budget design, except where specifically directed otherwise.	Projects using the Energy Cost Budget Method for Performance Path compliance.	Section 11.7.2 includes a list of information that must be submitted with the permit application when using Energy Cost Budget Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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CONDITIONED VESTIBULES				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Performance Rating Method)	mn Appendix G	**Performance Rating Method** Table G3.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Performance Rating Method for Performance Path compliance. The baseline model's representation of the HVACR systems must generally be consistent with Section G3.1.1 through G3.1.3, Table G3.1, and numerous tables at the end of Appendix G. ***Intention of Requirements:*** The baseline building modeled in the Performance Rating Method differs from the budget design in the Energy Cost Budget Method. The baseline building is intended to be minimally compliant with the code, but the HVACR system represents a "typical" design for the building type. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the baseline, except where specifically directed otherwise.	Projects using the Performance Rating Method for Performance Path compliance.	Section G1.3.2 includes a list of information that must be submitted with the permit application when using Performance Rating Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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RADIANT HEATING				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Requirement Summary & Intent	Typical Documentation in Construction Documents
Mandatory when using: ☑ Prescriptive Performance	6.4.4.1.5	**Radial Floor Heating** The bottom surfaces of floor structures incorporating radiant heating shall be insulated with a minimum of R-3.5. Adjacent building envelope insulation counts toward this requirement. ***Intention of Requirements:*** A floor exposed to the outdoors with radiant heating will have higher heat losses than other floors, so additional insulation is required to minimize these losses.	All radiant floor heating other than heated slab-on-grade floors which should instead follow requirements in Table 5.5-6 (for Climate Zone 6A) and Table 5.5-7 (for Climate Zones 7).	Mechanical or architectural details pages should include a diagram for illustration when radiant floor heating systems are used. A note under the radiant heater schedule within the mechanical schedules should call for underfloor insulation with a minimum R-3.5 and/or point to mechanical or architectural details page.
☑ Prescriptive	6.5.8.1	**Heating Unenclosed Spaces** Radiant heating shall be used when heating is required for unenclosed spaces. ***Intention of Requirements:*** Radiant heating is intended to provide heat by heating surfaces, objects, and people directly rather than heating the air. This type of heating therefore makes sense for unenclosed spaces where the air is not contained.	Unenclosed spaces other than loading docks equipped with air curtains.	Mechanical schedules and floor plans should indicate the use of radiant heating systems where required in unenclosed spaces.

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RADIANT HEATING				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Requirement Summary & Intent	Typical Documentation in Construction Documents
☑ Prescriptive	6.5.8.2	**Heating Enclosed Spaces with Radiant Systems** Systems must be radiant hydronic ceiling or floor panels (used for heating or cooling), combination or hybrid systems incorporating radiant heating (or cooling) panels and radiant heating (or cooling) panels used in conjunction with other systems such as VAV or thermal storage systems. ***Intention of Requirements:*** Where radiant heating or cooling systems are used in enclosed spaces, they must be efficient. They must either be hydronic (not electric resistance) or be installed in combination with other systems.	Radiant heating systems that are used as primary or supplemental heating for enclosed spaces.	Mechanical schedules and floor plans should indicate the use of radiant heating systems or combination/ hybrid systems where required in enclosed spaces.

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RADIANT HEATING				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Requirement Summary & Intent	Typical Documentation in Construction Documents
Performance (Energy Cost Budget)	11.5	**Energy Cost Budget Method** Table 11.5.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Energy Cost Budget Method for Performance Path compliance. The budget building simulation's representation of the HVACR systems must be based on a combination of the proposed design and prescriptive path HVACR requirements as detailed in Section 11.5.2 and Table 11.5.1. ***Intention of Requirements:*** The budget building design is specified to represent the performance of a building that complies with prescriptive requirements. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the budget design, except where specifically directed otherwise.	Projects using the Energy Cost Budget Method for Performance Path compliance.	Section 11.7.2 includes a list of information that must be submitted with the permit application when using Energy Cost Budget Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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RADIANT HEATING				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Requirement Summary & Intent	Typical Documentation in Construction Documents
Performance (Performance Rating Method)	mn Appendix G	**Performance Rating Method** Table G3.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Performance Rating Method for Performance Path compliance. The baseline model's representation of the HVACR systems must generally be consistent with Section G3.1.1 through G3.1.3, Table G3.1, and numerous tables at the end of Appendix G. ***Intention of Requirements:*** The baseline building modeled in the Performance Rating Method differs from the budget design in the Energy Cost Budget Method. The baseline building is intended to be minimally compliant with the code, but the HVACR system represents a "typical" design for the building type. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the baseline, except where specifically directed otherwise.	Projects using the Performance Rating Method for Performance Path compliance.	Section G1.3.2 includes a list of information that must be submitted with the permit application when using Performance Rating Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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REFRIGERATED SPACES				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: ☑ Prescriptive Performance	6.4.1.1	**Minimum Equipment Efficiencies** Section 6.4.1.1 requires equipment to meet minimum efficiencies prescribed in Tables in Section 6.8.1. ***Intention of Requirements:*** Minimum efficiency levels have been set by comparing the costs of increased efficiency to the energy cost savings and showing that the savings justify the costs in most applications.	All equipment included in the Tables in Section 6.8.1.	Minimum performance requirements for all HVACR equipment should be shown on the equipment schedules in the plans with the same units used in the tables in Section 6.8.1. For alterations that don't include plans, equipment cut sheets or purchase orders should be submitted with the permit application.
Mandatory when using: ☑ Prescriptive Performance	6.4.5	**Walk-in Coolers and Freezers** Section 6.4.5 includes several requirements to seal and insulate walk-in coolers and freezers such as requiring automatic door closers and strip doors/ curtains, and minimum insulation levels for doors, walls, floors and ceilings. Electronically commutated motors (ECM) or three-phase motors are required for some evaporator fans and high-efficient lighting is also required. ***Intention of Requirements:*** Walk-in coolers and walk-in freezers gain significant heat from adjacent conditioned space and from equipment and lights in the cooler or freezer which must be removed by the refrigeration system. Minimizing these gains with doors, air seals, insulation and efficient fans and lights reduces the energy required to remove the heat and helps reduce temperature swings in the cooler or freezer.	Site-assembled or site-constructed walk-in coolers and walk-in freezers.	Mechanical schedules should reflect motor requirements for condensing units and evaporators serving walk-in coolers and freezers. The Project Manual should include other requirements for sealing, insulation, etc. to meet Energy Code performance requirements. See Compliance Example

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REFRIGERATED SPACES				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: ☑ Prescriptive Performance	6.4.6	**Refrigerated Display Cases** Section 6.4.6 includes several requirements for refrigerated display cases such as minimum efficiency levels per Section 6.8.1, lighting controls, defrost termination controls, and anti-sweat heater controls. ***Intention of Requirements:*** Refrigerated display cases gain significant heat from lights in the case which must be removed by the refrigeration system and he lights consume energy directly. Minimizing the time that the lights are on to business hours when a person is nearby reduces the energy required to remove the heat and operate the lights. Controls to ensure that defrost systems do not operate too long save energy and avoid possible wastage by allowing the temperature in the case to get too warm. Energy consumption of anti-sweat heaters that keep condensation off the doors can be reduced when the space humidity is lower.	All refrigerated display cases being installed as part of a permitted project scope.	Mechanical schedules should list display case equipment. The Project Manual should detail controls requirements. See Compliance Example
☑ Prescriptive	6.5.11.1	**Condensers Serving Refrigeration Systems** Section 6.5.11.1 includes several requirements for design saturated condensing temperatures, fan motors, variable-speed fan controls, and minimum condensing temperature set point. ***Intention of Requirements:*** These requirements ensure that refrigeration systems will be able to provide adequate cooling at design outdoor temperature and will use efficient fans and controls.	Fan-powered condensers serving refrigeration systems.	Mechanical schedules for regulated refrigeration equipment should refer to specifications. The Project Manual should include performance requirements for fan motors and controls and other control set points. See Compliance Example

REFRIGERATED SPACES				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
☑ Prescriptive	6.5.11.2	**Compressor Systems** Section 6.5.11.2 includes several requirements for suction group control systems, liquid subcooling, and internal or external crankcase heaters. ***Intention of Requirements***: These requirements ensure that systems will have efficient compressor and control systems.	Refrigeration compressor systems.	Mechanical schedules for regulated refrigeration equipment should refer to specifications. The Project Manual should include performance requirements for condensing unit compressors if not already shown on equipment schedules. See Compliance Example

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REFRIGERATED SPACES				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Energy Cost Budget)	11.5	**Energy Cost Budget Method** Table 11.5.1 has direction around modeling the rated energy use for refrigeration equipment in the proposed design rated in accordance with AHRI 1200. Otherwise, the proposed design shall be modeled using the actual equipment capacities and efficiencies. The budget building simulation's representation of the HVACR systems must be based on a combination of the proposed design and prescriptive path HVACR requirements as detailed in Section 11.5.2 and Table 11.5.1. ***Intention of Requirements:*** The budget building design is specified to represent the performance of a building that complies with prescriptive requirements. Process loads (such as refrigeration), schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the budget design, except where specifically directed otherwise.	Projects using the Energy Cost Budget Method for Performance Path compliance.	Section 11.7.2 includes a list of information that must be submitted with the permit application when using Energy Cost Budget Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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REFRIGERATED SPACES				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Performance Rating Method)	mn Appendix G	**Performance Rating Method** Table G3.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Performance Rating Method for Performance Path compliance. The baseline model's representation of the HVACR systems must generally be consistent with Section G3.1.1 through G3.1.3, Table G3.1, and numerous tables at the end of Appendix G. ***Intention of Requirements***: The baseline building modeled in the Performance Rating Method differs from the budget design in the Energy Cost Budget Method. The baseline building is intended to be minimally compliant with the code, but the HVACR system represents a "typical" design for the building type. Process loads (such as refrigeration), schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the baseline, except where specifically directed otherwise.	Projects using the Performance Rating Method for Performance Path compliance.	Section G1.3.2 includes a list of information that must be submitted with the permit application when using Performance Rating Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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VENTILATION AND EXHAUST				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: → Simplified ☑ Prescriptive Performance	mn 6.4.3.4 6.4.3.8	**Ventilation System Controls** Several controls capabilities are required in Section 6.4.3.4 for ventilation systems including stair and shaft vent motorized dampers, shutoff damper controls, damper leakage, and automatic fan shut off. Section 6.4.3.8 requires Demand Control Ventilation (DCV) for spaces larger than 500 ft^2 and with a ventilation design occupancy greater than or equal to 25 people/ 1,000 ft^2 and where the system has an air economizer, or automatic modulating outdoor air damper, or design outdoor airflow greater than 3,000 cfm. ***Intention of Requirements:*** Ventilation air can consume significant amounts of energy to heat or cool it and reducing the ventilation air saves this energy. The requirements in 6.4.3.4 are intended to assure that ventilation air shuts off when it is not needed. Section 6.4.3.8 requires that demand control ventilation is used for systems capable of including it that serve densely occupied spaces. DCV controls the ventilation provided to a space based on how many occupants are present, allowing lower ventilation rates when occupancy decreases.	Applies to all ventilation systems. Several exceptions listed in Section 6.4.3.4 such as systems which are intended for continuous operation. Several exceptions to DCV are also listed in Section 6.4.3.8 including systems with design OA flow less than 750 cfm.	The fans schedule and automatic louver damper schedule should be included in the mechanical schedules. Control schematics within mechanical plans should include a sequence of operation for ventilators and demand control ventilation.

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VENTILATION AND EXHAUST				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
→ Simplified	mn 6.3.2	**Simplified Approach** Outdoor air intake and exhaust systems must meet ventilation system control requirements of Section 6.4.3.4. Systems must also meet demand control ventilation requirements in Section 6.4.3.8, occupied-standby controls in Section 6.5.3.9, and the ventilation design requirements in Section 6.5.3.8. See the Controls Section starting on page 61 for more details. ***Intention of Requirements:*** The Simplified Path provides all the requirements for the HVACR system in a relatively concise form but is only applicable to smaller buildings. The requirements for HVACR systems using the Simplified Path includes compliance with requirements for demand control ventilation, occupied standby ventilation controls and ventilation design.	Projects electing to use Simplified Approach Compliance Path and which meet eligibility criteria including buildings two stories or fewer and less than 25,000 ft^2 gross.	The fans schedule and automatic louver damper schedule should be included in the mechanical schedules. Control schematics within mechanical plans should include a sequence of operation for ventilators and demand control ventilation.

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VENTILATION AND EXHAUST				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
→ Simplified ☑ Prescriptive	mn 6.5.3.8	**Ventilation System Design** The required minimum outdoor air rate is the larger of the minimum outdoor air rate or the minimum exhaust air rate required by Standard 62.1, Standard 62.2, Standard 170, or applicable codes or accreditation standards. Additional requirements for minimum system outdoor air, dampers, ductwork, and controls, and exhaust air energy recovery are included in Section 6.5.3.8. ***Intention of Requirements:*** Heating and cooling ventilation air can be a significant source of energy use. These requirements intend to supply the required amount of ventilation for indoor air quality while incorporating energy saving features that control its supply and reduce energy used for conditioning.	All ventilation systems.	The minimum outside airflow should be indicated on the RTU, AHU, DOAS or other airside equipment schedule.

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VENTILATION AND EXHAUST				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
☑ Prescriptive	6.5.7.1	**Transfer Air** Conditioned supply air delivered to any space with mechanical exhaust shall not exceed the greater of the supply flow required to meet the space heating or cooling load; the required ventilation rate required by the authority having jurisdiction, the facility Environmental Health and Safety department, or ASHRAE Standard 62.1; or the mechanical exhaust flow minus the available transfer air from eligible conditioned spaces or return air plenums on the same floor. ***Intention of Requirements:*** Supply air volumes delivered to a space are usually based on the air required to provide heating or cooling and the air needed to provide ventilation. Some spaces however, may have exhaust air requirements that exceed these and must be made up. When transfer air from nearby conditioned zones or return plenums is available, any additional air supplied to the space cannot be more than the difference between the exhaust volume and the available transfer air. This minimizes the energy required to condition and supply additional air.	Spaces that are not class 3 laboratories or higher; not vivarium; not required by code to be maintained at positive pressure relative to adjacent spaces; or spaces where the demand for transfer air does not exceed the available transfer airflow rate where the spaces have a required negative pressure relationship.	Transfer air locations should be shown on mechanical floor plans. If AHJ requires copies of ventilation calculations, transfer air should be shown as appropriate.

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VENTILATION AND EXHAUST				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
☑ Prescriptive	6.5.7.2	**Kitchen Exhaust** Each kitchen hood must have an exhaust rate that complies with Table 6.5.7.2.2 based on type of hood and duty rating. In addition, hoods must meet either a minimum transfer air amount, or include a demand ventilation system, or include an energy recovery device. Field testing is required to evaluate design airflow rates and demonstrate proper capture and containment performance and DCV performance. ***Intention of Requirements:*** Kitchen exhaust removes significant amounts of air from the building and outdoor air must be brought into the building to balance the airflow. Table 6.5.7.2.2 limits the exhaust flow to avoid excessive exhaust, and Section 6.5.7.2.3 limits the amount of air brought into the building by using transfer air from other parts of the building, reducing exhaust flow during periods of less cooking, or recovering energy from the exhaust air. The performance testing is required to ensure that the exhaust systems are installed such that they properly capture and remove emissions from the cooking equipment.	Kitchen/dining facilities with a total kitchen hood exhaust airflow rate greater than 5000 cfm. If at least 75% of all the replacement air is transfer air that would otherwise be exhausted, the hood is exempt from the maximum exhaust flow rate requirement.	Kitchen exhaust hood schedules should show duty and type in addition to exhaust rate. Should demand ventilation or energy recovery be used to meet Energy Code requirements, these should also be shown on the hood schedule. Field testing requirements should be included in Project Manual. See Compliance Example

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VENTILATION AND EXHAUST				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
☑ Prescriptive	6.5.7.3	**Laboratory Exhaust** Section 6.5.7.3 gives several options to reduce exhaust and makeup airflow rates and/or incorporate a heat recovery or to provide direct makeup air supply. ***Intention of Requirements:*** These requirements allow exhaust airflow to be reduced or to have heat recovery or have makeup air configured to minimize the heating or cooling required. Each of these save heating or cooling energy and some also save fan energy.	Buildings with laboratory exhaust systems having a total exhaust rate greater than 5000 cfm.	Mechanical controls schematics to indicate sequence of operation to comply with Energy Code requirements and will depend on design approach used to comply.
Performance (Energy Cost Budget)	11.5	**Energy Cost Budget Method** Table 11.5.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Energy Cost Budget Method for Performance Path compliance. The budget building simulation's representation of the HVACR systems must be based on a combination of the proposed design and prescriptive path HVACR requirements as detailed in Section 11.5.2 and Table 11.5.1. ***Intention of Requirements:*** The budget building design is specified to represent the performance of a building that complies with prescriptive requirements. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the budget design, except where specifically directed otherwise.	Projects using the Energy Cost Budget Method for Performance Path compliance.	Section 11.7.2 includes a list of information that must be submitted with the permit application when using Energy Cost Budget Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

VENTILATION AND EXHAUST				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Performance Rating Method)	mn Appendix G	**Performance Rating Method** Table G3.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Performance Rating Method for Performance Path compliance. The baseline model's representation of the HVACR systems must generally be consistent with Section G3.1.1 through G3.1.3, Table G3.1, and numerous tables at the end of Appendix G. ***Intention of Requirements:*** The baseline building modeled in the Performance Rating Method differs from the budget design in the Energy Cost Budget Method. The baseline building is intended to be minimally compliant with the code, but the HVACR system represents a "typical" design for the building type. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the baseline, except where specifically directed otherwise.	Projects using the Performance Rating Method for Performance Path compliance.	Section G1.3.2 includes a list of information that must be submitted with the permit application when using Performance Rating Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

mn denotes sections with MN Amendments to ASHRAE 90.1-2019

COMPUTER ROOMS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: ☑ Prescriptive Performance	6.4.1.1	**Minimum Equipment Efficiencies** Section 6.4.1.1 requires equipment to meet minimum efficiencies prescribed in Tables in Section 6.8.1. ***Intention of Requirements:*** Minimum efficiency levels have been set by comparing the costs of increased efficiency to the energy cost savings and showing that the savings justify the costs in most applications.	All equipment included in the Tables in Section 6.8.1.	Minimum performance requirements for all HVACR equipment should be shown on the equipment schedules in the plans with the same units used in the tables in Section 6.8.1. For alterations that don't include plans, equipment cut sheets or purchase orders should be submitted with the permit application.
Alternative to Prescriptive	6.6.1	**Computer Room System Alternate Compliance Path** Section 6.6.1 allows eligible computer rooms systems to comply with ASHRAE Standard 90.4, Energy Standard for Data Centers. ***Intention of Requirements:*** Computer rooms pose unusual challenges for HVACR system designers and specialized approaches may be required. ASHRAE Standard 90.4 sets requirements for energy efficient data centers and computer rooms.	HVACR systems only serving the heating, cooling, or ventilating needs of a computer room with IT equipment load greater than 10 kW.	Mechanical schedules should reflect computer room equipment in compliance with ASHRAE Standard 90.4.

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COMPUTER ROOMS				
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Performance (Energy Cost Budget)	11.5	**Energy Cost Budget Method** Table 11.5.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Energy Cost Budget Method for Performance Path compliance. The budget building simulation's representation of the HVACR systems must be based on a combination of the proposed design and prescriptive path HVACR requirements as detailed in Section 11.5.2 and Table 11.5.1. ***Intention of Requirements:*** The budget building design is specified to represent the performance of a building that complies with prescriptive requirements. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the budget design, except where specifically directed otherwise.	Projects using the Energy Cost Budget Method for Performance Path compliance.	Section 11.7.2 includes a list of information that must be submitted with the permit application when using Energy Cost Budget Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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COMPUTER ROOMS				
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PARKING GARAGES				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: ☑ Prescriptive Performance	mn 6.1.1.4	**Enclosed Parking Garage Heating** Heating of enclosed commercial parking facilities is prohibited. ***Intention of Requirements:*** Heating of enclosed parking facilities can consume significant amounts of energy, especially in climates like Minnesota. Prohibiting the heating of parking garages saves this energy and avoids the cost of installing heating systems.	Applicable unless the garage meets one of the listed exceptions: 1. Parking open to the public that is accessory to private parking where the parking open to the public is less than 10% of the total number of spaces. 2. Vehicle showrooms for vehicle sales.	If heating system is shown on the construction documents, parking plans should identify which spaces are public parking and the calculation showing the percentage of total parking that is public to justify the exception.

Additional Resources

ENERGY CODE HELPLINE

MINNESOTA ENERGY CODE SUPPORT PROGRAM

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PARKING GARAGES				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: ☑ Prescriptive Performance	mn 6.4.3.4.5	**Parking Garage Ventilation Systems** Parking garages must have separate ventilation and controls systems for each garage section. Control systems must be configured to reduce fan airflow to 20% or less of design capacity and must automatically detect and control contaminant levels. Controls must result in fan motor demand of no more than 30% of design wattage at 50% of design airflow. ***Intention of Requirements:*** Ventilation of parking garages is required because of the emissions from vehicles moving inside them. The amount of those emissions can vary widely based on the emissions characteristics of the specific vehicles, how far they are driven in the garage, and other factors. The ventilation systems must have variable speed exhausts to save fan power at lower flow rates and be controlled by sensors that detect contaminants in the space. This allows lower airflow and fan energy consumption when few cars are moving or the cars have lower emissions, such as new or electric vehicles.	All parking garage ventilation systems except ventilation systems with a total motor nameplate horsepower under 5 hp that serve a single parking garage section without mechanical heating or cooling.	Mechanical schedules should list the fans and automatic louver damper (ALD) schedule. The mechanical controls schematic and Project Manual should list the sequence of operations to meet controls requirements. Mechanical garage plans should show ductwork layout for ventilation/ exhaust system.

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PARKING GARAGES				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Energy Cost Budget)	11.5	**Energy Cost Budget Method** Table 11.5.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Energy Cost Budget Method for Performance Path compliance. The budget building simulation's representation of the HVACR systems must be based on a combination of the proposed design and prescriptive path HVACR requirements as detailed in Section 11.5.2 and Table 11.5.1. ***Intention of Requirements:*** The budget building design is specified to represent the performance of a building that complies with prescriptive requirements. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the budget design, except where specifically directed otherwise.	Projects using the Energy Cost Budget Method for Performance Path compliance.	Section 11.7.2 includes a list of information that must be submitted with the permit application when using Energy Cost Budget Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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INDOOR POOL DEHUMIDIFIERS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: ☑ Prescriptive Performance	6.4.1.1	**Minimum Equipment Efficiencies** Section 6.4.1.1 requires equipment to meet minimum efficiencies prescribed in Tables in Section 6.8.1. ***Intention of Requirements:*** Minimum efficiency levels have been set by comparing the costs of increased efficiency to the energy cost savings and showing that the savings justify the costs in most applications.	All equipment included in the Tables in Section 6.8.1.	Minimum performance requirements for all HVACR equipment should be shown on equipment schedules in the plans with the same units used in the tables in Section 6.8.1. For alterations that don't include plans, submit equipment cut sheets or purchase orders with the permit application.
☑ Prescriptive	6.5.6.4	**Energy Recovery** Indoor pool dehumidifiers must include an exhaust air energy recovery or condenser heat recovery system that meets the performance requirements listed in Section 6.5.6.4: - An exhaust air sensible energy recovery system with a sensible energy recovery ratio of ≥50% *OR* - A condenser heat recovery system capable of and configured to use 100% of the heat generated through dehumidification to heat the pool water when there is a pool water heating load *OR* - An exhaust air energy recovery system that results in an enthalpy recovery ratio ≥50%. ***Intention of Requirements:*** A heated indoor pool will have significant evaporation to the air in the space. Dehumidification systems are needed to avoid condensation on surfaces which can be very damaging. This section requires use of heat recovery to reduce the energy required for dehumidification.	An indoor pool dehumidifier serving a natatorium with a heated indoor pool over 500 ft^2 in size. Natatoriums heated by on-site renewable energy or site recovered energy capable of and configured to provide at least 60% of the annual heating energy required are exempt.	Pool dehumidification unit (DHU) that is equipped with energy recovery system should be included in the mechanical schedules. Mechanical control diagrams and sequences should outline the unit operation.

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INDOOR POOL DEHUMIDIFIERS				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Energy Cost Budget)	11.5	**Energy Cost Budget Method** Table 11.5.1 has direction around how the HVACR system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design need to be simulated when using the Energy Cost Budget Method for Performance Path compliance. The budget building simulation's representation of the HVACR systems must be based on a combination of the proposed design and prescriptive path HVACR requirements as detailed in Section 11.5.2 and Table 11.5.1. ***Intention of Requirements:*** The budget building design is specified to represent the performance of a building that complies with prescriptive requirements. Schedules, occupancy types, occupant loads, ventilation rates, and other parameters are modeled the same for the proposed design and the budget design, except where specifically directed otherwise.	Projects using the Energy Cost Budget Method for Performance Path compliance.	Section 11.7.2 includes a list of information that must be submitted with the permit application when using Energy Cost Budget Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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SUBMITTALS, VERIFICATION, TESTING AND COMMISSIONING				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: → Simplified ☑ Prescriptive Performance Alternative to Prescriptive	6.7.3.1 and 6.7.3.2	**Record Documents and Manuals** Record documents are required to be provided to the building owner or the designated representative of the building owner. Construction documents shall require that an operating manual and a maintenance manual also be provided within 90 days after the date of system acceptance. Section 6.7.3.1 and 6.7.3.2 provide more detail for what record documents and manuals should include. ***Intention of Requirements:*** Record documents provided to the owner assist the owner with maintenance and repair of installed equipment and provides a starting point for the design of future replacement projects.	All permitted projects	The Project Manual should require record documents and O&M manuals are turned over to the owner. If commissioning is required on the project, this should also be included in the commissioning specifications.

Additional Resources

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SUBMITTALS, VERIFICATION, TESTING AND COMMISSIONING				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: → Simplified ☑ Prescriptive Performance Alternative to Prescriptive	6.7.3.3	**Air and Hydronic System Balancing** Construction documents shall require that a written balance report be provided to the building owner or the designated representative of the building owner for HVACR systems serving zones with a total conditioned area exceeding 5000 ft^2. Air systems shall be balanced in a manner to first minimize throttling losses. Then, for fans with fan system power greater than 1 hp, fan speed shall be adjusted to meet design flow conditions. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses; then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. **Intention of Requirements:** System balancing ensures that the airflows being provided by the HVACR systems are correct and that flows are adjusted as much as possible by adjusting fan speed rather than by closing dampers. Similarly, hydronic system balancing must adjust pump speed as much as possible rather than closing valves. Balancing should be repeated regularly, and the written balancing report can make future balancing projects more efficient and effective.	All HVACR systems are to be balanced in accordance with generally accepted engineering standards. Exceptions for trimming impellers and adjusting pump speed are included in Section 6.7.3.3.3.	The Project Manual should include TAB specifications that outline all the requirement for the balancing contractor. If commissioning is required on the project, the commissioning specifications should require the TAB report to be reviewed by the commissioning team and submitted to the owner.

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SUBMITTALS, VERIFICATION, TESTING AND COMMISSIONING				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Mandatory when using: → Simplified ☑ Prescriptive Performance Alternative to Prescriptive	4.2.5.1 6.9.1	**Verification and Testing** HVACR control systems shall be tested in accordance with Section 6.9.1 and provisions of Section 4.2.5.1. Testing shall verify that systems and control elements are calibrated, adjusted, configured, and operating in accordance with applicable requirements of Sections 6.3, 6.4, and 6.5. Verification and FPT documentation shall comply with Sections 4.2.5.1.2 and 4.2.5.1.3. ***Intention of Requirements:*** Testing and verification of the HVACR control systems ensures that systems will operate correctly. Incorrectly operating controls will waste energy and may not provide the space conditioning or ventilation rate required.	All buildings must comply.	The Project Manual should require verification and testing during the acceptance phase of construction. Requirements listed in 4.2.5.1.1 must be reflected in the construction documents within the verification and testing specification section or by submitting a verification and testing plan with the permit application.
Mandatory when using: ☑ Prescriptive Performance Alternative to Prescriptive	4.2.5.2 6.9.2	**Commissioning** The performance of the mechanical systems shall be commissioned in accordance with Section 4.2.5.2 Detailed instructions for commissioning HVACR systems shall be provided in the construction documents. Commissioning reporting shall comply with Sections 4.2.5.2.2 and 4.2.5.2.3. ***Intention of Requirements:*** Commissioning provides a check following construction to assure that systems and equipment have been properly installed and are operating correctly.	HVACR control systems in buildings, additions or alterations with <10,000 ft^2 of conditioned space AND with combined heating, cooling and service water heating equipment totaling <96 kBtu/h in capacity; or in buildings or portions of buildings using the Simplified Approach compliance path. Dwelling units and refrigerated warehouses do not need to be commissioned and their areas should not be counted toward the 10,000 ft^2 threshold.	The Project Manual should require commissioning during the acceptance phase of construction by including a section on commissioning requirements. A draft commissioning plan and results from the design review should be submitted with the permit application.

SUBMITTALS, VERIFICATION, TESTING AND COMMISSIONING				
Compliance Path (See page 6 for details)	Energy Code Section	Requirement Summary & Intent	Trigger	Typical Documentation in Construction Documents
Performance (Energy Cost Budget)	mn 11.2	**Energy Cost Budget Method** Proposed building systems or controls used to comply under the Energy Code Budget Method that do not have criteria in Sections 6 must be included in the verification and testing scope to document proper installation and operation in accordance with Section 4.2.5. ***Intention of Requirements:*** Code compliance using a performance approach offers vast flexibility to the design team but is challenging for code officials to verify. Specification of submittals attempts to assist code officials by ensuring that minimum documentation is provided.	When using energy and cost conservation measures in the Proposed Design to comply and where those measures are not already addressed in Section 6 of the Energy Code.	Section 11.7.2 includes a list of information that must be submitted with the permit application when using Energy Cost Budget Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.
Performance (Performance Rating Method)	mn Appendix G	**Performance Rating Method** Proposed building systems or controls used to comply under the Performance Rating Method that do not have criteria in Sections 6 must be included in the verification and testing scope to document proper installation and operation in accordance with Section 4.2.5. **Intention of Requirements:** Code compliance using a performance approach offers vast flexibility to the design team but is challenging for code officials to verify. Specification of submittals attempts to assist code officials by ensuring that minimum documentation is provided.	When using energy and cost conservation measures in the Proposed Design to comply and where those measures are not already addressed in Section 6 of the Energy Code.	Section G1.3.2 includes a list of information that must be submitted with the permit application when using Performance Rating Method. Location in construction documents will be similar to the locations listed in this table for similar Prescriptive Path measures.

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Example Compliance Documentation

Back to TOC

These annotated examples show best practices for documenting compliance with the MN Energy Code in construction documents. Where available, examples have been provided of what the measure might look like in the floor plans, equipment schedules, specifications, and other design documents.

6.1.1.3.6 INSULATED ROOF CURB

Go to requirements

ROOFTOP UNIT SCHEDULE - HEAT PUMP

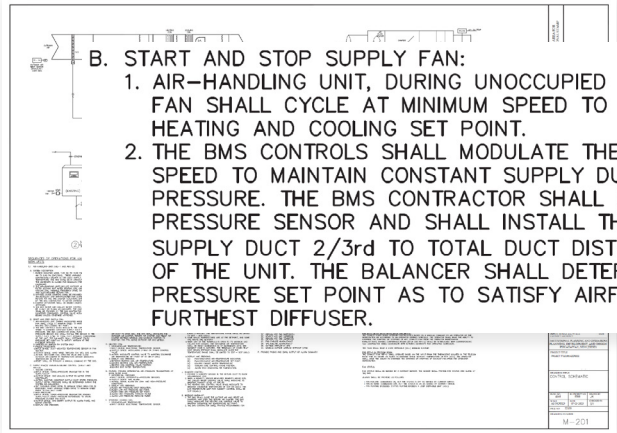
MARK (RTU-#)	MANUFACTURER	MODEL	EER (SEER)	IEER	AIR FLOW (CFM)	OA FLOW (CFM)	AMBIENT OAT (°F)	EXT. S.P. (IN. W.C.)	DX COOLING COIL EAT (°FDB/WB)	DX COOLING COIL TOTAL (BTU/HR)	DX COOLING COIL SENSIBLE (BTU/HR)	HEAT PUMP HEATING OUTPUT @ 47°F	HEAT PUMP HEATING OUTPUT @ 17°F	HEAT PUMP HEATING COP (HSPF)	AUXILIARY ELECTRIC HEAT INPUT (WATTS)	AUXILIARY ELECTRIC HEAT OUTPUT (BTU/HR)	ELECTRICAL VOLTAGE	ELECTRICAL PHASE	ELECTRICAL MOTOR HP	ELECTRICAL MCA (AMPS)	ELECTRICAL MOCP (AMPS)	APPROX. WEIGHT (LBS)	NOTES
1			11.0	20	6,500	550	100	0.75	75.3 / 63.2	188,700	140,500	172,000	100,000	3.5	40,000	136,500	480	3	7.5	88	100	3,000	1-5, 7-18
2			11.9	20.3	4,150	985	100	0.75	76.3 / 64.7	124,900	93,900	116,000	64,000	3.5	20,000	68,200	480	3	7.5	68	70	2,100	1-5, 7-18
3			(18)	--	1,800	360	100	0.75	78.0 / 65.8	59,200	43,000	58,000	0	(10.1)	10,000	31,000	480	3	2	19	20	1,000	1-4, 6-18
4	CARRIER	48HC	11.0	21.0	6,335	1,400	100	0.5	81.5 / 65.6	189,200	160,900	172,000	100,000	3.5	60,000	204,700	480	3	7.5	116	125	3,000	1-5, 7-13, 15-18
5			11.0	21.0	6,335	1,400	100	0.5	81.5 / 65.6	189,200	160,900	172,000	100,000	3.5	60,000	204,700	480	3	7.5	116	125	3,000	1-5, 7-13, 15-18
6			11.0	21.0	6,335	1,400	100	0.5	81.5 / 65.6	189,200	160,900	172,000	100,000	3.5	60,000	204,700	480	3	7.5	116	125	3,000	1-5, 7-13, 15-18
7			11.0	21.0	6,335	1,400	100	0.5	81.5 / 65.6	189,200	160,900	172,000	100,000	3.5	60,000	204,700	480	3	7.5	116	125	3,000	1-5, 7-13, 15-18
8			11.0	21.0	6,335	1,400	100	0.5	81.5 / 65.6	189,200	160,900	172,000	100,000	3.5	60,000	204,700	480	3	7.5	116	125	3,000	1-5, 7-13, 15-18
9			11.0	21.0	6,335	1,400	100	0.5	81.5 / 65.6	189,200	160,900	172,000	100,000	3.5	60,000	204,700	480	3	7.5	116	125	3,000	1-5, 7-13, 15-18

NOTES:
1. PROVIDE FACTORY FABRICATED 24" HIGH ROOF CURB. INSULATED ROOF CURB

Curbs should be included in plan notes on mechanical roof plan sheet. Also include a note in the mechanical schedule for rooftop units and fans.
Contractors should provide a roof curb submittal with data for insulation, acoustical performance, and vibration.

6.5.3.1 & 2 FAN CONTROL & STATIC PRESSURE SENSOR

Go to requirements

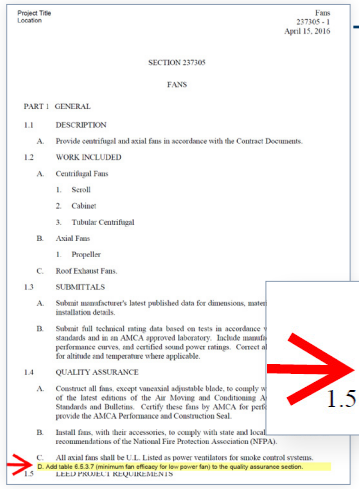


Mechanical drawing control schematic and the Sequence of Operation (SOP) or Automatic Temperature Controls (ATC) specification sections should indicate the fan controls sequence. Duct plans should indicate location to install duct static pressure sensor.

The controls contractor should furnish the static pressure sensor and install the sensor in the supply duct at the location indicated on ductwork plans. The balancer should determine the static pressure setpoint to satisfy airflow at the furthest diffuser.

6.5.3.7 LOW POWER FANS

Go to requirements



Project Title
Location

Fans
237305 - 1
April 15, 2016

SECTION 237305

FANS

PART 1 GENERAL

1.1 DESCRIPTION

A. Provide centrifugal and axial fans in accordance with the Contract Documents.

1.2 WORK INCLUDED

A. Centrifugal Fans

1. Scroll
2. Cabinet
3. Tubular Centrifugal

B. Axial Fans

1. Propeller

C. Roof Exhaust Fans.

1.3 SUBMITTALS

A. Submit manufacturer's latest published data for dimensions, mater
installation details.

B. Submit full technical rating data based on tests in accordance
standards and in an AMCA approved laboratory. Include manufa
performance curves, and certified sound power ratings. Correct a
for altitude and temperature where applicable.

1.4 QUALITY ASSURANCE

A. Construct all fans, except vaneaxial adjustable blade, to comply w
of the latest editions of the Air Moving and Conditioning A
Standards and Bulletins. Certify these fans by AMCA for perf
provide the AMCA Performance and Construction Seal.

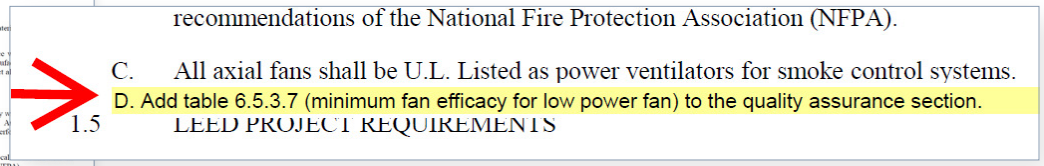
B. Install fans, with their accessories, to comply with state and local
recommendations of the National Fire Protection Association (NFPA).

C. All axial fans shall be U.L. Listed as power ventilators for smoke control systems.

D. Add table 6.5.3.7 (minimum fan efficacy for low power fan) to the quality assurance section.

1.5 LEED PROJECT REQUIREMENTS

The fan section of the mechanical schedules should include a note to select fans that meet the efficacy requirement. The project manual should include Table 6.5.3.7 (minimum fan efficacy for low power fans) in the fan section under part-1 quality assurance.



recommendations of the National Fire Protection Association (NFPA).

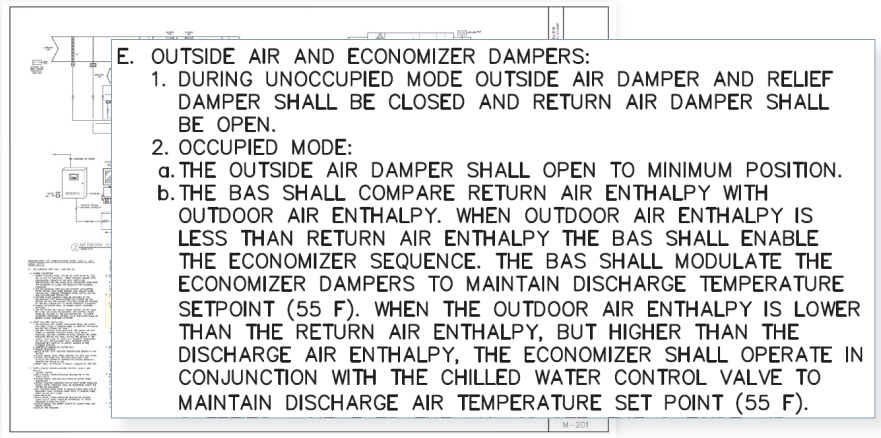
C. All axial fans shall be U.L. Listed as power ventilators for smoke control systems.

D. Add table 6.5.3.7 (minimum fan efficacy for low power fan) to the quality assurance section.

1.5 LEED PROJECT REQUIREMENTS

6.4.3.12, 6.3.2, 6.5.1.1 and 2 Economizer Sequence

Go to requirements



E. OUTSIDE AIR AND ECONOMIZER DAMPERS:
1. DURING UNOCCUPIED MODE OUTSIDE AIR DAMPER AND RELIEF DAMPER SHALL BE CLOSED AND RETURN AIR DAMPER SHALL BE OPEN.
2. OCCUPIED MODE:
a. THE OUTSIDE AIR DAMPER SHALL OPEN TO MINIMUM POSITION.
b. THE BAS SHALL COMPARE RETURN AIR ENTHALPY WITH OUTDOOR AIR ENTHALPY. WHEN OUTDOOR AIR ENTHALPY IS LESS THAN RETURN AIR ENTHALPY THE BAS SHALL ENABLE THE ECONOMIZER SEQUENCE. THE BAS SHALL MODULATE THE ECONOMIZER DAMPERS TO MAINTAIN DISCHARGE TEMPERATURE SETPOINT (55 F). WHEN THE OUTDOOR AIR ENTHALPY IS LOWER THAN THE RETURN AIR ENTHALPY, BUT HIGHER THAN THE DISCHARGE AIR ENTHALPY, THE ECONOMIZER SHALL OPERATE IN CONJUNCTION WITH THE CHILLED WATER CONTROL VALVE TO MAINTAIN DISCHARGE AIR TEMPERATURE SET POINT (55 F).

The mechanical drawings should include control schematics and sequence of operation. The sequence of operation in the Project Manual should include economizer fault detection.

6.3.2 Energy Recovery Unit

Go to requirements

The mechanical schedule should indicate a system with energy recovery functionality including a note to see the mechanical specification for energy recovery units. The Project Manual should include a section for the energy recovery unit that requires performance per the Energy Code requirements.

SECTION 236220

ENERGY RECOVERY UNITS (ERU'S)

PART 1 GENERAL

1.1 DESCRIPTION

A. Provide packaged rooftop air conditioning units heating units in accordance with the Contract Documents.

1.2 WORK INCLUDED

A. Air Cooled Packaged Units.

1.3 SUBMITTALS

A. Submit manufacturer's latest data on capacity, dimensions and installation instruction.

1.4 WARRANTY

A. Unit shall subject to manufacturer's standard warranty for the following periods:

1. Overall unit, 12 months from substantial completion but no more than 18 months from shipment.
2. Compressors, 60 months substantial completion but no more than 66 months from shipment.
3. Energy recovery wheel, 60 months from substantial completion but no more than 66 months from shipment.

1.5 LEED PROJECT REQUIREMENTS

A. Related Sections

1. See Division 01 Section "Sustainable Design Requirements" for additional LEED documentation and requirements.

B. Submittals

1. Product Data: For each type of product.
2. Sustainable Design Submittals:

a. Product Data: For recycled content, indicating postconsumer and pre-consumer recycled content and cost.

6.4.5 Refrigerated Space (Walk-in and Cases)

Go to requirements

REFRIGERATION CASE AND EVAPORATOR SCHEDULE

									DEFROST		EVAPORATOR COILS					
SYSTEM NO	DOORS	MODEL	USE	DISCH. TEMP	BTUH/ DOOR	BTUH	EVAP. TEMP	CONTROL	TYPE	QUANT. & DURATION	QUANT	MANUF	MODEL	DIMENSION	BTUH CAP.
A01	10	N5FGNA	ICE CREAM	-12 °F	1476	14760	-23 °F	CPC, LL SOLENOID	ELECT	1 @ 60 MIN	---	---	---	---	---
A02	12	N5FGNA	ICE CREAM	-12 °F	1476	17712	-23 °F	CPC, LL SOLENOID	ELECT	1 @ 60 MIN	---	---	---	---	---
A03	8-6X14X9-6	WALK-IN	FREEZER	-15 °F	---	6849	-23 °F	CPC, LL SOLENOID	ELECT	2 @ 20 MIN	1	BOHN	LLE-080	45.5"x15"x16"	8000
A04	7	N5NGNA	DAIRY	30 °F	869	6083	20 °F	CPC, LL SOLENOID	OT	1 @ 60 MIN	---	---	---	---	---
A05	9	N5NGNA	DAIRY	30 °F	869	7821	20 °F	CPC, LL SOLENOID	OT	1 @ 60 MIN	---	---	---	---	---
A06	8-6X14X9-6	WALK-IN	COOLER	36 °F	---	8567	24 °F	CPC, LL SOLENOID	OT	2 @ 20 MIN	1	BOHN	ADT-090	45.5"x15"x16"	9000

add notes:
1. Refer to specification "Refrigerated case" for minimum efficiency level to comply with enegy code.

Mechanical schedules should reflect motor requirements for condensing units and evaporators serving walk-in coolers and freezers. The Project Manual should include other requirements for sealing, insulation, etc. to meet Energy Code performance requirements.

SECTION 13040
STOCKROOM WALK IN COOLERS AND FREEZERS (OWNER FURNISHED)

NOTE: THIS SECTION IS INCLUDED FOR REFERENCE ONLY. IT COVERS INFORMATION ON OWNER-SUPPLIED EQUIPMENT AND WORK.

PART 1 - GENERAL

1.1 SUMMARY

A. This section applies to furnishing walk-in cooler and freezer boxes for , Including delivery and warranty. In general walk-in boxes consist of insulated panels, alignment strips, seismic re-enforcement parts, trim, lighting accessories, fasteners, pre-hung low temperature insulated door sections with door heaters, hardware, thermometer, electrical junction boxes, and conduits

1.2 RELATED ITEMS

A. Section 01090 - Reference Standards.
B. Section 01600 - Materials and Equipment: General requirements for material and equipment.
C. Section 01700 - Project Closeout.

1.3 REFERENCES

A. UL "Building Materials Directory".
B. NSF- National Sanitation Foundation.
C. USDA- United States Department of Agriculture.
D. ASTM- American Society of Testing Materials.
E. UBC- Uniform Building Code.
F. BOCCA.
G. State of Wisconsin Material Approval.

1.4 QUALITY ASSURANCE

A. UL approved panel.
B. UL approved electric.
C. NSF 7 approved construction.
D. State of New York MEA.
E. California Bureau of Home Furnishings and Thermal Insulation License.
F. State of Oregon Approval.

1.5 SUBMITTALS

A. Comply with requirements of Section 01300, Submittals, unless otherwise indicated.
B. Provide complete Shop drawings, installation instructions and parts lists, to the General Contract no later than 2 weeks prior to the under floor "A" change issue deadline.
1. Room arrangement, dimensions, and other physical features.
2. Layout and identification of all enclosure components.
3. Itemized list of all equipment provided and a list of work required for field installation.

1.6 DELIVERY, STORAGE, AND HANDLING

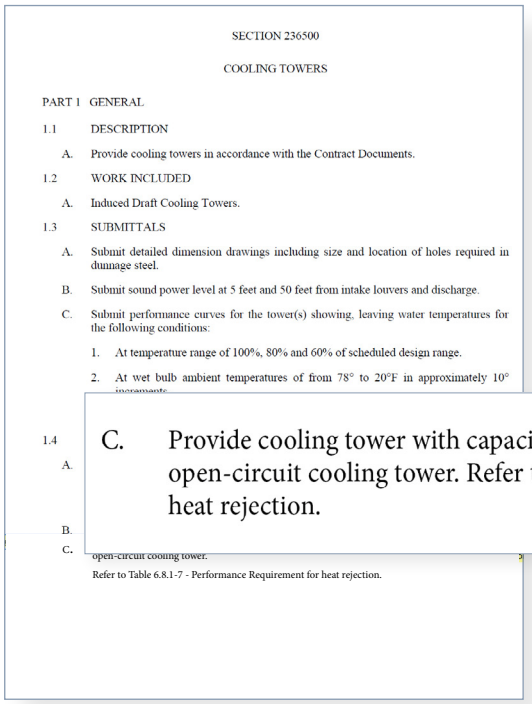
A. Freight to jobsite shall be included in manufacturer's price.
B. Schedule delivery of walk-in box enclosure components to job site and coordinate installing contractor as directed by Owner or Owners Site Representative (OSR).

1.7 WARRANTY

A. The manufacturer shall warrant walk-in box insulated panels against defective materials for a period of five years from date of grand opening.
B. Hardware and electrical components shall be warranted against defects in materials and workmanship under normal use and service for a period of one year from date of grand opening.
C. Manufacturer at his, own expense must immediately correct defects of any kind due to faulty workmanship, materials or shipping. Warranty shall not apply to injuries or damages occurring after grand opening due to "Act of God", fire, violence, abuse, or carelessness of separate Contractors or Agents of the Owner; however, Owner reserves the right to make temporary repairs necessary to keep equipment in operating condition without voiding manufacturer's warranty or relieving manufacturer of responsibilities during warranty period.

6.5.5.3 Centrifugal Fan Open-Circuit Cooling Towers

Go to requirements



SECTION 236500

COOLING TOWERS

PART 1 GENERAL

1.1 DESCRIPTION

A. Provide cooling towers in accordance with the Contract Documents.

1.2 WORK INCLUDED

A. Induced Draft Cooling Towers.

1.3 SUBMITTALS

A. Submit detailed dimension drawings including size and location of holes required in dunnage steel.

B. Submit sound power level at 5 feet and 50 feet from intake louvers and discharge.

C. Submit performance curves for the tower(s) showing, leaving water temperatures for the following conditions:

1. At temperature range of 100%, 80% and 60% of scheduled design range.

2. At wet bulb ambient temperatures of from 78° to 20°F in approximately 10°

1.4

A.

B.

C.

open-circuit cooling tower.

Refer to Table 6.8.1-7 - Performance Requirement for heat rejection.

C. Provide cooling tower with capacity that meet the energy code 6.5.5.3 centrifugal fan open-circuit cooling tower. Refer to Table 6.8.1-7 - Performance Requirement for heat rejection.

Specifications should refer to or include Table 6.8.1-7 - Performance Requirement for heat rejection.

Key Terms

Back to TOC

Section 3 of the MN Energy Code includes definitions, abbreviations and acronyms used in the code language. Terms defined in other chapters of the Minnesota State Building Code also apply. Minnesota has amended Section 3 to refer to the Merriam-Webster Collegiate Dictionary, available at www.m-w.com, for terms not defined in the Energy Code or other chapters of the *Minnesota State Building Code*.

Terms relevant to the content in this Guide have been copied from Section 3 here for convenience.

A

addition: an extension or increase in floor area or height of a *building* outside of the *existing building envelope*.

alteration: a replacement or addition to a *building* or its *systems* and *equipment*; routine maintenance, *repair*, and service, or a change in the *building*'s use classification or category shall not constitute an *alteration*.

authority having jurisdiction: the agency or agent responsible for enforcing this standard.

automatic or automatically: self-acting, operating by its own mechanism when actuated by some non-manual influence, such as a change in current strength, pressure, temperature, or mechanical configuration.

automatic control device: a device capable of *automatically* turning loads off and on without *manual* intervention.

B

balancing, air system: adjusting airflow rates through air *distribution system* devices, such as fans and diffusers, by manually adjusting the position of dampers, splitter vanes, extractors, etc., or by using *automatic control devices*, such as constant-air-volume or *variable-air-volume (VAV)* boxes.

balancing, hydronic system: adjusting water flow rates through hydronic *distribution system* devices, such as pumps and coils, by manually adjusting the position valves or by using *automatic control devices*, such as *automatic* flow *control* valves.

baseline building design: a computer representation of a hypothetical design based on the proposed design. This representation is used as the basis for calculating the *baseline building performance* for rating above-standard design or when using the *Performance Rating Method* as an alternative path for minimum standard compliance in accordance with Section 4.2.1.1.

baseline building performance: the annual *energy* cost for a *building* design intended for use as a baseline for rating above-standard design or when using the *Performance Rating Method* as an alternative path for minimum standard compliance in accordance with Section 4.2.1.1.

boiler: a self-contained, low-pressure appliance for supplying steam or hot water.

> ***modulating boiler:*** a *boiler* that is capable of more than a single firing rate in response to a varying temperature or heating load.
>
> ***packaged boiler:*** a *boiler* that is shipped complete with heating *equipment*, mechanical draft *equipment*, and *automatic controls*, and that is usually shipped in one or more sections. A *packaged boiler* includes factory-built *boilers* manufactured as a unit or *system*, disassembled for shipment, and reassembled at the site.

boiler system: one or more *boilers* and their *piping* and *controls* that work together to supply steam or hot water to heat output devices remote from the *boiler*.

budget building design: a computer representation of a hypothetical design based on the actual *proposed design*. This representation is used as the basis for calculating the *energy cost budget*.

building: any structure used or intended for supporting or sheltering any use or occupancy.

C

ceiling fan, large diameter: a ceiling fan that is greater than or equal to 84.5 in. in diameter.

commercial parking facility: a building or structure intended for containment of motor vehicles where the parking is related to or associated with commerce, defined as the activity of buying and selling goods and services, which may include the parking itself.

commissioning: a quality-focused process for enhancing the delivery of a project for verifying and documenting that the *building* and its *systems*, controls, and *building envelope* are planned, designed, installed, tested, and include plans for operation and maintenance to meet specified requirements.

commissioning provider: an entity who manages the commissioning team to implement *building commissioning*.

computer room: a room whose primary function is to house *equipment* for the processing and storage of electronic data and that has a design electronic data *equipment* power density of greater than 20 W/ft^2 (20 watts per 0.092 m^2) of conditioned floor area or a connected design electronic data equipment load of greater than 10 kW.

condensing unit: a factory-made assembly of refrigeration components designed to compress and liquefy a specific refrigerant. It consists of one or more refrigerant compressors, refrigerant condensers (air-cooled, evaporatively cooled, and/or water-cooled), condenser fans and motors (where used), and factory-supplied accessories.

construction documents: drawings and specifications used to construct a *building, building systems*, or portions thereof.

control: to regulate the operation of *equipment*. This definition is not applicable to the use of this word as a noun to describe a combination of *control devices* and software, used to achieve *control* of HVAC, lighting, or other equipment or *systems*.

control device: a specialized device used to regulate the operation of *equipment*.

D

dead band: the range of values within which a sensed variable can vary without initiating a change in the controlled process.

demand: the highest amount of power (average Btu/h over an interval) recorded for a *building* or facility in a selected time frame.

demand control ventilation (DCV): a *ventilation system* capability that provides for the *automatic* reduction of *outdoor air* intake below design rates when the actual occupancy of *spaces* served by the *system* is less than design occupancy.

design capacity: output capacity of a *system* or piece of *equipment* at *design conditions*.

design conditions: specified environmental conditions, such as temperature and light intensity, required to be produced and

maintained by a *system* and under which the *system* must operate.

design energy cost: the annual *energy* cost calculated for a *proposed design*.

direct digital control (DDC): a type of *control* where controlled and monitored analog or binary data (e.g., temperature, contact closures) are converted to digital format for manipulation and calculations by a digital computer or microprocessor and then converted back to analog or binary form to *control* physical devices.

distribution system: conveying means, such as ducts, pipes, and wires, to bring substances or *energy* from a source to the point of use. The *distribution system* includes such auxiliary *equipment* as fans, pumps, and *transformers*.

ductwork: a *system* of ducts for distribution and extraction of air.

dwelling unit: a single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking, and sanitation.

E

economizer, air: a duct and damper arrangement and *automatic control system* that together allow a cooling *system* to supply *outdoor air* to reduce or eliminate the need for *mechanical cooling* during mild or cold weather.

economizer, fluid: a *system* by which the supply air of a cooling *system* is cooled indirectly with a fluid that is itself cooled by heat or mass transfer to the environment without the use of *mechanical cooling*. Examples of commonly used fluids are water, glycol mixtures, and refrigerants.

efficiency: performance at specified rating conditions.

enclosed space: a volume substantially surrounded by solid surfaces, such as *walls, floors, roofs,* and openable devices, such as *doors* and *operable* windows.

energy: the capacity for doing work. It takes a number of forms that may be transformed from one into another such as thermal (heat), mechanical (work), electrical, and chemical (Btu).

energy cost budget: the annual *energy* cost for the *budget building design* intended for use in determining minimum compliance with this standard.

enthalpy recovery ratio: change in the enthalpy of the *outdoor air* supply divided by the difference between the *outdoor air* and entering exhaust air enthalpy, expressed as a percentage.

energy recovery ratio, series (SERR): the difference between the dry-bulb air temperatures leaving the series energy recovery unit and leaving the dehumidifying coil divided by the difference between 75°F and the dry-bulb temperature of the air leaving the dehumidifying cooling coil.

energy recovery, series: a three-step process in which the first step is to remove *energy* from a single airstream without the use of mechanical cooling. In the second step the airstream is mechanically cooled for the purpose of dehumidification. In the third step, the energy removed in step one is reintroduced to the airstream.

equipment: devices for space heating, space cooling, *ventilation*, humidification, dehumidification, electric power, lighting, transportation, refrigeration, cooking, or *service water heating*, including but not limited to furnaces, *boilers*, air conditioners, heat pumps, chillers, *water heaters*, *lamps*, *luminaires*, *ballasts*, elevators, escalators, or other devices or installations.

existing building: a *building* or portion thereof that was previously occupied or approved for occupancy by the *authority having jurisdiction*.

existing equipment: *equipment* previously installed in an *existing building*.

existing system: a *system* or *systems* previously installed in an *existing building*.

F

fan array: multiple fans in parallel between two *plenum* sections in an air *distribution system*.

fan brake horsepower (bhp): the horsepower delivered to the fan's shaft. Brake horsepower does not include the mechanical drive losses (belts, gears, etc.).

fan energy index (FEI): the ratio of the electric input power of a reference fan to the electric input power of the actual fan as calculated per AMCA 208.

fan nameplate electrical input power: the nominal electrical input power rating stamped on a fan assembly nameplate.

fan system brake horsepower (bhp): the sum of the *fan brake horsepower* of all fans that are required to operate at *fan system design conditions* to supply air from the heating or cooling source to the *conditioned spaces* and return it to the source or exhaust it to the outdoors.

fan system electrical power: the sum of the fan electrical power of all fans that are required to operate at *fan system design conditions* to supply air from the heating or cooling source to the *conditioned spaces* and/or return it to the source or exhaust it to the outdoors.

fan system motor nameplate horsepower (hp): the sum of the motor *nameplate horsepower* of all fans that are required to operate at *design conditions* to supply air from the heating or cooling source to the *conditioned spaces* and return it to the source or exhaust it to the outdoors.

floor area, gross: the sum of the *floor* areas of the *spaces* within the *building*, including basements, mezzanine and intermediate-floored tiers, and penthouses with a headroom height of 7.5 ft or greater. It is measured from the exterior faces of *walls* or from the centerline of *walls* separating buildings, but excluding covered walkways, open roofed-over areas, porches and similar *spaces*, pipe trenches, exterior terraces or steps, chimneys, *roof* overhangs, and similar features.

> ***gross conditioned floor area:*** the *gross floor area* of *conditioned spaces*.

F

flue damper: a device in the flue outlet or in the inlet of or upstream of the draft *control device* of an individual, *automatically* operated, *fossil-fuel*-fired appliance that is designed to *automatically* open the flue outlet during appliance operation and to *automatically* close the flue outlet when the appliance is in a standby condition.

fluid economizer: see economizer, fluid.

fuel: a material that may be used to produce heat or generate power by combustion.

fossil fuel: *fuel* derived from a hydrocarbon deposit, such as petroleum, coal, or natural gas derived from living matter of a previous geologic time.

functional performance testing (FPT):a systematic process to verify that controls and other elements of the *building* project are capable of and configured to operate or perform as required.

H

heat trace: a heating *system* where the externally applied heat source follows (traces) the object to be heated (e.g., water *piping*).

historic: a *building* or *space* that has been specifically designated historically significant by the *adopting authority* or is listed in The National Register of *Historic* Places or has been determined to be eligible for such listing by the U.S. Secretary of the Interior.

hot-water supply boiler: a *boiler* used to heat water for purposes other than *space* heating.

humidistatic controls: *automatic controls* used to maintain humidity at a fixed or adjustable *set point*.

HVACR system: the *equipment, distribution systems*, and *terminals* that provide, either collectively or individually, the processes of heating, ventilating, or air conditioning to a *building* or portion of a *building*.

HVACR zone: a *space* or group of *spaces* within a *building* with heating and cooling requirements that are sufficiently similar so that desired conditions (e.g., temperature) can be maintained throughout using a single sensor (e.g., *thermostat* or temperature sensor).

I

indoor pool dehumidifier: a type of air-cooled or water-cooled electrically operated vapor compression refrigeration *system*, factory assembled as a single package or split *system*, that includes an indoor cooling/dehumidifying coil, an air *reheat* coil, one or more compressors, and an air moving device. It may also include a refrigerant heat recovery unit, an auxiliary refrigerant condenser, an economizer, and an air-to-air heat recovery device. It shall provide the function of dehumidification, air circulation, and air *reheating* and may include the function of air-cooling, air-cleaning, *pool* water heating, and air-to-air heat recovery.

isolation devices: devices that isolate *HVACR zones* so that they can be operated independently of one another. *Isolation devices* include, but are not limited to, separate *systems*, isolation dampers, and *controls* providing shutoff at *terminal* boxes.

IT equipment energy: annual *energy* used for computer storage and network *equipment* along with supplemental *equipment* represented by the uninterruptible power supply (UPS) output calculated in accordance with industry-accepted standards (see Informative Appendix E).

M

makeup air (dedicated replacement air): *outdoor air* deliberately brought into the *building* from the outside and supplied to the vicinity of an exhaust hood to replace air, vapor, and contaminants being exhausted. *Makeup air* is generally filtered and fan-forced, and it may be heated or cooled depending on the requirements of the application. *Makeup air* may be delivered through outlets integral to the exhaust hood or through outlets in the same room.

manual (nonautomatic): requiring personal intervention for *control*. *Nonautomatic* does not necessarily imply a *manual* controller, only that personal intervention is necessary. (See automatic.)

mechanical cooling: reducing the temperature of a gas or liquid by using vapor compression, absorption, desiccant dehumidification combined with evaporative cooling, or another *energy*-driven thermodynamic cycle. Indirect or direct evaporative cooling alone is not considered *mechanical cooling*.

mechanical heating: raising the temperature of a gas or liquid by use of *fossil fuel* burners, *electric resistance* heaters, heat pumps, or other *systems* that require *energy* to operate.

motor power, rated: the rated output power from the motor.

N

nameplate horsepower (hp): the nominal motor output power rating stamped on the motor nameplate.

nameplate rating: the design load operating conditions of a device as shown by the *manufacturer* on the nameplate or otherwise marked on the device.

networked guest room control system: a *control system*, accessible from the hotel/motel front desk or other central location, that is capable of identifying rented and unrented rooms according to a timed schedule, and is capable of controlling HVACR in each hotel/motel guest room separately.

nonrecirculating system: a domestic or *service* hot-water distribution system that is not a *recirculating system*.

nonresidential: all occupancies other than *residential*. (See residential.)

nontransient: occupancy of a dwelling unit or sleeping unit for more than 30 days.

O

occupancy sensor: a device that detects the presence or absence of people within an area and causes lighting, *equipment*, or appliances to be regulated accordingly.

occupied-standby mode: when a zone is scheduled to be occupied, and an occupant sensor indicates no occupants are within the zone.

optimum start controls: *controls* that are designed to *automatically* adjust the start time of an *HVACR system* each day with the intention of bringing the *space* to desired occupied temperature levels immediately before scheduled occupancy.

outdoor (outside) air: air that is outside the *building envelope* or is taken from outside the *building* that has not been previously circulated through the *building*.

P

parking garage section: a part of a parking garage where airflow is restricted from other parts of the garage by solid walls.

Performance Rating Method: a calculation procedure that generates an index of merit for the performance of *building* designs that substantially exceeds the *energy efficiency* levels required by this standard or when using the *Performance Rating Method* as an alternative path for minimum standard compliance in accordance with Section 4.2.1.1.

permanently installed: *equipment* that is fixed in place and is not portable or movable.

piping: the pipes or tubes interconnecting the various parts of a fluid *distribution system*, including all elements that are in series with the fluid flow, such as pumps, valves, strainers, and air separators, but not including elements that are not in series with the fluid flow, such as expansion tanks, fill lines, chemical feeders, and drains.

plenum: a compartment or chamber to which one or more ducts are connected, that forms a part of the air *distribution system*, and that is not used for occupancy or storage. A *plenum* often is formed in part or in total by portions of the *building*.

pool: any structure, basin, or tank containing an artificial body of water for swimming, diving, or recreational bathing. The term includes, but is not limited to, swimming *pool,* whirlpool, spa, and hot tub.

proposed building performance: the annual *energy* cost calculated for a *proposed design*.

proposed design: a computer representation of the actual proposed *building* design, or portion thereof, used as the basis for calculating the *design energy cost*.

pump: equipment designed to move liquids that may include entrained gases, free solids, and totally dissolved solids by physical or mechanical action and that includes a bare pump and, if included by the manufacturer at the time of sale, mechanical equipment, driver, and controls.

pump system power: the sum of the nominal power *demand* (*nameplate horsepower*) of motors of all pumps that are required to operate at *design conditions* to supply fluid from the heating or cooling source to all heat transfer devices (e.g., coils, heat exchanger) and return it to the source.

R

radiant heating system: a heating *system* that transfers heat to objects and surfaces within the *heated space* primarily (greater than 50%) by infrared radiation.

rated motor power: see motor power, rated.

recool: to lower the temperature of air that has been previously heated by a mechanical heating *system*.

record documents: drawings and other documents that record the conditions of the project as constructed. These include any refinements of the *construction* or bid documents.

refrigeration system, low-temperature: *system* for maintaining food products in their frozen state in refrigeration applications.

refrigeration system, medium-temperature: *system* for maintaining food products above their frozen state in refrigeration applications.

reheat: to raise the temperature of air that has been previously cooled either by mechanical refrigeration or an economizer *system*.

repair: the reconstruction or renewal of any part of an *existing building* for the purpose of its maintenance.

replacement air: *outdoor air* that is used to replace air removed from a *building* through an exhaust *system*. *Replacement air* may be derived from one or more of the following: *makeup air*, supply air, *transfer air*, and *infiltration*. However, the ultimate source of all *replacement air* is *outdoor air*. When *replacement air* exceeds exhaust, the result is exfiltration.

reset: *automatic* adjustment of the controller *set point* to a higher or lower value.

residential: *spaces* in buildings used primarily for living and sleeping. *Residential spaces* include, but are not limited to, *dwelling units*, hotel/motel guest rooms, dormitories, nursing homes, patient rooms in hospitals, lodging houses, fraternity/sorority houses, hostels, prisons, and fire stations.

resistance, electric: the property of an electric circuit or of any object used as part of an electric circuit that determines for a given circuit the rate at which electric *energy* is converted into heat or radiant *energy* and that has a value such that the product of the resistance and the square of the current gives the rate of conversion of *energy*.

S

setback: reduction of heating (by reducing the *set point*) or cooling (by increasing the *set point*) during hours when a *building* is unoccupied or during periods when lesser *demand* is acceptable.

set point: point at which the desired temperature (°F) of the heated or *cooled space* is set.

simulation program: a computer program, including the simulation engine and the corresponding user interface, that is capable of simulating the *energy* performance of *building systems*.

single-zone system: an *HVACR system* serving a single *HVACR zone*.

site-recovered energy: waste *energy* recovered at the *building* site that is used to offset consumption of purchased *fuel* or electrical *energy* supplies.

site-solar energy: thermal, chemical, or electrical *energy* derived from direct conversion of incident solar radiation at the *building* site and used to offset consumption of purchased *fuel* or electrical *energy* supplies. For the purposes of applying this standard, *site-solar energy* shall not include passive heat gain through *fenestration systems*.

slab-on-grade floor: that portion of a slab *floor* of the *building envelope* that is in contact with the ground and that is either above *grade* or is less than or equal to 24 in. below the final elevation of the nearest exterior *grade*.

heated slab-on-grade floor: a *slab-on-grade floor* with a heating source either within or below it.

small electric motor: a NEMA general purpose, alternating current, single-speed induction motor, built in a two-digit frame number series in accordance with NEMA Standards Publication MG1-1987, including IEC metric equivalent motors; constructed in the NEMA 42, 48, and 56 frame sizes or IEC metric equivalent.

space: an *enclosed space* within a *building*. The classifications of *spaces* are as follows for the purpose of determining *building envelope* requirements:

conditioned space: a *cooled space, heated space*, or *indirectly conditioned space* defined as follows:

a. ***cooled space:*** an *enclosed space* within a *building* that is cooled by a cooling *system* whose sensible output capacity is ≥3.4 Btu/h·ft^2 of floor area.

b. ***heated space:*** an *enclosed space* within a *building* that is heated by a heating *system* whose output capacity relative to the floor area is greater than or equal to the criteria in Table 3.2.

c. ***indirectly conditioned space:*** an *enclosed space* within a *building* that is not a *heated space* or a *cooled space*, which is heated or cooled indirectly by being connected to adjacent *spaces*, provided

1. the product of the *U-factors* and surface areas of the *space* adjacent to connected *spaces* exceeds the combined sum of the product of the *U-factors* and

surface areas of the *space* adjoining the outdoors, *unconditioned spaces*, and to or from *semiheated spaces* (e.g., corridors) or

2. that air from heated or *cooled spaces* is intentionally transferred (naturally or mechanically) into the *space* at a rate exceeding 3 ach (e.g., atria).

semiheated space: *an* enclosed space *within a* building *that is heated by a heating* system *whose output capacity is greater than or equal to 3.4 Btu/h·ft² of floor area but is not a* conditioned space.

unconditioned space: *an* enclosed space *within a* building *that is not a* conditioned space *or a* semiheated space. *Crawlspaces, attics, and parking garages with natural or mechanical* ventilation *are not considered* enclosed spaces.

story: portion of a *building* that is between one finished *floor* level and the next higher finished *floor* level or the *roof*, provided, however, that a basement or cellar shall not be considered a story.

system: a combination of *equipment* and auxiliary devices (e.g., *controls*, accessories, interconnecting means, and *terminal* elements) by which *energy* is transformed so it performs a specific function, such as HVAC, *service water heating*, or lighting.

T

thermally effective panel surface: any exterior surface of a panel that is intended to transfer heat between the panel and the occupants and/or the indoor *space*.

thermally ineffective panel surface: any exterior surface of a panel, which is not intended to transfer heat between the panel and the occupants and/or the indoor *space*.

thermostat: an *automatic control device* used to maintain temperature at a fixed or adjustable *set point*.

thermostatic control: an *automatic control device* or *system* used to maintain temperature at a fixed or adjustable *set point*.

transfer air: air transferred from one room to another through openings in the room envelope, whether it is transferred intentionally or not. The driving force for *transfer air* is generally a small pressure differential between the rooms, although one or more fans may be used.

V

variable-air-volume (VAV) system: *HVACR system* that *controls* the dry-bulb temperature within a *space* by varying the volumetric flow of heated or cooled supply air to the *space*.

variable-refrigerant-flow (VRF) system: an engineered direct expansion (DX) multisplit *system* incorporating at least one variable capacity compressor distributing refrigerant through a *piping* network to multiple indoor fan-coil units, each capable of individual zone temperature *control*, through integral zone temperature *control devices* and common communications network. Variable refrigerant flow uses three or more steps of *control* on common, interconnecting *piping*.

vent damper: a device intended for installation in the venting *system* of an individual, *automatically* operated, fossil-*fuel*-fired appliance in the outlet or downstream of the appliance draft *control device*, which is designed to *automatically* open the venting *system* when the appliance is in operation and to *automatically* close off the venting *system* when the appliance is in a standby or shutdown condition.

ventilation: the process of supplying or removing air by natural or mechanical means to or from any *space*. Such air is not required to have been conditioned.

ventilation system motor nameplate horsepower (hp): the sum of the motor *nameplate horsepower* of all fans that are required to operate as part of the *system*.

verification and testing provider (V&T provider): an entity who completes the activities needed to implement the building *functional performance testing (FPT)* activities or verify that elements of the *building* project meet stated requirements.

W

walk-in cooler: an enclosed storage *space* of <3000 ft^2 that can be walked into and that is designed to maintain a *space* temperature of >32°F and ≤55°F.

walk-in freezer: an enclosed storage *space* of <3000 ft^2 that can be walked into that is designed to maintain a *space* temperature of ≤32°F.

warm-up: increase in *space* temperature to occupied *set point* after a period of shutdown or *setback*.

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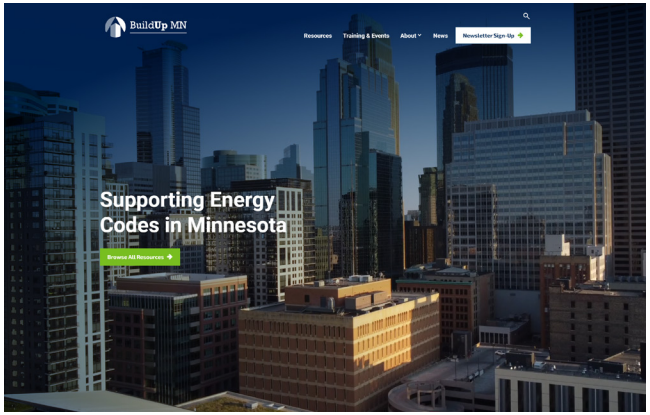

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