Built to Stretch: Systemair's Geniox

Navigating Massachusetts' New Building Energy Codes

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What do commercial buildings and Systemair's products have to do with one another? Ventilation. At least according to the Massachusetts (MA) Building Energy Code, which the 2023 version now includes an updated Stretch code and a new Specialized Opt-in code. MA is one of 14 states to institute an act to reduce emissions by more than half by 2050. A major component of this plan is to reduce carbon emissions offset by buildings, which as of 2009, produce more than 40% of emissions annually in the United States and 54% annually in MA.[1]

One important facet of the energy code's latest update revolves around Section C403.7, Ventilation Energy Recovery. These requirements were strengthened in the separation of 225 Code of Massachusetts Regulations (CMR) 23, Commercial Amendments to IECC 2021. This section now requires higher energy recovery requirements from mechanical ventilation equipment used in commercial buildings. Specifically, different builds require flexibility from air handling units or Dedicated Outdoor Air Systems (DOASs) to meet an Enthalpy Recovery Ratio (ERR) of at least 70%.[2]

Additionally, the integration of Variable Refrigerant Flow (VRF) systems with Systemair's Geniox units offers an all-electric solution that enhances energy efficiency. VRF systems provide precise temperature control and reduce energy consumption, aligning perfectly with the updated energy codes.

This paper will explore the pathways commercial specifiers can choose to meet MA codes, how Systemair's Geniox can help specifiers meet these codes, and what this means for specifiers in other states moving forward.

Background

The Global Warming Solutions Act (GWSA) of 2008 created a framework for reducing heat-trapping emissions to levels that scientists believe give us a reasonable chance of avoiding the worst effects of global warming.[3] As an update to this act, Charlie Baker, the governor of MA from 2015–2023, signed into law legislation to further ensure the commonwealth reaches Net Zero (or no less than 85% below the 1990 level) in carbon emissions by 2050.[4]

Previously published under 780 CMR, statutory changes required the MA Department of Energy Resources (DOER) to create an additional tier of specialized energy code for municipal opt-in.[5] This change resulted in the creation of 225 CMR. It also prompted updates that made construction more cost-effective and more energy-efficient than in past years. Specifically, 225 CMR 23, which covers commercial and all other construction (including most multi-family) for Stretch and Specialized code municipalities, details how municipalities must create regulations for designers that develop and construct new, or renovate existing, commercial buildings.[6]

Building Energy Codes in Massachusetts

There are three building energy codes in MA: Base Code, Stretch Code, and the Specialized Code.

Base Code

The base energy code is developed from the IECC (International Energy Code) 2021 edition with MA amendments. All municipalities must abide by the base code (unless they choose to adopt the Stretch or Specialized energy code) when developing new construction or major renovations.[7]

Stretch Energy Code

The Stretch code is optional for each municipality in Massachusetts. It was developed in 2009, but legislation in 2021 moved the authority to DOER. The latest edition is developed from the IECC 2021 version along with the same MA amendments as the base code **plus amendments specific to the Stretch code.** The Stretch code also applies to new construction or major renovations.[7]

Specialized Code

Like the Stretch Code, the Specialized Code is optional for municipalities to adopt as their building code. The Specialized Code is required by statute (MGL Session Laws of 2021 Chapter 8: Section 31) to achieve Massachusetts Green House Gas emission limits and sub-limits set every five years from 2025 to 2050. Accordingly, all compliance pathways under the Specialized Code are designed to ensure new construction that is consistent with a net-zero Massachusetts economy in 2050, primarily through energy efficiency, reduced heating loads, and efficient electrification.[7]

Pathways for Commercial Buildings Under the Stretch Code

Depending on the building type, the updated Stretch code includes 3 code pathways.

1. **Targeted Performance— Thermal Energy Demand Intensity (TEDI) Pathway**
   Building applications—such as dormitories, fire stations, libraries, offices, schools, police stations, post offices, and town halls over 20,000 sq. ft.—and buildings that have average ventilation at full occupancy of 0.5 CFM/ft2 or less, are required to use Targeted Performance; also known as the TEDI Pathway. **After 1 July 2024**, residential buildings over 12,000 ft2, or portions of buildings that have residential use over 12,000 ft2, are required to use Targeted Performance.[8,9]

2. **Prescriptive Pathway**
   Small commercial buildings (any building use except multi-family) under 20,000 ft2 will be able to continue to comply through an updated prescriptive pathway or can opt to use the TEDI pathway. [8,9]

3. **Home Energy Rating System (HERS) and Passive House**
   Multi-family buildings, larger than those covered by the residential low-rise code, can choose between HERS and Passive House pathways. These pathways must contain the same energy-efficiency requirements as the updated Residential low-rise Stretch Code.[8,9]

Pathways for Commercial Buildings Under the Specialized Code

The specialized code acts the same as the stretch code except for the added specialized code amendments to craft homes and buildings to stringent efficiency standards. This code gives three pathways for new construction or major renovations.

1. **All Electric Building Performance Standard**
   This pathway requires all space heating, water heating, cooking equipment, and drying equipment to be powered by electricity. They also must meet minimum efficiency standards, with requirements from CC104. **Any Stretch code compliance pathway is suitable.** HERS pathway starts at HERS 45 rather than HERS 55.[2,8]

2. **Mixed-fuel Building Performance Standard**
   Under the specialized code, specifiers have to follow minimum requirements if they design a new building with space heating systems, water heating systems, or appliances capable of using fossil fuels such as natural gas, heating oil, or propane oil. These minimum requirements include emission mitigation for water and space heating, solar development, and pre-wiring and electrical service provisions. Additionally, these requirements demand future electrification of space and water heating, cooking, and drying equipment. This pathway uses requirements from CC105 and CC106.[2,8]

3. **Zero Energy Building Performance Standard**
   The most stringent of the 3 pathways in that it requires renewable energy to offset all annual energy used by the building. Additionally, any fossil-fueled equipment must be pre-wired for future electric equipment. This pathway uses requirements from CC103.[2,8]

Detailing 225 CMR 23

The separation of 225 CMR 23 strengthened the commercial construction pathways for designers through individual components, as seen in sections such as C403.7.4, Energy Recovery Systems.

C403.7.4

From 225 CMR 23, C403.7.4 **is required for all paths in C401.2.1** (Prescriptive, Targeted Performance, Relative Performance, and Certified Performance Standard Compliance). One of the largest changes for this section involves mechanical ventilation equipment. Specifically, **the now increased Enthalpy Recovery requirement**, measured as Enthalpy Recovery Ratio (ERR).[2]

Enthalpy Recovery Ratio (ERR) in 225 CMR 23

ERR is showcased in C403.7.4 with increased values from 780 CMR for both Non-Transient Dwelling Units and Spaces Other Than Non-Transient Dwelling Spaces. Enthalpy Recovery Ratio, defined in 225 CMR 23, **refers to the transfer of both heat and moisture from the exhaust air stream to the supply air stream.** The definition specifies the ratio of change required between the entering supply airflow and the leaving supply airflow, compared to the difference between the entering supply airflow and the entering exhaust airflow. **It is important to bring as much of the exhaust air back to the energy recovery device as possible to help achieve compliance.**[2]

C403.7.4.1 - Non-Transient Dwelling Units

Minimum enthalpy recovery effectiveness values are and have been set at 50% in cooling conditions. This value didn't change. However, in heating conditions, **the minimum recovery effectiveness increased from 60% to 70%.** The requirements of C403.7.4.1 apply only to the floor area in the dwelling units. Common areas and commercial spaces are subject to the requirements of C403.7.4.2.[2]

C403.7.4.2 – Spaces Other Than Non-Transient Dwelling Spaces

The required recovery ratio varies based on the air class type of each space or the air class exhausted from the space served by the system. Defined by ASHRAE 62.1-2019, there are 4 air classes:

1. **Class 1 Air** – Found in many commercial spaces such as offices and classrooms. Can be recirculated to any other space type.
2. **Class 2 Air** – Considered moderately contaminated and possibly with odors, found in daycare areas, dining facilities, fitness centers, etc. This type of air is restricted in its circulation.
3. **Class 3 Air** – Contains contaminants that require the air to be exhausted and not recirculated.
4. **Class 4 Air** – Includes laboratory fume hood exhaust, not to be recirculated.[2]

Systems that provide makeup air for Class 3 or 4 exhaust **require sensible recovery ratio of at least 50%** at heating design conditions, while all other makeup air systems require a minimum **enthalpy recovery ratio (ERR) of 70%** at heating and cooling conditions. This requirement can be satisfied for each system individually, or based on a weighted average of the ventilation airflow for all applicable systems in the entire building.[2]

How Geniox Can Help Specifiers

Keeping the demand for energy low is a key point throughout these pathways. With Geniox, specifiers can rest assured that high-quality and energy-efficient recovery options are available to keep their TEDI, HERS, and/or Passive House values low. Geniox units with energy recovery improve the overall efficiency of heating and cooling systems by reducing the workload on heat pumps. **This is particularly important on very cold or hot days (down to the 99.6% design day temperature), ensuring the building remains comfortable without overloading the HVAC system.**

Geniox counterflow cores can achieve up to 90% recovery, while the Energy Recovery Wheel (ERW) options can reach up to 85% based on nominal airflow. Plus, Geniox uses the ECB series of controllers to communicate with the BMS (Building Management System). This affords the ability to set specific schedules, such as occupied/unoccupied settings to ensure less energy is used.

Additionally, Geniox's EC motors are controlled by an analog 0-10VDC signal to dial in airflow rate, further reducing the amount of energy used. On fair-weather days, the bypass damper allows the owner to introduce fresh air without the need for recovery; reducing the energy load on the grid.

Even if these codes are not considered law in your state or province, they may soon be. The United States government released a long-term strategy detailing how all sectors can get to net zero energy by 2050.[10] As change comes, future-proofing your new or existing building with the Geniox unit now can improve the energy efficiency of your building application, the quality of life for people who enter the building daily, and the adherence to future renovations within the building area.

Conditions	Requirements	Systemair's Geniox*
Enthalpy Recovery – Heating Conditions	70%	ERW – 85% Counterflow Cores – 90% Crossflow Cores – 80%
Enthalpy Recovery – Cooling Conditions	50%	ERW – 85% Counterflow Cores – 85% Crossflow Cores – 75%
Code Pathways • Prescriptive • Targeted Performance • Relative Performance • Certified Performance Standard Compliance • All Electric Building Performance Standard • Mixed-fuel Building Performance Standard • Zero Energy Building Performance Standard	C403.7.4	Complies

*Based on nominal airflow

References

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[4] https://www.hklaw.com/en/insights/publications/2021/03/massachusetts-gov-charlie-baker-signs-comprehensive-climate-change-leg#:~:text=On%20March%2026%2C%202021%2C%20Massachusetts,action%20to%20address%20climate%20change

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