

# Sustainability Requirements for the Green Repair Program

## Executive Summary

MSBA's Green School program provides incentives for a District to increase the energy efficiency and sustainability for its new construction and major renovation / addition projects, using either the US Green Building Council's LEED for Schools or the Massachusetts Collaborative for High Performance Schools criteria. MSBA's updated Green Repair Program provides a new opportunity to apply similar sustainable standards to specific building systems, more appropriate for repair projects that include replacement of roofs, boilers and/or window systems. This new standard will use the Massachusetts Stretch Energy Code (780 CMR Appendix 120 AA) as a basis for those projects that include the replacement of those systems within their scope of work.

For schools seeking MSBA funding for replacement/repair/upgrade of their facilities roof, boiler and/or windows, projects will be required to follow the "Stretch Code" prescriptive requirements as a mandatory requirement.

## What is the Stretch Energy Code?

The Stretch Energy Code is a set of enhanced building system energy-efficiency requirements, listed in Appendix 120 AA of the Massachusetts 7<sup>th</sup> Edition Basic Building Code. For commercial buildings, it is similar to the latest International Energy Conservation Code (IECC 2009), with enhancements that require about 20% greater building energy efficiency. The prescriptive requirements are based on the Core Performance program of the New Buildings Institute.

An overview of the Stretch Energy Code can be viewed here:

[http://www.mass.gov/Eeops/docs/dps/inf/stretch\\_code\\_overview\\_jun05\\_09.pdf](http://www.mass.gov/Eeops/docs/dps/inf/stretch_code_overview_jun05_09.pdf)

The full Stretch Energy Code text can be viewed here:

[http://www.mass.gov/Eeops/docs/dps/inf/appendix\\_120\\_aa\\_jul09\\_09\\_final.pdf](http://www.mass.gov/Eeops/docs/dps/inf/appendix_120_aa_jul09_09_final.pdf)

The following tables, from portions of the Stretch Code, are replicated here to show minimum standards for the replacement of roofs, windows, and boilers. For more information, refer to the code in its entirety.

## Roof Replacement

(From 502 : Envelope Requirements, Table 502.1.2 – Building Envelope Requirements, Opaque Elements) and Table 502.2 – Building Envelope Requirements, Opaque Assemblies)

Maximum U – factors :

| Roofs                                     |          |
|---|----------|
| Insulation entirely above deck            | U-0.039  |
| Metal buildings (with R-5 thermal blocks) | U-0.049  |
| Attic and other                           | U- 0.027 |

Minimum R – values :

| <b>Roofs</b>  |             | <b>Note: IECC 2009 equivalent</b> |
|---|-------------|-----------------------------------|
| Insulation entirely above deck                            | R-25 ci     | Zone 7                            |
| Metal buildings (with R-5 thermal blocks <sup>a,b</sup> ) | R-13 + R-19 | Zone 7                            |
| Attic and other   | R-38        | Zone 2-7                          |

a. Thermal blocks are a minimum R-5 of rigid insulation, which extends 1-inch beyond the width of the purlin on each side, perpendicular to the purlin.

b. The first R-value is for faced fiberglass insulation batts draped over purlins. The second R-value is for unfaced fiberglass insulation batts installed parallel to the purlins. A minimum R-3.5 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins. Reference: ASHRAE/IESNA 90.1 Table A2.3 including Addendum "G"

### Window Replacement

(From 502 : Envelope Requirements, 502.3.2 Maximum U-factor and SHGC, Table 502.3 – Building Envelope Requirements, Fenestration, 502.4.1 Window and door assemblies, and 502.4.2 Curtain wall, storefront glazing and commercial entrance doors.)

For vertical fenestration, the maximum U-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3, which is uniformly set at 0.40. For skylights, the limit is set at 3% of roof area, but can be expanded to 5% of roof area in conjunction with automatic daylighting controls. In all cases, the maximum U-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3 below

Maximum U - factor and SHGC :

|  |      |
|--|------|
| <b>Framing materials other than metal with or without metal reinforcement or</b>           |      |
| U-Factor   | 0.35 |
| <b>Metal framing with or without thermal break</b>   |      |
| Curtain Wall/Storefront U-Factor   | 0.42 |
| Entrance Door U-Factor   | 0.80 |
| All other U-Factor <sup>a</sup>  | 0.45 |
| <b>SHGC- All Frame Types</b>   |      |
| SHGC   | 0.40 |
| <b>Skylights (3% maximum, or 5% maximum with automatic daylight controls <sup>b</sup>)</b> |      |
| U-Factor   | 0.45 |
| SHGC   | 0.40 |

a. All other includes operable windows, fixed windows and doors other than entrance doors.

b. Automatic daylighting controls shall meet the requirements of Section 505.2.2.1.3

The air leakage of window, skylight and door assemblies that are part of the building envelope shall be determined in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, or NFRC 400 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Window and skylight air leakage shall not exceed 0.2 cfm/ft<sup>2</sup> at 1.57 pounds per square foot (psf) (75Pa), or 0.3 cfm/ft<sup>2</sup> at 6.24 psf (300 Pa). Door assembly air leakage shall not exceed 0.3 cfm/ft<sup>2</sup> for all other products at 1.57 psf (75Pa).

Exceptions:

- a. Site-constructed windows and doors that are sealed in accordance with Section 502.4.8.

Curtain wall, storefront glazing and commercial-glazed swinging entrance doors and revolving doors shall be tested for air leakage at a pressure of at least 1.57 pounds per square foot (psf) (75 Pa) in accordance with ASTM E 283. For curtain walls and storefront glazing, the maximum air leakage rate shall be 0.06 cubic foot per minute per square foot (cfm/ft<sup>2</sup>) (1.1 m<sup>3</sup>/h × m<sup>2</sup>) of fenestration area. For commercial glazed swinging entrance doors and revolving doors, the maximum air leakage rate shall be 1.00 cfm/ft<sup>2</sup> (18.3 m<sup>3</sup>/h × m<sup>2</sup>) of door area when tested in accordance with ASTM E 283.

**Boiler Replacement - REVISION**

(Revised from 507 : Alternative Prescriptive Compliance Packages, 507.2.1 Efficient Mechanical Equipment)

Boilers shall meet the minimum efficiency requirements below:

|                     |              |           |               |
|---------------------|--------------|-----------|---------------|
| Source Color Legend | ASHRAE 189.1 | Combined* | 189.1 Based** |
|---------------------|--------------|-----------|---------------|

| Equipment Type | Fuel | Size Category                | Minimum Efficiency        |
|----------------|------|------------------------------|---------------------------|
| Hot Water      | Gas  | < 300,000 Btu /h             | 89% AFUE <sup>f</sup>     |
|                |      | 300,000 Btu /h - 2.5 mBtu /h | 89% Et <sup>f</sup>       |
|                |      | > 2,500,000 Btu /h           | 91% Ec <sup>f</sup>       |
|                | Oil  | < 300,000 Btu /h             | 89% AFUE <sup>f</sup>     |
|                |      | 300,000 Btu /h - 2.5 mBtu /h | 87% Et <sup>f</sup>       |
|                |      | > 2,500,000 Btu /h           | 87% Ec <sup>f</sup>       |
| Steam          | Gas  | < 300,000 Btu /h             | 75% AFUE                  |
|                |      | 300,000 Btu /h - 2.5 mBtu /h | 77% Et/79% Et*** & 80% Ec |
|                |      | > 2,500,000 Btu /h           | 77% Et/79% Et*** & 80% Ec |
|                | Oil  | < 300,000 Btu /h             | 80% AFUE                  |
|                |      | 300,000 Btu /h - 2.5 mBtu /h | 81% Et & 83% Ec           |

\* Combined rating – ASHRAE 189.1 modified by adding elements of IECC 2009 & ASHRAE 90.1-2007 to ensure efficiencies are as rigorous as current Massachusetts building code.  
 \*\* 189.1 Based ratings – ASHRAE 189.1 lowered until three commercial boilers are available.  
 \*\*\* Lower Et rating applies to gas-fired, natural draft boilers, higher Et to all other types.  
 f Systems shall be designed with lower operating return hot water temperatures (<130°F) and use hot water reset to take advantage of the higher efficiencies of condensing boilers.