

### **Storm Windows**

At their most basic, storm windows are secondary windows installed at the exterior face of existing window openings. Historically, these would involve these wood framed auxiliary windows would be installed and removed seasonally to help combat winter drafts. Hung from hooks above the existing window casing these windows could be propped open a few inches to allow for some ventilation during the fall and spring swing seasons or even had operable panels for this purpose. Interest in storm windows has peaked over the last 30-40 years as a result of the US energy crisis in the 1970s and as an alternative option for the wholesale replacement of wood sash by the replacement window industry. Storm windows also protect the exterior of the window and help delay the need for maintenance of the paint and window glazing.

Storm windows may not be appropriate interpretively for a historic house museum depending on the period of presentation and the historical record for that site. The following advice is primarily for owners of historic homes considering whether to add storm windows to their property.

### **The Case for Storm Windows**

While the replacement window industry makes many claims about the increased energy efficiency of replacement windows over original, wooden, multi-lite, double-hung sash, one of the key claims is related to double glazing. Double (or even triple) glazed replacement windows feature two panes of glass with an inert gas between the panes. The standard measure of window efficiency is U-value which is a measure of energy transmittance through the glass. Single glazed windows typically have a U value of approximately 1.0 while double glazed can have a U-value of approximately .5 ó thus, less energy transmittance across the glass in a double glazed window.

But, is it necessary to replace original or otherwise historic, multi-lite wooden sash to achieve that reduction in energy transmittance? With the addition of a storm window, the U-value of the combination existing sash and storm window can result in a similar decrease in energy transmittance. When the storm window is fitted with low-e (low emissivity) glass, the U-value can drop further.

In addition to the effect of double glazing, the storm window ó either interior or exterior ó will also help seal against air loss around the window. Historic New England air infiltration studies at the Lyman Estate demonstrated a 10% decrease in infiltration with window conservation plus the use of weather stripping on the existing six over six double hung sash; an additional 10% decrease with the addition of exterior storm windows or an additional 20% decrease with the addition of interior storm windows.

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### Storm Window Considerations

Buildings in historic districts or covered by preservation restrictions can often gain desired energy efficiency with the use of storm windows and several options are typically allowed in these cases. Conscientious or otherwise historically minded owners may prefer the retention of the original sash for aesthetic and sustainability reasons, but still desire some level of energy efficiency gains.

Assuming that the decision has been made to retain the existing sash, individual properties must weigh the various pros and cons associated with determining what type of storm window best addresses the goals of the intended project.

<b>Type</b>	<b>Pros</b>	<b>Cons</b>
Exterior	Provides double glazing which decreases energy loss	Can negatively affect the exterior aesthetic
	Provides a level of air sealing around the window which decreases air infiltration	Depending on type, can add to seasonal maintenance costs
	Protects the primary sash allowing longer intervals between maintenance cycles	
	Depending on type, allows for typical use of the primary sash	
Interior	Provides double glazing which decreases energy loss	Does not protect primary sash
	Provides a level of air sealing around the window which decreases air infiltration	Improperly sealed, can create damaging micro-climate on interior of primary sash (i.e., condensation)
	Invisible from exterior point of view	Restricts access to the use of the window
		May require infringement on historic fabric
		May have negative affect on interior aesthetic

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As with most products, storm windows are available along a cost continuum that reflects the available features. The price / feature / quality continuum between storm windows and replacement windows is roughly the same. That is, inexpensive vinyl replacement windows cost about the same as basic triple-track exterior storm windows while high end replacement windows will cost the same ó or more ó than custom, low profile exterior storm windows. Only storm windows allow for the retention of the original windows.

### **Storm Window Installation**

Exterior storm windows should be installed such that the top and sides are sealed to the window frame with an appropriate caulking product leaving at least two small weep holes at the level of the sill. While this seems counter to appropriate sealing, air leakage around the primary sash will result in warm interior air condensing on the cold glass of the exterior storm window. The weep holes will facilitate a small amount of air movement that will help evaporate the condensation.



The key to interior storm installation is a tight seal. Without the tight seal, warm interior air will get around the storm window and condense on the glass of the primary sash. While this behavior is expected with an exterior storm window, this condensation will quickly result in water damage on the muntins of the primary sash. If this behavior is observed, adjustments to the sealing of the storm window are required.

### **Energy Efficiency**



After installation of both interior and exterior storm windows at the Lyman Estate as part of a 2012 project, various blower door tests were performed in the rooms with these storm windows. Testing the performance of the just the windows after conservation and the installation of minor weather-stripping shows a reduction of air infiltration of approximately 10%. For exterior storm windows, measurements found that there was an additional decrease in air infiltration by 10%, or 20% total reduction, in each room tested. For interior storm windows, the decrease was closer to 20%, with an overall decrease closer to 30%. It should be noted that there was no performance difference between the wooden and aluminum storm windows used in that project.

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### Types of Storm Windows

\$	<p>Basic triple-track exterior aluminum storm window</p>	
<ul style="list-style-type: none"> <li>• Sliding glass and screen panes that allow the user to easily change from all glass to a screen option by sliding the components as necessary</li> <li>• Typically have a deep profile to allow for the three pieces to move up or down individually</li> <li>• Limited color options, although custom color matching options can be an upgrade</li> <li>• Can upgrade to include low-e glass for additional energy savings</li> <li>• Readily available at a local building center or local storm window manufacturer</li> </ul>		
\$\$	<p>Custom wood framed storm window</p>	
<ul style="list-style-type: none"> <li>• Typically no sliding glass / screen option for seasonal changes</li> <li>• Two basic options             <ol style="list-style-type: none"> <li>1. Overlay window hung from hooks that would be removed seasonally</li> <li>2. Inlay window that may fit within existing window casing (less noticeable)</li> </ol> </li> <li>• Can be easily color matched to existing trim and easily changed if colors change</li> <li>• Can upgrade to include low-e glass for additional energy savings</li> <li>• Can upgrade to a removable lower glass panel that can be replaced with a screen</li> <li>• Requires same level of maintenance as any exterior wooden component</li> <li>• Custom built to idiosyncrasies of each window opening</li> </ul>		

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\$\$\$	<p>Custom aluminum frame, low profile windows</p>	
<ul style="list-style-type: none"> <li>• Typically no sliding glass / screen option for seasonal changes</li> <li>• Inlay window that may fit within existing window casing (less noticeable)</li> <li>• Can be color matched to existing trim but not easily changed if colors change</li> <li>• Can upgrade to include low-e glass for additional energy savings</li> <li>• Can upgrade to a removable lower glass panel that can be replaced with a screen</li> <li>• Custom built to idiosyncrasies of each window opening</li> </ul>		
\$\$	<p>Interior Storm Window</p>	
<ul style="list-style-type: none"> <li>• Inlay window that fits within existing window casing</li> <li>• Vinyl extrusion with compression fitting for tight air seal</li> <li>• Limited color options</li> <li>• Low-e glass option</li> <li>• UV Plexiglas® option for large or odd shaped openings</li> <li>• Minimal infringement on historic fabric</li> </ul>		