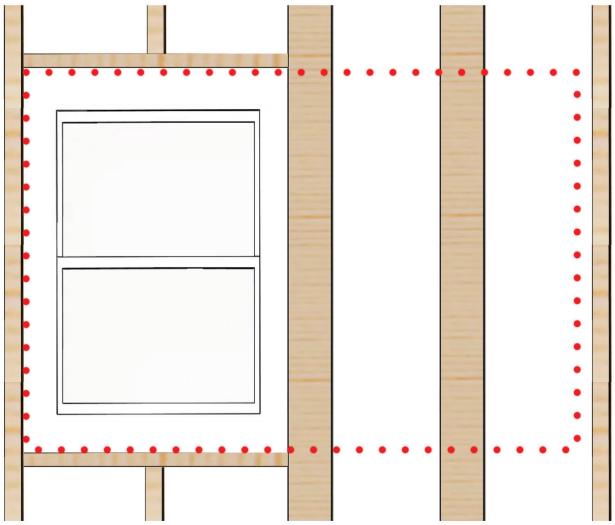
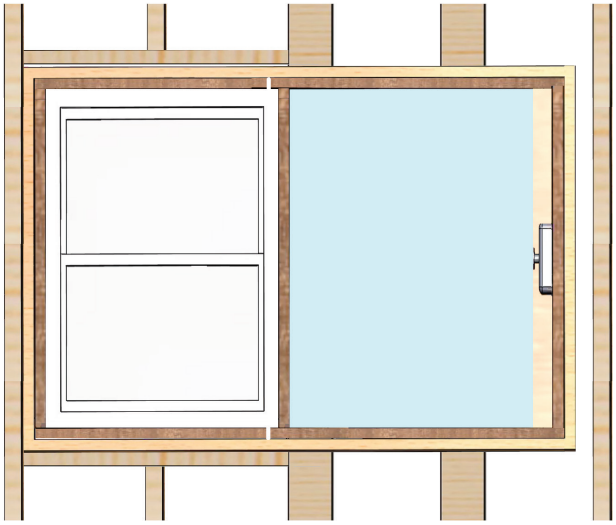
Proposed Window Thermal Cover Standard

By Glenn Weinreb, Director, The Manhattan 2 Project, Oct 27, 2021

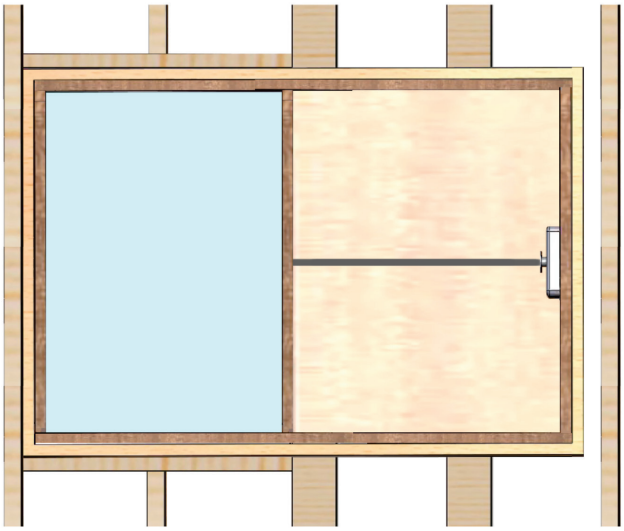
This document suggests a mechanical standard that defines how replaceable plug-in thermal covers could reduce energy loss at windows, as illustrated below. This is free and open, which means no one owns this design. For details, see Standards are needed to Thermally Cover Windows.



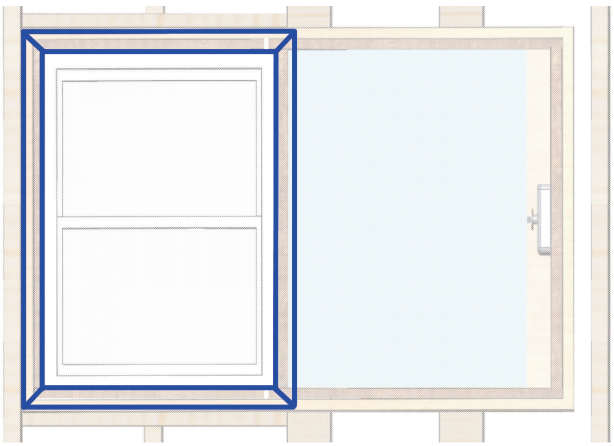
Shown above is wood framing (e.g. 2x6) and window without thermal cover. Framing bears load and is not effected by thermal cover, with the possible exception of rotating several breams by 90 degrees. Window must transfer load from hurricane force winds to framing. Alternatively, thermal cover assembly bears no load, and therefore does not increase framing costs.



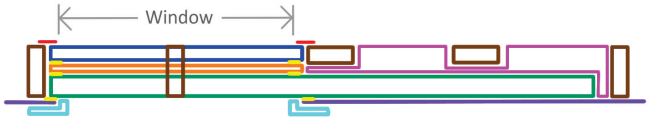
Motor and worm-drive moves thermal cover (blue) into stow position behind drywall and out of view. Thermal cover assembly is pressed against drywall while insulation resides between thermal cover and exterior plywood sheathing. Moveable cover is light and therefore involves little force, ensuring safety. Internally, it contains Styrofoam like insulation several inches thick.



Thermal cover (blue) seals airflow at perimeter via gaskets after being moved in front of window via mechanism. Shown here is worm drive, yet one could use alternative systems such as pulley/cable or linear gear.

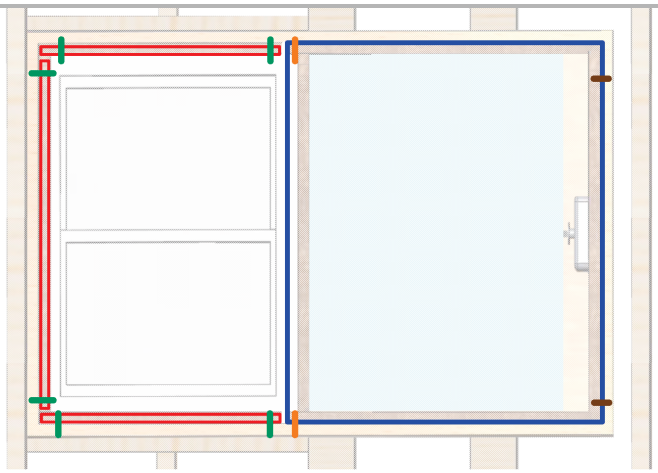


Molding (blue) is viewed by occupant and surrounds window opening in a traditional manner. Occupant sees drywall outside this molding.

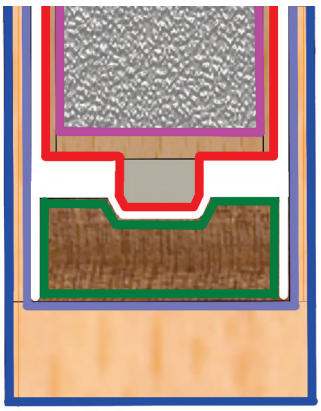


This top view shows window (blue) bonding to framing (brown) via metal plate (red). Thermal cover assembly (green) is pressed against drywall (purple) while insulation (violet) resides between assembly and external sheathing. Carpenter seals assembly via caulk (yellow) to stop airflow from inside wall. Carpenter also installs filler window casing (orange) between assembly and window, where casing thickness is determined by final wall thickness. Final wall thickness is determined by building requirements (e.g. amount of insulation).

Thermal cover assembly outer frame (red) permanently attaches to wall framing (e.g. 2x6) along two surfaces (blue) via fasteners (e.g. screws) and/or glue bond. Everything inside assembly is the "thermal cover product" and is responsibility of thermal cover manufacturer; whereas everything outside is the responsibility of architect and carpenter. Wall framing is accurate to ~1cm whereas windows and window covers are significantly more precise due to internal seals.

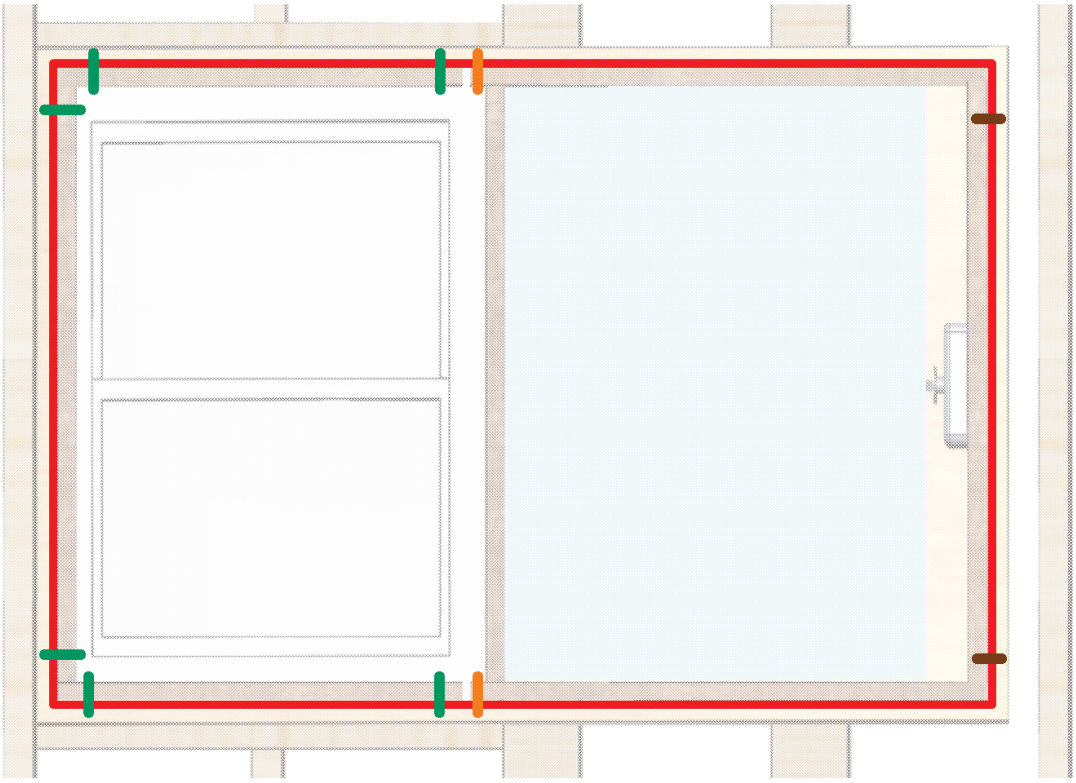


Replaceable plug-in module (blue) slides out after internal rails (red) are removed via bolts (green). Module (blue) is secured by bolts (orange) and pins (brown). Module contains components that will not last building lifetime. This includes moveable thermal cover, motor, worm-drive, electronics and gaskets. Standardization of module sizes ensures compatibility between different manufacturers; which increases access to replacement modules over building lifetime.



This is right side view of lower rail. Styrofoam-like insulation (violet) resides inside moveable cover (red). Thermal cover assembly (blue) and box inside assembly (purple) permanently attach to building. Plug-in module (green) houses cover and supports replacement. Carpenter seals permanent assembly (blue) to wall via caulk; and therefore prohibits airflow from inside wall to room.

This supports standardization by specifying several parameters for each of several sizes: assembly frame thickness, assembly frame internal height/width (red), placement of bolts that secure internal removable rails (green), placement of bolts that secure plug-in module



(orange), and placement of pins that secure module to right side (brown).

This means any product that meets these requirements will plug-and-play into an existing frame. Replacement gear consist of one plug-in module and three removable rails. Subsequently, manufacturers control: entire contents of module, gaskets, mechanics, motor, electronics, and different thermal designs.

Manufacturers might offer different levels of quality at different prices.

Over time, thermal properties might improve due to innovation. For example, one might utilize vacuum insulation to provide high thermal insulation at low thickness. Theoretically, internal electronics could power a small pump.

For more details, see:

- Standards are needed to Thermally Cover Windows, Power Electronics, Nov 2021
- Using processors and software to make buildings smarter, EDN, Mar 2021
- Manhattan 2 Window Thermal Cover R&D Initiative