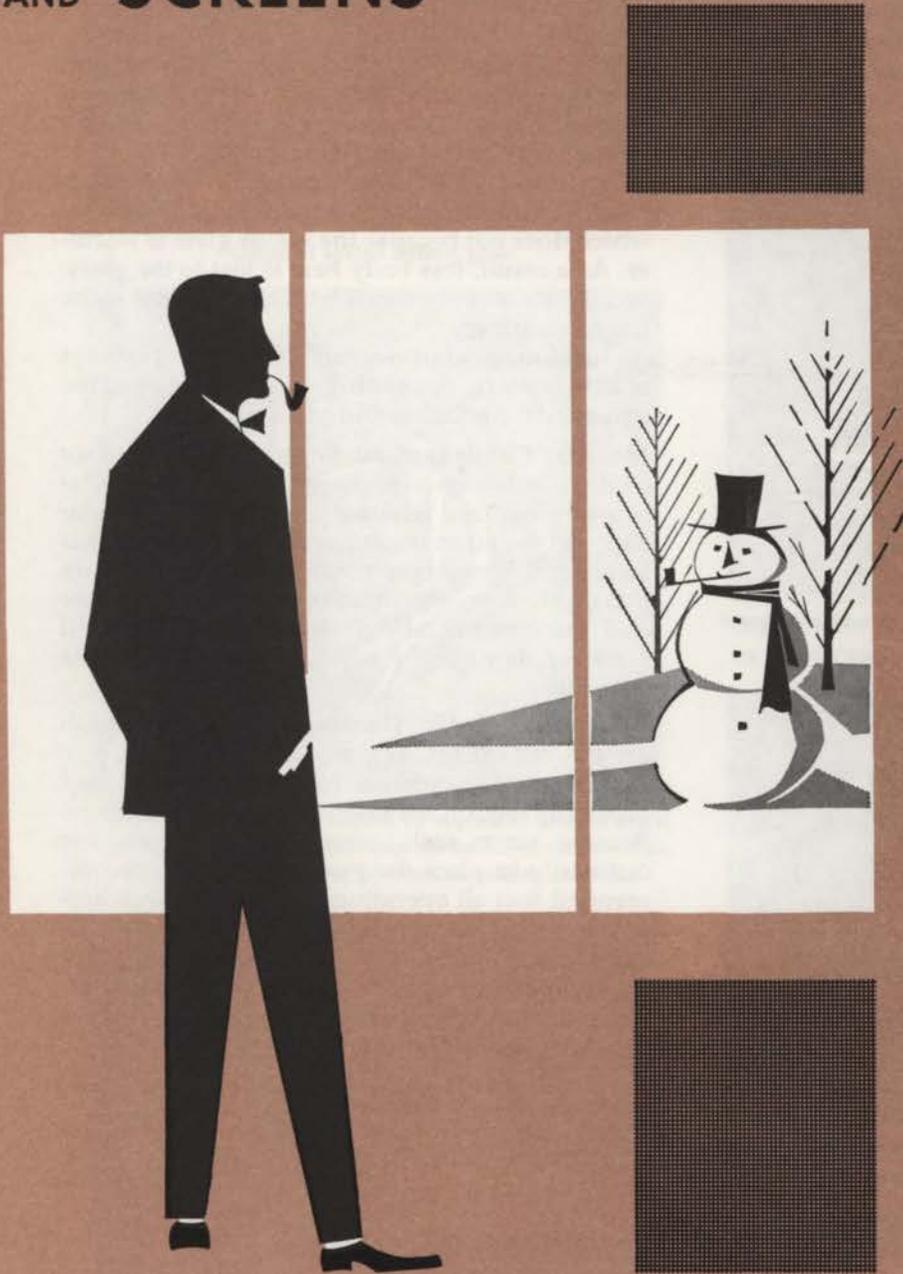


INSULATING-WINDOWS AND SCREENS



ISSUED BY THE
SMALL HOMES COUNCIL – BUILDING RESEARCH COUNCIL

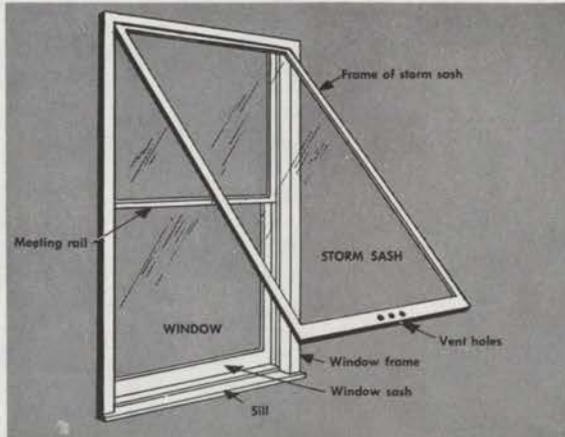
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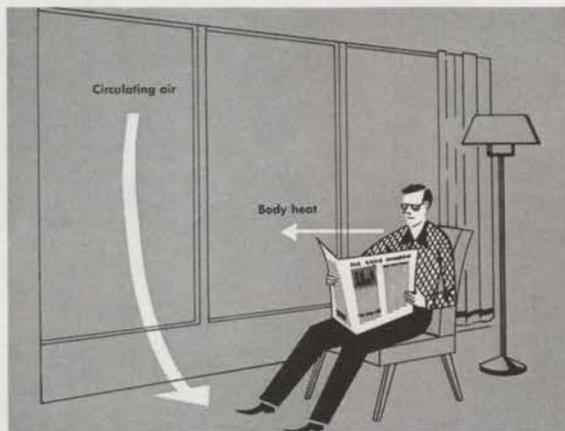
MATERIAL IN ORIGINAL CIRCULAR BY W. H. KAPPLE, AIA

INSULATING-WINDOWS

Insulating-windows reduce heat loss from the house in winter and also reduce heat gain from the outdoors in summer. Such windows consist of multiple layers of glass separated by air spaces. (Three layers may now be justified on the basis of fuel cost and energy conservation, especially for north windows.) Heat flows easily through the glass but is retarded by the air space which acts as insulation.



The several parts of a window and a storm sash are shown.



If the inside glass of a window is warm, comfort is increased.

An air space can be achieved by the installation of a second sash (storm sash) or by sealing the edges of panes of glass together at the factory. Triple glazing may be either a factory-sealed triple unit or a double-glass sealed unit plus storm window. The type of insulating-window to be used should be determined when windows for the house are selected.*

Heat Loss: From the standpoints of comfort and heating costs, insulating-windows are recommended for areas where the average January temperature is 45°F. or colder.

A house which has insulating-windows is more comfortable for the occupants than one which does not because the inside glass is warmer. As a result, less body heat is lost to the glass, and the air moving down from the window to the floor is warmer.

Insulating-windows can result in fuel savings of 20% or more, depending on the climate and the amount of insulation and glass used.†

Moisture Condensation: Since the inside surface of an insulating-window is warmer than that of a single-glazed window, the tendency of water vapor in the air to condense on the inside glass is lessened. If moisture condensation appears on this glass, there is too much moisture in the house and the amount should be reduced to avoid possible damage by condensation within the structure.

Infiltration of Air, Dust and Soot: Storm sash are the only insulating-windows which help to reduce the infiltration of cold air, dust, and soot occurring around the sash of operating windows. Because storm sash, even when used, are not ordinarily in place the year around, it is recommended that all operating windows be weatherstripped (that is, the space around the sash be closed with strips of rubber, spring metal, or other material). When windows are weatherstripped, heat loss is about the same for all types of double-glazed windows.

* See Small Homes Council-Building Research Council circulars F11.1, "Selecting Windows" and F6.2, "Moisture Condensation."

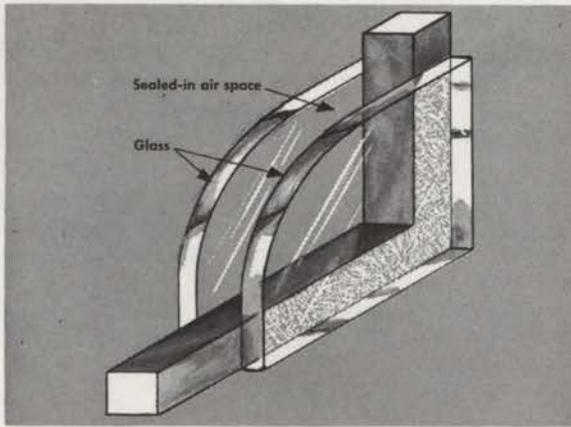
† Based on research studies at University of Illinois Engineering Experiment Station.

INSULATING-WINDOWS SAVE FUEL

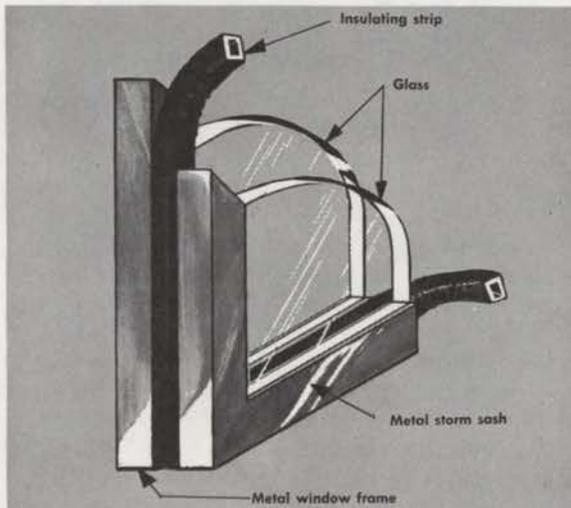
Below are the fuel savings possible during a heating season for a house in Springfield, Illinois, under various conditions of winter protection for its 20 average-sized double-hung windows (3'-4'

by 4'-6"). Fuel necessary to offset the heat lost through these single-glazed windows without weatherstripping is estimated at 700 gallons of oil, 860 therms of gas, or 20,000 kwh of electricity.

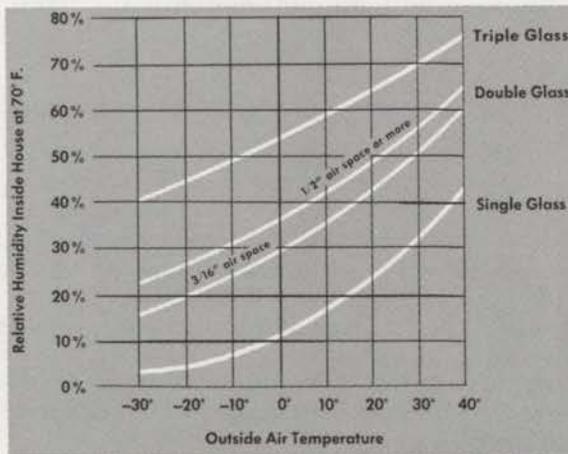
	SAVINGS —	OIL	GAS	ELECTRICITY
Single glass, weatherstripped		110 gal.	135 therms	3,200 kwh
Sealed double-glass, no weatherstripping, or storm panels, no weatherstripping		220 gal.	270 therms	6,300 kwh
Sealed double-glass, weatherstripped, or storm sash, with or without weatherstripping, or storm panel, weatherstripped		340 gal.	415 therms	9,700 kwh
Triple glass, weatherstripped		410 gal.	500 therms	11,700 Kwh



Detail of sealed double glass



A metal window frame should be separated from a metal storm sash or storm panel to lessen condensation on the metal. Use strips of wood, rubber, or other insulating material.



MOISTURE CONDENSATION ON GLASS

The probability of moisture condensing on windows depends on the temperature of the glass and the amount of water vapor in the air within the house. The chart shows the point at which condensation occurs on the room-side surface of single-, double-, and triple-glass windows for various percentages of indoor humidity and various outdoor temperatures. The humidity must be kept below this point to avoid condensation.

SEALED GLASS

Moisture and dust cannot get into the air space between panes of glass when the edges of the glass are properly sealed at the factory. During the sealing process, the air is dried so that there is no moisture to condense on the inside surfaces of the glass. Some manufacturers guarantee the seal for 20 or more years.

Sealed glass can be installed in an operating sash or can be set in a frame to form a fixed window. Most operating windows can be purchased with double glass, and some with triple glass.

Sealed units offer the following advantages:

- **Convenience and easy maintenance:** Windows of sealed glass are a permanent installation; they do not have to be put up and taken down with changing seasons as do storm sash. Because the sheets of glass are sealed, only two surfaces need to be washed.
- **Ventilation:** When sealed glass is used in an operating sash, there is no interference with ventilation.

STORM SASH

A storm sash (storm window) is a removable extra sash which is fastened to the frame of a window. In most cases, it has a wood frame.

Since a storm sash is attached to the window frame and not to the operating sash, it must be removed and replaced with a screen for summer cooling. Therefore, a storm sash is not desirable for year-round use on a house without mechanical cooling.

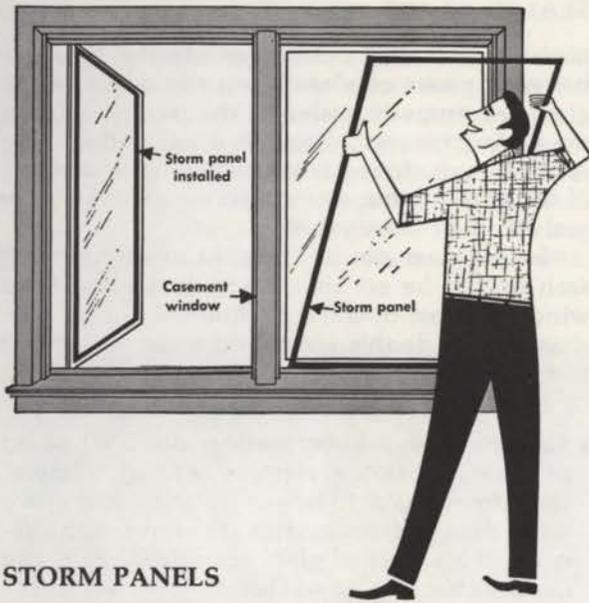
Storm sash for sliding windows can be applied on either the inside or the outside of the house. Outswinging windows, such as casement or awning, usually need inside storm sash. Storm sash are most commonly used with double-hung and awning windows.*

The initial cost of storm sash is low, but if service people must be hired to wash, install, and remove them, maintenance costs over a period of years may result in their being more expensive than sealed glazing. The combination storm-screen has been developed as a compromise.

Moisture Condensation: To reduce the likelihood of moisture condensation between the glass, the inside sash must fit more tightly than the outside sash. Storm sash installed on the inside should be weatherstripped.

Storm sash installed on the outside should fit rather loosely and the inner window sash should be weatherstripped. If storm sash fit tightly, drill three 1/4-inch vent holes in their frame so that the outside air can circulate between the glass and, thus, reduce the possibility of condensation between the inside and outside sash.

* See SHC-BRC circular F11.1, "Selecting Windows."



STORM PANELS

An easier-to-handle version of the storm sash is the storm panel – a pane of glass set in a narrow frame which can be clipped to either the outside or the inside of a window sash. Panels can be used only on sash which have special hardware or a groove into which the panels can be fitted. Panels are not commonly available for double-hung windows.

Unlike storm sash, storm panels move with the operating sash and, thus, do not interfere with operation of the window or with ventilation.

Panels can be applied on the inside or outside of the window sash. Inside panels are more convenient, but installation on the outside reduces the possibility of moisture condensation. Inside storm panels should have a good seal around the edge – *i.e.*, rubber strips if metal panels are used with metal windows; rubber or spring metal weatherstrip if panels or windows are of wood.

SCREENS

Only the opening portion of the window should be screened. To screen the rest of the window, or a window that is fixed, is an unnecessary expense and is undesirable since screens shut out daylight and interfere with the view. To maximize the heat gain from the sun on south windows during the heating season, it is essential to be able to easily remove the screens. Full screens on a double-hung window block out approximately 50% of the available daylight; painted screens further reduce the amount of daylight admitted.*

To keep out insects, 16 mesh screen (minimum of 256 openings per square inch) is recommended. A metal louver-type screening which reduces the sun load during the cooling season is suggested for east and west windows having no other type of sunshade; however, such screening does interfere with vision.

* Based on research findings of the University of Michigan Engineering Research Institute, Ann Arbor, Michigan.

Mesh of exterior screens should be of non-corrosive materials. Aluminum is the most popular material, but bronze or fiberglass is available.

Screens for sliding windows can be installed on the inside or on the outside. Outswinging windows must have inside screens. Outswinging windows which do not have an operating crank or bar require screens with sliding access panels or hinged screens. These must be opened each time the window is opened or closed.

Most screens are rigid in construction, with a wood or metal frame similar to that of storm sash. A flexible screen which is stored at the top of the window and operates similar to a roll-up shade is available.

COMBINATION STORM-SCREEN

A double- or triple-track combination screen and storm sash is the most popular insulating unit for double-hung windows. These units usually have one screen panel and two glass panels which can be moved up and down in tracks on the window frame. A double-track unit has a storm panel and a screen in one track; in the second track there is a second glass panel which can be raised to permit ventilation through the screen or lowered for insulating purposes. While all three units can be removed from the inside for washing, the screen cannot be taken out during the winter, resulting in reduced solar gain on windows exposed to the sun. In the triple-track system, each panel rides in its own track, and the screen can be removed independently.

The frames of combination storm-screens are usually aluminum, either anodized or factory painted. They are low in maintenance, and their major advantage is that the storm windows and screens can be inserted or removed from inside the house, eliminating the need for ladders and/or service people to change them.

TEMPORARY STORM WINDOWS

While the various types of storm sash or panels previously described are the most satisfactory, temporary protection can be provided at considerably less cost using various plastics materials. The plastics may be attached with staples or nails, preferably using batten strips, to the outside or inside of the window. If installed on the inside, tape rather than fasteners can be used to avoid marring the trim. If the window has screens but no storm window, the plastics can be attached to the screen frame.

The least expensive of the plastics materials is polyethylene, which is frosted but translucent. It is damaged by sunlight and is good for only one year. Vinyl is clear but has some distortion, and may last three to five years. The flexible polyester glazing material used for home greenhouses is the best, but most expensive. These materials are available in various thicknesses. Generally, the thicker materials have a longer life.