2.4.5 Window Films and Interior Window Treatments

Metallized, plastic window films like those used to tint automotive windows can save substantial amounts of cooling energy when applied to existing glass. Shiny metal flakes or metal vapors deposited on a plastic film reflect the solar radiation back outdoors. Metallized films reflect 50 to 75 percent of the solar heat hitting a window

Reflective window films installed on the interior side of the glass repel solar heat and reduce glare and fading through single-pane glass in south-, east-, and west-facing windows.

Special all-season metallized films, sometimes called Low-E films, also reflect heat energy from inside the home back outside. These films are more cost-effective than films that merely reflect solar heat, in all but the hottest, sunniest climates. Low-E films transmit more visible light and look clearer than reflective films from indoors.

Window films (both all-season and reflective) come in different types for different climates. In sunny southern climates, use a film that stops most of the solar heat and glare. In more northern climates, use a film that lets more light and heat into the home. ***Caution:*** *Do not use reflective metallized window films on the inside of double-paned glass because it may lead to glass breakage.*

Installing window films is a moderately difficult do-it-yourself project. The films designed for do-it-yourselfers have a protective layer to remove and may be

Percent of Solar Heat Blocked by Various Window Shading Devices

Treatments for Single-Pane Glass (Includes a single pane of clear glass)

Sun Screen (indoors)	20-30%
Colored Venetian Blind	25-40%
Draperies (light colored)	40-55%
Opaque Rolling Shade (dark)	45-50%
White Venetian Blind	45-50%
Window Films	40-75%
Light-Transmitting Rolling Shade	60-70%
Sun Screen (outdoors)	65-75%
Opaque Rolling Shade (white)	75-80%
Aluminum Louvered Sun Screen	80-85%
Awnings	50-90%

Table 2-E Solar Heat Blocked *- The table above shows the approximate percentage of solar heat blocked by different types of glass and shading devices. There is no universally accepted test for measuring the percentage of window shading.*

installed for $1 or less per square foot. Insist on a warranty for materials. Expect to pay $2 to $5 per square foot for professional, guaranteed installation.

Modern window films have a scratch resistant coating and can be cleaned with soapy water and a soft cloth. Lower-quality window films may become cloudy or deteriorate due to intense sunlight, harsh cleaning fluids, or abrasion from rough towels.

Window films are probably the best shading method for sliding glass doors in unshaded areas. Window films also work well on outwardly opening windows which are unsuitable for exterior sun screens. However, removable sun screens are better than window films if you want solar heating during the winter.

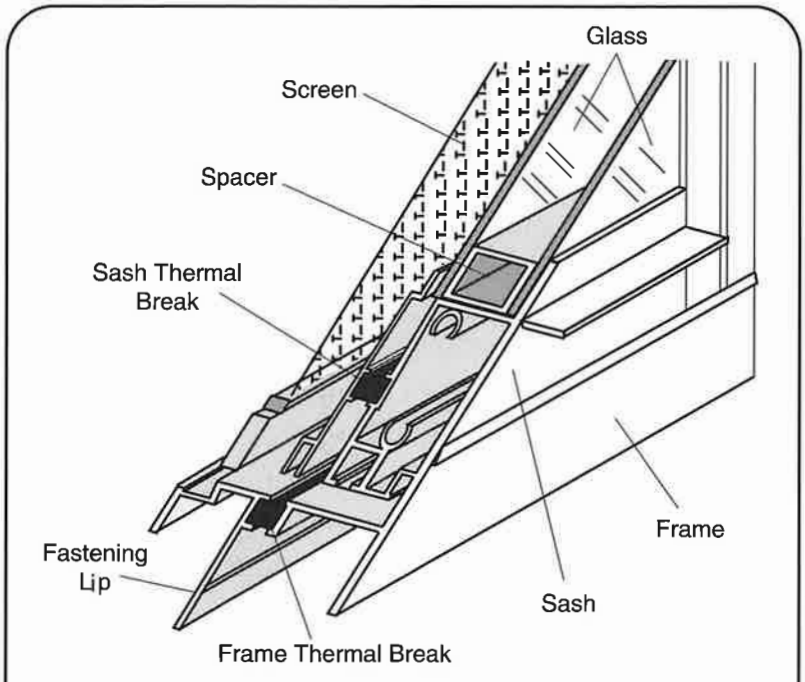
Interior shades, blinds, and draperies are effective at shading if they have a reflective white surface facing the outdoors. The white surface reflects direct sunlight and heat radiating from the warm glass.

Opaque rolling shades with a white outer surface block up to 80 percent of the solar heat which strikes the window. White venetian blinds and draperies with white linings also reflect heat well (*see Table* ***2-E***). The disadvantage of shades and draperies is that they must be closed to be effective. Blinds block 30 to 50 percent of the solar heat when partially open.

2.4.6 Windows

If you plan to replace the windows in your home there are a variety of options for specialty glass designed to reduce cooling costs. In very hot, sunny climates where heating costs are not significant, single-pane glass with a reflective coating may be a good option. Reflective glass looks like a mirror from the outside and will color the outdoors gray or bronze when looking from the inside. This tinted, reflective glass blocks much of the visible light from the sun in addition to the heat rays. Some people object to the tint and low levels of visible light transmitted by reflective glass.

Newer types of coated, reflective glass transmit most of the visible light while blocking most of the heat rays. These so-called "Low-E" or selective coatings for new windows are installed on one or another of the interior glass surfaces of a



2-11 Double-Pane Window *- High-performance glass with special coatings to reflect heat is packaged in modern double-pane windows.*

double-pane window—depending on whether heating or cooling is the primary energy concern (*see figure* **2-11**). The standard Low-E glass double-pane, designed primarily to reduce heat loss in the heating season, also significantly reduces heat gain during the cooling season. Low-E double-pane glass performs very well at saving heating and cooling energy in most areas of the country. And, some of these new coatings are specially designed for southern climates. These hot-climate Low-E coatings are designed to block more solar radiation than the standard Low-E windows while transmitting more visible light than tinted, reflective glass (*see Table* **2-F**). They also help reduce heat loss through the windows during the heating season.

Solar and Visible Transmittance for New Window Glass

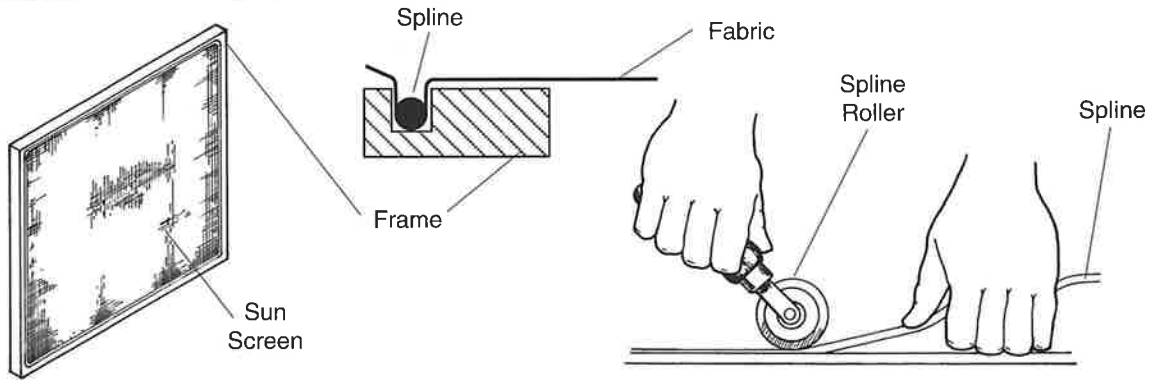
Glass Type	Solar Transmittance	Visible Transmittance
Single-Pane	85-90%	90%
Single-Pane Reflective	25-30%	30%
Double-Pane	70-80%	80%
Double-Pane Low-E (standard)	55-65%	75%
Double-Pane Low-E (hot climate)	45-50%	50%

***Table 2-F** shows the approximate solar and visible transmittances of two types of single-pane glass and three types of double-pane glass.*

Low-E windows have R-values that range from 2.5 to 3.5 depending on the coating and whether air or argon (which insulates better than air) fills the space between the panes. In contrast, single-pane glass is about R-1 and double-pane glass is about R-2. The R-value is more important in the heating season than the cooling season, but windows with higher R-values save significant cooling energy, too. Most new windows have low air leakage rates—so, the leakage rate is not a very important characteristic for comparison shopping.

Replacing your windows is an expensive way of reducing your cooling costs compared to the other window options discussed in this guide. However, new windows can give you a variety of other benefits: reducing solar gain to a minimum, transmitting visible light, preserving the view, and enhancing the value and appearance of your home. If you plan to replace your windows, then the newer glass products for windows are very cost-effective compared to standard glass. In choosing glass for your new windows, look at the following performance factors:

- Total Solar Transmittance - The percentage of total solar radiation tranmitted by a window.
- Visible Transmittance - The percentage of visible light transmitted by a window.
- R-Value - The resistance of a window to the conduction of heat through the window.
- Shading Coefficient - A decimal number like .55 which compares the



2-12 Sun Screens *- Sun screen fabric is stretched onto a metal frame and held in place by a plastic spline inserted in a track.*

transmittance of a window assembly with clear glass which has a shading coefficient of 1.00. A window with a shading coefficient of .55 would transmit 55% of the solar energy of single-pane glass.

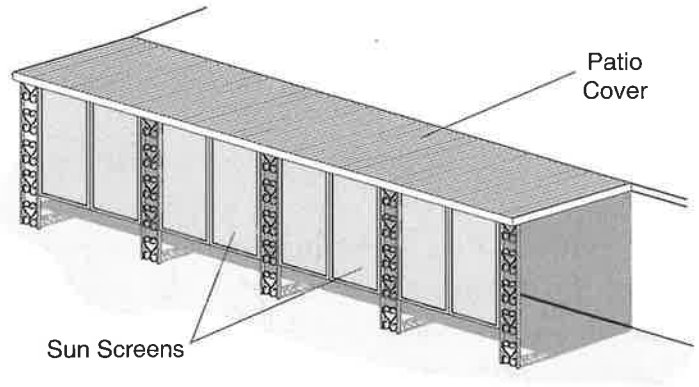
2.4.7 Sun Screens

Sun screens are constructed like insect screens. The sun screening is stretched onto an aluminum frame and held in place by a plastic spline pushed into a track (*see figure* ***2-12***). **Sun screens are often the least expensive window shading option which still allows a view.** You can remove them during the winter to let solar heat in.

Sun screens, like window films, are a good substitute for awnings when headroom or price prevents the use of awnings. They don't work on outward-opening jalousie and casement windows because exterior sun screens would prevent the window from opening. Putting the screen inside allows solar heat to penetrate the home (*see Table* ***2-E***). Sun screen walls installed outdoors shade patios from the sun in hot climates (*see figure* ***2-13***).

The fabric used on sun screens is designed to absorb and/or reflect 65 to 70 percent of the solar heat before it enters the home. Sun screen fabric is available in a variety of colors.

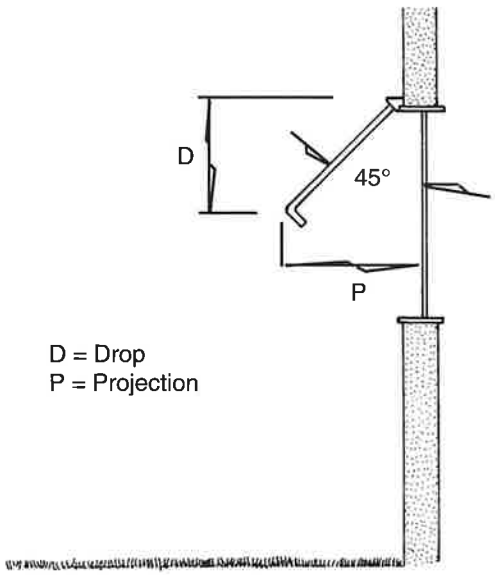
A different type of sun screen, made of aluminum with tiny louvers, blocks out about 85 percent of the solar heat. Expect to pay



2-13 Shaded Patio *- An aluminum patio cover and a wall of large sun screens shade west windows and the patio area.*

from $2 to $4 per square foot for professionally-installed sun screens. The aluminum-louvered sun screens are $5 to $6 per square foot.

Sun screens are not easy do-it-yourself projects. Kits are available but your final product probably won't last as long as a professionally-built sun screen.



2-14 Awning Parameters *- The drop of the awning determines how much shade it gives. East and west windows need more drop than south windows to provide the same amount of shade. 45° is a pleasing angle to the eye for mounting an awning. Make sure the awning doesn't project into the path of foot traffic unless its lowest point is at least 6 feet 8 inches from the ground.*

2.4.8 Awnings

Awnings are usually more expensive than window films and sun screens. However, they are very effective at shading because they intercept the solar heat before it gets to the window. Awnings are popular in hot, sunny climates. Custom-made canvas and aluminum awnings can be fairly expensive and are not as cost-effective as shade trees, window films, and sun screens. However, some awning companies sell do-it-yourself awnings that are only slightly more expensive than sun screens and window films (*see figure* **2-15**).

The three most important considerations in selecting and designing awnings are: the amount of shade desired, the importance of maintaining the view out of the window, and the appearance of the awning.

The amount of shade that an awning will produce is most closely related to the distance that the awning drops down over the window. This distance is referred to as the "drop" of the awning (*see figure* **2-14**). Awnings on the south side block solar radiation coming from higher in the sky. They need a drop measuring 45 to 60 percent of the window height. Awnings on the east and west should have a drop of 60 to 75 percent to block solar radiation coming from lower in the sky.

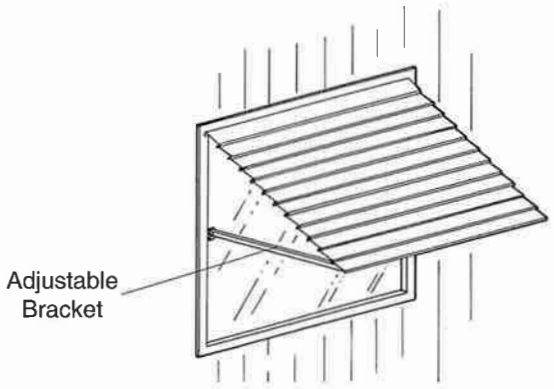
Awnings with sides in addition to a top provide the most effective shade on south facing windows. Do-it-yourself awnings usually do not have sides but this can be partially compensated for by making the awning wider than the window. The greater the drop of the awning the more the view is reduced, so you may have to compromise between shade and view.

Awnings with slats rather than a solid surface (*see figure* **2-16**) will allow some limited viewing through the top of the window. A patio cover can shade large windows that are grouped together in one area of a home (*see figure* **2-13**).

Canvas and other fabric awnings are more attractive than metal awnings. But they

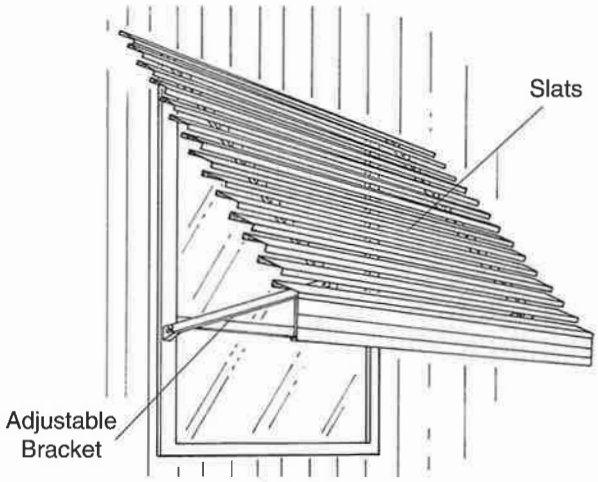
are also more expensive and slightly less effective because they absorb more solar heat. Fabric awnings are more difficult to maintain and have a shorter life span than metal awnings.

Consider these factors when locating awnings: the direction your windows face, how much wall space your windows cover, the amount of roof overhang, and the location of natural shade. North-facing windows and windows with good natural shade don't need artificial shading.



2-15 Aluminum Awnings *- Awnings like this are sold as do-it-yourself kits. They include adjustable mounting brackets and fasteners.*

It can be difficult to strike a perfect balance among the important factors of shade, view, appearance, and cost in selecting an awning. Awnings for tall narrow windows may need to be considerably wider than the window for a more balanced appearance. Awnings installed at a 45-degree angle seem most attractive (*see figure* ***2-14***). If a maximum amount of view is important, use sun screens and window films instead of awnings.



2-16 Slatted Awning *- The slatted construction of this do-it-yourself awning allows limited viewing through the top of the window between the slats.*

Local building codes may have restrictions on materials, construction, or installation of awnings, particularly in areas where hurricanes or earthquakes are possible. Maintain headroom above driveways and sidewalks for safety. Check with your local building department before purchasing or installing awnings.