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Insiders Guide to Replacement Windows

A buyers guide for consumers who are interested in replacing their old windows. Answers to common questions and tips for finding the best replacement window for your particular application.



Available exclusively through www.replacement-window-center.com

Window Replacement Buyer's Guide

Window Design

Four principal units make up the assembly of windows: the glass assembly, the sash, the frame and the structural opening into which the frame fits. Each of these units presents an individual opportunity for energy conservation. The benefits of insulated glass above single pane are very well known in today's market.

Glass Assembly

Spacers- non-aluminum

An insulated glass assembly involves two or more glass panes, suspended at a small distance from one another by a spacer, traditionally made of aluminum. However, it has been recently discovered that much of the insulating benefit of the space trapped between the two panes is lost through the conductivity of aluminum; hence alternative materials and designs are now on the market. Preferable spacer materials include dense foam plastic, plated, thin-walled and thermally broken steels, vinyl, fiberglass and wood.

Pocket- argon-fill over air

The insulating capability of the air pocket itself has also been improved with the introduction of lower-conductivity gas, subjugating air. Though the exotic gases krypton and xenon edge out the competition in performance, argon, an abundant gas both in the atmosphere and on the market, yields a roughly 33% improvement over air at only a slight incremental cost. Increasing the thickness of the air pocket has also been well considered, as theoretically a greater volume of gas allows for more heat absorption. However, the space can become so large that convection currents form, which suck heat in from the room and transfer it to the colder outside, defeating the very purpose of the pocket. The margin of 1/2" to 1" has been established as the ideal width for air and argon-filled insulated glass.

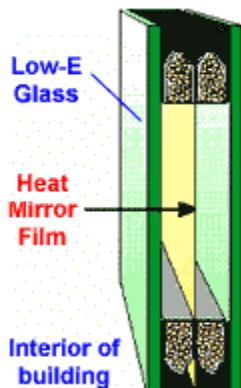
Low-e coatings

The greatest energy savings are made, however, through a coating applied either directly to the glass panes or a thin polyester film hung within the air pocket (Heat Mirror®). The low-emission (low-e) coating restricts energy, according to its wavelength, from passing through the glass. Unlike a reflective surface or tint, transparent low-e coatings block out radiation without dramatic distortions to incoming visible light. The exact low-e coating and the pane face(s) chosen for application depend upon the needs of the circumstance. Referring to the diagram on the right, if the coating is placed on surface #3 then the heat generated inside the room collects in the window glass until hitting the coating when it is then reflected back into the room. If the coating is placed on surface #2 however, the same process keeps outdoor heat from entering into the building. The reason for why the coating would be applied to the inner faces of glass rather than the outer has to do with the fragility of the coating. Though hard-coat low-e coatings exist that are rugged enough for single-glazed and storm window use, they transmit more solar energy, the foe for a commercial building already warmed by machines and heavy lighting.

Performance Measurement

Scale of 1 – 10

Double Vitrage	(2)
Low – E	(3)
Low – E Argon	(4)
Heat Mirror	(4.5)
Heat Mirror +	(7)
Super Glass	(10)



Heat Mirror Plus Application

Diagram from: <http://www.southwall.com/products.html>

Sash, Frame and Unit Installation

Aesthetics over Energy Conservation

The sash is that portion of the window in which the glass panes are fitted. Sliding and hinged sashes allow the window to be opened for ventilation and while fixed, they provide better insulation. All three-sash designs have a very different look. The casement or awning windows (vertically and horizontally hinged) provide better ventilation and seal more tightly than double-hung (sliding sash).

Frame as a Function of Sash

The sash fits inside of the frame, which is that portion of the window, attached to the building. Obviously, for continuity of design and look, the material chosen for the frame would correspond with that of the sash.

Moving Away From Conductive Materials

Aluminum and Steel

Considerable attention should be given to the aspect of selecting a sash and frame. The number one consideration is always the choice of material. The once popular non-thermally broken aluminum and steel frames have been identified as conduits for indoor heat to the outside. Though thermally broken alternatives, which typically use epoxy or vinyl to break up the aluminum continuum, are on the market, the insulation supplied by these windows is still substandard.

Conductivities	
Material	Conductivity BTUs/hrs/sf
Aluminum	117
Steel	26
Glass	0.65
PVC	
Wood	0.13
Fiberglass	
Air	0.015

Wood and Plastic Claddings

Though an appealing sash and frame material because it is both natural and a fine insulator, pure wood is unfortunately maintenance-intensive, even when factory finished. Manufacturers have tried coating the frame with vinyl cladding in an attempt to offset

some of the upkeep requirements. GE Plastic's new CYCOLACÒ, an acrylonitrile butadiene styrene (ABS), has shown better results for this purpose and is available in a greater line of colors, including dark ones not achievable with vinyl.

Vinyl (PVC)

Pure vinyl frames require no maintenance and are the most popular form of replacement windows. However, once you choose the color it cannot be changed at a later date.

PVC-Wood Composite

Anderson's Minnesota Twin Cities' plant creates this product where scrap PVC from other production lines in the plant is combined with wood to form a material called FibrexÒ . Used in their RenewalÒ Line, the sash and frame material is as strong as wood, but virtually maintenance free like PVC.

Fiberglass

Rounding out the competition, new and improved fiberglass has been making a comeback in the industry, especially since the inception of fiberglass/wood hybrid frames. Virtually maintenance free, less likely to expand and contract with temperature than aluminum and vinyl, and quite durable, fiberglass has seen a rapid growth in popularity and production since its tepid introduction, some years back.

Insulating Hollow Frames

One more bonus to vinyl and fiberglass hollow frames, over others such as wood, is that they may be filled with polyurethane foam for even greater insulating capability.

Certified Wood

However, especially in renovation projects, wood is often the only acceptable material to the architects for aesthetic continuity. Nonetheless, there are still considerations to be made within the material choice to ensure both maximum durability as well as minimum environmental impact. Obviously only the top quality, knot free; hard wood is ideal for sashes and frames, which unfortunately is increasingly scarce and expensive.

Engineered Woods

Since treatment renders the wood unfit for both recycling and reuse, longevity is of key importance from an environmental standpoint as well as economical. Engineered woods, which include laminated-veneer and laminated-strand lumber, have greater resistance to

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weather than externally treated woods and should be incorporated in all unseen joints as some manufacturers are willing to do.

ALUMINUM CLAD WOOD WINDOW

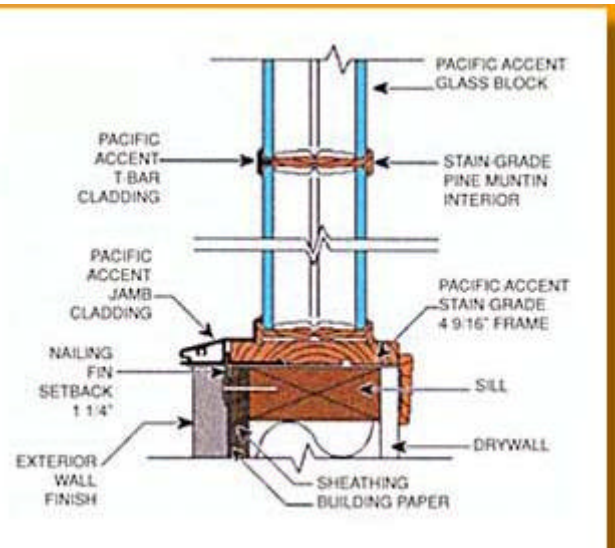
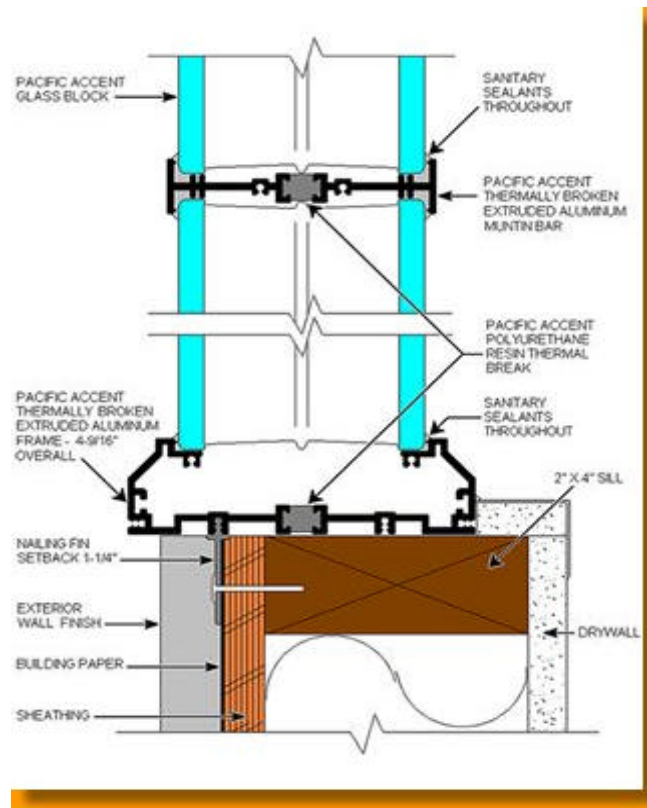


Diagram from: <http://www.pacificaccent.com/pa2000/detaildrawings.html>



Thermally Broken Aluminum

Diagram from: <http://www.pacificaccent.com/pa2000/detaildrawings.html>

Air Tightness

Air leakage around a window is typically negligible when stacked up against drafts coming through the floor, ceiling and wall cavities. New residential windows usually allow 0.1 to 0.5 cubic feet of air per minute to pass through, under test conditions, which is a minute amount. In fact, in a well-insulated building, a tiny air stream leaking through a window is seen as beneficial in maintaining good air quality. Of course this is assuming the window unit is properly installed into the building, with effective weatherstripping and high performance insulation in and around frame.

Glass Pane Dimensions

Windowpanes lose most of their heat at the edges, so true-divided-lite windows are highly inefficient. True divided lite windows are those typical of residential buildings where the sash is split up into smaller square units, each with its own individual pane. To offset these energy losses, while still achieving a traditional aesthetic, manufacturers have taken to inserting single panes of glass into the perimeter sash, and popping faux grills onto the outside. In addition to minimizing heat loss, such a system reduces manufacturing costs, the possibility of seal and weatherstripping failure and cleaning hassle.

Comparing Windows

U and R-Value Universal Indicators

There are several universal scales through which windows, designed by different manufacturers, may be compared. The most important of which are the U and R-values. R stands for Resistance and denotes the window's ability to block heat flow. U, which has no obvious namesake, is the reciprocal of R and therefore represents the amount of heat that does transfer through the window. The National Fenestration Council has recently introduced this U value as intuitively it makes more sense to think in terms of minimizing heat flow rather than maximizing resistance. In addition the U value is on a scale from 0 to 1 while R ratings are becoming more cumbersome as they extend into the double digits. However, it should be noted that with the newer system, a big improvement in insulating capability now appears merely marginal.

Ingredients to a U-value

The total heat transfer coefficient aggregates the heat passage through the window by means of conduction, convection and radiation. Measured in BTUs (British Thermal Units) per square foot per hour per degree Fahrenheit, the official U-value averages the individual sub U-values of each component of the window unit by weight of area. Obviously the lower the U-value, the greater insulation the window provides and conversely for the R-value (recall $R=1/U$).

The danger of U and R-values lies in their simplicity. Though the values are determined from a standard set of specifications, some manufacturers will apply the tests only to the glass portion of the window rather than the entire unit. As discussed above, most of a window's key conceivable energy inefficiencies stem from the spacers, sash and frame, not solely the center of the glass, therefore making such values often deceptively high. To ensure that the published value is both standard and an accurate reflection of the entire window unit look for the NFRC accreditation.

Tinted Glass

Tinted glass is used primarily to reduce the heat gain from windows with a southern or western exposure. Tinted glass can also be combined with a Low E coating where there is a major problem with heat generated by the sun.

Because tinted glass reduces the amount of light allowed into your home, you should insist on actually seeing the tinted glass that will be used in your home. In this way, you can determine whether it is transmitting enough light and whether you are comfortable with the appearance of the glass. Often times the most efficient way to block solar gain is worth a type of Low E designed specifically for solar control. The best way to evaluate

the effectiveness of any glass is to look at the Solar Heat Gain Coefficient (SHGC) on the NFRC label. The lower the number, the more effective the solar control.

Tempered Glass

Tempered glass is glass that has been heated and then quickly cooled. This procedure not only strengthens the glass but it also creates surface tension so that the glass cannot shatter into large jagged pieces. Instead, it will break into small pieces that are less dangerous. This type of glass is also called "safety glass."

Solar Heat Gain

Light and Heat

Sun light through a window is both a foe and a friend for those inside. Ideally the light would provide illumination all year round but only provide heat in the winter. Yet illumination always carries heat with it, therefore a trade-off must be made between natural light and low heat gain. What energy is saved in one area will be lost financially and environmentally through counteractive measures in the other.

Performance Specifications For Evaluating Energy Savings

1/8" Glass - 1/2" Air Space

Glazing	U-Value	SHGC*	UV Trans.
Clear Single 1/8"	1.11	.85	73%
Clear Insulating	.50	.77	69%
Low-E/Clear	.35	.72	60%
Bronze/Low-E	.35	.60	34%
Titanium Low-E/Clear	.29	.47	30%
Solar Titanium Low E/Clear	.29	.39	29%

Solar Heat Gain Coefficient

Through a number of assumptions and standards, the NFRC has devised a single value to represent not only the transmittance of solar heat ("solar transmittance") a particular window model permits, but also the heat absorbed and reradiated by the glass. The Solar Heat Gain Coefficient (SHGC) is the ratio of the indoor solar heat gain to the solar energy striking the window outside. As any measures to minimize solar energy transmittance also reduces sunlight permeation, the east and west facing windows should

have a very low SHGC, while the north facing should not. Windows facing the south should either have a high SHGC if passive solar heating is seen as a viable option during the colder months, or a very low SHGC if the noonday sun comes out.

	Titanium Low E	Titanium Solar Low E	"Regular" Low E
U Value	0.29	0.29	0.35
UV Transmittance	30%	29%	60%
SHGC*	0.47	0.39	0.72

*solar heat gain coefficient

Breaking Down the SHGC

The factors hiding beneath the SHGC umbrella include shading provided by the window's inherent and applied devices such as reflective coatings and tints, the transmittance of visible light, and the UV radiation. Shade is quantified by the Shading Coefficient that compares the solar transmittance through the window with that of a single pane of glass. Visible transmittance, arguably the most important feature of a window, is just a straight percentage of how much light gets through with no internal base line with which to compare. UV radiation fades furniture colors and therefore is a critical consideration especially for rooms with valuable interior decorating.

Visible Transmittance

Visible Transmittance (VT) measures how much light comes through a product. The visible transmittance is an optical property that indicates the amount of visible light transmitted. VT is expressed as a number between 0 and 1. The higher the VT, the more light is transmitted.

Condensation

Water condensation not only fogs up a window's view but also leads to its rapid deterioration. Mitigation of this common problem entails increasing the thermal resistance of the window's interior surface and/or reducing the relative humidity of the building. Hence higher R-values (lower U-values) not only reduce energy loss through the window but also minimize humidity problems.

Window Replacement Installation Options

REMEMBER:

The lower the "U" value -- the lower your heating costs will be.

The lower the UV transmittance -- the less your drapes and carpets will fade.

The lower the SHGC -- the lower your cooling costs will be.

Window replacement tends to have a long payback period, however they are certainly a crucial step when overhauling the thermal envelope of a structure. Replacing windows tends to be a difficult process primarily because of the difficulty in finding windows to fit the building's existing rough openings. There are three approaches to fulfilling the task:

Custom Frames

The most popular choice, this approach involves completely knocking out the original window frame and starting from scratch with the rough opening. Vinyl, fiberglass and aluminum windows are typically offered in one inch-incremented size, facilitating a custom fit. Unfortunately wood window manufacturers are not so accommodating, and so the rough opening must usually be tucked and stuffed somewhat to fit the standard size offerings. Because choosing the right kind of frame is an important issue, you'll want to make sure the window company you deal with carries more than one type of frame. In this way, you can be certain you will be advised on the type of frame that is best for you, not pressured to buy the only type sold by that company. Now, let's take a look at each kind of frame.

Vinyl Frames

Some of the early vinyl windows did not perform very well. As a result, vinyl windows have a negative connotation in many people's minds. However, all of that has changed now. In fact, vinyl frames are actually more efficient than thermally broken aluminum, and in some cases, even more efficient than wood.

Here are some other pluses:

- ? Vinyl never needs painting and is guaranteed not to peel, chip or warp.

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Because vinyl is the same color throughout, scratches are virtually unnoticeable.

- ? Good quality vinyl windows are welded together, not held together with screws.
- ? Because screws tend to pull out of vinyl, good quality vinyl windows will have metal reinforcements in the parts of the windows where hardware (such as a lock) is screwed in.
- ? Vinyl windows are generally available in two colors: white or beige. Dark colored vinyl frames weather quickly in our New Mexico climate and are not recommended.

Thermal Break Aluminum Frames

Good quality aluminum windows have a thermal barrier that prevents the frame from conducting heat or cold. However even with the thermal barrier, these windows are not as efficient as vinyl or wood. It's important to make sure that windows in aluminum frames are "marine glazed". This is a process that helps to insure that there is no direct contact between the glass and the metal frame, thus prolonging the life of the insulated glass unit.

Thermal break aluminum windows are generally available in two colors: dark bronze and white.

Other important things to look for in a Thermal Break aluminum window are:

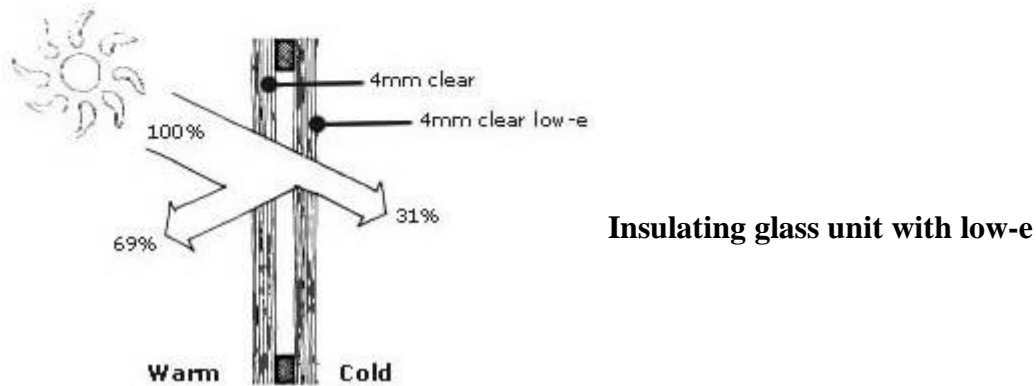
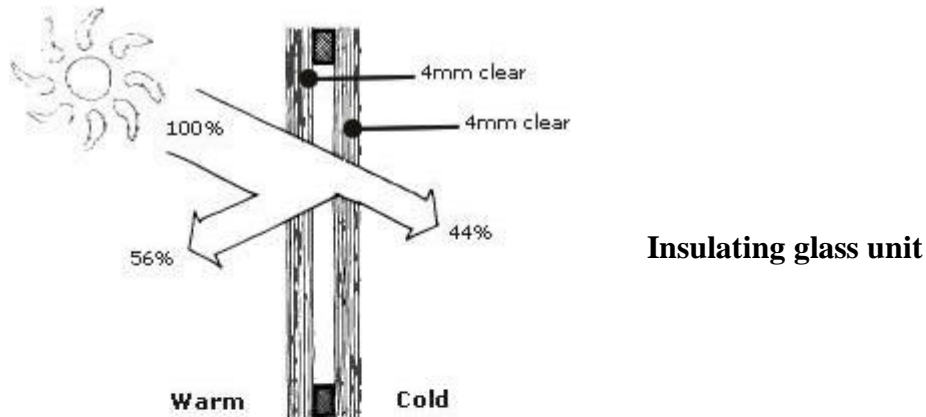
1. Air space between the panes of glass should be at least 1/2 inch
2. Interlocking sashes
3. Good quality roller systems on sliding windows
4. Double locks on windows over 30 inches
5. Variety of glass option



**Cross
Section
Of
A
Thermal
Window**

Diagram from: <http://www.simonton.com/homeowner/glass/index.htm>

INSULATING GLASS UNITS TRAP HEAT INSIDE THE HOUSE. *Even more heat can be trapped using low-e glass in the insulating units*



Diagrams from: http://www.greenhouse.gov.au/yourhome/technical/fs18d_2.htm

Wood Frames

If you choose to use wood windows for your home, you'll want to look for the following features:

1. Airspace between the panes of glass of at least 1/2"
2. Metal or vinyl exterior to reduce maintenance and eliminate painting
3. High quality hardware and locks
4. Uses good quality wood that won't warp or twist

There are as many different configurations of windows as you can imagine. Below is a list of the most common:

1. Fixed-non operable picture windows
2. Single hung, a window where the bottom sash slides up
3. Double hung, a window where the bottom sash slides up and the top sash slides down.
4. Horizontal slider, which slides open to the side.
5. Picture slider, which has 3 sections; a fixed part in the center and two end vents that slide open to the middle.
6. Casement, a window that cranks open and is hinged on the side.
7. Awning, a window that cranks open and is hinged on top

Custom Opening

A big and arduous task, some chose to remove the entire existing window and frame and then begin hacking away at the rough opening to fit a larger standard sized window. This is extremely labored intensive and costly, because a new header beam must be installed, as well as new outdoor siding and indoor paint or wallpaper work. This approach would be found to be needed if the damage or decay has extended past the confines of the window into the building its self, in which case cleaning up the rough opening might as well entail making it appropriate for an enlarged but standard fitting.

Custom Sized Sash and Panes

Especially appropriate when the frame is in good condition, but perhaps, the glass panes are separating from a warped and weather sash, installing a custom-sized window into an existing frame can be another alternative. Though the least expensive initially, such measures are usually short-lived and aesthetically unappealing.

Bi-Glass

The system uses the original frame and sash, provided they are in good shape, but replaces the inefficient true lites with a single plate of insulated glass. Efficient to a science, the window replacement specialist first removes the sash from the frame and takes it outside into his truck, where most of the work is completed. Using a special machine, the glass is cut out of the sash, with special attention paid to maintaining the integrity of the external grill. The sash must usually be expanded a tad to make room for the insulated glass, but the replacement's fit is tight and just. The grill is then glued on top so that the window looks the same as its traditional forefather, in spite of its vast thermal improvement. The final step, before the sash is reinstalled, is to insulate the typically hollow frame and insert new jamb liners, between the sash and frame, to ensure maximum air tightness.

Quality Insulation

The proper installation of your replacement windows must be as important of a factor as your choice of the windows themselves. Being an informed consumer, you will want to know everything involved with the installation process so be prepared to ask plenty of questions. There are as many different types of installation as there are types of homes. You have recourse knowing that when the company that installs your windows also manufactures them so that you never get caught in the middle.

Consider the following questions before agreeing on your replacement windows and installation.

- ? Will subcontractors be used on the job? Consider that employees rather than contractors are paid by the hour and not by the job and so they will generally take the time to do the job right.
- ? If there is the possibility that your stucco will be damaged in the process, ensure that there will be a patching repair included in the price.
- ? Inquire as to the type, if any, of trim that will be used? How will it be attached? How will it look?
- ? Will solid shims be used under the sills of vinyl windows? Be prepared that, if not, the windows won't operate properly a year from now.
- ? Will installers use tarps and clean up broken glass when the job is done?
- ? Will the old windows be hauled off of your property?
- ? What type of caulking and insulation will be used around the windows?
- ? Does the company specialize in windows? Can the salesperson explain the installation process to you?

Warranty/Service

Warranties that are not straightforward and not easily understood can present problems for you down the road. Look for a warranty that is simple as being the best. Keep in mind that a warranty is only as good as the company that issues it so make very sure that you are choosing to deal with a reputable company from the get go. Remember that ideally, you want to deal with a company that not only sells you your windows but will install them too. When requesting the warranty ask to read it yourself and not to be read by the salesman and then be at his interpretive mercies. When assessing the warranty do not be taken in by large promises. Read between the lines. Check up on their customer service record and be assured of how well they treat their customers after the product has been installed. Keep in mind that problems that may arise from faulty installation may not be included in your warranty. Check into all of these finer points before the problem arises. A good rule of thumb is to know that better window replacement companies will cover all installation-related problems (including labor and materials) for at least 3 years.

Price

That age-old question still begs to be answered. How do I get a quality product and service at a very fair price?

A smart consumer will want to consider the following:

- ? How does the company do with "repeat" business? Are their customers buying from them time after time?
- ? Has the company been in business for at least ten years and do they have a stellar reputation?
- ? Do their consultants assist you to make a wise choice or do you feel you're being talked over and pressured into buying?
- ? Is the price clearly spelled out in writing without the tiny print to confuse you?

Finally, after having learned about replacement windows from A – Z and if you are fully satisfied that the quality of product that you want is being delivered, chances are, the company you're dealing with will be giving you a fair price.