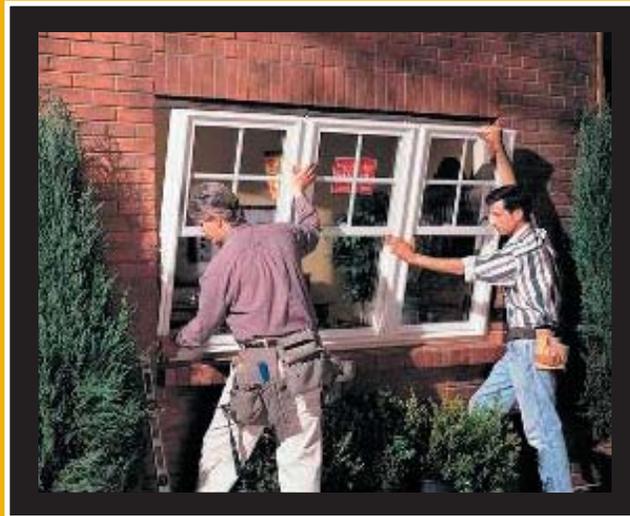


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F R E E L I T E

WE DELIVER DAYLIGHT.

INSIDER'S GUIDE TO REPLACEMENT WINDOWS

A FREE REPORT FOR PHOENIX AREA HOMEOWNERS



—By Chip Marvin, CRS, CPC

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INTRODUCTION

REPLACING WINDOWS is one of today's most popular home improvement projects, with good reason. New windows dramatically improve the comfort, appearance, and efficiency of your living space — and they're a sound investment. Every year *Remodeling Magazine* surveys hundreds of contractors, realtors, and appraisers from major cities across the country, compiling data to determine the cost of various types of residential remodeling projects and their impact on the resale value of homes. In Phoenix, results are impressive. According to the *2005 Cost vs Value Report*, homeowners here recoup on average *104% of the money spent on having upscale windows installed and 109% when they use mid-range products.*

But replacing windows can be a daunting prospect. Did you know that over 100 brands are sold in Arizona alone? And that you can spend anywhere from a few *hundred* to a few *thousand* dollars per opening for materials and labor? Home magazines are filled with advertisements in which manufacturers tout their products as better than all the rest. Likewise, most replacement contractors will promise the sky in an effort to win your business. The sad truth is that for many homeowners, remodeling is a disaster. Too often, people pay too much for windows and/or end up with inferior products or products ill-suited to our environment. Frequently they are improperly installed. Incompetence and a lack of ethics seem to be rife in our industry.

So how *do* you make the right decision when it comes to buying new windows? *Whom* do you believe? And how much *should* you pay?

This report was borne out of a desire to ease the frustration and sense of overwhelm that most homeowners face when undertaking the process of having their windows replaced. The information I'm going to share with you comes from my 25-plus years in the industry. I don't pretend to know everything, but I think I recognize what's important in this type of project, and I've come up with a list of priorities and issues that I think you should consider up front, as well as warnings about what to avoid. I'm confident this report will simplify the remodeling process for you and will help you get started in the right direction.

First, some background information and a few points of clarification:

ONE My credentials:

Founder and President of FREELITE, INC., specializing in the sales and installation of windows, doors, and skylights —since 1977

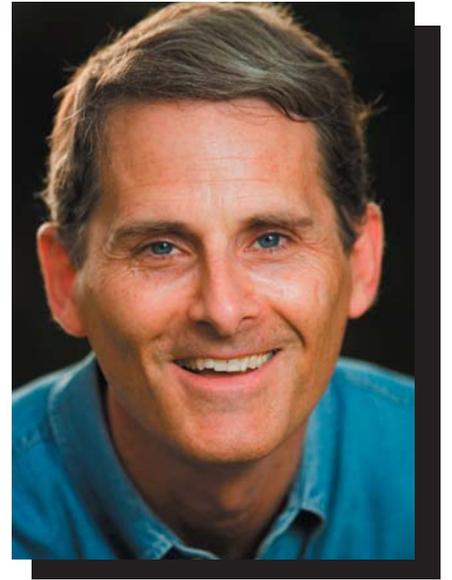
B.A., Yale University

Member and past President, Arizona Chapter of NARI
(National Association of the Remodeling Industry)

(NARI-designated) *Certified Remodeling Specialist* (CRS)

Certified Pella Contractor (CPC)

Chosen one of the “BIG 50” Remodelers nationally by
Remodeling Magazine



TWO This is a guide to replacing windows in the Phoenix area specifically, where we face extreme weather conditions not common elsewhere. Much of the information is pertinent regardless of geographic location, but some is not. A certain product or technology that is recommended for *this* climate may not make as much sense in, say, Fargo, North Dakota.

THREE The prices I quote assume professional installation by a reputable contractor, in the Phoenix market, who is licensed, bonded, and insured. *The figures are an approximation only.* Depending on the particular company you deal with and the specifics of your project, you may pay a bit more or less. Prices quoted that are significantly higher (or lower for that matter) should be cause for concern.

FOUR I am not a spokesman for any particular window manufacturer and am not paid for my endorsements. The products I recommend are those with which I’ve had firsthand, successful experience. There may be other, equally good windows available that I’ve simply never used. Or, a high-quality brand that I *am* familiar with may suffer in this market due to poor distribution or poor service after-the-sale and, for one of those reasons, I can’t endorse it.

WHAT TYPE OF WINDOWS SHOULD I PURCHASE

There are two parts to the decision-making process as it pertains to window replacement:

1 What type of window should I purchase? and **2 Who should install it?**

Let's tackle these issues one at a time.

WHY DO YOU WANT TO REPLACE YOUR WINDOWS?

Recently we took a survey of our past customers and asked this question. Here are the five main reasons given:

- 1) Increased Energy Efficiency
- 2) Aesthetics
- 3) Performance / Ease of operation
- 4) Freedom from Maintenance
- 5) Reduction of Dust and Noise

As you start thinking about your own window replacement project, consider which of these reasons are motivating *you*. Deciding in advance what's important will eliminate many of the available options while bringing others to the fore.

Now, let's look at the ways in which today's windows address the concerns and desires of the marketplace.

ENERGY-EFFICIENCY

A house loses up to 40% of its energy through its glass; if you're looking to save money on heating and cooling costs, replacing your windows is an excellent way to start. But a product that helps keep your cousin warm in the dead of winter in Boston, Massachusetts is altogether different from one that allows you to make it through our 100-plus degree Phoenix summers without the compressor on your air conditioner running continuously. Let me explain.

Negative energy transfer occurs in four primary ways: **conduction, convection, radiation, and infiltration.**

CONDUCTION: When two environments are separated by a physical barrier, nature seeks an equilibrium between them. Thus, in winter, warm interior air is *conducted* through a window to the exterior — much as heat applied to the bottom of a frying pan is conducted through to the cooking surface. As a result, the inside of the house becomes cooler and the outside of the house (at least in the immediate vicinity of the window) grows warmer. We insulate the walls and ceilings of our homes to slow the process of conduction through these barriers, and “**R-value**” is the measure of the insulation's resistance. By contrast, windows are usually rated in terms of “**U-value.**” This is the inverse of R-value and quantifies the number of BTU's conducted per square foot, per hour, through a piece of glass. Thus, while we want as *high* an R-value as possible for insulation, the *lower* the U-value of your windows, the better.

CONVECTION: *Convection*, which describes the naturally occurring phenomenon of hot air rising, works in combination with conduction to cause energy loss through windows. As explained above, in wintertime some of the heated interior air that comes into contact with a window passes through the glass to the outside. As the air that remains on the inside surface is cooled, it grows heavier than the surrounding interior atmosphere and drops to the floor. New air now flows in to take its place and some of it, too, is conducted outside. Convection allows for ongoing negative energy transfer by providing a constant supply of warm air to rub up against the window glass and bleed off to the outside.

RADIATION: Visible light comprises only a small portion of the total energy that we receive from the sun; most of the electromagnetic spectrum is invisible, reaching us in the form of ultra-violet or near-infrared rays — i.e., heat. In Phoenix, the intensity of this solar *radiation*, which passes easily through conventional glass, is the prime reason our energy bills spike upward starting in June of each year. To make matters worse, outside objects such as paving and adjacent buildings that are warmed by the sun's energy also give off radiation. Finally, there's a cumulative effect: electromagnetic waves that enter through a window heat interior objects which, in turn, *re-radiate* the heat to the surrounding atmosphere. This hot air, blocked from escaping back out through the window, builds up inside the house. Any Phoenician who has left his car parked out in the open in the summer with the windows rolled up is all too familiar with this "greenhouse effect."

INFILTRATION: It should be no surprise to anyone that drafty windows are energy inefficient. If your old single pane aluminum sliders rattle whenever a door slams or a plane passes overhead, that's an indication of poor seals between the glass and frame. These windows are "energy sieves," admitting cold air in the winter and allowing it to escape in the summer, and they end up costing you countless unnecessary dollars in energy bills.

ENERGY-EFFICIENT GLASS

The introduction of *insulated* (also known as "dual pane" or "double pane") *glass* was crucial to the goal of limiting conductive energy transfer through windows. When cold air has to pass through two panes or barriers instead of just one, the process is made more difficult. To maximize efficiency, the air space between the two panes should be between 1/2" and 1" and should be filled with an inert gas such as *argon*, which is heavier than air. The type of spacing material that separates the two panes is also important. While aluminum is still widely used, its high conductivity makes it less than desirable. *Warm-edge spacers* incorporate a "thermal break" or, better yet, are constructed entirely of a non-metallic, low-conductivity material such as butyl rubber or silicone foam to impede the negative transfer of energy.

However, while insulated glass is a necessary component of an energy-efficient window, by itself it's not sufficient to control the radiant heat that bombards our homes during Phoenix summers. What *is* the best way to deal with this problem?

Three things happen to solar radiation as it comes into contact with a glazing material: 1) some is transmitted, 2) some is absorbed, and 3) some is reflected. Prior to the last twenty years, *tinting* was the standard glass technology used to address the problem of heat from the sun (it's still used in most car windshields). Dark bronze or gray glass *absorbs* up to 40% of solar radiation, significantly reducing the amount transmitted through to the interior of a house. But this approach has its drawbacks. Standard tinting blocks electromagnetic waves indiscriminately, cutting down heat and illumination by the same amount. Obviously no one likes to sacrifice the light; moreover, while darkening a room reduces the load on your air conditioner, it increases your energy use in another way since you have to turn on the lights earlier in the evening.

Recent glazing technology has been revolutionized through use of the principle of *reflection*. In the first formulation of Low E2 glass, a single microscopic layer of silver was applied to one of the interior surfaces of insulated glass with the result that much of the long wave heat portion of the electromagnetic spectrum was reflected away, rather than allowed to penetrate to the inside of the building. The silver is sandwiched between zinc oxide (or a similar anti-reflective material) to avoid having the glass look like a mirror — instead it has a slight greenish, purplish color. Over time this process was improved by adding a second microscopic layer of silver, and Low E2, which is 40% more effective than single-coat Low E at stopping negative energy transfer, has been the window industry glass standard for the last several

years. Additionally, scientists discovered that the placement and specific “recipe” of the silver coatings could be manipulated to better suit the thermal requirements of the region in which the glass was used. Thus in Phoenix low-solar-gain Low E is applied to the inside surface of the outer pane of insulated glass and is formulated to keep out up to 70% of solar radiation. By contrast, in northern climates, high-solar-gain Low E allows a greater level of infrared energy to be transmitted through the glass (taking advantage of its warming effect), and the coatings are applied to the inside of the inner pane in order to keep the heat inside a home in the winter.

Now, yet another generation of this technology of reflection has arrived. Triple-coat Low E glazing, coming to market as of this writing (fall, 2006), has even greater radiant heat-blocking capability than its precursors (see table below).

From an energy-efficiency standpoint, the single most important piece of information Phoenix homeowners need to know about their new windows is the **Shading Coefficient** or **Solar Heat Gain Coefficient**. These terms, which refer to the product’s solar control properties, are expressed as a number between 0 and 1 and tell us the amount of heat from the sun that is transmitted, relative to what passes through a pane of “_” clear glass — obviously, the lower the number, the better.

As critical as this measure of negative energy flow is, however, it must always be weighed against **Visible Light Transmittance**. In glass technology there’s always a tradeoff between heat and light: in order to reduce the former you have to sacrifice the latter — the question is, by how much? Remember that the “old” technique of tinting glass kept heat out by blocking a corresponding amount of light. Theoretically, you could paint the outside of all your windows black and thereby stop almost all of the sun’s radiation from penetrating — but who wants to live in a cave? The most amazing characteristic of Low E technology is its “spectral selectivity.” Acting as a filter, it differentiates between the longer wavelengths constituting the heat portion of the electromagnetic spectrum and the shorter wavelengths that reach us in the form of visible light, and thus provides for the best of both worlds: maximum illumination with minimal warming effect.

TYPE OF GLASS	SOLAR HEAT GAIN COEFFICIENT (the lower the number, the better)	VISIBLE LIGHT TRANSMITTANCE (the higher the number, the better)
Single-pane, clear	.86	90%
Double-pane, clear	.76	81%
Tinted Glass	.58	55%
Single-coat Low E	.72	75%
Double-coat Low E (Low E ²)	.40	72%
Triple-coat Low E (Low E ³)	.27	65%

ENERGY-EFFICIENT FRAMES

Fifty years ago, choices in window frames were pretty much limited to **wood** and **steel**, both of which are still prevalent throughout Phoenix. But these materials have significant drawbacks: wood, prone to warping and rotting, needs frequent repainting; steel rusts and is a poor insulator. And old steel casement windows are notorious for being difficult to operate.

In the 1960’s, **aluminum** emerged as an affordable, durable replacement for steel, but while aluminum windows solved the problem of rusting, they did little to improve thermal performance (they, too, are highly conductive). Then along came **vinyl**. Vinyl windows have experienced tremendous growth

over the past few decades owing to their relatively low cost, freedom from maintenance, and energy-efficiency (they conduct heat and cold much less readily than steel and aluminum). Today, well over 50% of the replacement windows sold nationally are constructed of polyvinylchloride. And while Phoenixians have been understandably skeptical about the ability of “plastic” windows to hold up to our brutal summer temperatures, technological advancements such as ultra-violet inhibitors have made vinyl windows both practical and increasingly popular in the local market.

Unlike steel which has gone the way of the dinosaur, **wood** is still widely used in window construction and makes for a very energy-efficient product. Typically, an exterior protective “skin” or cladding, made of aluminum or vinyl, is applied to protect the wood and eliminate the old problems of warping and rotting.

Fiberglass is the latest trend in window frames. In many ways this is the perfect building material: it has greater tensile strength than wood, steel, vinyl, or aluminum; it will never warp, rot, split, or corrode; and it’s impervious to insects. Like vinyl and wood, fiberglass has excellent insulating properties. Moreover, since fiberglass is made of glass particles, the two components, the frame and the glazing, expand and contract at the same rate, minimizing the stress on the seal and thus the potential for air infiltration.

What do all of these technological advancements in the manufacturing of windows mean in terms of dollars and cents? According to the website of Efficient Windows Collaborative, replacing single pane aluminum windows in a 2000 square foot house in Phoenix with wood or vinyl frame products with insulated, low-solar-gain Low E glass results in a 32% savings in energy costs.

TAX CREDITS

Beginning in January 2006, a federal tax credit of up to \$200.00 is available for homeowners who install “Energy Star” certified windows. Be sure to remove and save one of the stickers that carries the energy star logo to show in case of an audit. (For more information, visit the Energy Star website listed under “References/Links” at the end of this report).

AESTHETICS

You may be restricted in choosing the look of your new windows. For example, you may want to duplicate windows already installed in another part of your house, or your homeowners’ association may dictate a certain frame color. Unfortunately, in neighborhoods designated “historical,” energy efficiency takes a back seat to aesthetics (for example, single pane glass is usually required in an effort to match the look of the original windows). It’s a good idea to check with all relevant boards and agencies before deciding on replacement windows. Once you know what, if any, restrictions apply, here are some features to consider:



Aluminum Frame

Vinyl Frame



Fiberglass Frame

Wood Frame



Color is always an important factor. Aluminum frames are generally available in white, tan, silver, or bronze (actually, a dark, brownish-black). Typically, vinyl is restricted to white or tan/almond. In the case of both these frame types, the color is the same on the inside and the outside which can be a problem: many customers like the way tan blends in with their exterior walls or the way bronze stands out, but want white on the interior. One big plus to *fiberglass* windows is the fact that they can be painted, allowing for compatibility with any color scheme. Likewise, wood can be painted or stained on the inside, and most wood window manufactures offer exterior aluminum or vinyl cladding in a wide range of colors. In aluminum and vinyl windows, the color of the hardware usually matches that of the frame, while fiberglass and wood products often come with such options as polished brass, satin nickel, and oil-rubbed bronze.

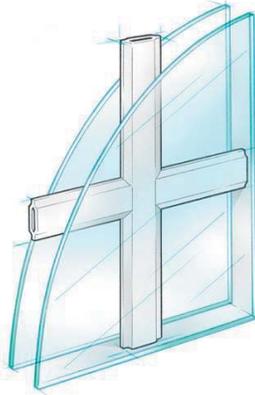
Different types of window have varying **frame widths**. Residential aluminum windows are often chosen to replace old steel casement windows because their narrow frames are similar in appearance. However certain aluminum brands have a thicker commercial-type frame that works well with a modern, mock-industrial décor. Vinyl's heavy (some say "clunky") appearance is reminiscent of wood and thus a good choice for traditional homes. Fiberglass falls somewhere in between — thicker than standard aluminum but thinner than vinyl.

In addition to providing light to interior spaces, windows also afford a view of the outdoors and they provide ventilation. Sometimes these two roles clash: windows that open come with **screens** which impair visibility. In response to this dilemma, *Pella* offers "Vivid View" screens made of superfine mesh that's nearly invisible and "Rolscreens" which retract out of view when the window is closed. Another approach is to stack large picture windows on top of venting windows; combined, they allow for both air flow and unobstructed views.

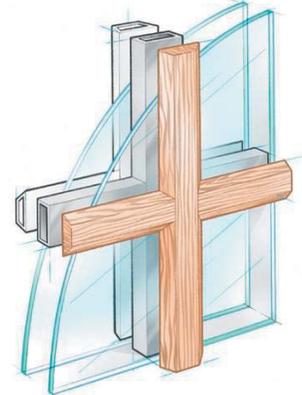
In "**True-divided-lite**" windows, individual panes of glass are framed into separate squares or rectangles. This design element, characteristic of colonial homes, is still popular today but the technology has evolved. Now, one large piece of glass is used for each window panel with **grids** (sometimes referred to as "grilles" or "muntins") incorporated to create the *illusion* of individual panes. Internal grids, sandwiched between the sheets of insulated glass, are common in aluminum and vinyl windows and are usually available in either a narrow flat or a wider "sculptured" profile. Most fiberglass and wood windows offer the additional options of interior removable grids or permanent grids applied to the interior and exterior surfaces of the glass and aligned with internal metal spacers. This last configuration, often called *SDL* (short for "simulated-divided-lite"), most closely replicates the look of individual panes. Generally the muntins are configured to create equal size squares or rectangles, but, increasingly, other patterns are gaining in popularity.



Flat Internal Grids

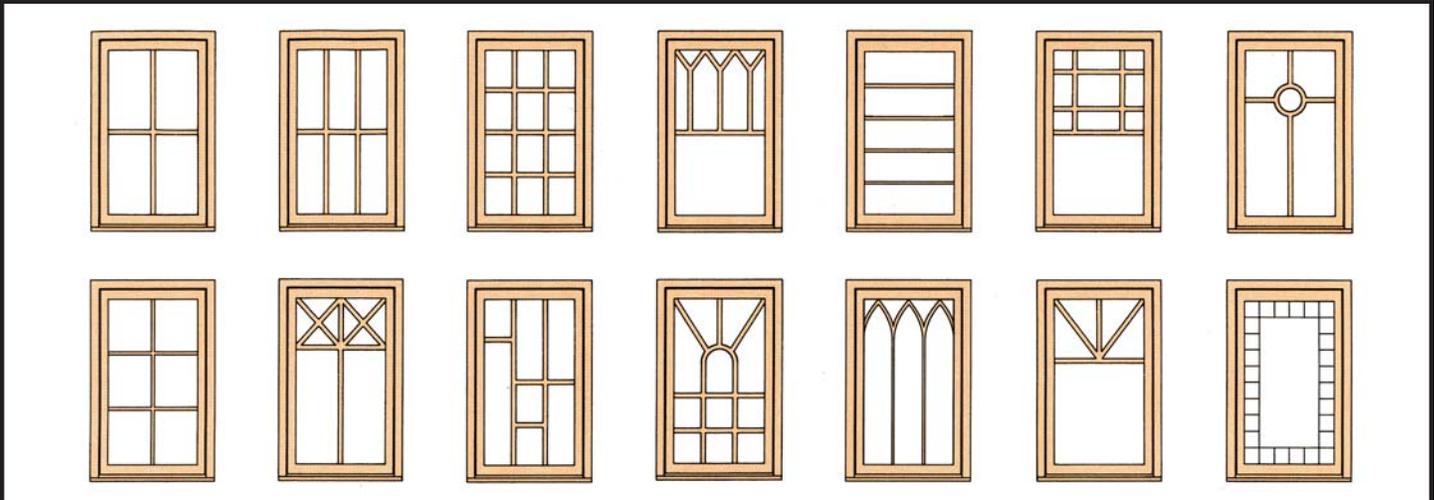


Sculptured Grids



SDL Grids

Courtesy MILGARD Windows



Sample Grid Patterns - courtesy MARVIN Windows

In making your design choices, think ahead to what type of **window coverings** you'll be using. Because most new windows are thicker than the ones they replace and will take up more of the wall jambs, you may not be able to recess blinds into the openings afterwards. *Pella* allows you to incorporate blinds or pleated shades directly into their products, between the glass. Obscure glass, which lets in light but blocks the view, is an alternative to window coverings altogether. Commonly used in bathrooms, this type of glass is now available in several decorative styles, including "rain" glass, "reed" or "fluted" glass, "glue chip," etc.



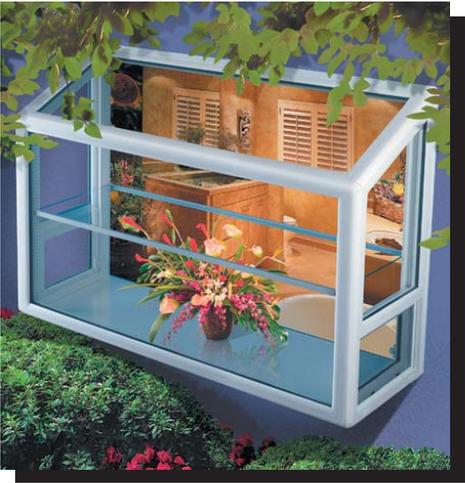
Pella between-the-glass shades

Typically, wood windows are finished with **casing** which bridges between the window frame and the interior wall. This trim is available in a wide range of profiles, from simple "streamline" to ornate Victorian. Conversely, in the case of aluminum, vinyl, and fiberglass window installations, drywall is generally returned into the frame for a cleaner, more contemporary look.

Specialty windows add architectural interest and curb appeal to any home. A **Bay Window** projects out (typically at a 45 degree angle) beyond the wall it's installed in. **Garden Windows**, usually placed over kitchen sinks, jut out at 90 degrees and provide a shelf for plants or knick knacks. Viewed from the inside, both types of windows have a room-enlarging effect that opens up your house to the outdoors.



Bay Window - Courtesy MILLGARD Windows



Garden Window - Courtesy MILLGARD Windows

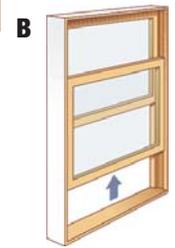
PERFORMANCE / EASE OF OPERATION

Most homeowners are amazed at how easily new windows operate, particularly if they're used to sliders with worn-out rollers or wood or steel casements that have been painted shut. Modern mechanical components insure that today's windows rarely stick or squeak and almost always open and close easily. Picture windows come in a wide range of geometric shapes: rectangles, triangles, trapezoids, arches, etc. With respect to *operable* windows, there are five basic types:

A) HORIZONTAL SLIDERS: These are the most common windows in Valley homes built after 1970, particularly in bedrooms where a large net opening is required to meet egress code (more on this later).



B) SINGLE HUNG: This type of window, in which the top panel is fixed and the bottom panel slides up, is used where the width of the opening is less than the height.



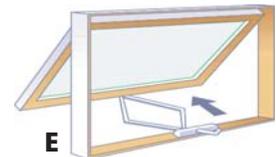
C) DOUBLE HUNG: Here the bottom panel slides up and the top panel slides down, and they tilt in for easy cleaning.



D) CASEMENTS: Hinged along the side, the entire sash swings out for maximum ventilation. Casements are often used as "flankers" or "bookends" to a center picture window.



E) AWNINGS: These windows are like casements except they're hinged along the top instead of the side. Common in small, horizontally oriented openings, they can also be stacked above or below picture windows.



REPLACEMENT WINDOWS AND SASHES

When it comes to *replacement* windows specifically, there are three approaches. First, and most commonly, the old window is removed entirely and a new one is installed in its place. Alternatively, a complete new window with a decorative fin flush to the exterior can be set within the perimeter frame of the old unit, which is left in place. Typically this is done to avoid damage to stucco that might otherwise occur in pulling out the original window (the downside to this approach is that, because the new unit has to be undersized, you end up with a reduction in net visible glass area). The last option is to replace only the *sashes* of the window. This is frequently done with double hung windows in older homes; this technique allows for preserving the existing wood trim (which may be difficult to replicate) while upgrading the glass and mechanical components of the window.



Pella Precision Fit Replacement Window

MAINTENANCE

Compared to old windows, modern products are a breeze to maintain. Gone are the days where homeowners have to scrape and repaint or re-putty wood or steel sashes. Aluminum and vinyl windows come with a factory finish and never need painting. Fiberglass units can be painted or left “as is” (usually white). While you’ll need to paint or stain the interior of wood windows, the exterior is typically clad with a maintenance-free protective “skin” (*Pella* and *Marvin* use aluminum, *Andersen* uses vinyl) so that the wood never comes into direct contact with the elements. And while earlier generations of insulated glass were notorious for developing dirt or fog between the panes (an indication of seal failure), modern technology has all but eliminated this problem in today’s quality windows.

DUST AND NOISE REDUCTION

A cleaner house is a pleasant, often unexpected, byproduct of replacing your windows. The same engineering that minimizes air infiltration in today’s products (i.e., efficient gaskets and weather-stripping), also keeps out most of the dust.

On the other hand, **sound-proofing** is often a prime reason for upgrading windows. Today we find ourselves living closer than ever to freeways, airports, and, as lot sizes shrink, our neighbors; as a result our world is an increasingly noisy place. And, just as windows are the weakest link in insulating the building envelope against negative energy transfer, they’re also the path of least resistance when it comes to sound infiltration. **STC (Sound Transmission Class) Ratings** measure the noise-blocking capability of building materials — the higher the number the better (this system of quantification is based on a logarithmic scale much like the Richter Scale used to measure earthquakes, meaning that even a small increase in STC rating translates to a significant reduction in the amount of noise transmitted). The walls of a typical home (2x4 frame construction, exterior wood siding, interior drywall, and fiberglass insulation) usually rate between 40 and 42 (a solid-grouted masonry wall could score as much as 20 points higher). Contrast this to single pane windows which typically have STC ratings in the mid 20’s and windows with standard insulated glass which test in the low 30’s.

There are three primary ways to improve the STC ratings of windows: 1) increase the number of panes of glass, 2) increase the amount of dead air between the glass, and 3) vary the thickness of the panes. This last principle works because two pieces that both measure, say, 1/8" will vibrate at the same frequency, creating a harmonic. Varying the thicknesses (e.g., substituting a 1/4" pane for one of the 1/8" panes) changes the pattern of the sound waves and impedes their penetration. Windows specifically designed for sound-control such as *Milgard’s* “QuietLine Series,” consist of a double-paned unit with different thicknesses of glass, plus a third pane separated by about 2” of dead air. The sound dampening effect is maximized if one or more of the panes is laminated glass (i.e., two layers with a plastic film sandwiched between them).

Although not as important as the glazing, the type of frame also contributes to the sound-control properties of a window. In general, the most thermally-efficient materials (i.e., vinyl, fiberglass, and wood) seem to be the best at mitigating noise. Likewise, introducing argon or other inert gases between the panes of glass improves the acoustic performance of a window.

WINDOW TYPE	AVERAGE STC RATING
SINGLE PANE	26
STANDARD DOUBLE PANE (1/8" + 1/8" GLASS)	32
DOUBLE PANE (1/8" + 1/4")	36
"SOUND-CONTROL" (1/8" + 7/32" LAMINATED + 7/32" LAMINATED)	47

RELATIVE COST

In addition to the five reasons for replacing windows that I've detailed above (energy-efficiency, aesthetics, performance, freedom from maintenance, and dust/noise reduction), cost is obviously an important factor in one's choice of product.

From least to most expensive, the four primary types of windows are: aluminum, vinyl, fiberglass, and wood. State-of-the-art glazing is no longer a luxury: insulated, Low E2 glass is now standard on almost all of today's better windows (soon, no doubt, to be replaced by Low E3), and it doesn't cost much to add argon gas. Typically, you have to spend more for casement and awning windows than you do for horizontal or vertical sliders. In terms of grids, the flat, internal variety are the lowest priced option. Internal *sculptured* grids are at least double the cost while *SDL* (*simulated-divided-lite*) grids hit the wallet the hardest — easily five to six times the price of the flat internal variety.

CODE COMPLIANCE

A final issue I want to touch on is that of code compliance. With respect to windows, Phoenix building codes are intended to mitigate two possible dangers: 1) being trapped inside a bedroom during a fire, and 2) injury resulting from broken glass.

To comply with **egress requirements**, a window must have:

- a) an overall net openable area of at least 5.7 square feet
- b) a 20 inch minimum net opening width
- c) a 24 inch minimum net opening height
- d) a finished sill height not more than 44" off the floor

NOTE: These requirements apply to *bedroom* windows only (a room is technically considered a bedroom if it has a closet — even if it's being used as an office or storage room). None of these requirements apply if the bedroom has a door to the outside.

Tempered glass (also called "safety" glass) is designed to crumble into small, rounded pieces when broken, rather than jagged shards, and is required whenever any part of a window is:

- a) within 18 inches of the floor
- b) within 24 inches of a door (unless more than 60 inches off the floor)
- c) within a shower or bath enclosure (unless more than 60 inches off the floor)

NOTE: Each piece of tempered glass must be clearly stamped by the manufacturer in the corner, identifying it as tempered.

RECOMMENDATIONS/WARNINGS

Here are my recommendations and warnings for window selection based on the different priorities and issues discussed above:

PRIORITY: ENERGY EFFICIENCY

RECOMMENDATIONS:



Vinyl, Fiberglass, or Wood frames.

Insulated, low-solar-gain products (“spectrally selective”) Low E3 glass (or at least Low E2)

Insist on windows that are “Energy Star” certified. This is a designation of the federal government reserved for proven energy-saving products that qualify for federal tax credits (Energy Star windows approved for this region necessarily have both U-values and Solar Heat Gain Coefficients of .40 or less). Another important certification is the one from NFRC (National Fenestration Rating Council).

WARNING:

Don’t pay extra money for “triple pane” windows. Yes, they may slow conduction and thus help keep your home more comfortable in the winter (and they help with noise reduction), but they don’t address the more critical problem of *radiant heat gain* in the summer.

Don’t get caught up in hype about a window’s R-value or U-value — *Solar Heat Gain Coefficient* or *Shading Coefficient* is what’s important in this climate.

However, don’t be sold windows with a low Solar Heat Gain Coefficient or Shading Coefficient without first checking their *Visible Light Transmittance*.

PRIORITY: AESTHETICS

RECOMMENDATIONS:

Aluminum frames for sleek, contemporary look or to replicate steel casement windows.

Vinyl or wood where a heavier frame and more traditional appearance is desired and white or tan colors work for you.

Fiberglass or wood for flexibility in terms of color, grid and hardware options. (Stained) wood for rich custom look.

Combination of fixed and operable windows to allow for both ventilation and a good view.

Bay, Bow, or Garden Windows for a room-enlarging effect.

Decorative obscure glass in bathrooms in lieu of window coverings.

WARNING:

Make sure the configuration of your new windows is compatible with your interior wood shutters (i.e., the component panels of each should line up). Be careful when using window grids in conjunction with shutters, blinds, or security bars — the visual effect may be too “busy.”

PRIORITY: PERFORMANCE

RECOMMENDATIONS: Horizontal Sliders to comply with egress code.
Casements and Awnings to maximize ventilation and also to minimize air and dust infiltration (owing to their compression seals).
Double Hungs in sitting areas (sliding the top panel down lets in fresh air without having it blow directly on you) and in second story rooms (sashes that tilt in all low for easy cleaning from the inside — no need for a ladder).

WARNING: Avoid placing casement or awning windows near exterior walkways where people might bump into them when they're open.

PRIORITY: FREEDOM FROM MAINTENANCE

RECOMMENDATIONS: Aluminum, vinyl, or fiberglass frames — none of them require painting.
“Clad” wood windows with an exterior protective skin of aluminum or vinyl.
A large, national manufacturer (as opposed to a local “garage operation”) that will stand by its products. A minimum 10-yr warranty against defects in materials and workmanship and a 20-year warranty against glass seal failure (find out if materials *and* labor are covered and if the warranty is transferable to another owner).

WARNING: Avoid any manufacturer that doesn't have Phoenix based service technicians; otherwise you might have to wait months for them to address any problems discovered after installation.

PRIORITY: NOISE REDUCTION

RECOMMENDATIONS: “Sound-control” windows utilizing three panes of glass including at least one piece that's laminated.
Insulated glass with the two panes of varying thicknesses.

WARNING: Don't pay the high cost of sound-control windows to achieve an STC rating of 45 or above if the walls of your walls only test in the low 40's.
Because sound travels in a straight line, you only need to upgrade the acoustic properties of the windows facing the source of the noise (e.g., a busy street or a neighbor with a barking dog); you can get by with standard windows on the other sides of the house.

PRIORITY: COST

RECOMMENDATIONS: Aluminum or vinyl frames.
Insulated, low-solar-gain Low E2 glass.
Horizontal and vertical sliders (as opposed to casement and awning windows).
Sash-only replacements for older double hung wood windows.

WARNING:

No aluminum window that I know of carries the “Energy Star” rating — thus they are disqualified from the federal tax credits. Be sure to factor this in when considering cost.

Don’t pay extra for wood if you’re going to paint as opposed to stain — Fiberglass will look the same and will often save you money.

Don’t scrimp on glass — the small discount most manufacturers offer for clear (as opposed to Low E2) glass simply isn’t worth it.

If you have wood shutters, they’ll hide the inside of your windows — why pay extra for fiberglass or wood frames? Go with aluminum or vinyl if their colors work for you on the exterior.

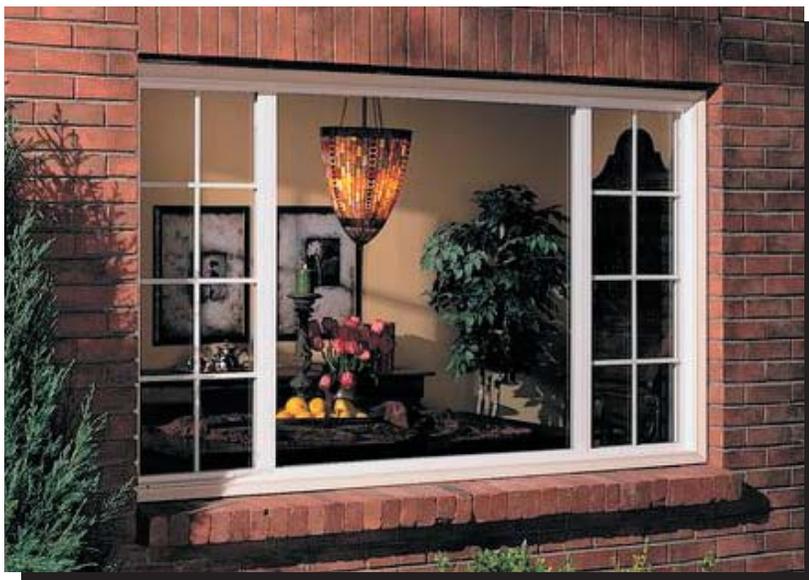
You don’t necessarily need grids in *all* your windows. Consider including them on just the front elevation (for curb appeal) while leaving the side and back windows open for an unobstructed view into your yard. Likewise, in wide windows you can incorporate grids in the flanker panels at each end but not in the center picture window. (see the picture below)

If an opening is within 18 inches of the floor, design the new window in two sections (e.g., as a picture window stacked over a horizontal slider) so that only the lower portion needs to be tempered.

Don’t pay extra money for triple pane windows (see above under “Energy Efficiency”) unless it’s for sound-control windows.

Don’t be sold *Heat Mirror* glass in which a reflective film is suspended between the two panes — it’s very expensive, the film has a tendency to curl at the corners over time, and state-of-the-art Low E3 glass has solar control properties that are as good or better.

Varying the thickness of the glass in standard dual-pane windows is much less expensive than using true “sound-control” windows and achieves acoustic results that are sufficient for most situations.



Courtesy MILGARD Windows

WINDOW COMPARISON/COSTS BY TYPE OF FRAME

	ALUMINUM	VINYL	FIBERGLASS	WOOD
ADVANTAGES	Narrow, sleek appearance Maximum glazing area Maintenance-free Least expensive	Energy-efficient Maintenance-free Relatively inexpensive Best value for the money in terms of energy-efficiency	Energy-efficient Stronger than aluminum, vinyl or wood Paintable (looks like wood) Impervious to insects Greatest resistance to seal failure (frame expands and contracts at same rate as glass) Multiple grid and hardware options Least environmental impact in manufacturing	Energy-efficient Paintable and stainable Multiple grid and hardware options Pella offers between-the-glass shades and retractable screens.
DISADVANTAGES	Thermally-inefficient Color limitations (white, tan, silver, bronze) Grid limitations (usually internal only) Hardware limitation	Heavy (clunky) appearance Color limitations (white or tan/almond) Grid limitations (usually internal only) Hardware limitation	More expensive than aluminum or vinyl Not available in arch configurations	Most expensive Requires some maintenance
BRAND CHOICE	Milgard IWC	Milgard Amerimax	Milgard Marvin	Pella Marvin
APPROXIMATE COSTS INSTALLED*	\$500.00 - \$600.00 (Horizontal Slider)	\$600.00 - \$700.00 (Horizontal Slider) \$900.00 - \$1000.00 (Milgard, "QuietLine" Sound-control Horizontal Slider with STC rating of 46)	\$700.00 - \$800.00 (Horizontal Slider)	\$1400.00 - \$1600.00 (2-wide Casement)

*Prices quoted assume a 4' x 4' window with insulated Low E2 glass (and with no grids or other accessories) installed in a standard block or frame opening; painting/staining is NOT included.

WHO SHOULD INSTALL MY WINDOWS?

Now that we've broken down windows into their various types, examined the important issues surrounding them, and, hopefully, given you a sense of which product will work best for your situation, let's look at the second component of the window replacement decision: choosing a company to install them.

Let's face it: remodeling contractors as a whole do not have a great reputation. A recent independent survey (this one was not conducted by my company) identified the four major complaints cited by homeowners after completing a project:

- 1) Pushy Salespeople
- 2) Paying Too Much for the Job
- 3) Shoddy Workmanship
- 4) Poor Communication and Follow-through
- 5) "Hidden Costs" Revealed at the End of the Project

In an effort to avoid potential problems, it's helpful to recognize some of the unethical practices or "tricks of the trade" prevalent in our industry.

PUSHY SALESPEOPLE

During sales presentations, unscrupulous window contractors will use tremendous pressure to get you to sign their contract — right then, on the spot. These "tin men" know that once they're out of your house, once you have a chance to think about what you're committing to, the odds of them closing the deal go down dramatically. How do they try to strong-arm you into signing?

Many salesmen use the "close by hanging around" technique (also known as "dropping anchor"). After they've gone through their presentation, they ask for the order. If you say you're not ready to make a decision (maybe you want to think about it or talk it over privately with your spouse), they change the subject. After a while, they return to the business at hand and ask for the order again. When they meet with resistance a second time, they ease off the pressure for a while, then, later, try once more. What these guys are really trying to do is to wear you down. They will not leave your house! They're taking advantage of the basic decency and politeness of most people and are banking on the improbability of you kicking them out. Unfortunately, some homeowners will sign the contract of one of these jokers just to get rid of them.

Another technique used to close a deal is to offer a steep discount (25% or more) if you buy immediately. Different reasons are given for price-cutting. One ploy is the "model home" or "advertising" discount: if you give your permission to use your home as a model to advertise the services of the company in your neighborhood, they will rebate several thousand dollars to you. The only catch is you must sign now. Another justification for heavy discounting is the "keep our workers busy" line. The salesman tells you that, because it's their slow season, they'll do the job for significantly less than they normally charge just to avoid having to lay off their installers. Obviously these discounts are totally bogus. The prices quoted by these types of companies are so inflated to begin with that rebating a few thousand dollars is meaningless. And, of course, despite their claims that it's a "once in a lifetime opportunity," it isn't a limited offer at all. Everyone is given the same "special" discount.

One last ploy is to use the Right of Rescission Law to convince you to part with your money. Even if you're not quite ready to commit to the contract, the salesman will urge you to write a check for the deposit anyway, just so he doesn't have to make a return trip later to pick it up. Meanwhile, he'll say (correctly), that if you decide to cancel within three days, his company will refund your money as per the Right of Rescission Law. This sounds great in theory, but in practice it's another story: getting your deposit back from one of these companies is like pulling teeth. First, the salesman won't return your phone calls. Then, after stonewalling for several days, he'll claim that the time limit has passed and your right

to rescind has been forfeited. Yes, you can fight the company and probably win — eventually. But all too often homeowners lack the time or energy to do battle. Instead they just give up. *And that's exactly what these unscrupulous contractors are banking on.* They win, you lose.

PAYING TOO MUCH FOR THE JOB

There are two ways you can pay too much for new windows. First, as explained above, pushy salespeople will simply overcharge for their product. A top-of-the-line 4' x 4' vinyl window with insulated Low E2 glass should run you about \$600.00 - \$700.00, installed. Incredibly, some companies charge up to \$2000.00! (In most cases, 20% or more goes to the salesman in commission which explains his perseverance in trying to close the deal.)

Another type of rip-off is selling a homeowner more than he or she needs. Triple-pane windows in Phoenix, Arizona is a classic example (as explained in the “Energy-efficient Glass” section above, this is a “northern states” technology designed to reduce conductive heat loss in winter and does little to address our big concern: radiant heat gain in the summer). “Heat Mirror”, significantly more expensive but with thermal properties only marginally more effective than Low E2 glass, is another. The “What Type of Window Should I Purchase” portion of this report attempts to link the proper window styles and technologies to the specific priorities of the consumer. If you purchase additional features (I might say “gimmicks”), you'll end up paying too much.

SHODDY WORKMANSHIP

Shoddy workmanship can take many forms: windows installed out-of-square or out-of-plumb, too much or too little caulking, wood casing that doesn't butt neatly at the mitered corners, damage to your property (e.g., scuffed floors, dented walls, stucco or plaster “blow-outs”), poor clean-up, etc. The sad truth is that good craftsmen are a diminishing breed. Many window installers are unqualified or simply don't care. And, unfortunately, there's no way to guarantee that your job will be done right the first time. As I'll show a bit later, however, there are ways to stack the deck in your favor and to minimize the chances of a disaster.

POOR COMMUNICATION AND FOLLOW-THROUGH

Like it or not, when you enter into a contract with a remodeling company, you've embarked on a relationship that's far more personal than most business transactions: *these people will be in your home, disrupting your daily routine.* Within this context, poor communication and follow-through is particularly aggravating. It's a common ploy of unethical contractors to hold on to a deposit for months before scheduling a job, refusing to return phone calls in the interim (deposits are considered “free money” — the company doesn't incur any costs on the job until they receive the product and send out installers — so they're in no hurry). Or how many times have you heard of a friend or neighbor taking the day off from work only to wait around for installers who never show up? And how about installers who show up to start the job but then pull off before it's finished to go work on another project? Even if the company is well-intentioned and ultimately delivers a quality product, poor business practices and a lack of professionalism can taint the experience for the homeowner.

“HIDDEN COSTS” REVEALED AT THE END OF THE PROJECT

I'm continually amazed at how many contractors present their “proposal” in the form of a dollar figure scribbled on the back of a business card or window brochure. Unfortunately, any consumer who enters

into an agreement based on this type of “contract” is leaving themselves wide open to additional charges for all sorts of “hidden costs.” The window replacement company always has the upper hand in this area. They know (or should know) all the variables of the job. Meanwhile, all the homeowner cares about is getting new windows — they don’t have a clue as to what actually goes into the process. Again, the company may be well-intentioned and merely sloppy, as opposed to unethical, but unless each aspect of the job is detailed or specifically excluded, *in advance, in writing*, the stage is set for misunderstandings and monetary disputes at the end of the project.

RECOMMENDATIONS

I hope at this point I haven’t frightened you away from having your windows replaced altogether. Yes, remodeling can be stressful and problematic. On the other hand, if you do some basic research, you can navigate your way safely through the minefield of potential disasters and end up with quality products, professionally installed — all with a minimum of hassle.

Here’s what you need to do:

1) Confirm that your contractor is licensed. By “licensed,” I don’t mean that he’s purchased a fifty dollar city sales tax certificate — I mean that he’s licensed with the *Arizona Registrar of Contractors*. This credential means that he’s passed testing to determine basic competence in both technical knowledge and business acumen. More importantly, the agency provides an arbitration service in the event that any disagreement develops between the two parties, and an official record, available to the public, of how many complaints have been lodged against the company. Lastly, the Registrar’s “Recovery Fund” may be available to reimburse you for any damages you suffer at the hands of your contractor.

And don’t take his word for it when he tells you he’s licensed — call this number: **602-542-1525**, or visit this website: www.rc.state.az.us/ to find out for yourself.

2) Check out the company with the Better Business Bureau. This is another agency that can alert you to any problems the contractor might have had with past customers.

Phone Number: 602-264-1721

Website: www.arizonabbb.org

3) Choose an installation company that represents more than one manufacturer. The “What type of window should I purchase?” section of this report gives you some idea of the wide range of styles available. Someone who walks into your home promoting one type of window exclusively is usually more interested in blindly selling you his product than in listening to what it is you want and in meeting your needs. I liken it to purchasing insurance, working with an independent agent rather than a representative from one specific carrier.

4) Make sure that the workers who actually install your windows are company employees. In our industry labor is usually furnished by *subcontractors* (most of whom are unlicensed) and not by the company whose name is on the contract you sign. Under this scenario, installers have an incentive is to get the job done quickly but not necessarily in accordance with high standards of craftsmanship, particularly if the cost of incidentals such as caulking, insulation, and trim is coming out of their own pockets. Likewise, they’re poorly motivated to return to a job later to fix any defects. When technical problems arise in the middle of the project, buck-passing frequently occurs between the salesman and the subcontractor (this is one reason I urge against using “big box” stores for window replacement — these companies are notorious for the disconnect between the corporate sales department and the various subcontractors who actually

perform the work). I strongly recommend choosing a company that uses *payrolled employees* to work on your house. This way, one entity is taking complete responsibility for your job.

5) Regardless of who installs your windows, verify that they're covered by Workers' Compensation. Years ago I was told a story by one of our customers, an elderly lady living in Sun City, who had contracted with a handyman to install ceiling fans throughout her house. The worker, while crawling through the attic, fell through the ceiling and landed on an antique coffee table, destroying it. Here's the kicker: the lady not only lost a cherished and valuable family heirloom, she also had to pay the handyman's medical bill! Because he had no workers' compensation (and no money), he went after her homeowners' insurance policy to recoup the cost of mending his broken arm. Here's another troubling fact: *the vast majority of window replacement jobs in this market are done by installers with no workers compensation coverage.* I know this because hardly a week goes by that I'm not contacted by someone looking for work — most of these applicants have bounced from one window company to another where, almost invariably, they've been doing piecework (i.e., they've been paid "per window" rather than "by the hour"). I always ask these guys, "Who paid for your Workers' Compensation," and, nine times out of ten, the installer shrugs and answers, "We never worried about that." *Remember: Workers' Compensation insurance protects you from liability if a worker is injured while on your property. Demand to see a copy of your contractor's policy.*

6) Choose an installation company that's been around for a while — at least a decade. Most remodelers fail within the first three years. If you enter into a contract with a newly-formed business, what assurance do you have that they'll be around to provide service down the road? And don't be fooled by the "20 Years Experience" line. "Experience" means either that they were an employee somewhere else (which is a lot different from being an owner and running a successful operation) or that they had a different business previously, under a different name (in which case you would do well to ask, "What happened to the other business?"). What's important is the longevity of *this* company, operating under *this* name, *here in Phoenix*.

7) To avoid misunderstandings and the possibility of "hidden costs" at the end of the job, make sure the contractor addresses the following issues, in advance, in writing:

What frame type will the windows be (i.e., aluminum, vinyl, fiberglass, or wood)?

What color will they be?

What type of glass will each window have (e.g., Low E, tempered, obscure)?

Is argon gas included?

Are screens included — if so, what color will they be?

What color is the hardware?

Are grids included — if so, what type and pattern?

Are any other accessories included (e.g., between-the-glass shades, retractable screens)?

What is the handing of each window (e.g., do the sliders open left-to-right or right-to-left; which side are the casements hinged on?)

If an existing opening is to be modified, who takes care of re-routing any electrical or plumbing lines?

Will any interior and/or exterior trim be needed? Is this included?

Will any drywall or stucco repair be needed? Is this included?

Will any painting or staining be needed? Is this included?

At the end of the job will the contractor haul off all the old windows and any debris?

8) Select a company with a showroom — and go visit it. This is important for two reasons. First, it's always a good idea to see the product before you buy. Glossy brochures are great, but there's no substitute for a hands-on demonstration. Secondly, a trip to the company's facility can be revealing. Many installers are one-man operations working out of their home and may or may not be in business one year from now. On the other hand, investment in an attractive showroom with numerous displays indicates financial stability and commitment to providing long-term service. And note how you're treated during your visit. Are you greeted in a pleasant manner? Is the staff helpful? Professional? Is the atmosphere "customer-friendly?" Remember: representatives of this company will be guests in your home. Find out as much as you can, in advance, about the way they do business.

9) Ask your contractor to provide you with references, preferably in your neighborhood. He should do this gladly. After all, if the company has a history of good work done professionally, past customers are a great selling tool to help land new business. Call some of these people and inquire as to how the contractor performed — most people are happy to give you an honest evaluation. You may also want to look at a project he's done that's similar to yours. If you're hesitant about "imposing" on another homeowner, ask for an address so you can drive by and view the job from the street.

10) Make sure you're comfortable with the salesperson. Does he/she arrive on time or call if he's running late? Is he "pushy?" Does he listen attentively or does he "talk over" you. Does he seem to be in a hurry or uninterested? Is he knowledgeable? Professional? This person should be your advocate within the company, communicating your needs to the production department, ensuring that they be met. Do you have confidence in his willingness and ability to do this?

11) Don't buy on the salesperson's initial visit. *Most window salesmen are instructed to go for the "one-visit close."* Deciding in advance to delay your decision will relieve pressure during the presentation and will allow you to focus on the merits of the products shown to you. Regardless of what you're told, there's no rule that states that you have to commit right away. If what the salesman offers is really a good deal, it will still be a good deal tomorrow (or next week). And with some time to think it over you'll be better able to make a sound, informed decision. Don't worry about "hurting his feelings" or inconveniencing him by forcing him to make a return trip — that's part of his job.

12) Pick a company that uses a live person to answer the phone rather than a recording or answering service. In the weeks that follow your signing a contract, you will need to have numerous conversations with the company to finalize the details of the job and to schedule and confirm your installation date. Having to leave a message and then waiting, sometimes days, for a response will drive you crazy. Likewise, if there's a problem once the job begins (e.g., installers not showing up on time, windows not being the right size or color, etc.) you'll want to speak to someone right away. Again, this is one of those important details that indicates stability, professionalism, and commitment to customer service.

CONCLUSION

I hope at this point you have a better sense of what's involved in replacing your windows, both from the standpoint of the product options available and in terms of the things to look for to insure a professional installation. In answering the question "What type of window should I purchase?" it's helpful to step back and consider what your prime motivation is — energy-efficiency, aesthetics, performance, freedom from maintenance, or dust/noise reduction (or perhaps something else). Being clear on what you want up front will point you in the right direction. As I show in the first part of this report, window manufacturers have gone to great lengths in designing products that effectively address each of these issues. But make sure there's a match between the features of a particular window and your specific needs; the technology you pay for should deliver the results you desire. There are lots of bells and whistles that add to the cost of products and that might be beneficial in another part of the country, but that perform no better here, in Phoenix, Arizona, than a simpler, less expensive option. One of my prime motivations is to save you money.

And in response to the question "Who should install my windows?" really all I'm advocating is a bit of common sense. I've pointed out some scams and potential pitfalls to look out for and I've suggested some keys to identifying ethical, professional contractors, but my basic message is this: trust your instincts and do your homework.

Thanks for taking the time to read this report. Please feel free to contact me personally with any questions or feedback (my phone number is 602-233-1981 or you can email me at cmarvin@freeliteAZ.com). And if you'd like my company, **FREELITE**, to take a look at your project, we'd love the opportunity to earn your business. You can either give us a call to arrange a free in-home estimate, or you can use the online bid form on our website (www.freeliteaz.com) and we'll fax or email you a quote. Regardless of whom you choose to work with, I wish you all the best with your remodeling.

REFERENCES/LINKS

www.remodelingmagazine.com

Click on the “Cost vs. Value Report” icon for an analysis of popular home improvements, including window replacement, by region

www.efficientwindows.org/

This site, sponsored by the US Department of Energy and window industry members, provides unbiased information on the benefits of energy-efficient windows, descriptions of how they work, and recommendations for their selection and use.

www.energystar.gov

The website for the “Energy Star” rating system, a government-backed program helping businesses and individuals protect the environment through superior energy efficiency. Check here for the latest information on federal energy tax credits.

Residential Windows

A Guide to New Technologies and Energy Performance

— John Carmody, Stephen Selkowitz, Dariush Arasteh, Lisa Hescong

Published by W.W. Norton & Company

www.rc.state.az.us/

The website for the Arizona Registrar of Contractors — log on to verify that a company is licensed and to determine if they have a history of complaints

www.arizonabbb.org

The website for the local Better Business Bureau — another good resource for checking the “track record” of a contractor

www.milgard.com

The website of Milgard Windows, a recommended manufacturer of aluminum, vinyl, and fiberglass windows and doors.

www.amerimax.windows.com

The website of Amerimax Windows, a recommended manufacturer of vinyl windows and doors

www.pella.com

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www.marvin.com

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www.intlwindow.com

The website of International Window Corporation, a recommended manufacturer of aluminum windows and doors.