

Cap & Trim Framing Guide

Note: We do not sell framing or ridge flashing material, shop local.

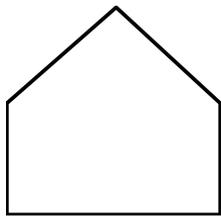
Introduction: Focus is on wood framing, but frames can also be fabricated from steel or aluminum. Layout is the same for all frame types.

Select Polycarbonate: The thicker the sheet the higher the insulation and strength. Thick sheets require less framing to support the load. Ultimately the frame supports the load. Polycarbonate is simply a sheet that gets fastened to the frame.

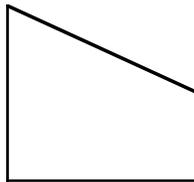
Cap Only System

- Cap available in 8 ft. lengths only. Simply splice to do longer runs.
- System used on stud & rafter or post and beam framing.
- Low cost.
- Polycarbonate sets directly on framing.

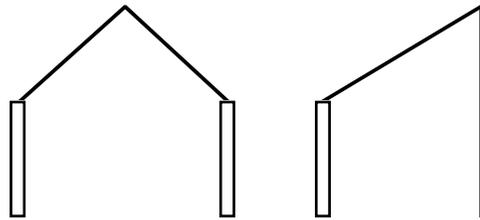
Typical Projects:



Greenhouses &
Pool Enclosures

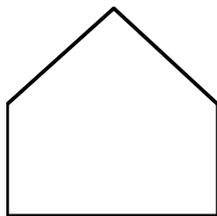


Sunrooms

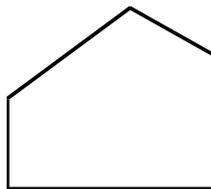


Covered Walkways, Skylights,
Patio Covers, Canopies, etc.

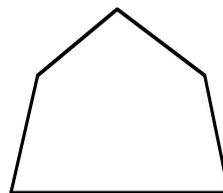
Styles:



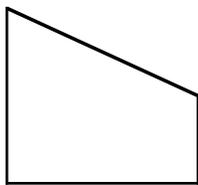
Conventional
Freestanding



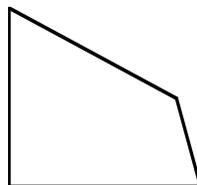
Solar Style
Freestanding



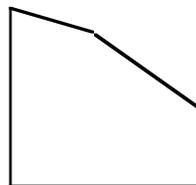
Gambrel Roof
Freestanding



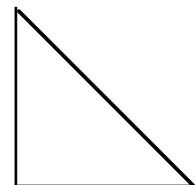
Conventional
Lean-To



Solar Slope
Lean-To



Double Slope
Lean-To



Single Slope
Lean-To

Solar Siting: Position structure with long wall facing true south. If structure orientation within 45 degrees of true south & roof pitch minimum of 4/12 (18 degrees) it will function well as a solar collector. Check for obstructions that cause shade as sun passes overhead. Deciduous trees offer shade during warm months and let in the sun during cooler months. Refer to solar reference books should you wish to be more exacting than these rule-of-thumb guidelines.

Wood is an excellent framing material. Redwood, cedar & cypress are rot resistant. Seal high moisture areas of frame with satin spar varnish or Varathane. Coat top and bottom plate and areas where poly contacts wood. This decreases wood rot and stops discoloration. The smooth, nonporous surface is ideal for placement of a thin coat of ArmorAll, place on areas of frame that come in contact with polycarbonate, prior to install of sheet. ArmorAll assists in free expansion & contraction of the poly, decreasing possible movement noise. **For ACQ pressure treated see page 9.**

If you desire a painted frame select dry lumber. Prime and paint on one coat of high quality semi-gloss paint. The semi-gloss provides for easy cleaning. Also, the smooth, nonporous surface is ideal for placement of a thin coat of ArmorAll, to be placed on areas of frame that come in contact with the polycarbonate, prior to installation of the sheet. Let dry thoroughly, lightly sanding between coats. Assemble frame and apply final coat. White is highly reflective and best for greenhouse use. Make sure to paint butt ends of boards prior to assembly of frame. Select straight kiln dried lumber.

Frame Design for Cap & Trim System: The simplest way to frame for the multi-wall poly is to set studs and rafters 24-1/8" on-center. This allows for a slight gap between sheets, required for fasteners & sheet movement. 1st & last frame member should be 24-1/8" from outside frame to center of 1st or last rafter or stud. This lines up outside edge of the 1st and last sheet with outside edge of first and last rafters and studs. Make first and last dimension less if you choose to have sheet overhang gable end.

For small greenhouses, frame lumber is typically 2x3's or 2x4's. On larger structures and in areas with high snow loads, take care to make roof framing strong enough to support the load. To decrease rafter size, incorporate a brace or truss in your design, see next page. On long rafter runs, install blocking to keep the rafters straight. Hold blocking 3/8" back from the inner surface of the sheet, allowing for movement of condensation past blocking (see following charts and diagrams).

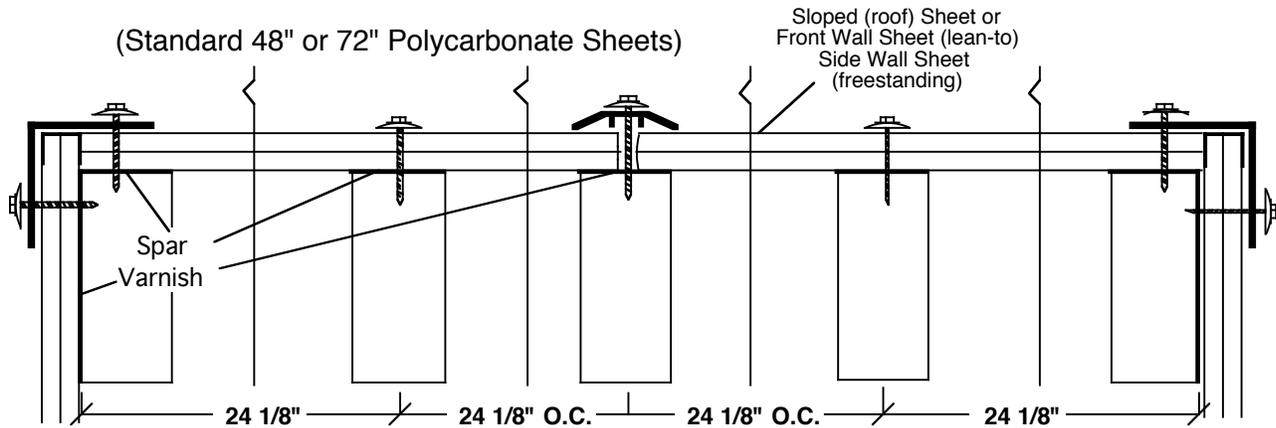
On large structures designer may want large rafters and studs positioned further apart. Set intermediate rafters & studs 48-1/4" on-center. The first & last framing member positioning should be 48-1/4" from outside of framing to center of 1st or last rafter or stud. Make first & last dimension less if you choose to have sheet overhang gable end.

Use 48" wide roof sheets, as it is difficult to reach fastening points with 72" sheets. Blocking that supports the sheet is required. To allow for the movement of condensation past blocking set our neoprene spacer at the center of blocking. Select lumber with less height than surrounding frame material and set the blocking back from the outer surface of the adjoining rafter (see following charts and diagrams).

In either case polycarbonate sheet must be supported on all 4 edges with min. 1/2" of sheet bearing on frame. When using sheets that are cut along the width, and no longer have a rib at the edge, position so first rib is supported by a minimum of 1/2" of frame.

The chart below provides guidelines for blocking spacing. The chart is provided to address roof snow & wind load, but may also be used as a guide for wall design.

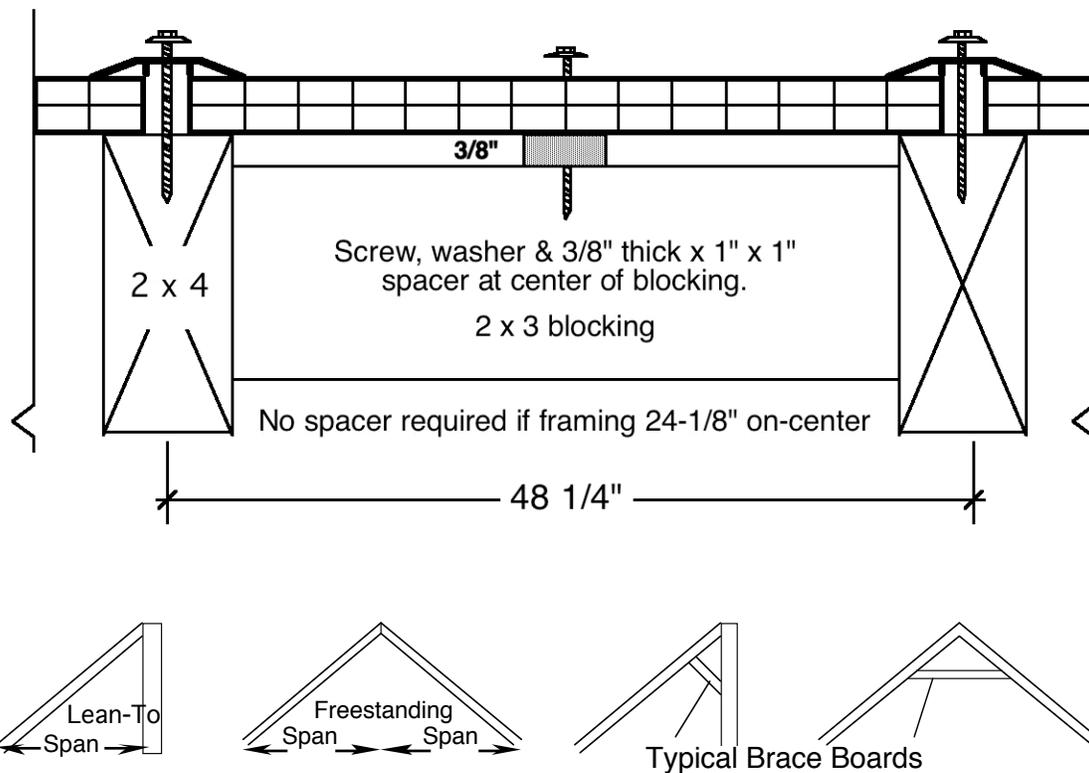
Typical Framing Layout For Cap & Trim Over Wood Frame



End wall framing determined by wall size. Maintain 1/4" space between sheets. Place studs as needed.

Sheet Thickness	Rafter Spacing	Blocking Spacing		
		35 lb. load	45 lb. load	60 lb. load
8mm	24-1/8"	not needed	every 8 ft.	every 6 ft.
8mm	48-1/4"	every 2.5 ft.	every 2 ft.	do not use
16mm	24-1/8"	not needed	not needed	not needed
16mm	48-1/4"	every 4 ft.	every 3 ft.	every 2.5 ft.

Load For Blocking & Rafter Spacing: Load is live (wind & snow) & dead (weight of rafter and what lies on it). 35 lb. is for areas with no snow, little wind. 45 lb. is areas of normal wind & snow. 60 lb. loads, high wind and snow. Roof slopes over 30 degrees (7/12 pitch) the roof span may be increased or rafter size decreased due to a decrease in snow load from the steep slope. Speak to building department for snow load adjustments.



Structural Loads & Special Screw Positioning for High Wind Areas.

Structural Loads are stresses to structure from external or internal forces.

- Dead loads are gravity loads that are constant throughout the structure's life. These include equipment such as fans, heaters and plants suspended from the frame.
- Live loads are temporary, such as snow loads and wind loads.
- Snow loads are determined by factors influencing snow & ice accumulation on structure. Snow loads vary considerably by geographic location. Ask your local bldg. dept. for snow load in your area. (12 inches of light, fluffy snow or 2 to 4 inches of heavy, wet snow = about 5 lbs per sq. ft.)
- Wind loads come from any direction, usually hit side walls at a perpendicular angle.

Figures are in lbs. per sq. ft

Wind	85 mph	90 mph	100 mph	120 mph	130 mph	140 mph	150 mph	160 mph
	18	20	25	36	43	48	56	85

Above wind load figures provided by SABIC Innovative Plastics, Lexan manufacturer.

Wind speeds up to 90 mph: Screws with 3/4" sealing washers to be set at corners of glazed areas and every 1 ft. on-center. Cap and Corner receive screws at ends of each Trim piece and every 1 ft. on center. **In winds of 110 mph** and over decrease distance between screws to every 10". **In winds of 120 mph** and over we will make recommendations, but consult with engineer to receive a stamp and bldg. dept. approval. For placement of screws in body sheet see Polycarb. Position & Attach, in the Install Manual. Increase quantity of screws in mid sheet, horizontally across the sheet, to every 12" for wind speeds 110-130 mph. 10" for wind speeds 131-150 mph. 8" for wind speeds 151 or greater.

- Combination loads are common. For example, a snowstorm may include high winds.

If bldg. dept. says design for a 45 lb. snow load & a 90 mph wind, snow will effect the roof with a 45 lb. load and wind will effect roof with a 20 lb. load. To safely design your roof framing, take the 45 lb. snow load, add 20 lbs. for positive loading effect the wind may have on the roof. Design for a 65 lb. load.

Large Span Wood Frame Systems: Laminated Timber Beams (glulams) are an excellent choice for large span (width) sunrooms, greenhouses, pool , etc.

These manufactured wood products are made by stacking, gluing and clamping layers of sawn lumber. For example, a standard size glulam of 3" wide x 5-1/2" high will consist of 4 layers of sawn lumber, laid flat. The end result is a structural member with a bending strength approximately double that of the equivalent size commercially available solid sawn timber. Much improved shear strength is also realized with this structural wood product. Common wood species used are douglas fir or larch & pine.

To determine timber size refer to Recommended Spans for Rafters, see following page. From this chart estimate timber size. Keep in mind, laminated timbers are approximately twice as strong as dimensional lumber of the same size. Now run design by your bldg. dept. for their approval. If you are a builder, designer or architect refer to appropriate load chart resources available to you.

For joints and connections we suggest using structural connectors engineered for this specific purpose. For an excellent selection of connectors see the Simpson Strong-Tie web site at strongtie.com or visit your local lumber yard for a catalog.

For photos and an overview of glulams see the Unadilla Laminated Products web site at unalam.com. For a more in depth coverage of glulams visit a local lumber yard that caters to professional builders. They typically deal with a number of major laminated timber manufacturers and will have access to product literature and design guides.

Metal Plate Connected Wood Roof Trusses can be used to span large width structures, such as freestanding greenhouses and pool enclosures. Trusses are made from dimension lumber and metal connector plates.

Pre-fabricated trusses have revolutionized residential roof framing over the last three decades. Today, over 75 percent of all new homes are constructed with trusses. Trusses are lightweight and no on-site assembly is required.

Main disadvantages of trusses are the triangular pattern of 2 x 4's is not as attractive as conventional lumber or glulams, the structure occupies overhead space & trusses block

light. To increase reflected light & help trusses blend into clear or white polycarbonate roof, paint trusses white. Minimize noise as sheet moves. Use flat paint on surfaces facing poly or semi-gloss and ArmorAll on surfaces facing poly (see Wood top of p 2).

Advantages are lower cost and installation is quick, making large span wood frame greenhouses and pool enclosures possible for those with more modest budgets.

We suggest nominal 4 ft. spacing to create an open effect, but nominal 2 ft. spacing is also okay. Always present your design to the building department for final approval.

RECOMMENDED SPANS FOR RAFTERS

2 and 4 ft. spacing is common when covering frame with 4 ft. wide polycarbonate. Refer to Cap & Trim or Base & Cap framing instructions for exact framing dimensions.

Load shown in lbs./sq. ft. **Spans** increased by incorporating a brace board that attaches to corresponding rafters, or wall of adjoining structure, creating a strong truss.

Spacing	Load	2 x 3	2 x 4	2 x 6	2-(2 x 3's)	2-(2 x 4's)	2-(2 x 6's)	4 x 4
2 foot	35 lb.	4'7"	6'6"	9'6"	6'5"	9'3"	13'5"	8'9"
	45	4'1"	5'8"	8'4"	5'10"	8'0"	11'10"	7'7"
	60	3'6"	4'11"	7'3"	5'0"	7'0"	10'3"	6'8"
4 foot	35 lb.	3'2"	4'7"	6'8"	4'7"	6'6"	9'5"	6'2"
	45	2'7"	3'8"	5'11"	3'8"	5'2"	8'4"	4'11"
	60	2'0"	2'9"	4'4"	2'10"	3'10"	7'3"	3'8"

Maximum allowable spans apply to #2 Douglas fir or larch with roof slope of (7/12 pitch) or less. For steep roof slopes refer to bldg. dept. for deductions in snow load and rafter size.

Table may be used for other species & grades of wood, adjust the spans as follows.

For these grades & species span may be increased by the following percentages:

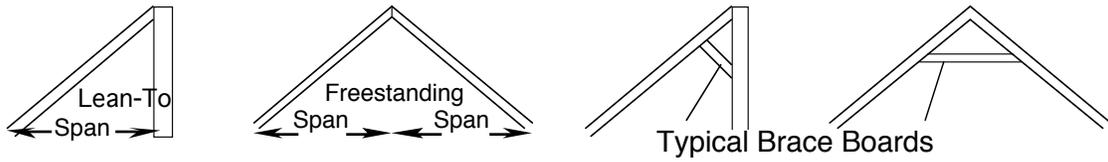
Douglas fir or larch, select structural: increase 20%	Douglas fir or larch, #1: increase 10%
Southern pine, select structural: increase 18%	Southern Pine, #1: increase 7%
Calif. redwood, clear select structural: increase 36%	C. Redwood, select str.: increase 18%
Calif. redwood, #1: increase 36%	Western cedar, select str.: increase 2%

For the these grades & species span may be decreased by the following percentages:

Southern pine, #2: decrease 2%	Calif. redwood #2: decrease 2%
Western cedar, #1: decrease 6%	Western cedar #2: decrease 14%
Hemlock or fir, #1: decrease 2%	Hemlock or fir #2: decrease 11%
Spruce, #1: decrease 9%	Spruce #2: decrease 16%

(Source: Add-On Solar Greenhouses & Sunspaces by Andrew M. Shapiro)

Note: Cypress is similar in strength to douglas fir. Consult with your source for exact figures.

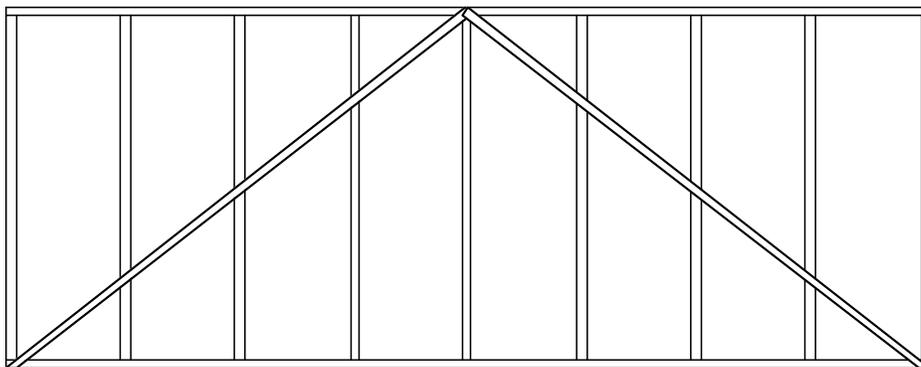


Diagonal Bracing: To eliminate racking of a wood structure, conventional construction methods incorporate diagonal bracing and/or a skin material with shear strength (such as plywood). Greenhouses are covered with glazing materials that are great for letting in the light, but offer no shear strength. It is wise to use some method of diagonal bracing on, at least, the end bays of freestanding greenhouse side walls (front walls of attached greenhouses) and also on roofs in extreme high wind areas.

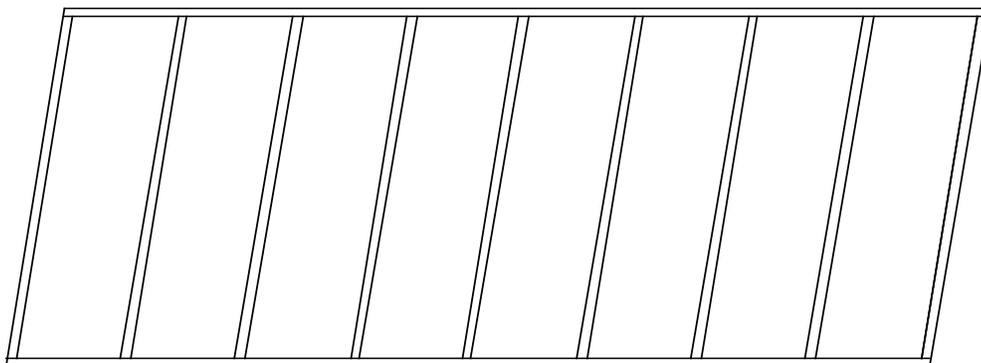
To maximize light transmission and minimize installation time we suggest using light gauge steel Wall Bracing Straps, as manufactured by Simpson Strong-Tie (#WB) and other structural connector manufacturers, using similar product numbers. These 1-1/4" wide x 9' 6" long straps are manufactured from galvanized steel. Numerous holes are punched in the strap, providing for simple and quick attachment. You may choose to paint these prior to installation. White blends well with clear polycarbonate. Position on exterior surface of frame, as shown below, and then install the polycarbonate.

These structural building components are recognized by your local building department. If the building department questions you about diagonal bracing, bring the structural connector product literature along with your plans.

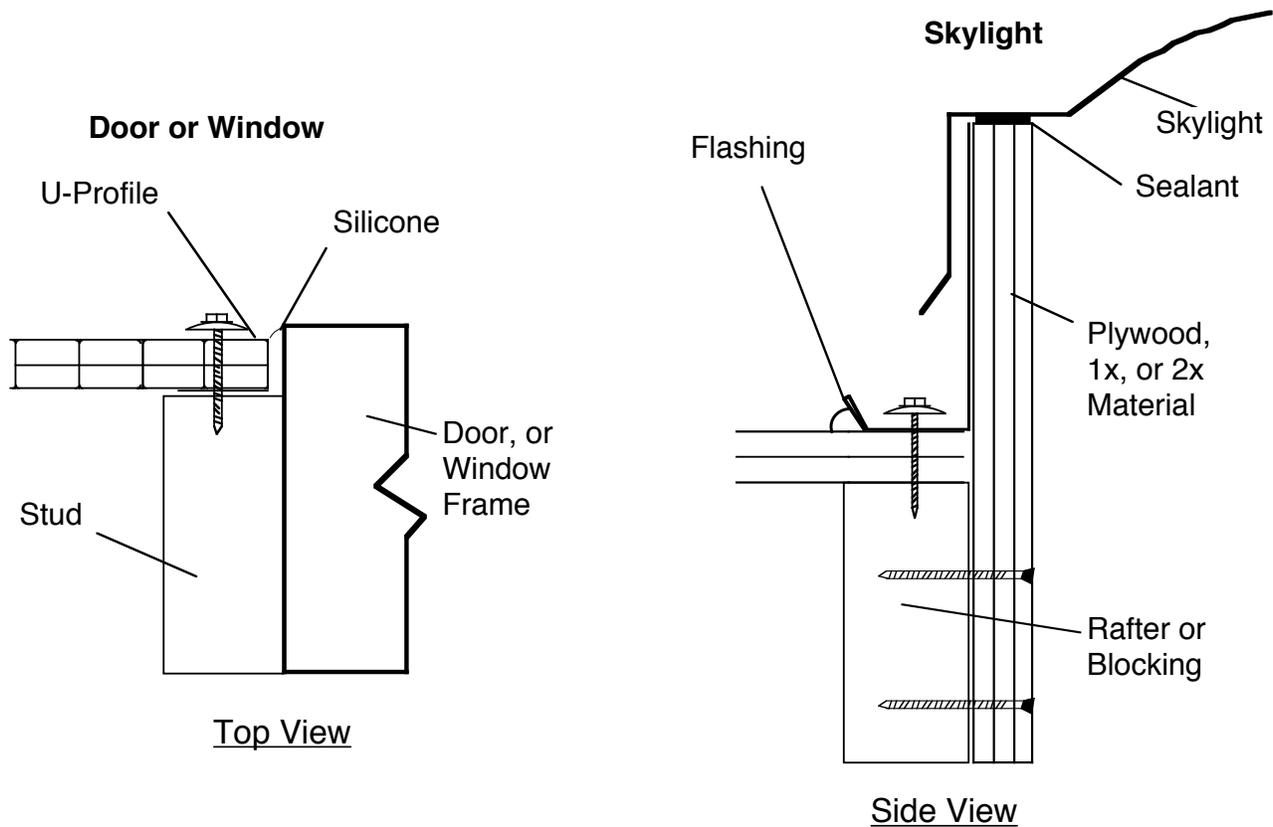
Stud wall with steel Wall Bracing Straps in place.



Stud wall where racking has occurred.



Window, Door & Skylight Details: Installing polycarbonate sheet adjacent to these building components is a straightforward process. Refer to drawings below for examples of common installation techniques. A greenhouse typically does not include skylights and windows, but a sunroom often does. Doors are most often purchased from a lumber yard or home improvement center. Select one that is appropriate for your application. A wide selection of doors are available. Common choices are wood entrance doors with 1 large lite of glass, many small pieces of glass, combination storm doors and patio doors. Some builders will construct a door frame and cover the frame with polycarbonate. Select option best suited to your needs & skill.



Lumber and ACQ Pressure Treated Notes:

For maximum frame & fastener life use redwood or cedar. Avoid sap wood.

Seal high moisture areas of frame with satin marine spar varnish or Varathane. This protects top & bottom plate, and areas where polycarbonate contacts wood. This decreases wood rot, stops wood discoloration and creates a barrier between the chemicals in pressure treated and the polycarbonate. The smooth, nonporous surface is ideal for placement of a thin coat of ArmorAll, place on areas of frame that come in contact with poly, just prior to installation of the sheet. ArmorAll assists in free expansion & contraction of the poly, decreasing possible movement noise.

#300 series or 18.8 stainless steel (or other ACQ approved) screws should be used with ACQ Treated Lumber. Other screws will corrode

Our standard screws are hardened carbon steel with a special Organic Polymer Coating. This screw is appropriate for all species of wood. The ACQ chemical will corrode the screw so we do not recommend using ACQ if possible.

We do have some options for fastening polycarbonate to ACQ and will be developing more over time.

One option is our typical painted screw and washer type assembly but the screw is a strong, corrosion resistant, #14 - 304 stainless hex head screw. These are rather expensive, about 4 times the cost of our standard steel screw assemblies, and are sold in the same 250 bag quality.

The other option is separate, unpainted and unassembled, pan head style 18.8 screws and separate washers. These screws are softer and one has to set carefully or the head will strip and/or the screw will snap. Cost is twice the cost of of our standard steel screw assemblies, sold in same 250 bag quality.

Simple solution is "Avoid ACQ".