

# CARBOLITE Polycarbonate Data

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## LIGHT TRANSMISSION/ HEAT TRANSMISSION:

Twin Wall Sheet	Light Transmission	Heat Transmission
Clear	86%	72%
Grey	42%	45%
Bronze	42%	45%
Solar Metallic	25%	28%
Opal	68%	68%

Definition of:

**Light Transmission:** The percentage of incident visible light that passes through an object.

**Heat transmission:** The percentage of incident solar radiation that passes through an object.

The wavelength of sunlight arrives at the earth's surface range in between 295-2140nm. This is generally divided into the following wave bands.

Middle ultra – violet areas: UV-B280-315nm

Near ultra – violet areas: UV-A315-380nm

Visible light areas: 380-780nm

Near infrared light areas: 780-1400nm

Middle infrared light area: 1400-3000nm

## THERMAL INSULATION

Polycarbonate twin wall material has special advantages in relation to temperature insulation. The middle air gap between the flutes produces lower thermal losses than single skin translucent material. Thermal losses is figured in “K” unit (w/m<sup>2</sup>k)

### Comparative products.

Glass Thickness	4mm	6mm	8mm	10mm	12mm	16mm
K(W/m <sup>2</sup> K)	5.82	5.77	5.71	5.66	5.61	5.51
Solid Polycarbonate Sheet	4mm	6mm	8mm	10mm	12mm	n/a
K(W/m <sup>2</sup> K)	5.33	5.09	4.84	4.69	4.35	3.85
Twinwall Polycarbonate Sheet	4mm	6mm	8mm	10mm	12mm	16mm
K(W/m <sup>2</sup> K)	n/a	n/a	3.3	3.0	n/a	2.4

Long Service Temp

-40C to 120C.

The co efficient of thermal expansion is

0.065mm/m°C

The co efficient of linear expansion is

0.07mm/m°C

The thermal conductivity is

8mm – 3.3w/m°C

10mm – 3.0w/m°C

## SOUND INSULATION

Thickness	Reduction in sound parameter (db)
8mm	18
10mm	19
16mm	21

Decibels (dB) are measured logarithmically. An increase of 10 dB is ten times as loud. Thus, 80 dB is 10 times louder than 70 dB and 90 dB is 100 times louder than 70 dB.

Therefore the material reductions are quite significant as stated in the table above.

## IMPACT RESISTANCE

Twin wall polycarbonate can withstand impact (such as hail) but under certain stipulations. A sheet will withstand a hail stone measuring no more than 20mm in diameter falling at no faster than 75km/h (as measure by the Dept. of Meteorology.)

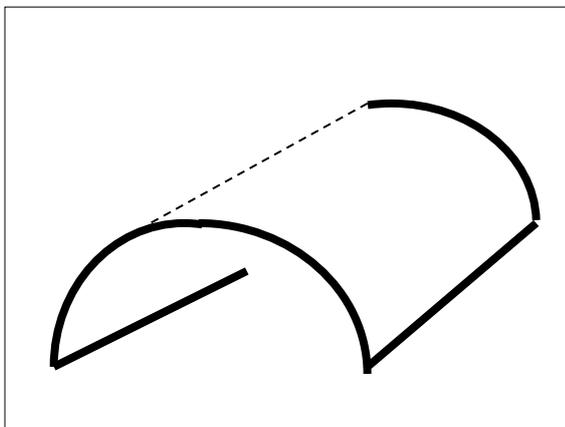
At this point, the material is deemed to have failed if the top layer is broken. Please note denting/dimpling may occur when this event occurs but under warranty conditions does not constitute a damaged sheet.

PC hollow sheet features excellent impact resistance, it is 80 times stronger than normal glass. A 2kg falling dart drop from 1 meter high, sheet surface won't show any cracks. Its service temperature range is from -40°C to +120°C, in which all its physical performance keep stable.

## FIRE RETARDANCY

CARBOLITE sheets have been tested to comply with

## BENDING RADIUS



Sheet Thickness	Max. curve radius
8mm	1400mm
10mm	1750mm
16mm	1750mm

## CHEMICAL CAPABILITY

The following chemicals **are incompatible** with the use of CARBOLITE twin walled polycarbonate sheeting.

acetic aldehyde	carbolic acid	dioxin
acetic acid	carbon difulasade	ethylamine
acetone	carbon tetrachloride	ether
acrylonitrile	chlorobenzene	pvc
ammonia water	lilac	gasoline
ammonium fluoride	cresol	nitrobenzene
benzene	cyclohexanone	nucleolus
pyridine	petroleum	phenol
chlorperoxide	styrene	tetrachlorothene
thf	tetralin	thiophenes
toluene	xylene	ammonium hydroxide
cement	oil	2-ethanolamine
ketone	sodium hydroxide	nitric acid
benzoic acid	dimenthylformanide	pyridine

### Compatible Silicones.

With regards to silicone, we recommend the following silicones that can be applied to the sheet. Silicones with neutral cure are recommended but care should be taken when purchasing. Always read the silicone tube prior to purchase as most silicones will specify “neutral cure” or “non acetic”. Silicone should only be applied to the aluminium joining strips rather than the sheet which will avoid unnecessary problems.

CARBOLITE recommends Dow Corning3793 (clear) as it conforms.

## SHEET SPAN CHARTS

Sheet Width	Wind Loads	Distance between centres Ratio 1:1	Distance between centres Ratio 1.5:1	Distance between centres Ratio greater 1.5:1
	Kg/m <sup>2</sup>	mm	mm	mm
8mm	50	900	700	500
	80	700	500	350
	100	500	400	-
	120	400	300	-
10mm	50	1250	1000	750
	80	1200	750	550
	100	1100	600	500
	120	950	520	450
16mm	50	1500	1200	1100
	80	1300	1100	1050
	100	1200	1050	900
	120	1100	950	850
25mm	50	2100	1650	1350
	80	1900	1550	1300
	100	1750	1450	1250
	120	1600	1350	1200
32mm	50	2100	1800	1450
	80	2100	1650	1350
	100	1950	1550	1300
	120	1800	1450	1250

- 1) Data has been based on load tests on typical twin wall sheets and additional extrapolations.
- 2) 90% of the highest ratios distances depicted, indicates the recommended span between longitudinal supporting bars or glazing profiles for two sides clamped glazing.
- 3) Recommended spans are calculated on the basis of a maximum deflection sow 1/20 (5%) of sheets width (perpendicular to rib channels).
- 4) The glazing sheet may withstand even higher loads without buckling, however, excessive lateral shortening, created by higher deflection, may cause the edges to slip out of their supports.

## WIND LOADS

The following table represents the wind pressure load placed on polycarbonate sheet. Wind speed is mathematically calculated as  $Q=KV^2$

Where  $Q$  = dynamic wind pressure

$K = 0.613$

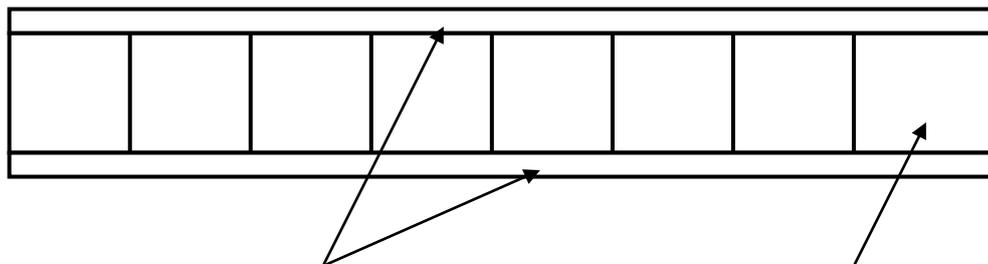
$V$  = wind speed

(m/s)	(n/m <sup>2</sup> )	m/s	(n/m <sup>2</sup> )	m/s	(n/m <sup>2</sup> )	m/s	(n/m <sup>2</sup> )
10	61	20	245	30	552	40	981
11	74	21	270	31	589	41	1030
12	88	22	297	32	628	42	1080
13	104	23	324	33	668	43	1130
14	120	24	353	34	709	44	1190
15	138	25	383	35	751	45	1240
16	157	26	414	36	794	46	1300

The sheets are assumed to be fixed on all four sides. CARBOLITE glazing systems comply with this.

## UV PROTECTION

All CARBOLITE polycarbonate twin wall sheets are UV co extruded both sides of the sheet. The UV protective layer enhances the sheets life allowing the longer life of the sheets warranty. Without UV protection, the sun will break down the polymer which will become yellow and brittle without the protection.



**Co extruded UV Protective film**

**CARBOLITE PC material**

The UV protective layer does not affect the bending radius or impact resistance of the sheet.

Chemicals are highly reactive to polycarbonate sheeting and must not be used on the sheet. Cleaning agents can remove the UV protective cover on these sheets. Please read the above list of chemicals that are NOT compatible.

The warranty on sheet degradation is subject to sheets being analysed before decisions are made. Part of the analysis is that sheets are tested to see if agents have been applied to the

Refer to warranty for further details.

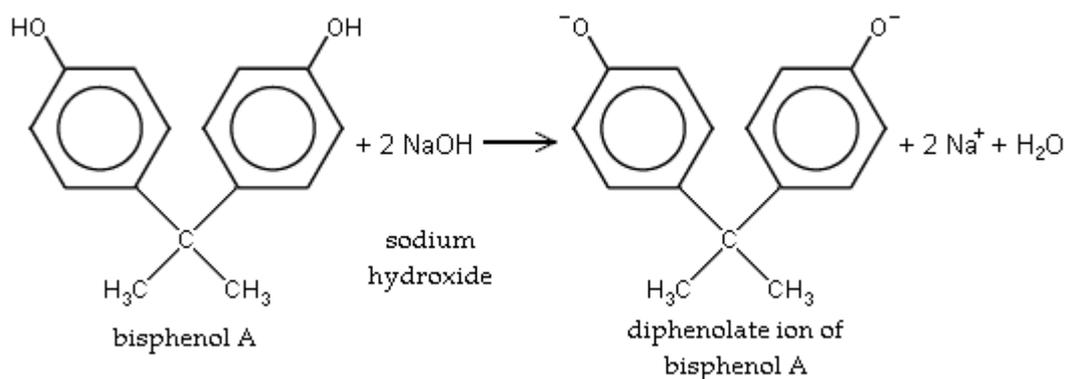
## SHEET STRUCTURE

**Polycarbonates** are a particular group of thermoplastic polymers. They are easily worked, molded and thermo formed; as such, these plastics are very widely used in the modern chemical industry. Their interesting features (temperature resistance, impact resistance and optical properties) position them between commodity plastics and engineering plastics. Their plastic identification code is 7.

**Polycarbonates** received their name because they are polymers having functional groups linked together by carbonate groups(-O-(C=O)-O-) in a long molecular chain. Also carbon monoxide was used as a C1-synthon on an industrial scale to produce diphenyl carbide, being later trans-esterified with a diphenolic derivative affording poly (aromatic carbonate) s.

### Synthesis

Polycarbonate can be synthesized from bisphenol A and phosgene (carbonyl dichloride,  $\text{COCl}_2$ ). The first step in the synthesis of polycarbonate from bisphenol A is treatment of bisphenol A with sodium hydroxide this deprotonates the hydroxyl carbons of the bisphenol A molecularly.

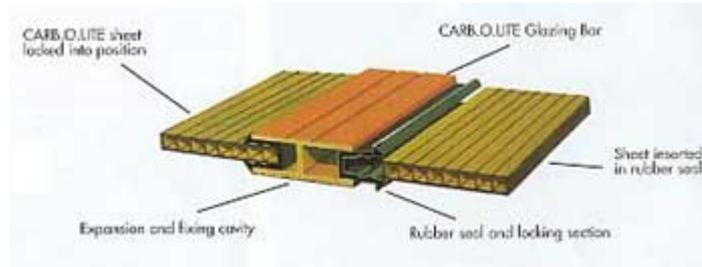


The deprotonated oxygen reacts with phosgene through carbonyl addition to create a tetrahedral intermediate (not shown here), after which the negatively charged oxygen kicks off a chloride ion ( $\text{Cl}^-$ ) to form a chloroformate.

Polycarbonate has a glass transition temperature of about  $150\text{ }^\circ\text{C}$  ( $302\text{ }^\circ\text{F}$ ), so it softens gradually above this point and flows above about  $300\text{ }^\circ\text{C}$  ( $572\text{ }^\circ\text{F}$ ). Injection molding is more difficult than other common thermoplastics owing to its non Newtonian flow behaviour. Tools must be held at high temperatures, generally above  $80\text{ }^\circ\text{C}$  ( $176\text{ }^\circ\text{F}$ ) to make strain- and stress-free products. Low molecular mass grades are easier to mould than higher grades, but their strength is lower as a result. The toughest grades have the highest molecular mass, but are much more difficult to process.

## The leak proof system

Carbolite Awnings are designed as a complete leak proof roofing system. This is how it's done:



### The H Bar/U Channel

The **H Bar** is an extruded aluminium section measuring 50mm x 15mm. The temper of the aluminium is softer than standard allowing us to curve the bar to a radius for the use of barrel vaults and bull nose finishes. The extrusions come in standard colours (white/primrose/black/bronzed anodised) but special colours can be done on request. The bar with the sheet can span 1600mm before a support beam is needed (depending on local conditions/wind factors). The bar is available for both 8mm and 10mm polycarbonate sheets.

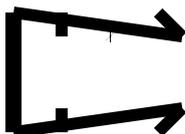
The **U Channel** measures 19mm x 16mm and is placed completely over the end of the H Bars to trim of the front.

### The Gasket Rubbers

The gasket rubbers are made from EPDM which is a neutral cured rubber capable of withstanding UV degradation. The rubbers are a special die cut suitable only for our system.



The H Rubber  
Along each H Bar



The U Rubber  
Cut between each H Bar at ends



The End Seal Plug  
Decorative trim for end H Bars.

## Sealing Tapes/Fixings

All twin wall sheets have open flutes which makes it necessary to seal the ends of the open flutes. We recommend two types of tapes.

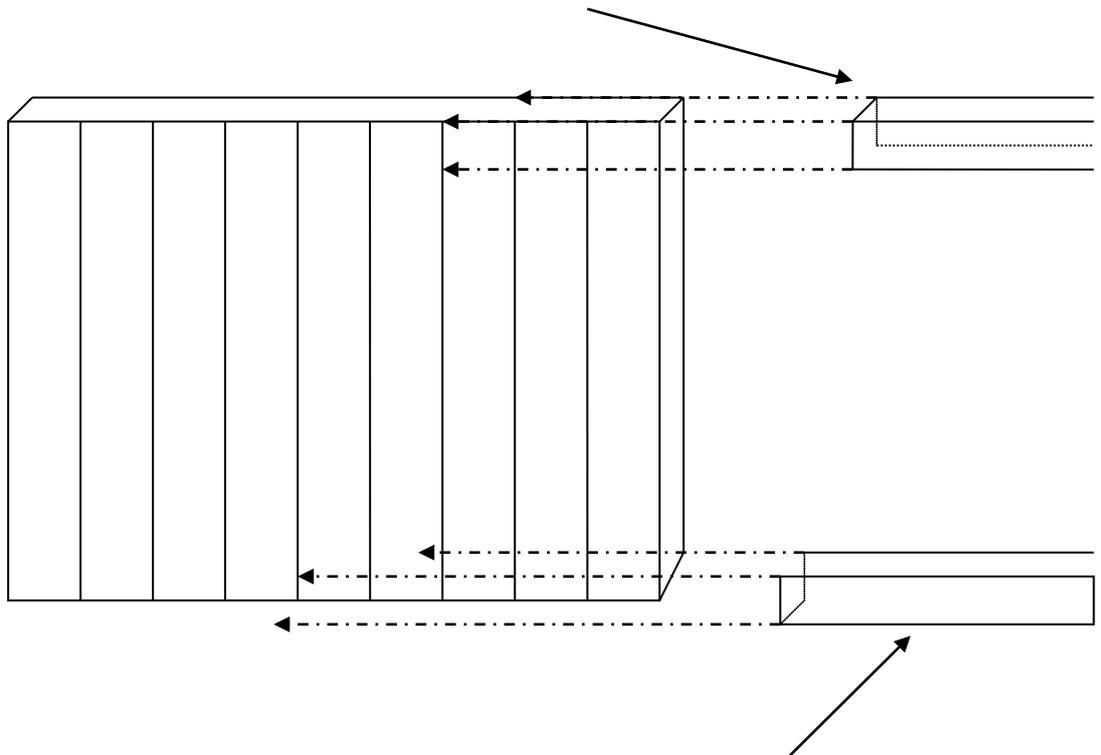
### Butyl Tape:

Is a silver aluminium foil tape with a tar based membrane extruded on the inside. This prevents any moisture that does reach the tape breaking down the tape to get inside the flutes. This tape is only place on the lower end of the sheets to which the water is running towards (i.e. the gravity end). If moisture does penetrate the sheets, it is often the result of the flutes not being properly covered by the tape. This part of the preparation is imperative.

### Silver Aluminium Tape:

The silver aluminium foil tape is used for the higher end of the sheets (non gravity end) merely to prevent dust getting inside the flutes.

Silver Aluminium Tape: Goes on the bottom of the sheet to where the water will run. Simply evenly place the sheet over the flute ends and press the sides down to give an even cover.

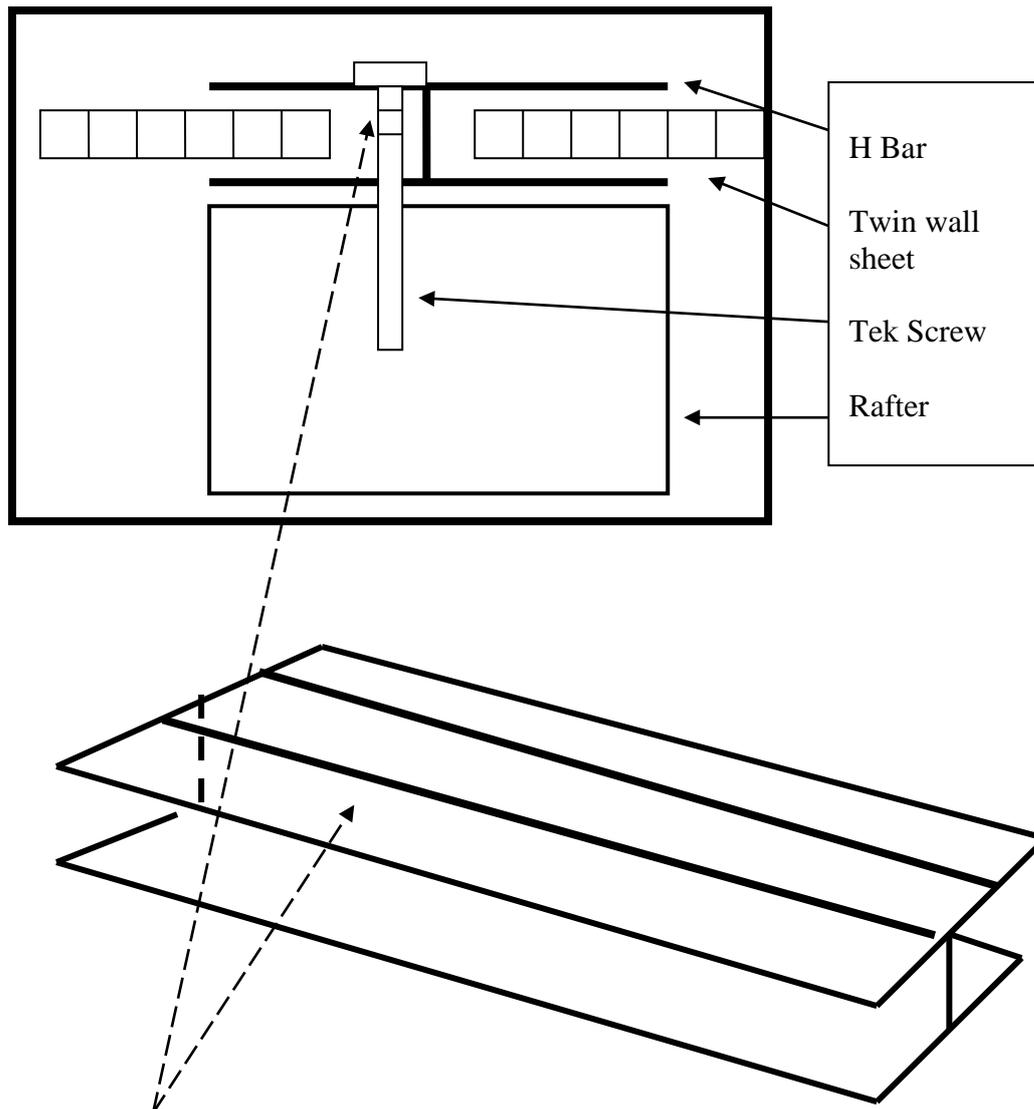


Butyl Tape: Goes on the bottom of the sheet to where the water will run. Simply evenly place the sheet over the flute ends and press the sides down to give an even cover.

## Timber/Aluminium Screw Fix

**Timber Fix:** 50mm Tek Screws with neoprene washer screwed through the groove on the top of the H Bar. Always take into account the quality of the existing timber before screwing.

**Aluminium Fix:** 35mm Tek Screws with neoprene washer screwed through the groove at the top of the H Bar. Same application can be used for steel frames.



Each H Bar has two groove lines on the top. Simply screw through one of these. The sheet and the rubber are not in line with the groove creating a cavity for the screw to bypass the sheet straight into the rafter.

Do not over screw during installation to prevent washer being squashed and aluminium being distorted.

## INSTALLATION PREPARATION

### 1) Storage and Transportation:

CARBOLITE sheets should be transported horizontally and flat well supported on all sides with supports of equal or greater size and same widths. This will allow the sheets to be secured at all sides preventing wind uplift during transportation.

CARBOLITE sheets should be stored out of the sun. The protective UV stabilized film on the outer skin of the sheet can under heat stick to the sheet making it very difficult to peel off. This really makes the sheet void and not replaceable under warranty.

CARBOLITE sheets should be stored out of the rain. Whilst they are a roofing material, the sheets are subject to condensation accumulating in the open flutes if left out in the weather prior to sheets being sealed.

CARBOLITE sheets should be stored out of the open. This will prevent dust collecting in the open flutes.

CARBOLITE sheets should never have bulky or heavy objects placed on top. The sheets are subject to denting as they are a soft material capable of high impacts.

### 2) Sealing Sheets: (see sealing tapes)

CARBOLITE sheets need to be sealed at both ends to prevent moisture and dust getting inside the flutes. As seen in the sealing tapes, we recommend the butyl tape at the gravity end of the sheet. This tape has a water resistant tar which will prevent it from breaking down in the event moisture gets past the U Channel rubber. The tape is individually placed on the open flutes of the sheets and the sides pressed down. This procedure is very important. At the top end of the sheets, aluminium silver tape is sufficient to prevent dust from getting inside the sheet.

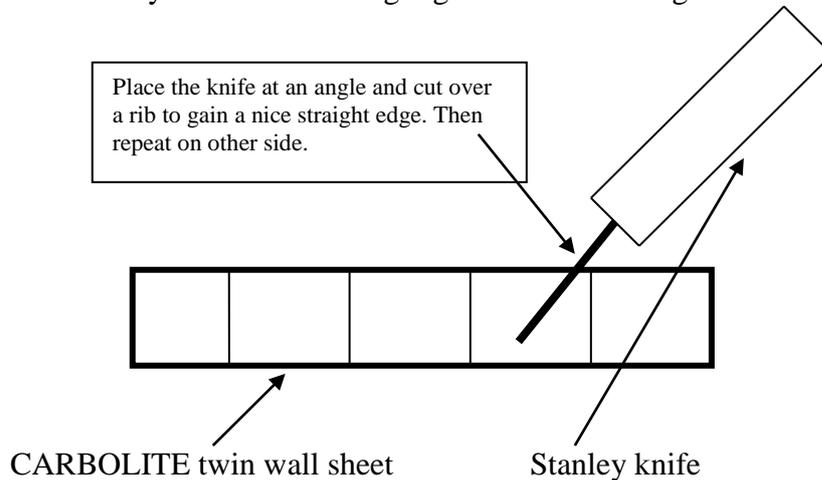
### 3) Preparing sheets

All sheets come with a protective PE film to prevent scratching and dirt during storage and transport. When using CARBOLITE sheets, simply peel the sides of the sheet back 100mm from each end and side. This will allow you to put the tapes and H Sections/Rubbers on whilst leaving the bulk of the sheet protected by the PE film. The film should be taken off once the sheet is installed preventing oily finger marks getting on the sheets.

All CARBOLITE sheets are UV2 meaning they can go either end up to face the sun. Single sided UV sheets put up the wrong way will yellow within 4 months.

#### 4) Cutting sheets

Cutting CARBOLITE twin wall sheets is easy. When cutting the **longitudinal** direction (i.e. with the ribs) a simple Stanley knife is sufficient. When using a Stanley knife, place the knife at around a 45 degree angle and cut on top of a rib wall. This will allow you to have a straight guide whilst cutting



Cutting the sheets across the ribs needs a fine tooth bladed circular saw / jigsaw. Be careful as this will create swarf/filings that will feed into the flutes due to the static electricity generated by the saw.

The higher the speed of the saw, the better result and cleaner cut you will achieve. Always support the sheet close to the area of the cut to prevent vibration of the sheet and clean swarf with compressed air or a vacuum cleaner.

#### 5) Cleaning

CARBOLITE twin wall sheets, whilst very strong and able to withstand high impact do scratch very easily. The top layer of the sheet that contains the UV stabilizer has a soft surface. When cleaning, very mild soapy water with a very soft cloth is sufficient to remove stubborn stains/markings. Make sure the detergent contain no abrasives or solvents. Pre wash with warm water and gently rub the stain. Rinse with water to remove excess residue.

**DO NOT USE ABRASIVE BRUSHES/RAGS AS YOU WILL GET SCRATCHES ON THE SHEET.**