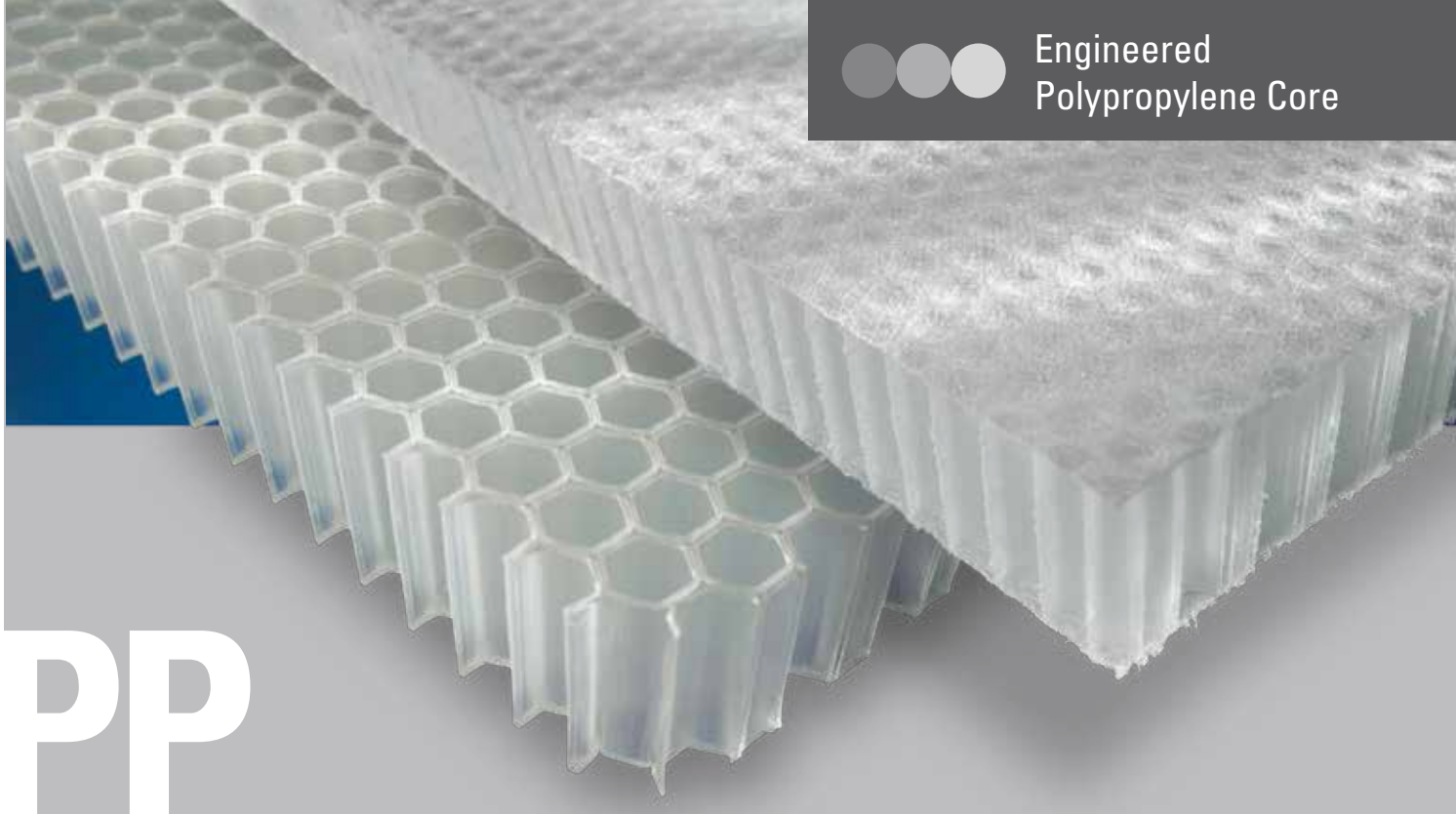
Engineered
Polypropylene Core

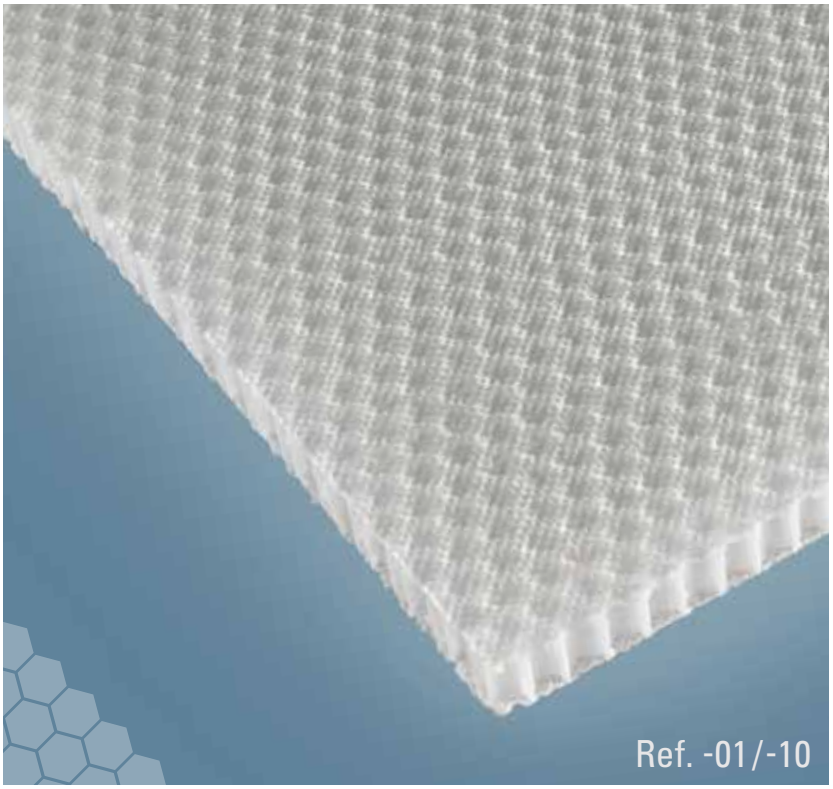


PP Honeycomb

PLASCORE®

Plascore PP Honeycomb

Light, Strong, Tough, Cost-Effective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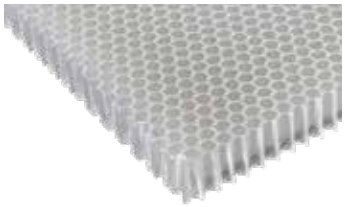
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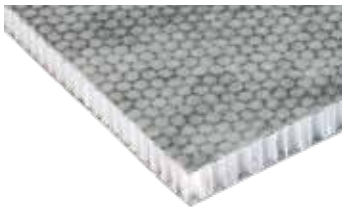
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Ref. -30

Plascore PP Honeycomb is a tough, lightweight and ductile polypropylene material that provides efficient and optimum mechanical performance in composite sandwich structures.

PP Honeycomb is an excellent alternative to traditional core materials such as plywood, balsa and foam used in the manufacturing of consumer and industrial products.

Available in a wide range of sheet sizes and facings, PP Honeycomb is engineered for ease of use in many mainstream manufacturing processes, is readily available and can be modified to meet specific requirements for strength and stiffness.

Plascore PP Honeycomb provides properties used in many composite sandwich structures that require core shear and compression along with adhesion performance. The unique cell structure, the use of a high impact copolymer PP and unique material processing contribute to its attractive performance levels.

- Multi-axial structure provides isotropic performance
- Engineered raw materials for higher performance
- Uniform and uninterrupted cell structure throughout entire sheet
- Integral and thermally fused facings for optimal adhesion
- Non woven surface is compatible with most Epoxy, Polyester, Vinyl Ester, Urethane and Methacrylate Resin systems
- Minimizes laminating resin while fully wetting out
- Continues to absorb energy, even after ultimate yield
- Recyclable

Value Added Configurations

To Meet Your Requirements

Open Cell
PP Honeycomb Ref. -00

PP Honeycomb with Veil or Veil with Film Ref. -01/-10

Infusion Grade
PP Honeycomb Ref. -20

PP Honeycomb with Reinforced PP Facings Ref. -30

Description	PP Honeycomb Core: • Open cell structure • No facings	PP Honeycomb Core: • Faced with a lightweight non-woven polyester (-01) • Faced with a lightweight non-woven polyester with an internal PP film barrier (-10)	PP Honeycomb Core: • Faced with a composite surfacing material • No flow medium incorporated	PP Honeycomb Core: • Faced with Reinforced-PP stress skins • Reinforcement types: - Chopped - Natural fiber - Woven - Uni-directional glass
Availability	All densities and sheet sizes	All densities and sheet sizes: • Options of unscored or scored to a 1" x 1" or 2" x 2" grid pattern • Scored material is limited to no larger than 96" dimensions	Sheet sizes: • All densities. Up to 48" x 96" standard • Pre-punched pass through holes available on sheet sizes up to 24" x 48"	Sheet sizes: • Up to 72" wide x 144" length standard • Facing material may limit some sizes • Special widths and lengths available upon request
Uses	• Core material for thermo-plastic molding of sandwich structures • Air and fluid flow medium	Core material in thermoset bonding of sandwich structures: • Open Molding • Platen Press • Wet Vacuum Bagging processes	Core material in closed molding: • Lite RTM • Closed Cavity Bag Molding • Vacuum Infusion	Preconsolidated lightweight boards to replace plywood or other thermoset composite sandwich panels

PP Honeycomb Core Mechanical Properties

CORE	CELL SIZE		DENSITY				BARE COMPRESSION[2]				PLATE SHEAR[3]							
							STRENGTH				STRENGTH				MODULUS			
			TYPICAL		MINIMUM		TYPICAL		MINIMUM		TYPICAL		MINIMUM		TYPICAL		MINIMUM	
	(in)	(mm)	lb/ft^3	kg/m^3	lb/ft^3	kg/m^3	psi	MPa	psi	MPa	psi	MPa	psi	MPa	ksi	MPa	ksi	MPa
PP1-5.0-N1-8	0.315	8	5	80.0	4.75	75.0	275	1.89	255	1.55	85	0.58	75	0.52	2.2	15.2	1.7	11.7
PP1-4.0-N1-10	0.395	10	4	64.0	3.8	60.0	180	1.24	140	0.96	60	0.41	50	0.38	2.0	13.8	1.5	10.3

The data provided is based on the testing of -01 *(veil only)* version of each core type.

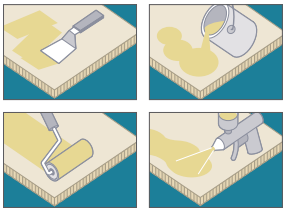
[2] Bare Compression
Tested per ASTM C 365

[3] Plate Shear
Tested per ASTM C 273

Ideal for your Process

Easily Bonded, Molded and Fabricated

Open Molding

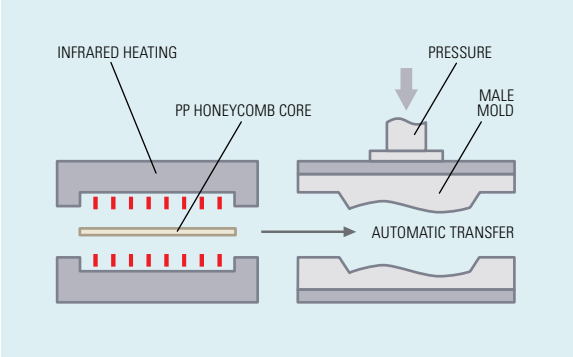


Adhesive resin can be applied in a variety of methods from spray, rolled, brushed and troweled on. Taking care to set the honeycomb core into the resin with hand pressure will ensure the resin comes in full contact with the non woven bonding surface of the PP Honeycomb. The lightweight non woven will not take much resin to wet out (400 g/m^2 or .08 psf), but getting good coverage and penetration through some process pressure is important. When applying the resin straight to the core surface or through a wet, glass laminate schedule, rolling the surface with a hard roller will also ensure good wet out and contact between the core and laminate. For complex shapes, scoring the PP Honeycomb will allow it to drape and contour to the shape desired and thus providing good contact to the core-laminate bond line.

Vacuum Bagging

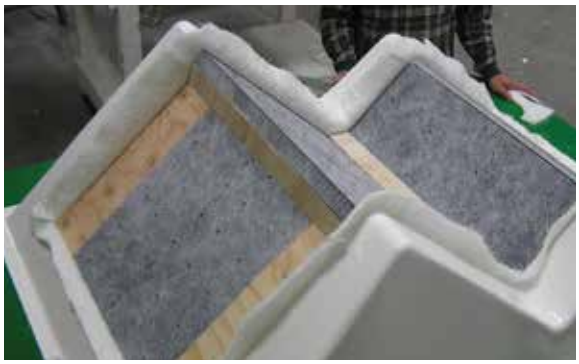
Traditional 'wet' vacuum bagging requires a standard PP film barrier under the non woven of the PP Honeycomb. This will minimize the amount of resin penetration into the cells of the honeycomb while under vacuum pressure. Though not 100% non porous, this film barrier provides enough of a barrier that 90% of the resin will stay at the bond line and in the reinforcement during the process. The amount of penetration will depend on resin viscosity, gel time, process temperature and ultimate vacuum pressure.

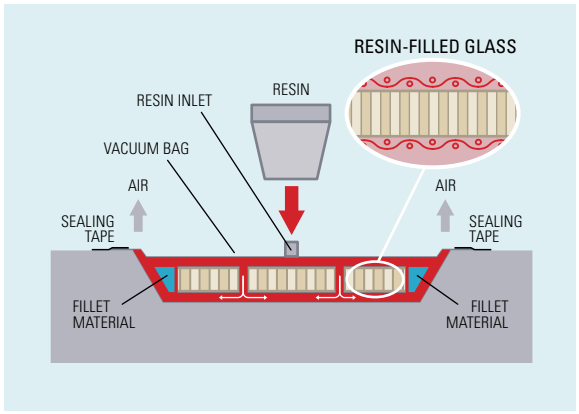
Compression Molding



PP Honeycomb with a variety of thermoplastic stress skins can be formed through a combination of conventional thermoforming and compression molding processes. Depending on the complexity of the part geometry, part thickness, Honeycomb density and stress skin type and amount, the process parameters of time, temperature and pressure will vary. The process objective is to drive enough temperature into the facing materials such that they are near their melting point for molding and laminating to the honeycomb core. As the stress skins heat up, so does the internal honeycomb core. The amount of heat on the honeycomb core should only be enough to mold into the desired shape. Too much heat internally on the honeycomb core will cause it to melt and loose its structure.

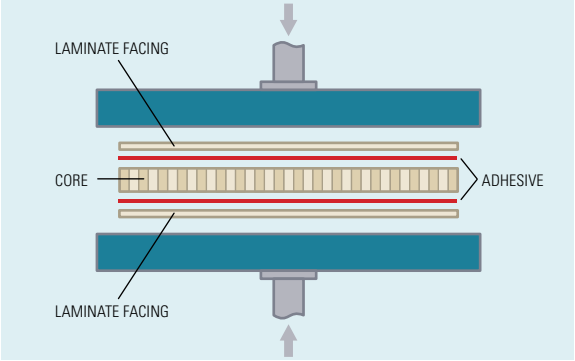
Closed Molding





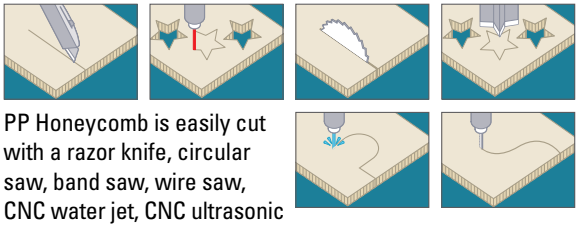
Lite RTM, Closed Bag or Vacuum Infusion processes at room temperature can be accomplished with Plascore PP Honeycomb — Infusion Grade. The open cell structure of the honeycomb is sealed, thereby allowing the flow of resin during processing to stay at the bond line with no or minimal penetration into the honeycomb core. Strategically placed through holes allow resin to flow top to bottom. Plascore PP Honeycomb — Infusion Grade does not have resin flow paths in its surface. Using infusion grade reinforcements, additional flow medium and infusion grade resins is critical to allowing good resin flow through the reinforcements.

Cold and Hot Platen Press



Uniform and constant pressure during the adhesive cure cycle ensures a good bond line. This can be accomplished both in Cold and Hot Platen press processes. Choosing which press process will be dictated by the resin-adhesive chosen to laminate the PP Honeycomb to the stress skin material. Resin out-gassing and thermal expansion need to be accounted for during Hot Platen press process to ensure an optimum bond between the PP Honeycomb and the stress skin.

Easily Fabricated



PP Honeycomb is easily cut with a razor knife, circular saw, band saw, wire saw, CNC water jet, CNC ultrasonic knife and steel rule die punching processes.

Key Performance Criteria

Outperforms Other Cores and Laminates

Excellent Cost-to-Performance Value

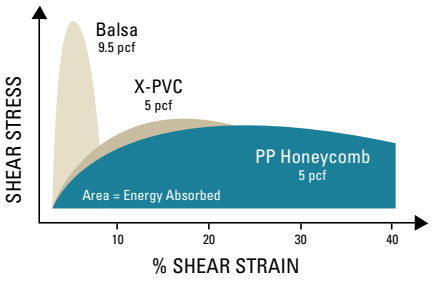
In most applications with moderate loading and unsupported spans of 24" or greater, PP Honeycomb core can provide a more cost effective solution than other core materials with higher shear properties. By balancing the overall sandwich thickness with an appropriate laminate type and amount, PP Honeycomb provides enough shear resistance to achieve most design deflection criteria in these cases. As the shear deflection component of total deflection is generally a smaller contributor than the laminate's contribution in bending, PP Honeycomb becomes an effective core solution.

Core Type	Relative Cost	Relative Weight	Relative Deflection
PP Honeycomb 5 pcf	1	1	1
Balsa 9.5 pcf	1.2	1.25	0.9

Panel Reference Type:
¾"T x 48" x 48", .02"T aluminum both sides, simply supported, center load.

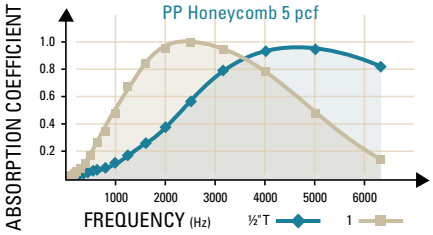
Continued Performance After Failure

Most core materials respond similarly to stress under normal operating loads. As loading increases the core begins to flex to accommodate the increase in shear stress on the core. Unlike other core materials that reach an ultimate yield stress and fail catastrophically, honeycomb, and in particular Plascore PP Honeycomb, continues to respond and perform. This continued response indicates the ability of the honeycomb to absorb energy even after ultimate yield strength failure.



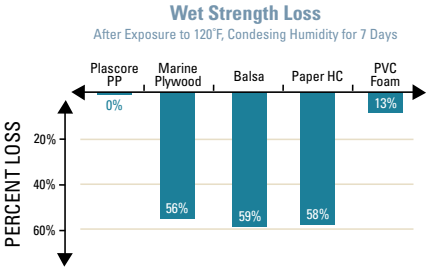
Efficient Sound Absorber

Varying the honeycomb cell size, density and thickness, in combination with the porous non woven polyester surfacing veil, one can tune PP Honeycomb to a specific frequency range for optimum absorption efficiency. Up to 99% sound absorption can be achieved.



Unaffected by Moisture

The mechanical properties remain unaffected even after long periods of exposure to moisture. Some minimal air drying may be required prior to laminating to remove any residual moisture from the surface or cells of the honeycomb. Always store the material in a dry environment.



Unaffected by Most Chemicals

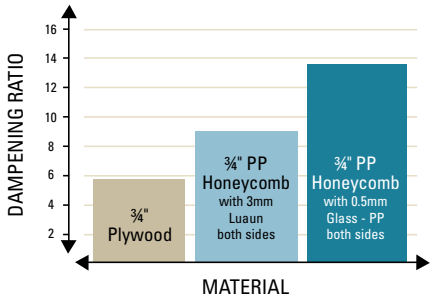
PP Honeycomb is unaffected by most acids, bases and to a lesser degree, organic substances and solvents. Certain chemical concentrations and temperature variables may reduce resistance; Refer to standard PP chemical resistance charts for additional information and reference points. Exposure and evaluation testing is always recommended to determine the actual affect to the honeycomb.

Flammability

Flammability: When tested to UL94 Horizontal Burn, the material is flammable. When used in conjunction with a variety of stress skins, Flammability ratings to UL 94, FMVSS 302, ASTM E84, DIN 4102 can be achieved.

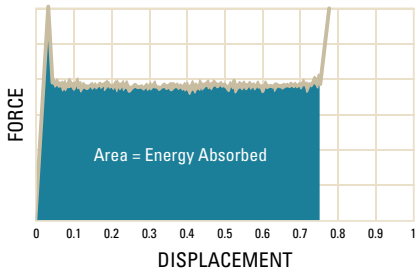
Quickly Dissipates Vibration

Plascore PP Honeycomb when used as a core material in a lightweight composite sandwich structure provides the user the benefit of a lightweight and rigid structure along with a vibration dampening medium. ¾”t PP Honeycomb core sandwich panels that are near the same flexural rigidity to ¾”t plywood can be less than ½ the weight and have about to 235% more dampening. The PP Honeycomb sandwich panel dissipates vibration 2.35 times faster than plywood.



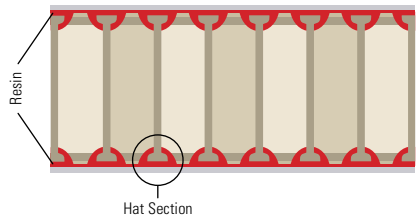
Efficient Energy Absorption

Plascore PP Honeycomb, like many other honeycomb structures, is an efficient constant force absorber. After the honeycomb passes its compressive yield strength, it continues to absorb energy through further deformation at a level near 50% of the yield strength. The absorption is maintained for 75% of its original thickness.



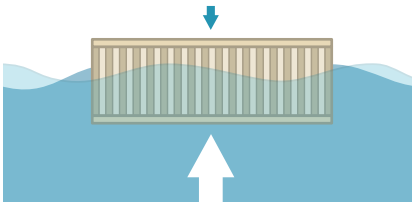
Fused for Optimal Tensile Properties

PP Honeycomb is available with a non woven facing fused directly to the cell edge, without any additional films or adhesives. This unique construction technique optimizes the adhesion of most resins systems to be equal to or greater than the tensile properties of the non woven itself. The ‘hat’ section cell edge allows resin to mechanically lock under its geometry.



Provides Positive Buoyancy

Plascore PP Honeycomb floats when water temperature and pressure conditions do not exceed the load carrying capacity of the honeycomb. Specific gravity of 5 pcf PP Honeycomb with veil = .08; 4 pcf PP Honeycomb with veil = .065. This equates to a positive buoyancy of approximately 10 times its own weight.



Coefficient of Thermal Expansion

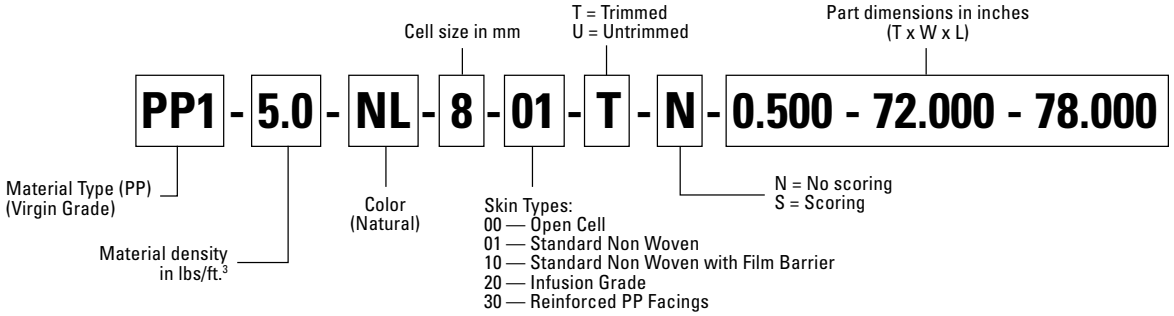
Plascore standard 5 pcf PP Honeycomb with non-woven veil has a Coefficient of Thermal Expansion (CTE) of 8.0 x 10E-5 inch / inch • °F.

Good Thermal Insulation

Plascore PP Honeycomb's thermal conductivity = .14 W/m • k when tested per ASTM C-518. Specific sandwich panel performance will vary depending on the definition of stress skin material type.

PP Honeycomb is specified as follows:

Material - Cell Size - Color - Thickness



Availability:

Densities:	2.5 to 12.0 pcf	**Length:**	Up to 50'	**Tolerances:** Length:	± .125"
Thickness:	¼" - 6" Laminated; Up to 24" open cell	**Width:**	72" max.	Width:	± .125"
				Thickness:	± .02"
				Open Cell:	± .03"
				w/reinforced PP facings	± .03"
				Density:	± 10%

Storage:

Store material flat and horizontal.
Store material in a dry and covered area, protected from UV sunlight and extreme temperatures.
Material may need to be dried prior to use if surface moisture is present.

ISO-9001 Quality

Plascore manufacturing standards meet or exceed North American and international industry requirements. Plascore, Inc. is ISO-9001 registered, employing Lean Principles throughout design, manufacturing and administration. In addition to our proprietary honeycomb manufacturing process, our value-added capabilities include adhesive development, CNC machining, powder coating, welding, thermoset and thermoplastic laminating and assembly. This extensive capability, along with Plascore JIT, Kanban and sequencing programs, allows us to maintain rigid quality standards on all components, control project scheduling and delivery in the manner best suited to the client's specific needs.

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Plascore, Inc., employs a quality management system that is ISO 9001 and ISO 14001 certified.

PLASCORE®