



Greenlam
LAMINATES

Contents

1.0 Introduction

- 1.1 Products Matrix
- 1.2 Certifications and sustainability

2.0 Maintenance and Cleaning

- 2.1 Maintenance
- 2.2 Care & Cleaning recommendations
- 2.3 Care & Maintenance recommendations-Greenlam AFX

3.0 Storage and transport

- 3.1 Transportation/Storage & Handling
- 3.2 Preconditioning for Fabrication

4. 0 Adhesives & Substrates

- 4.1 Adhesives
- 4.2 Substrates

5.0 Processing Greenlam Thin HPLs

- 5.1 Recommended pasting sequence for manual working at sites
- 5.2 Recommendations for satisfactory bonding results in HPLs in static presses
- 5.3 Post forming
- 5.4 Fabrication/Tooling Tips
- 5.5 Typical trouble shooting for manual bonding applications
- 5.6 Care to be exercised for Aluminum Foil HPLs

6.0 Greenlam Compacts Handling and Storage

- 6.1 Handling
- 6.2 Storage
- 6.3 Fabrication
- 6.4 Maintenance & Cleaning recommendations
- 6.5 Edges/milling templates
- 6.7 Installation guidelines for Compact Laminates for Rest Room applications



1.0

Introduction

1.1 Product Matrix:

Greenlam Industries offers customers, a complete range of HPL surfacing solutions for meeting specific applications and end use requirements. Following is the detailed product matrix that will help customers to help themselves with awareness of the product offer:

Size in feet (Meters)	General Purpose	Post Forming	Exterior Clads	Interior Clads	Compact Laminates	ESD Laminates	AFX	HD Gloss	Unicore
3' x 7' (0.94 x 2.16)	√	X	X	X	X	X	X	X	X
4' x 8' (1.22 x 2.44)	√	√	X	√	√	√	X	√	√
4' x 10' (1.22 x 3.05)	√	√	√	√	√	√	√	√	√
4¼' x 10' (1.30 x 3.05)	√	√	√	√	√	√	√	√	√
5' x 12' (1.52 x 3.66)	√	√	X	√	√	X	X	X	√
6' x 8' (1.83 x 2.44)	X	X	X	√	√	X	X	X	X
6' x 12' (1.83 x 3.66)	X	X	X	√	√	X	X	X	X
Size in feet (Meters)	Marker Grade	Chalk Grade	FR Grade Laminates	Phenolic Backers	Switch Board Panel	Digital HPLs	Lab Guardian	Foil HPL	Work Tops cut to sizes
3' x 7' (0.94 x 2.16)	X	X	X	X	X	X	X	X	X
4' x 8' (1.22 x 2.44)	√	√	√	√	√	√	X	√	X
4' x 10' (1.22 x 3.05)	√	√	√	√	X	X	X	X	X
4¼' x 10' (1.30 x 3.05)	√	√	√	√	√	√	√	√	√
5' x 12' (1.52 x 3.66)	√	√	√	√	X	X	√	X	X
6' x 8' (1.83 x 2.44)	X	X	X	√	X	X	X	X	X



Greenlam
LAMINATES

6' x 12' (1.83 x 3.66)	X	X	X	X	X	X	X	X	X
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Please check with Greenlam's authorized representative for further information on the above.

1.2 Certifications and Sustainability

Greenlam complies with several organizational compliances with respect to meeting Legislative, Statutory and System Certifications which are periodically reviewed, audited and updated as a part of continuous improvement.

Some of the system certifications are:

- ISO 9001-Quality Management System
- ISO 14001-Environment Management System
- ISO 45001-Occupational Health & Safety Management System
- Forest Stewardship Council® Certification (License no. FSC-C100034)
- Programme for Endorsement of Forest Certification (License no. PEFC/01-32-404)
- Greenlam is proud to be a SEDEX Organization

Greenlam is also certified for its HPLs and system compliances by

- CE
- TSE
- IMO & UL for MED
- IMO & RINA for MED

Greenlam's HPLs meet the respective requirements of the following National and International Standards:

- EN 438
- NEMA LD3
- BIS
- ISO

Greenlam's continuous commitment to sustainability comprises of

- Energy and water conservation
- Zero discharge manufacturing processes
- Use of Biomass fuels
- Use of Non-conventional resources
- Safety and Energy audits
- Use of alternative and synthetic substitutes for petrochemical raw materials
- Products are free from REACH restricted substances or Deleterious Materials
- Responsible forestry

Greenlam's products aimed to promote health and hygiene to customers through certifications like

- Greenguard Gold
- NSF & Food Safety
- Low emissions and VOCs as per latest EN Specification
- Green label etc.
- Anti-Virus, Anti-Bacterial and Anti-Fungal certifications

Technical data sheets for different products as applicable for different countries/regions are made available at our web site.

2.0 Maintenance and Cleaning

2.1 Maintenance

Greenlam HPL surfaces do not require any particular maintenance.

- All normal household cleaning products or disinfectants are well.
- For routine cleaning, use a melamine foam sponge.
- The use of non-aggressive aromatic solvents (acetone) is suggested for stubborn stains like paint marks etc.
- For product specific cleaning, please refer to the brochure or catalog

2.2 Care & Cleaning recommendations

a) Cleaning

- To clean the surface, use a damp cloth or a melamine sponge (and a mild soap or detergent only if required)
- Difficult “stain” such as coffee or tea can be removed using a mild household cleaner/detergent and a soft bristle brush, repeating as necessary.
- If a stain persists, use a paste of baking soda and water and apply with a soft bristled brush. Light scrubbing for 10 to 20 strokes in a single direction should remove most stains. Although baking soda is low abrasive, excessive scrubbing or exerting too much force may damage the decorative surface, especially if it is a gloss finish.
- products with a high content of acid or very alkaline solutions should be avoided as they could stain the décor surface
- while using solvents, use a clean cloth so as not to leave marks on the décor surface
- Avoid furniture polishes, paint thinners of low pH and wax based detergents, especially while cleaning Foil HPLs because they tend to form a sticky layer and affect the surface adversely.
- **Warning:** Prolonged exposure of the laminate surface to bleach will cause discoloration.

b) Abrasives

- Abrasive pads, scouring powders or cleaners may permanently dull and scratch the laminate surface making it susceptible to staining.

c) Harsh Chemicals

- Harsh chemical such as oven cleaner, toilet cleaner, or drain cleaner will etch and discolor the decorative surface. Some of the cleaners and chemicals that may cause surface damage are
 - Toilet bowl cleaners & Drain cleaners
 - Hydrogen Peroxide or Chlorine bleach
 - Oven cleaners
 - Metal cleaners and polishes
 - Coffee pot cleaners
 - Hard water stain removers
 - Fruit and berry juice & Tub and tile cleaners.

d) Hot Objects

- Do not place hot frying pans or dishes directly from the oven or cook top on the laminate surface. Even though Greenlam HPL has high heat resistance, exposure to temperature greater than 160°C is not recommended.
- As a precaution, protect the surface from heat generating appliances such as pressing irons, toasters, curling irons, and electric slow cookers by using a trivet or insulated pad. Prolonged exposure to high temperatures from these sources may damage the décor surface, cause blisters and surface dulling or result in separation of the laminate from the substrate.



e) Sharp Objects

- Never use knives or other sharp objects directly on the decorative surface. A chopping block or counter saver is recommended.

f) Impact

- Do not abuse the high-pressure decorative laminate (HPL) by dropping heavy objects such as cans, dinnerware, or glasses or deliberately hammering directly on the surface. Even though high-pressure decorative laminate (HPDL) have excellent impact resistance, chipping or cracking may occur.

2.3 Care & Maintenance recommendations-Greenlam AFX

Greenlam AFX is a special surface Anti-Finger print, smooth and zero reflection matt finish surfaced decorative laminate. Though the product needs minimum maintenance, necessary care is recommended while use.

Greenlam always intends to provide customers with a lifetime of aesthetics and utility of its products which is possible by following these recommendations for Care and Maintenance. The following tips help in retaining the originality of the décor surface and make it look new always:

a) Routine Care

- Keep the décor surface clean by regular vacuuming or dust mopping to remove any dust or abrasive grains that rest on the surface.
- To clean any marks on the surface, use a damp cloth or sponge and a mild soap or detergent. Use a spray bottle to apply soap solution.
- Mop up the dirt, if any, remove the dirty solution and buff dry the surface.
- Coffee or Tea stains or any such routine stains can be removed using a mild household cleaner/detergent and a soft bristle brush, repeating as necessary.

b) Intense cleaning

- If a stain persists, use a paste of baking soda and water and apply with a soft bristled brush. Light scrubbing for 10 to 20 strokes should remove most stains. Although baking soda is low abrasive, excessive scrubbing or exerting too much force may damage the decorative surface, especially if it has gloss finish.
- Some stains, especially the ones that were present for a long time, might require presoaking for few minutes in water or soap solution before cleaning is attempted.
- Stubborn stains may need use of diluted (or sometimes undiluted) bleach or solvents like nail polish remover. A maximum of two minutes should be the soak time while using such removers. Immediately after two minutes, the surface must be rinsed with warm water and wiped dry. These steps may be repeated if the stains start to go away and as long as the color on the decorative surface remains unaffected.
- In case of stains like pencil marks, soot marks, graffiti, shoe polish on the AFX surface, use organic solvents like acetone or methyl ethyl ketone to immediately clean wipe the surface. Follow the action by water wipe and buff drying. These stains if allowed to remain for long time may become difficult to clean.

c) Don'ts:

1. Don't allow dirt to get stuck to the adhesive traces left by labels, masking tapes etc. Clean them immediately by an organic solvent followed by hot water wipe and buff dry surface.
2. Don't allow the marks of cement, tar or paint to dry on the décor surface. Wipe them off immediately or cover the decorative surface while activities involving these in on.

3.0 Storage and transport

3.1 Transportation/Storage & Handling:

- To avoid damage while transportation/shipping, **Greenlam HPLs** should be kept flat. Avoid keeping laminate sheets in bundle for long periods of time.
- Storage and usage of material is best kept in cool/dry areas only. Excessive temperature exposure may lead to cracking and warping.
- Store **Greenlam HPLs** flat/horizontally and off the floor and on pallets or warehouse racking system; top sheet facing down in order to protect the material from damage and reduce the chance of warpage.
- **Greenlam HPLs** should be stored internally where conditions and temperatures are consistently between 25°C & 30°C and 45% to 65% relative humidity levels.
- Good circulation and air movement is recommended around Unicore stored sheets.
- Proper handling of material should be conducted by carrying the sheet on its side – Not Flat. Two people to lift and carry sheets in all situations.

3.2 Preconditioning for Fabrication:

The most important factor in achieving stability when working with **Greenlam HPLs** is during the fabrication preparation; it is always recommended to acclimatize **Greenlam HPLs** within the same area as the substrates it will be bonded to. Again, optimum temperature is approximately 25°C & 30°C, and both substrates and Unicore sheets should be conditioned for at least 48 hours at 45% to 65% relative humidity.

It is recommended to store Greenlam HPL sheets as follows:

- a) Stack the sheets horizontally and flat in a face-to-face manner at a temperature range between 23° and 30°C and at a humidity between 45%- and 65%.
- b) The stacking must be done at least 4" above the ground on a board which covers the entire surface area of the sheet. Use sufficient and uniform supports under the board to prevent bending of sheets.
- c) Never stack the sheets in direct contact with any type of floor.
- d) The use of a cover board over the top sheet to keep it flat is recommended.
- e) It is preferable to cover the sheets stack by a thick plastic sheet.

If horizontal storage is not possible, or only where small stocks of Greenlam HPL sheets are kept, these can be stacked on edge in slightly inclined (80° or thereabouts) vertical racks with support over the entire surface. A cover board should be used to prevent slipping.

Sheets as well as substrate should be allowed to acclimatize and stabilize in the same environment before fabrication for a minimum of three days.



4.0

Adhesives & Substrates

4.1 Types of adhesives

A general guideline about adhesives used for bonding HPLs to different substrates is given below. The end user is, however, advised to check with the manufacturing specification of the adhesive while making the choice of application. The choice of adhesive is based upon the service for which the assembly is intended and upon the bonding facilities available.

Type of Adhesive	Urea/Melamine Urea-Formalin system	Resorcinol-Formalin system	Epoxy systems	Polyvinyl Acetate based (PVAc)	Contact Adhesives	Hot Melt Adhesives
Description	These are rigid thermosetting adhesives. Curing is by polymerization when the recommended amount of catalyst is added to the resin. The rate of cure rapidly increases by the application of heat.			Aqueous emulsion adhesives which cure by dispersion of the solvent. Available in both single and double part (catalysed) varieties.	Poly-chloroprene based adhesives. Available in solvent or water based types. Also available with and without hardener.	Available in pellet or cartridge form.
Information on typical application and features of the adhesive	Used in flat lamination, hot or cold pressed to bond laminates to most wood based substrates. Melamine/Urea is useful for bonding to moisture resistant core materials.	Used in flat lamination, hot or cold pressed to bond laminates to moisture resistant wood based substrates, some flame retardant substrates and non-combustible substrates. Satisfactory bonds are produced at low pressure.	Used in flat lamination, hot or cold pressed to bond laminates to metal substrates after initial priming. Requires only low pressure.	Used in flat lamination, hot or, more usually, cold pressed to bond laminates to most wood based substrates. Also used for producing postformed components. Requires only low pressure. Easy wash down of equipment and removal of glue spillage.	Used for both flat bonding and postforming. Can be used to bond laminates to a wide variety of substrates. Bond occurs when both coated surfaces are brought into contact. Requires only momentary but high uniform pressure. Can be applied by spray (hot or cold) or by hand application with serrated spreader. Useful for on-site works.	Used exclusively for edge bonding applications. Will begin to soften under moderately elevated temperatures. Should not be used to edge materials for use near hot surfaces.
Information on gap filling properties	Poor gap filling properties but gives a good	Good gap filling properties.	Excellent gap filling properties.	Poor gap filling properties.		



	bond at relatively low pressures.					
Information on telegraphing with the adhesive			Minimal telegraphing due to high solids content (lack of shrinkage).	Requires carefully controlled glue spread to avoid	Minimal telegraphing providing laminating pressure is not excessive and glue-line is kept free from debris.	
Typical curing times for the adhesives	Cure time typically 1 to 3 hours at room temperature depending on hardener system.	Cure time typically 5-8 hours at room temperature.	Wide range of room temperature cure times depending on hardener	Fast curing at Room temperature giving quick press turn round (20-40 minutes).	Should only be used in warm dry conditions.	
Typical Temperature Resistance	Upto 120°C.	Upto to 150°C.	Upto to 100°C.	Standard upto 80°C Catalysed upto 120 °C	Standard upto 60°C Catalysed upto 100 °C	Upto to 50°C.
Typical EN 204 Durability class	D3 – D4	D4	D4	D2 – D3	D1-D2	D1

Interpretation of Durability Class: Adhesives' grading are part of the European standard BS EN 204: 2016 governing the classification of wood glues for non-structural applications.

- **D1**- Interior areas, where the temperature only occasionally exceeds 50°C for a short time and the moisture content of the wood is 15% maximum.
- **D2**- Interior areas, with occasional short term exposure to running or condensed water and/or to occasional high humidity provided the moisture content of the wood does not exceed 18%.
- **D3**- Interior areas, with frequent short-term exposure to running or condensed water and/or to heavy exposure to high humidity. Exterior areas not exposed to weather.
- **D4**- Interior areas with frequent long-term exposure to running or condensed water. Exterior areas exposed to weather.

Some of the brands that are available in market are:

- Fevicol, Henkel, Jowat, Vamicol, Araldaite, Soudal, Reactivit,
- Adkwik (Timbond, Tytext), Prowood, Danfix

4.2 Types of substrates

General

Greenlam HPLs, up to a thickness of 2.0mm, are surfacing materials that are essentially required to be bonded to a substrate. Thus the bonded assembly acquires the necessary structural rigidity for further fabrication. While there are plenty of choices in Greenlam HPL ranges that would match the end user's requirements, following overview of substrates is provided for general understanding. The end user, however, is advised to check with detailed intrinsic properties of the substrate of choice while finalizing its fitness for use.



The basic purposes of substrates are:

- To support the laminate
- To resist bonded assembly from warping
- To satisfactorily meet the performance criteria like moisture/humidity resistance, good screw holding capacity, mechanical strength and many such application aspects.

Particleboard, Medium or High Density Fiberboards are commonly used substrates across the globe due to ease of availability, variety of sizes and thicknesses and since they possess the degree of rigidity needed to support the laminate and offer a suitable face for bonding. Plywood and Chipboards are also used in certain geographies as substrates for furniture.

It is essential that the surface of the substrate should be sufficiently smooth to prevent the transfer of surface undulations through to the decorative laminate surface (commonly known as telegraphing). The dimensional movement of these substrates are similar to HPLs. Plywood, steel, aluminum, fiber reinforced plastic (FRP) may be used in some applications, but their dimensional movement is significantly different than high-pressure decorative laminate. This may result in potential panel warpage, stress cracking, and open seams and certain field related issues.

Plaster board, Gypsum board, plaster, concrete, and similar materials are not recommended for bonding with HPLs because their internal bond strength is not sufficient for this application.

Certain industrial applications call for specialized substrates such as mineral boards, metal sheets, honeycomb cores and plastic foams, and these will require special bonding and fabrication techniques.

The commonly used substrates and their overview, are listed below:

Aspects	Plywood	MDF	Particle Board
Substrate construction and production method	Plywood is an engineered wood product made up of sheets of wood veneer. These veneer layers are impregnated with resins and are pressed and bonded together to obtain a consolidated board.	MDF is an engineered wood composite made up of wood fibers. Because the MDF is composed of small wood fibers, there is no visible wood grain, rings, or knots.	Particle board is a wood product made by heat pressing resin coated wood chips, sawmill shavings, or even sawdust and resin together.
General Advantages	<ul style="list-style-type: none"> • Available in various thicknesses • Strong Material • Less Susceptible to Water Damage • Stainable and Paintable • Holds Screws Well • Possible to Purchase with Low or No VOCs. 	<ul style="list-style-type: none"> • Low Cost • Very Smooth, No Splinters • Easy to Paint • Easy Cutting • Denser and Stronger than Particle Board • Composed of Small Wood Fibers So There is No Wood Grain 	<ul style="list-style-type: none"> • Low Cost • Light-Weight • Perfect for Ready-Made Furniture



General Disadvantages	<ul style="list-style-type: none"> • More Expensive • Have to Finish Edges Because Layers Show • Plywood Often Splinters • Difficult to Cut 	<ul style="list-style-type: none"> • MDF is Dense, making it Heavy • Cannot Be Stained • Can Dull Blades Quickly 	<ul style="list-style-type: none"> • Low Strength - Cannot Support Heavy Loads • Not as Eco-Friendly as Wood Furniture • Expands or Discolors Due to Moisture
Fire rating	Substrates are made available in flame-retardant grades, which can be used to produce composite panels conforming to various fire performance requirements of Transport, Building or Furniture guidelines and respective regulations. Fire rated substrates are essentially bonded to Fire rated HPLs to conform to the fire rating specifications of the respective regulations		
Information about uses and end product features	High grades can be used for cabinets and shelving.	Generally denser than plywood, the substrate is a stronger material for building.	Most home and commercial builders use OSB particle board for floor and wall bases.
	Those with narrow core strips, less than 10mm in width and edge glued, are excellent substrates for decorative laminates for cabinetry and high class carcass work.	Provides an excellent surface for HPL bonding, and its excellent machining properties allow finely molded and smooth edge finishes. Primarily used in furniture cabinet work, post forming etc., where its properties are well suited to the needs of these industries	

Other substrates:

Block boards- only suitable as substrates for decorative laminates if their core batons are fairly narrow and edge glued, with double or extra thick surface veneers. Otherwise they are unsuitable because the cores may shrink unevenly in dry conditions, resulting in surface undulations (Telegraphing), or cause physical damages to the HPL surfaces on a longer run.

Metals: Aluminum and steels can provide excellent substrates providing the proper surface preparation. Aluminium and steels can provide excellent substrates providing the proper surface preparation is carried out prior to bonding. Metals have different dimensional movement characteristics to those of decorative laminates and this must be taken into account in considering the end application is carried out prior to bonding. Metals have different dimensional movement characteristics to those of decorative laminates and this must be taken into account in considering the end application

Foamed plastics (polystyrene, polyurethane, phenolic, etc.) in rigid boards, or injected in situ. Self-supporting and with good thermal insulation, they are suitable for direct laminating. Phenolic foams have excellent fire-retardant properties and low smoke emission.



Tempered glass

A likely support onto which FENIX NTM can be applied is tempered glass to obtain uniform colours, also on the edge of the glass panel, it is suggested to use specific polyurethane glues in combination with the paint on the balancing side of the support.

The following materials are NOT recommended as substrates for the application of decorative laminates.

- **Plastered or cement rendered wall surfaces Gypsum board (plain or paper faced) Solid wood**

With rare exceptions these are unsuitable for direct bonding because of surface irregularities, low internal bond strength and incompatible dimensional movement.

- **Gypsum Board (plain or paper faced):** The paper surface affords little restraint to the dimensional movement of decorative laminate, and can lead to cracking from screw holes and apertures.
- **Solid Wood:** Not suitable except in very small sizes because of possible surface undulations caused by irregular dimensional movement.

Following matrix give a quick reference of adhesives suitable for different substrates:

Substrate	Urea/Melamine Urea-Formalin system	Resorcinol-Formalin system	Epoxy systems	Polyvinyl Acetate based (PVAc)	Contact Adhesives	Hot Melt Adhesives
Wood Based (Plywood, Block Board, Particle Board, MDF, HDF etc.)	√	√	√	√		√
Paper Based with treatment (Hot or Cold) honeycomb structure		√	√	√		
PVC			√	√		
Phenol -Formaldehyde	√	√	√	√	√	
Polyurethane			√		√	
Metal based sheets or honey comb structure		√	√	√	√	√
Mineral substrates in sheets or plaster based foams				√		
Concrete foam			√	√	√	
Glass foam			√	√	√	

5.0 Processing Greenlam Thin HPLs

5.1 Recommended pasting sequence for manual working at sites:

Laminate and substrate should be kept for preconditioning/ stabilizing at temperature 23°-30°C and humidity 45-65% for 72 hours before attempting for bonding

1. Clean the surfaces of both plywood and laminate where adhesive is being applied. Ensure that face of the laminate and substrate should smooth and be free from grease, wax, dust or other contaminants that would interfere with adhesion.
2. Use a Sprayer or Roller or a Carpenter's glue spreader to ensure uniform glue layer on the surfaces
3. Apply the adhesive first on the Laminate surface and allow to dry
4. Apply the glue on the plywood thereby.



5. Wait till glue on the Laminate becomes dry and does not stick on paper or finger. A uniform semi-gloss appearance over the entire surfaces of the materials to be bonded indicates this stage.
6. Align two edges of the laminate with plywood and bring the glued surfaces into contact.
7. Nail the Fixed edges to hold the sheet in position.
8. Work from the middle portion of the sheet and start applying pressure, by using a wet cloth, and move towards the edge.
9. Ensure that pressure has been applied in the whole bonded area.
10. The edges will have to be pressed doubly.
11. Leave a gap of at least 3.0mm between the bonded panels to allow for expansion
12. Once the bonding is completed fix the edges of the entire sheet by tape or nails
13. Wherever panels of size bigger than 2'x 8' are involved, always it is recommended that a board of about 60% area is used as support in the middle portion in order to exert continuous pressure and contact
14. To cut in "L" Shaped cut out use Router cutter or drill a hole using a 6mm drill bit at all corners and cut through to avoid stress cracking from the right angle cut.
15. Smoothen the all edges by using planer to avoid minor cut or chipping which tends to cracking in laminate at a later date.

5.2 Recommendations for satisfactory bonding results in HPLs in static presses

For better understanding of the situation involving bonding of HPLs using static presses, we are sharing our recommended process and the customer can compare for better results:

- a. The flush doors or substrates are Calibrated and cleaned well to ensure any dust free surface before taking up bonding. Ensure no pits/dents post calibration. Repeat if pits persist.
 - b. The glue application is done on both sides in an applicator and a suitable glue line thickness is maintained (customer to decide based on the substrate type and quality)
 - c. The glue applied doors are allowed to dry (especially in humid conditions like now) and develop tackiness. With D3, it may reach tackiness in as high as 20 to 25 minutes based on the humidity in the plant.
 - d. Caution must be exercised to ensure appropriate tackiness on the glued surface. Attempting to press before this would cause blisters as the volatiles get trapped.
 - e. The HPL in this case does not require any glue to be applied and is placed on the flush doors directly.
 - f. The assembly of HPL + Flush door is hot pressed (Normally 3 to 4 minutes would suffice at 80°C). The pressure equivalent must be 2.0MT of a dead load or a specific pressure of 5 Kgs/ Sq. Cm.
2. In the case where they are attempting cold pressing, it is all the more simple and the process remains same except point f above. In this case a satisfactory bonding would be accomplished after a minimum of 24 hours.
 3. Few Trouble shooting tips in order to resolve the issue with respect to each of the bonding related variables:
 - a. Glue:
 - i. There is a suspicion that the solids in the glue are low and due to this the volatile matter would be proportionally higher. This is a potential reason for bubbles which is coinciding with the present situation.
 - ii. Alternatively they can use MUF glue, which is cheaper and yet a very good bonding medium. The parameters could be 100°C, 5' time and almost the same specific pressure.



- b. The surface of plywood/ substrate could be hard and less porous which is not absorbing the glue content to enable necessary bonding
- c. Pressing: The suggested pressing in case of such bubbling issue is to preheat the plywood for about 4 or 5 minutes, coat the glue and allow till tackiness is reached while it simultaneously gets cooled down. Match two perpendicular edges and place the sheet from these edges slowly to drive out the air. Run the hand all around the sheet by applying some pressure. Take the composite into press. Press for 100 to 110 seconds and release the pressure and let the press come down. Immediately, repress for an additional 80 to 90 seconds and unload the press.

5.3 Post forming process

Postforming process is generally automated. However, in certain cases and conditions, the machines are operated manually. The brief process is

- First step is to cut the materials to size
- The post forming edge of the substrate is shaped (half round, full round, cove etc) in a profiling step.
- The system then coats the substrate and the Greenlam Postlam HPL with adhesive.
- The substrate and laminate are aligned, ready to be bonded.
- A Pinch Roller is applied to bond the two together.
- The post-forming machine heats the HPL surface to $163^{\circ}\text{C} \pm 5^{\circ}\text{C}$ and molds the laminate around the substrate, then cuts away the backsplash from the main section.
- Normally, the recommended radius of curvature of formation of post forming HPLs is:
 - 0.60/0.70 mm-6.0mm (minimum radius)
 - 0.90 mm -8.0 mm (minimum radius)
- An Auto-Cove machine heats and molds the backsplash into a 90 degree position. It fixes this into place with a cove stick.
- The post-formed laminate countertops/ assemblies simply need to be cut to the desired length, mitered and fitted.
- Fitting tends to involve dropping the countertop into position, with the backsplash already in place. This is particularly advantageous when compared to conventional laminate, where the backsplash has to be added separately.
- The post-formed laminate countertop may also require edge banding as the case may be.
- **Care points:**
 - Temperature of the surface must be ensured as recommended for appropriate softening of HPL.
 - The speed of formation and time of contact of the heating bar at the forming junction also plays a crucial role in obtaining satisfactory forming results.
 - The normal practice is to standardize the machine with a pilot run by using the Greenlam HPL since the machine design is not uniform across the industry. Thus the operator is advised to ascertain the temperature, speed of forming and contact time for a run before proceeding ahead with bulk production so that cracking or blistering of HPL surface is prevented.
 - Another key care point is to ensure that the curved edge is smooth and free from undulations, protruded chips, cracks and surface deformities. These can adversely affect the outcome of the post formed operation.

5.4 Fabrication/Tooling Tips:

- Most of the conventional tools, machines and methods used in the fabrication of normal laminates apply, but some additional techniques are needed to take advantage of the full potential of **Greenlam HPLs**.



- All saw blades and router bits used for cutting should be Tungsten Carbide tipped and must be sharp to avoid chipping while cutting. Feed rate should be slow and tool speed should be high. However, these aspects vary according to the machine specifications.
- The circular cutting saw should be Diamond or Tungsten Carbide tipped. The number of teeth and speed must be chosen according to the machine design.
- Use of a sacrificial panel is essential beneath
- The sheets require fine finishing after cutting.
- For hand cutting **Greenlam HPLs** use a fine toothed saw, support the sheet well on both sides of the cut to prevent tearing.
- Cutting **Greenlam HPLs** on a laminate slitter is not recommended
- Inside corners of cutouts for electrical outlets, sinks, etc., should have a minimum radius of 1/4" (6 mm) and be filed smooth. This reduces the likelihood of stress cracks. Best to use a 2-fluted carbide router bit for flush-trimming on 1/8" inside radius corners. The applicable reasons for HPL hold good for **Greenlam HPLs** also.
- When nails or screws must be used, it is advisable to first drill an oversized hole through the laminate. This reduces the likelihood of stress cracks.

5.5 Typical trouble shooting for manual bonding applications

It is a known fact that climate and environmental factors affect the behavior of all types of Decorative Laminates (HPL). Hence, different issues may be reported during different seasons.

The fabricator will have to be cautioned to observe the possible reasons and adhere to recommendations listed here and follow them implicitly in order to avoid failures. Also, **a concise pasting sequence**, which would provide as helpful guidance, **is given at the end of this customer support information.**

The basic fact is that as humidity rises there is an absorption of moisture by HPL as well as the substrates like plywood, particle board etc. The absorption in a substrate is higher than HPL in all cases. At a later date, the substrate tends to stabilize itself and shed the excess moisture. Due to this behavior the following complications can arise on the bonded assemblies:

S. No.	Type of complaint	Possible reasons	Recommendations
1	Air bubbles on bonded assembly	<ul style="list-style-type: none"> ➤ Improper drying of the glue either on the HPL or on the substrate or both ➤ Wet Substrate or moisture absorbed by substrate ➤ Field bonding of oversized sheets 	<ul style="list-style-type: none"> ➤ Drying time of the glue varies depending on the temperature and humidity prevailing at the location. Always ensure that the glue is applied on HPL first followed thereby on the substrate. The bonding can be done when the adhesive does not transfer to a paper in a touch test. Over drying or under drying of the glue must be prevented. ➤ Substrate would absorb moisture during monsoon and pushes the HPL to form bubbles while losing the same over a period of time. Ensure that the substrate is dried sufficiently (by using a hot air blower if required) before applying the glue. ➤ The maximum size of the sheet used for vertical bonding at field must be limited to 610mm x 2440mm. Larger panels must be fabricated at workshops and installed to avoid occurrence of air bubbles



		<ul style="list-style-type: none"> ➤ Non uniform pressure applied for bonding ➤ Less gap between bonded panels to accommodate expansion 	<ul style="list-style-type: none"> ➤ After aligning the glue applied HPL to the glue applied substrate, the contact can be made while applying uniform pressure. Work on the bonded surface to apply uniform pressure to ensure full contact. Pressure should be applied first in the middle portion of the assembly and work towards the edges to avoid air trapping. The edges must be pressed twice. In many cases of vertical field bonding of assemblies, there is a need to fix a support board in contact with the HPL to hold it in contact and pressure till bonding is completely achieved. ➤ Sufficient spacing is required between panels to allow for movement and expansion.
2	Improper bonding of HPL to substrate	<ul style="list-style-type: none"> ➤ Improper conditioning of the HPL and the Substrate ➤ Improper practices ➤ Foreign particles entrapped while bonding ➤ Non uniform glue line ➤ Adhesive condition 	<ul style="list-style-type: none"> ➤ Allow both HPL and substrate to acclimatize for 48 hours at the location where bonding or fabrication is taking place. There must be proper air circulation at the location. ➤ Ensure complete bonding of the HPL to the substrate, especially in the edges by adopting correct practices suiting the environment and location. ➤ Thoroughly clean the substrate and the sanded side of the HPL to remove any trapping of foreign particles ➤ Ensure that the glue line in the bonded assembly is uniform by adopting correct practices ➤ The gluing temperature of the adhesive must be at least 27°C and must be thoroughly stirred before use.
3	Warping of the HPL	<ul style="list-style-type: none"> ➤ Top few sheets in the stack or storage area warp 	<ul style="list-style-type: none"> ➤ Ensure storage of HPL horizontally with the top sheet turned décor face down. ➤ Place a caul board or a thick board like plywood or particle board to prevent warpage of HPL ➤ Rotate the sheet stack to ensure older sheets are taken to use first. ➤ Never store the HPL in contact with floor. Always use a raised full size support ➤ However, a warped laminate can always be taken for bonding unless the warp is so high that handling itself becomes very difficult. Warp in HPL prior to bonding is not a cause for warp in the finished panel.

Using rollers rather than platens, are not recommended for bonding HPLs to substrates. Such arrangements are designed for use after glue/adhesive coating and prior to feed the HPL-Substrate assembly into a static press for



accompanying bonding. Attempting to bond by using such machinery is purely at user's risk since this process does not take care of the desired contact time that would result in satisfactory bonding.

These machines have a heating arrangement and can be used for bonding papers, vinyls, veneers, metal skins, continuous films and fabrics, heat reactive and pressure sensitive films to substrates such as particleboard, plywood, rigid or flexible foam, woven or non-woven fabrics, and honeycomb.

5.6 Care to be exercised for Aluminum Foil HPLs

What to follow?	Reason
✓ Ensure that the foil HPL is supplied for end use within six months from receipt at your stock point ✓ Never stock the peel coated foil HPLs for over six months	The peel coat can react with the lacquered surface due to prolonged contact and can affect the lacquer adversely. The surface color can come away with the peel coat which is a major risk.
✓ Use only in vertical applications <u>away from moist or humid environment</u>	Not recommended for horizontal and wet/moist environments related applications
✓ Clean the surface only with mild solvents or cleaning solutions	Harsh chemicals and cleaning solutions can affect the surface and would cause discoloration or tarnishing of the foil surface
✓ Do not rub the surface with hard bristled brushes or rub the surface excessively while cleaning	Severe surface scratches can result upon such non-recommended practices.

6.0 Guidelines for Compact Laminates

6.1 Handling

1. **Greenlam Compact Laminate** is a thick and heavy sheet material. During transport, use pallets of sufficient size to support the whole of the sheet area. Pallets must be strong and stable enough to support their load without bending or buckling.
2. The surface of each board must be free from debris, grit or foreign bodies which, by getting embedded under the weight of the stack, can damage the laminate surface.
3. When loading and unloading, do not push or drag boards over one another; lift cleanly by hand or suction device.
4. Do not slide the Compact boards when it is required to shift them. Always lift board by board by holding in two ends. This helps in avoiding scratches on surfaces and minimizes risk of accidents.


6.2 Storage

1. Ensure storage of **Greenlam Compact Laminates** in dry, clean, frost free and enclosed warehouses where normal interior conditions (18°C - 30°C and 50% - 65% relative humidity) are maintained.
2. Cover the top board of each stack with a moisture barrier / cover board, with sufficient weight to remain flat and in contact with the whole surface area of the top **Greenlam Compact Laminate**.
3. Try and let the **Greenlam Compact Laminates** remain in the original packing till the time of use.
4. The pallets or Compact boards or cut panels must be stored on a rigid and levelled surface that ensures support all across the full surface area of the boards or panels as the case may be. **Greenlam Compact Laminates** will remain flat if stored horizontally in packs on a flat base board, with their edges flush with one another.
5. Allow time for the stack of the Compact boards or the cut panels for conditioning at the fabrication site and allow them to reach equilibrium with the environment.
6. Never let the Compact boards or panels to rest on moisture absorbing supports like paper, cloth or gunny bags. The base board must be dry, and should ideally be covered with a material impervious to water, to act as a moisture barrier.
7. Protection Peel coat:
 - a. As far as possible try to keep the protection peel coat film till the installation is complete to avoid scratches, surface stains, dust etc.
 - b. In case it is required to remove the protection peel coat film, please ensure that the film applied on both sides has to be removed at the same time.
 - c. Never keep one side's film intact and remove the film from the other surface. This causes imbalance in the panel and can lead to warp.
8. Maintain this procedure throughout their storage (whether in a warehouse or on the fabrication shop floor) and reinstate it whenever a sheet is removed from the stack.
9. Failure to store **Greenlam Compact Laminates** flat for any length of time can cause deformation which is almost impossible to rectify, particularly with thicker boards.

6.3 Fabrication

Please observe the following recommendations for fabricating **Greenlam Compact Laminates**

a) General

- a. The greater thickness of Compact Grade Laminates imposes greater demands on cutting tools and causes greater wear.
- b. Slower feed speeds are required. The degree of feed speed reduction depends on the thickness of the compact laminate and the quality of finish required.
- c. Consult tool manufacturers as to the type and quality of tungsten carbide tipping needed to provide the best performance. For long production runs, and where a high quality finish is required, please use PCD (Polycrystalline Diamond) tooling.
- d. In all machine processes, avoid localized heating caused by poorly maintained saws and cutters.
- e. Ensure that the fabrication is done by an experienced and well trained team
- f. For optimum flatness, cut the longest dimension of the panel to coincide with the longest dimension of the Compact Grade sheet. An arrow marked sticker is pasted on the boards as guidance for cutting. 

b) Sawing

- a. Circular Saw blades are normally suitable for cutting **Greenlam Compact Laminates**. Saws of less than 2mm in thickness are not recommended.
- b. Break-out on the underside of Compact Laminates can be reduced by various methods:
 - using a pre-scoring blade on the underside (recommended);
 - using a base-board of plywood or hardboard beneath the sheet;
 - altering the exit angle of the saw blade by adjusting the height setting.
- c. When sawing Compact Laminates with two decorative faces, the feed speed essentially governs the quality of the saw cut. A speed of between 0.03mm and 0.05mm per saw tooth has been found to be the most successful.

c) Typical tool and machine parameters are given in the table below (for guidance only):

S. No	Particulars	Units	Typical values
1	Circular Saw Dimensions: <ul style="list-style-type: none"> ○ Diameter ○ Material ○ Thickness ○ Speed of the saw ○ teeth 	mm mm rpm nos.	300-400 Tungsten Carbide, Polycrystalline Diamond etc. 3.0 - 4.0 2500 – 6000 72 - 96
2	Scouring saw		Recommended
3	Pressurized holding beam		Mandatory to prevent vibration of the board
4	Cutting speed	meters/ min	8 to 16

Note

The higher the saw blade, the better the top cut and the worse the bottom cut; and vice versa.

d) Profile Cutting and Edge Finishing

- It is not necessary to apply edging strips or edge sealants to **Greenlam Compact Laminates**, and for many applications clean sawn edges are sufficient.



- To achieve a superior finish or a profiled edge, use a spindle molder or router. For this type of work PCD tooling is recommended. It is not possible completely to avoid cutter marks, but they can be minimized by feeding the work at a constant controlled speed with a mechanical power feed.
- Take care to avoid pausing during cutting and profiling, as burn marks which are difficult to remove may result. Where edges must be completely free from cutter marks, carry out a further sanding and scraping operation.
- Buffing with steel wool and applying silicone free oil enhances edges. Chamfering or profiling the edges of Compact Grade panels reduces the risk of edge impact damage.

e) **Drilling**

1. The most suitable drills for use on **Greenlam Compact Laminates** are those designed for plastic sheet materials. These drills are Carbide tipped HSS and have a point angle of 60° - 80° instead of the normal 120° for drilling metal.
2. To avoid break-out on the reverse side, gradually reduce the feed speed of the drilling head and the pressure applied when approaching the point of breakthrough.
3. Working on a firm underlay, such as plywood or chipboard, also reduces the risk of break-out.
4. For blind boring into the face, the depth of the hole should be such that at least 1.5mm of material remains between the bottom of the hole and the other side of the sheet.
5. TCT lip and spur drills produce clean flat-bottomed blind holes, with less risk of point penetration on the reverse side. This allows maximum depth of material to be used for fixings. Compact Grade sheets less than 10mm thick are not suitable for blind fixing.
6. When drilling parallel to the surface (edge drilling) at least 3mm of material must remain on either side of the hole. Threaded holes can be produced using engineer's screw cutting taps. Self-tapping screws or threaded brass inserts may also be used.

6.4 Maintenance & Cleaning recommendations

1. Though, **Greenlam Greenlam Compact Laminates** do not need special care, due to its resistant, hygienic and dense hard surface, as a general rule, clean immediately any spilled substances such as tea, coffee, wine etc., as the cleaning effort increases if they are left to dry. When necessary, cleaning should be done with mild solutions.
2. Cleaning agents must in particular not contain any abrasive components, as they may adversely affect the texture gloss or scratch the surface.
3. As many kinds of soiling can occur, from slight and fresh to heavy and stubborn, and a huge range of different substances may be involved, it is essential to use the correct cleaning procedure. The following instructions provided by the manufacturer should be observed in daily use:
 - Placing burning cigarettes on the compact laminate surface leads to surface damage--**Always use an ashtray.**
 - Greenlam Compact laminate surfaces should not be used as a cutting surface, as this can leave cutting marks --**Always use a chopping board.**
 - Placing hot cooking utensils such as saucepans, hot cookers and frying pans directly from the hob or oven onto the compact laminate surface should be avoided, as, depending on the heat exposure, a change in the gloss appearance or damage to the surface can arise-- Always use heat resistant mats.







- Spilled liquids should always be cleaned up immediately, especially in the areas around cut-outs and joints, as prolonged exposure to some substances may cause a change in the gloss appearance of the compact laminate surface.

Disclaimer:

- **Greenlam's** products and samples are produced within the specified color tolerances and the colors (of production batches) may differ, even if the same color is used. Customers and third parties must have a professional adviser inform them about (the suitability of) the **Greenlam's** products for all desired applications.
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Global Headquarter: 2nd Floor, West Wing, Worldmark 1, Aerocity | G| Airport Hospitality
District, New Delhi - 110037. Tel: [91 11-4279-1399] | Email: info@greenlam.com | www.greenlam.com

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