ROLLER PRESS · VACUUM BAG · AUTOCLAVE

Lamination Guide for Ionoplast Interlayer Film

> *Handling, lay-up and process conditions for CNCGLASS ionoplast interlayer film in laminated safety and architectural glass.*

01 PURPOSE AND SCOPE

This guide sets out the handling, lay-up and process conditions we recommend for CNCGLASS ionoplast interlayer film, from goods-in to the finished laminate. It is written for laminating plants: it assumes a roller press, or a vacuum bag with an autoclave, tempered or annealed glass, and a clean lay-up room.

The process windows quoted here are starting points, not a specification. Plant capability, glass build-up, coating type and autoclave behaviour all move the optimum, so the first production run of any new build-up should be a controlled trial — boil test and visual check — before the batch is released.

02 MATERIAL AND SUPPLY FORMATS

The film is an ethylene–methacrylic acid ionomer copolymer carrying about 1 % by mass of sodium ions. That ionic phase is what separates it from a plasticised PVB interlayer. The film is stiff rather than soft: it bonds to glass by ionic interaction and keeps both panes working together in bending, so the laminate behaves closer to a monolithic sheet. The practical consequences are a higher shear modulus, a smaller deflection under the same load, and edge behaviour that does not depend on a plasticiser staying where it was put.

It is supplied clear, in roll or sheet form:

TABLE 1 · SUPPLY FORMATS

PROPERTY	VALUE	REMARKS
Thickness	0.76 · 0.89 · 1.14 · 1.35 · 1.52 mm	Micrometer measurement
Width	2,400 mm	Roll goods
Length	Up to 100 m per roll	Typical range 50–100 m
Packing	Roll — vacuum moisture-barrier bag	1.52 mm also supplied as cut sheets
Appearance	Clear, unpigmented film	Interleaved, ready for lay-up

Typical applications are structural glazing, facades, balustrades and stairs, open-edge laminates, canopies, floors, point-supported and sloped or overhead glazing, and security or blast-resistant assemblies in which the panes must stay in place after breakage. Transport glazing — rail, marine and automotive — follows the same process logic under the relevant approval regime.

THREE CONDITIONS BEFORE THE FIRST PANEL

Film moisture at or below 0.2 % · tin face confirmed on both panes · lay-up room clean, at or below 25 °C and 30 % RH

03 TYPICAL PROPERTIES

The values below are typical for the film as supplied, measured in our laboratory under the conditions stated. They describe the material, not a guaranteed limit for any single roll.

TABLE 2 · PHYSICAL, MECHANICAL, THERMAL AND OPTICAL PROPERTIES

GROUP	PROPERTY	METHOD	UNIT / CONDITION	TYPICAL VALUE
Physical	Length (roll)	—	m	50–100
Physical	Width	—	mm	2,400
Physical	Thickness	Micrometer	mm	0.76 / 0.89 / 1.14 / 1.35 / 1.52
Physical	Specific gravity	ASTM D792	g/cm³	0.93–0.98
Mechanical	Tensile strength	ASTM D638	MPa	≥ 30
Mechanical	Tear strength	ASTM D638	MJ/m²	50
Mechanical	Elongation at break	ASTM D412	%	≥ 300
Mechanical	Hardness	ASTM D2240	Shore D, 12.5 mm stack	65
Thermal	Coefficient of linear expansion	ASTM D831	10^3·cm/cm·°C, −20 to 32 °C	10–15
Thermal	Heat deflection temperature	ASTM D831	°C	40
Thermal	Melting point	ASTM D831	°C	94
Thermal	Ignition temperature	ASTM D1929	°C	470
Optical	Yellowness index	JC/T 2166-2013	—	< 1.5
Optical	Refractive index, 20 °C	JC/T 2166-2013	—	1.5
Optical	Light transmittance	JC/T 2166-2013	%, 0.76 mm	90.2
Optical	Haze	JC/T 2166-2013	%, 0.76 mm	< 1.5
Optical	UV blocking	JC/T 2166-2013	%, 380 nm peak	> 99

Notes. Methods are those named in the table. Optical values are quoted at 0.76 mm film unless a thickness is stated. Hardness is measured on a stack built up to 12.5 mm.

04 STORAGE, HANDLING AND MOISTURE

Moisture is the one variable that can spoil an ionomer laminate silently, and it behaves differently from PVB. The ionomer takes up water slowly, but it gives it back very slowly as well; a warm, humid conditioning room will not dry an over-moist roll back into specification. Control therefore has to happen before the bag is opened, not after.

- **Store in the sealed bag.** Recommended conditions are 25 °C or below, 30 % RH or below, and a clean area.
- **Unopened rolls** keep for two years at ordinary warehouse temperature without blocking, with performance unchanged inside that window.
- **Use within two years of purchase**, and before the first use of any roll that has been opened or stored for a long time, determine moisture by the loss-on-drying method. Reject film above 0.2 %.
- **Reseal after every opening**, using a bag larger than the film itself, and bring the in-bag humidity back into range. A bag that only just fits leaves a leaking seal.
- **Handle in lint-free gloves and antistatic, dust-free clothing.** Static on the film collects particles, and particles become inclusions in the finished laminate.
- **Stage film inside the lay-up room**, not in the open plant, and keep the roll covered between panels.

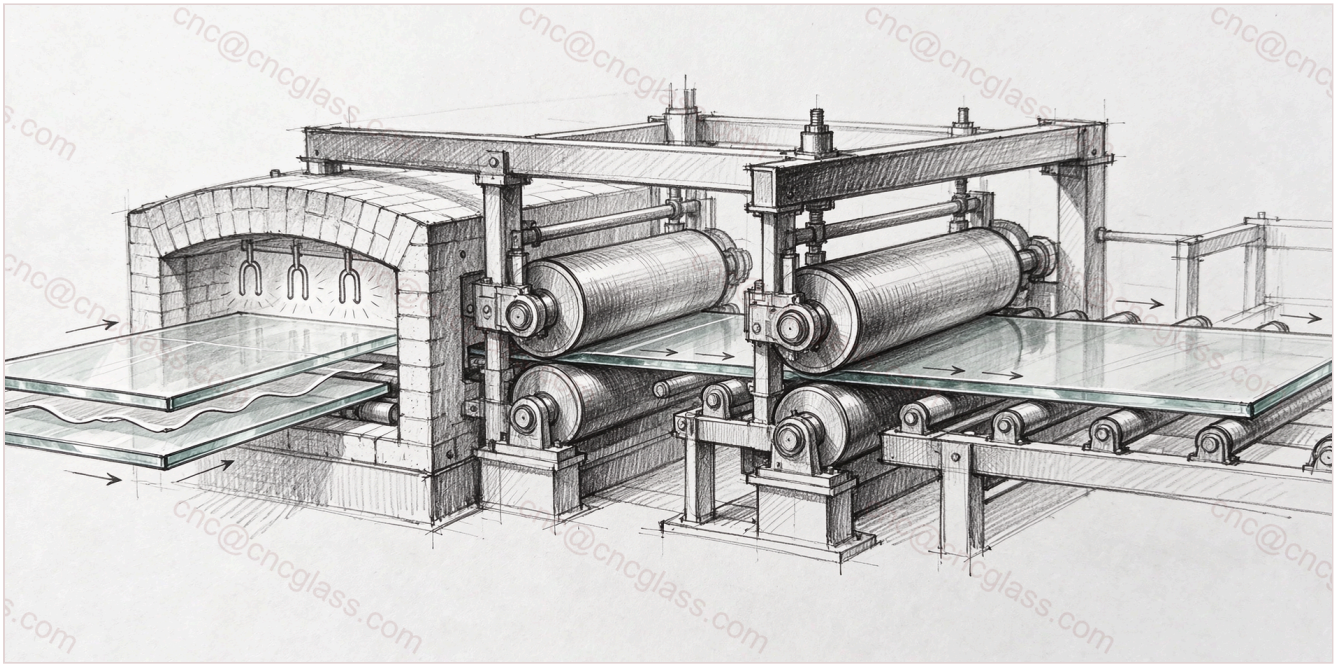
05 LAY-UP

Lay-up decides the bond and the edge, and most defects traced to the roller press actually start at this bench.

- **Confirm the tin face of every pane.** Build up air / tin / film / tin / air. The film bonds more strongly to the tin face, and the laminate lasts longer for it.
- **Wash water quality.** Deionised water where available; no organic residue left on the glass, which both weakens adhesion and shows up as contamination.
- **Tempered glass.** Check bow and warp and the match of the pair; edge-seal quality is decided by the fit of the two panes, not by the roller.
- **Clean the film** with an adhesive roller immediately before lay-up — film-borne, attracted and accidental particles all have to come off.
- **Cutting.** Score the outline along a template with a blade, then tear along the score.
- **Multiple film plies.** Fix the panes with high-temperature tape so they cannot shift during handling.
- **Edge trim.** Remove surplus film after a cooling interval, not at the roller exit: the film is still soft there and trimming pulls the edge back.

06 ROLLER-PRESS ROUTE

One film ply, annealed or tempered glass. The build-up is preheated, pressed through two zones and consolidated in the autoclave; the second nip is what closes the edge before the autoclave sees the panel.



Roller-press line. The build-up enters the heating section, passes the first and second nip, and leaves on the run-out conveyor.

01 · LAY-UP	02 · PREHEAT	03 · SECOND NIP	04 · AUTOCLAVE
Tin to tin, film cleaned	150 °C entry zone	60 ± 3 °C exit	≥ 130 °C, 12–14 bar

TABLE 3 · REFERENCE PROCESS PARAMETERS AT 1.52 MM FILM

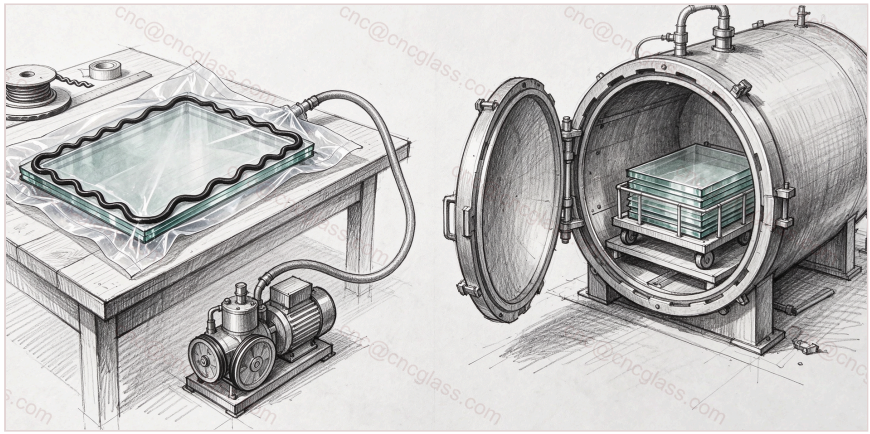
BUILD-UP (MM)	PREHEAT ZONE	MAIN ZONE 1	MAIN ZONE 2	ROLL SPEED
6 + 1.52 + 6	150 °C	190 °C	190 °C	1.4–1.5 m/min
8 + 1.52 + 8	150 °C	200 °C	200 °C	1.1–1.2 m/min
10 + 1.52 + 10	150 °C	210 °C	200 °C	0.9–1.0 m/min
12 + 1.52 + 12	150 °C	210 °C	200 °C	0.7–0.8 m/min

Reference values only. Adjust temperature and speed for glass length, panel size and machine capability, then lock the window for the build-up being run.

- **First nip.** At one ply the film is stiff enough that the first nip is usually unnecessary; run the second nip after the main heating oven.
- **Second nip gap** 1–2 mm less than the nominal glass thickness. Exit surface temperature 60 ± 3 °C, with roller speed trimmed to the measured surface temperature and the condition of the edge seal.
- **Stacking.** Leave gaps of at least the nominal thickness between panels. Do not use metal bars as spacers: they obstruct airflow, heat and cool the panels unevenly and leave optical distortion.
- **Autoclave.** Hold at not less than 130 °C for not less than 80 min at 12–14 bar; vent temperature not above 42 °C.
- **Coated glass** — frit, solar-control, Low-E — needs a compatibility and adhesion trial before the coating is run against the film in production.

07 VACUUM-BAG AND AUTOCLAVE ROUTE

Three or more plies, or two film layers, are not roller-pressed. Pre-roll the assembly without completing the edge seal, bag it and draw a cold vacuum. On large panels or thick stacks use several vacuum lines so the bag holds vacuum across the whole area.



Vacuum bag and autoclave. Left: bagged assembly under cold vacuum. Right: autoclave section with the glass rack and door.

When the film faces a non-tin surface, an adhesion promoter is mandatory. Two reference formulations are given below; both are silane solutions applied as a thin film, not as a coat.

TABLE 4 · REFERENCE ADHESION-PROMOTER FORMULATIONS (PARTS BY MASS)

COMPONENT	VARIANT A	VARIANT B
Isopropanol	92.0	89.92
Water	7.90	8.47
Acetic acid	0.01	—
White vinegar	—	1.50
3-aminopropyltriethoxysilane	0.09	0.11
Total	100.0	100.0

Handling the promoter. Use variant B only with high-purity isopropanol and white vinegar free of additives. Let the mixed solvent stand 24 h before use, store it in a sealed plastic or glass container away from heat and ignition sources, and use it within four months.

- **Application.** Spray onto the glass and wipe with a dry cloth; or load a lint-free cloth and wipe; or use a dedicated solvent-wipe unit.
- **Do not over-apply.** Excess promoter reduces bond strength rather than improving it.
- **Lay up immediately** after wiping, and carry out the whole operation inside the clean lay-up room.

08 DEFECT DIAGNOSIS AND CORRECTION

Five defects account for most reject rates on ionomer laminates. They are listed with the mechanism behind each, because the correction follows from the cause.

TABLE 5 · DEFECTS, CAUSES AND CORRECTIVE ACTION

DEFECT	WHAT YOU SEE	CAUSE	CORRECTION
Delamination, bubbles, boil-test failure	Unbonded patches, bubbles, or failure in the boil test	Film moisture above limit; incomplete de-airing or pressing; autoclave temperature, pressure or time short; edge sealed too early	Hold film at or below 0.2 % moisture and fix storage; re-set roller and vacuum parameters — temperature, pressure, line speed, evacuation time, vacuum level
Edge shrink-back	Film pulls back from the edge after pre-press	Trimming while the film is still soft at the roller exit; panes shifting in multi-ply builds	Trim after a cooling interval; fix panes with high-temperature tape
High haze	Finished laminate less clear than specified	Autoclave cooling too slow or uneven across the rack	Space panels on the rack; check cooling-fan speed and cooling-water pressure, flow and temperature; re-run affected panels through a heat-and-fast-cool cycle
Inclusions	Visible particles inside the laminate	Static on the film attracting dust; particles carried on the film itself	Antistatic clothing and lint-free gloves; adhesive-roller cleaning; clean lay-up room; reseal film between runs
Local iridescence	Patchy rainbow visible in the laminate	Local pressure peaks in the autoclave; uneven film thickness and residual stress producing optical distortion	Correct loading and spacing on the rack; avoid point loads and uneven pressure

09 DATA BASIS AND LIMITATIONS

Property values in Section 03 are typical figures measured by the methods shown. They are not guaranteed limits for any individual roll, and they do not replace incoming inspection where a project requires it.

Process windows in Sections 06 and 07 are drawn from production practice on conventional roller-press and autoclave equipment. A plant with different oven geometry, roller pressure or autoclave circulation will land on a different optimum, so treat the numbers as a starting point and confirm the window with a trial panel before committing a batch. Anything outside the ordinary — multi-ply structural builds, coated or fritted glass, oversized panels, a new autoclave — is worth a conversation with us before the first panel is run.

STATUS OF THIS DOCUMENT

This document is a CNCGLASS lamination guide. It sets out process practice and typical properties; it is not a product warranty, and it does not replace a first-off trial on the equipment that will run the work.

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