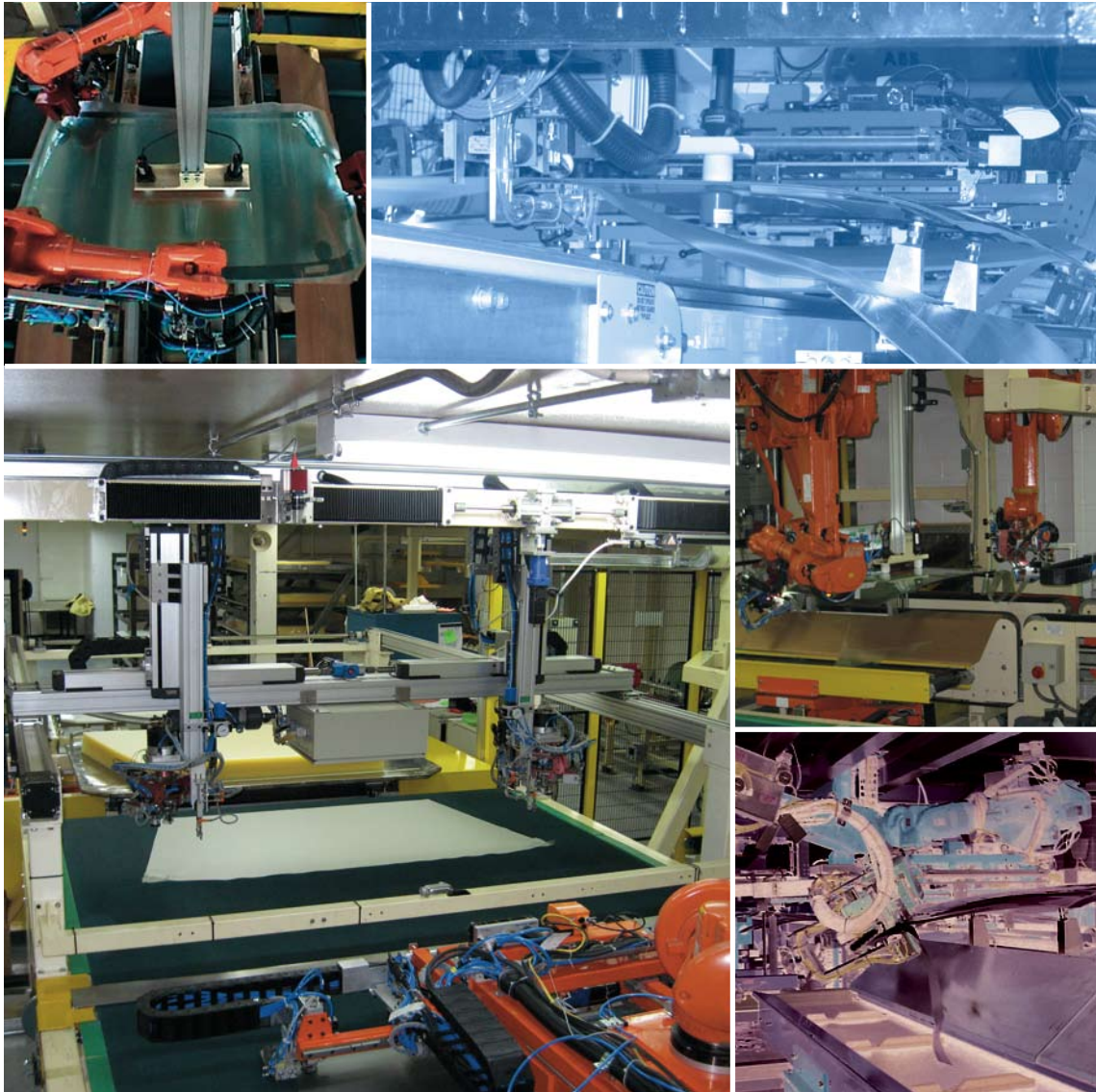


SOLUTIONS FOR THE AUTOMOTIVE GLASS INDUSTRY

The Automatic Windshield Assembly



THE ASSEMBLY OF WINDSHIELDS

The systems developed by STAR carry out automatically the assembly of windshields through different tasks.

The single steps of the sequence of operations can be performed by different types of equipment that leads to solutions which differs from each other in terms of lay-out, cost and performance, i.e. production rate.

Squaring of glass parts, for example, can be accomplished by using servo reference conveyors, position transducers and vision systems; the assembly of the two glass windows can be obtained by moving one of them over the second one which acts as a reference or by squaring both of them with respect to an absolute reference.

In the various phases of the process the system makes use of:

- *pneumatically actuated tools for peeling one PVB sheet at a time*
- *a vision system for squaring the PVB sheet*
- *two independent systems based on contact distance transducers for squaring the two glass windows*
- *one pick-up and stretch apparatus for inserting the PVB sheet between the glass windows*
- *shuttles and conveyors to move the two glass windows through all the operations and finally sandwiching them.*



TECHNICAL SPECIFICATION

Assembly equipment composition

The system is composed of the following main items:

- *Vinyl Peel-off unit*
- *PVB Handling tool*
- *Glass Handling/Squaring tools*
- *Electronic squaring device*
- *PVB robotic cutting*
- *PVB excess evacuation*

These units are used in the “clean room” to carry out different operations: the first machine is able to pick up one vinyl sheet at a time, from the PVB stuck pile, while the second carries out the handling of the peeled vinyl.

The “Glass Handling Tool” picks up both the inner and outer glasses from the belt conveyor, and by means of the electronic squaring device move the two glasses in order to match them together. After this operation, the handling tool with the information of the PVB position coming from a vision system, reaches the PVB sheet in the exact position and couple the glasses making the sandwich. Following there is a description of the main equipment.

DESCRIPTION OF THE EQUIPMENT

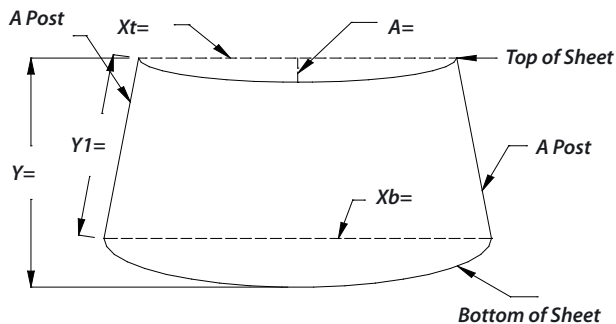
Vinyl Peel-off Unit

This machine is a unit predisposed to pick up one sheet at a time from a stack composed of PVB sheets of identical dimensions and substance.

The device has been designed to be inserted in a “clean room”, as part of the automatic windshields assembling line, but it can be adapted to a PVB manual insertion line, avoiding manual peel-off from the vinyl pile. The machine is made of a self-supporting frame, specially designed to be placed over a typical belt conveyor line.

The main dimensions, excluding the belt used to transfer the PVB sheet out of the machine, are the following:

Width: 2364 mm;
 Length: 3310 mm (belt 1500 mm);
 Height: 2435 mm (max. height during the functioning).

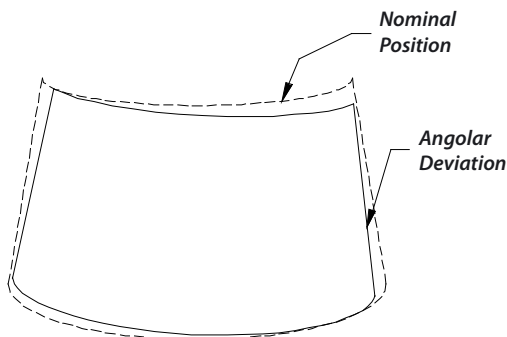


Performances

PVB sheet standard dimensions:

Largest Size	Smallest Size
Xt= 1625 mm	Xt= 700 mm
Xb= 1800 mm	Xb= 700 mm
Y= 1300 mm	Y= 500 mm
Y1= 1200 mm	Y1= 400 mm
A= 150 mm	A= 0 mm
thickness: 0,78;	

Other sizes available on request.



Sheet manufacturing characteristics:

Trapezoidal cut, die cut and stretched.

Working Temperature and Humidity:

Temperature: 18°C - 20°C;

Humidity: 21±3%.

Cycle time:

The vinyl peeler cycle time depends basically on the sheets' adhesion: a typical figure is 15 second / windshield.

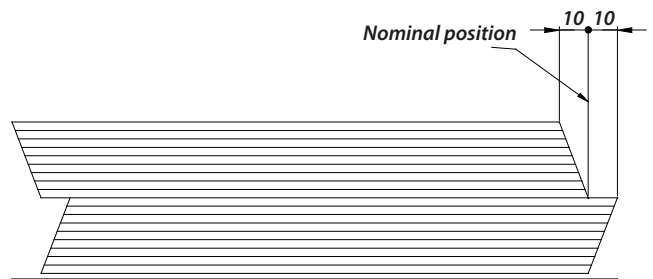
Maximum Pile dimensions:

Shaped Sheet Die Cut pieces
 Maximum stack height 200 mm
 Maximum error allowed for a sheet in the pile with respect to nominal position is ± 10 mm.

Maximum angular error allowed concerning the sheet's positioning, is that one admitted inside a shape, which is 10 mm larger than the theoretical dimensions.

Robotic PVB Handling Tool

The vinyl-handling tool is specifically designed to pick up and hold one sheet at a time. The device is equipped with a set of particular clamping elements, which carry out the pick up operations close to the sheet's edges. The pick up device is equipped with two types of tools operating at the same time and working on vinyl sheets edges while it rests on a special belt. A vision system is used to identify the position of the PVB sheet.



Glass Handling Tools

The glass handling tools are specifically designed to pick up the inner and the outer glass. In particular they have a group of vacuum cups in the lower part to handle and pick up the inner glass and a group of vacuum cups in the upper part, to handle and pick up the outer glass.

The Tool has also three controlled motors and several pneumatic actuators that allow the system to square and couple the two glasses without any risk of damaging such thin elements.

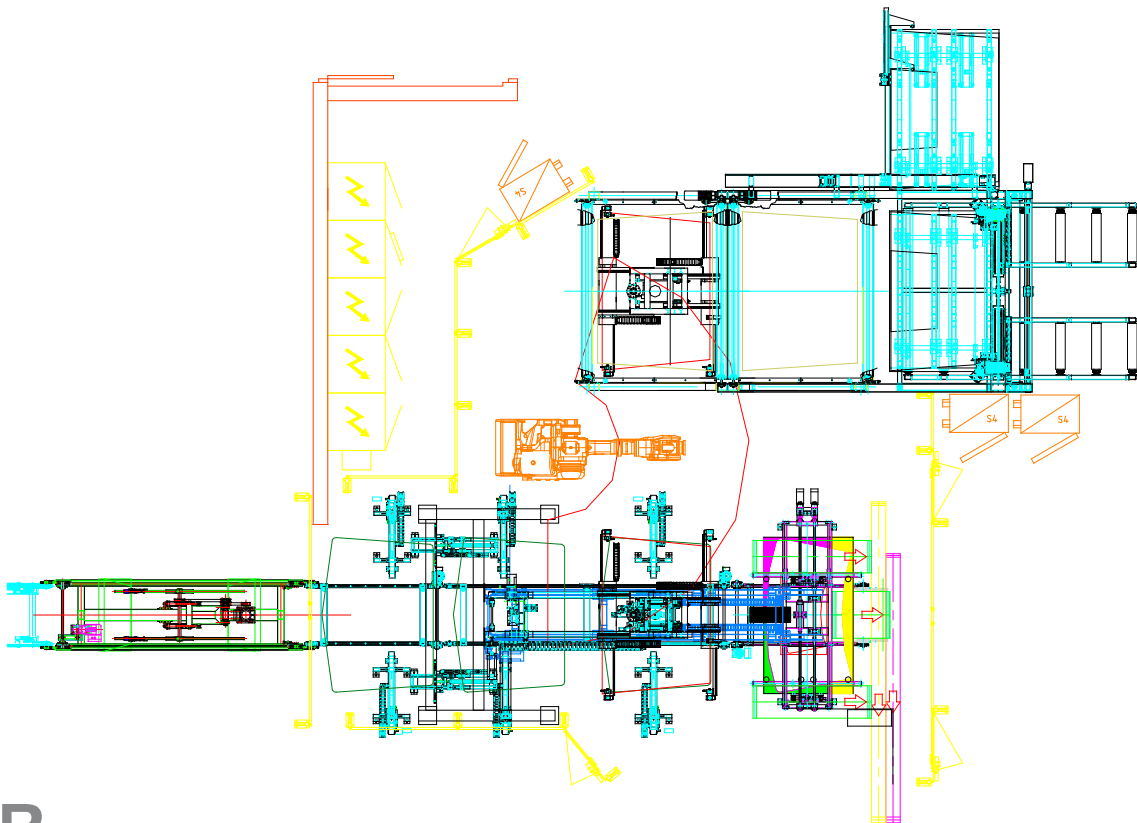
Distance Sensors Glass Squaring Device

This system works together with the handling tools in which are installed the actuators that move the inner and outer glasses.

The device makes use of four sensing devices that are actuated at very low thrust against the glass edges.

The exact position of the glasses is then detected and the information transferred to the motors of the handling for correcting the positions of the glasses until they are squared.

Following is typical LAY OUT .



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