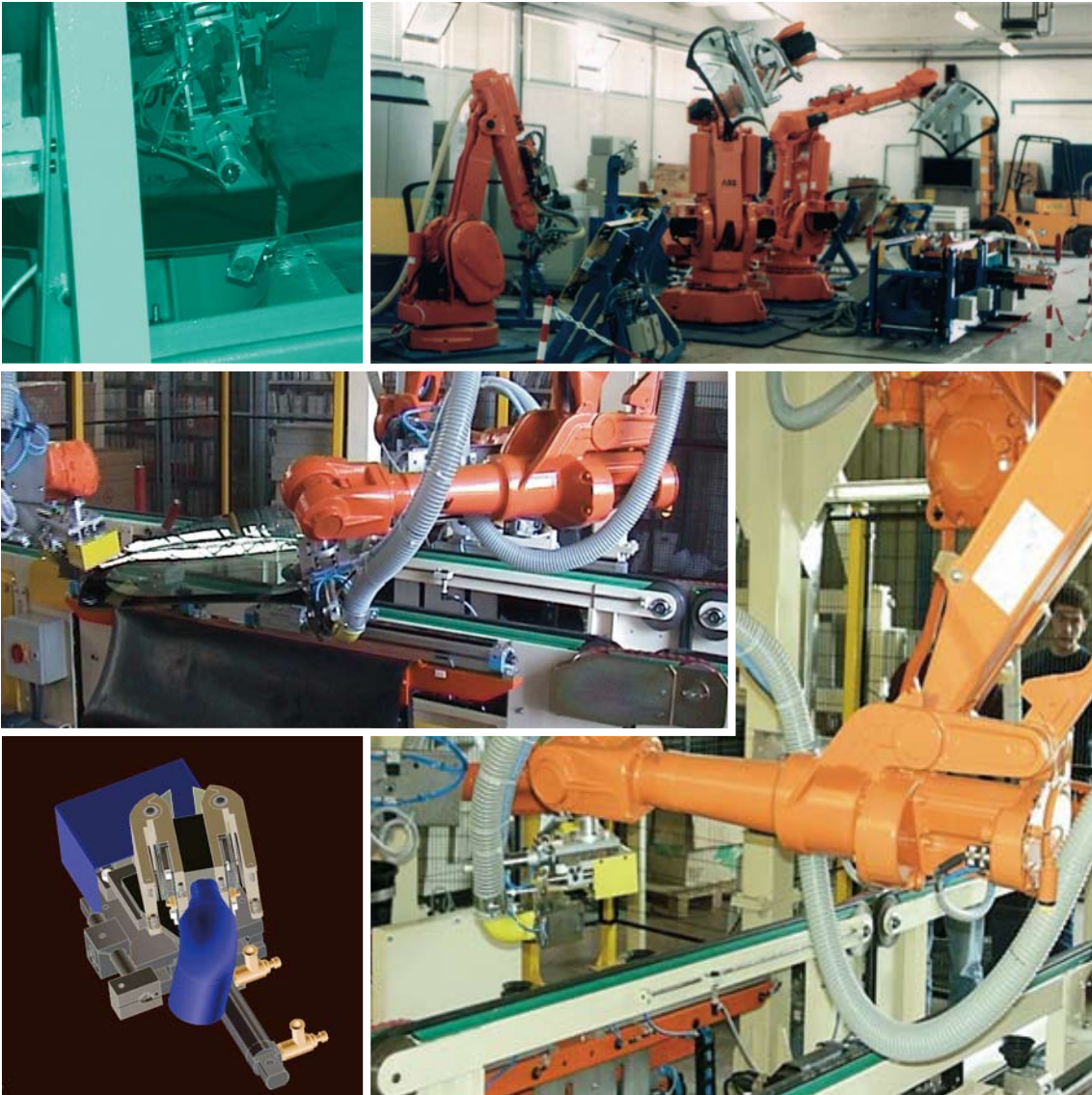


SOLUTIONS FOR THE AUTOMOTIVE GLASS INDUSTRY

The Automatic Vinyl Trimming



GENERAL DESCRIPTION

The operation of cutting the excess Polyvinylbutirrale (PVB) is necessary right after the two glass sheets that make the windshield are ultimately assembled together by the autoclaving process.

Such process, as a matter of fact, can cause the PVB to be squeezed out even in some areas where it was originally cut perfectly following the glass edges.

The cutting operation, usually called vinyl trim, when manually performed by means of blades, reveals critical as far as work safety and quality of the product and its consistency are concerned.

Automation in this area cannot be but attractive as the product to handle already carries very high added value.

STAR SYSTEM

STAR developed solutions to automate the operation are all based on a special dedicated assembly, called the trimming head, which is designed to allow programming and real-time controlling the contact pressure of a cutting knife against the edges of the two glass sheets of the windshield. The knives themselves are of a special kind, specifically designed by STAR for the best suitability of the application.

The trimming head is carried around by an industrial robot through which it is possible to determine trajectories, speed, orientation and the pressure of the blade all along the windshield perimeter: it is so possible to adjust such parameters by zone, according to the particular and local shape of the edge (such as straight sides, acute corners, profile notches, etc.).

Moreover, the control system, based on load cells and a PID feed back modules, grants the consistency of the programmed contact pressures despite the accidental dynamic loads which randomly occur on the cutting knife during the travel around the windshield. A very important item for the effectiveness of the process, specifically to minimise the risks of glass edge chipping, is the cutting blade type TAI-SC25; this has been studied and designed as the best compromise between the need to have a long lasting cutting edge also granting a reasonable cutting speed, and the must not to scratch the glass edge.

This has been achieved with a special compound material internally soft and partly elastic (soft core) with an original design hard metal coated cutting edge. All included devices, robots, conveyors and holding stands, incorporate power adjustable tools for the changeover operation: adjustments are recorded and stored into the cell controller memory to allow automatically resuming the configuration for a windshield model in the due course.



A single "jobname" can be recalled (or transmitted by a line supervisor) and the whole cell resumes in a number of seconds the required configuration.

Among the ancillary devices always employed in all types of solutions, the major are:

- The blades dispensing unit, each capable for up to 1000 cycles;
- The debris collector for the cut vinyl, equipped with a collection tank, usually big enough for more than one eight hours productive shift.

LAY-OUT

The basic machine to perform the automatic trimming, the industrial robot equipped with the trimming head, can be employed in different configurations to realise as many plant solutions and layouts.

Solution A - 30 sec. Workcell

The first set-up is a station made of one single trimming robot across a glass streaming line: the squaring conveyor for the glass, directly derived from the type TAI-C, stops, squares and holds a windshield right under a trimming robot hanging from a gantry framework .

During the trimming cycle, the glass is held in position by a set of vacuum cups which keep the glass firmly as squared and leaving all the perimeter free from any encumbrances.

This station can work at a cycle of ab. 30 seconds per windshield and incorporates the automatic blade change (usually needed after every 10 cycles).

Solution B - 20 sec. Workcell

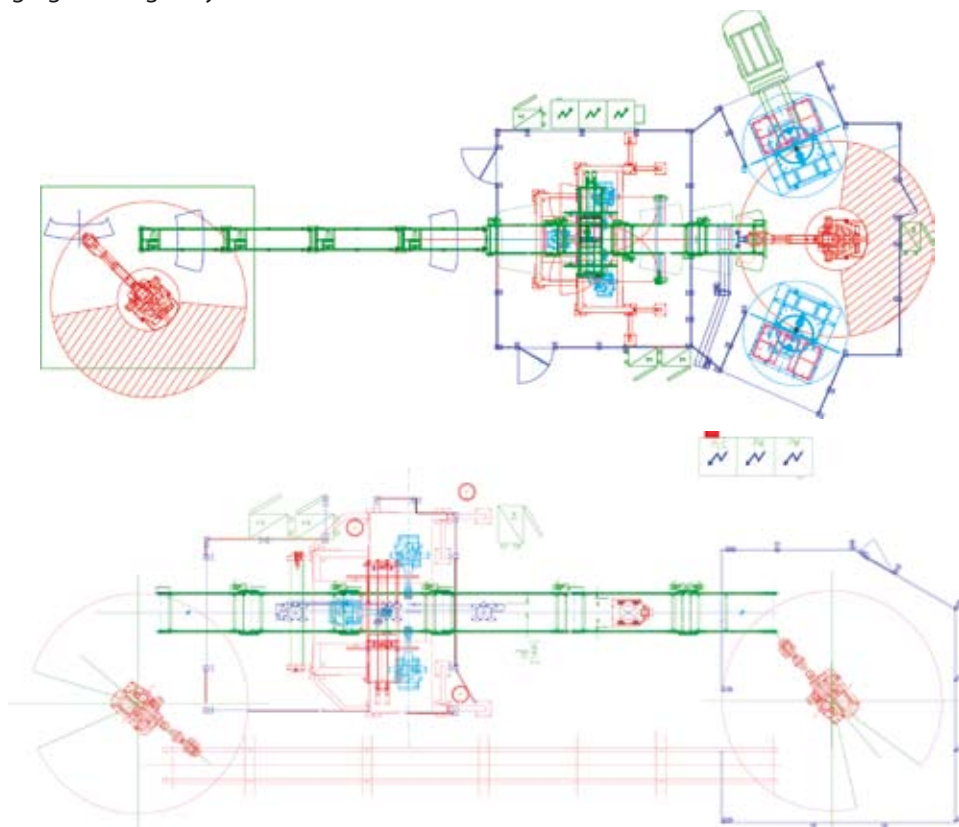
One other inline solution is where a pair of trimming robots are placed at the opposite sides of a squaring/holding conveyor.

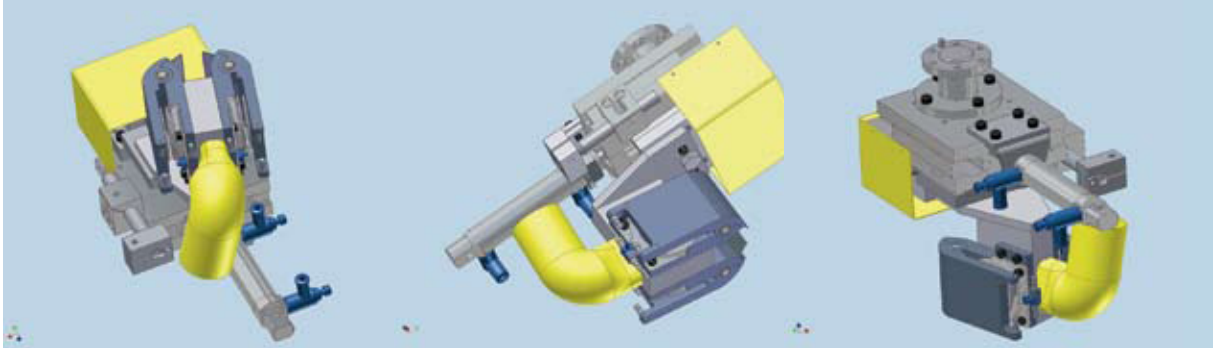
The two trimmer robots simultaneously work on half of the glass perimeter, being dog-watched to prevent from collision. This line output rate can reach 20 seconds per windshield.

Solution C - 12 sec. Workcell

One other inline solution is where three of trimming robots are placed around the squaring/holding conveyor.

The three trimmer robots simultaneously work on part of the glass perimeter, being dog-watched to prevent from collision. This line output rate can reach 12 seconds per windshield.





Solution C - 10 sec. Workcell

For even higher production rates, work island solutions are available, where a combination of glass handling robots and trimmer robots is provided. A four robots configuration is suitable for up to 10 seconds per windshield output rate.

Two handling robots, equipped with vacuum cup end-of-arm tool, alternatively pick-up a windshield from the squaring conveyor type TAI-C and take to one of the pair of supporting stands provided in each trimming station.

Here the robot equipped with the trimming head makes the PVB cutting, working alternatively on either supporting stands: as one

cycle is over the trimmer robot moves to the other stand, while the respective handling robot removes the trimmed windshield and takes it down to the line for unloading.

Said sequence of operation is perfectly balanced, meaning that all four robots perform their respective task without any interference nor inactive waits.

The control system of the whole workcell incorporates hardware and software watchdog modules to prevent from robot collision. Upon needing, or in case of partial failure, the cell can operate either at half rate with only two robots in work, or even allow free glass transit with no trimmer enabled.



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