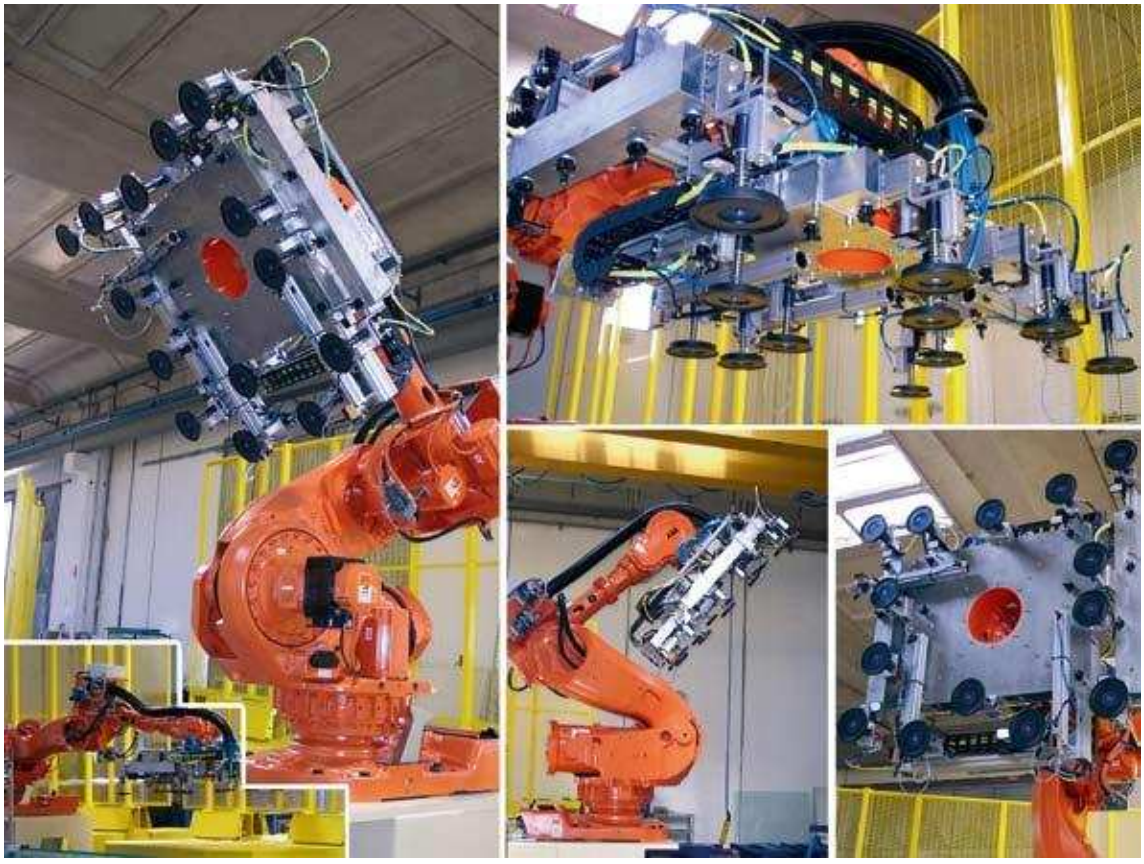
SOLUTIONS FOR THE AUTOMOTIVE GLASS INDUSTRY

Float Cold End Robotic Unloading



STAR
Engineered Robotics Solutions

PREMISE

The glass handling at the exit of the float lines represents one of the most intensive operations in the flat glass industry.
Being very flexible and accurate, robots are more and more used for stacking tasks, taking off the glass plates directly from the conveyor lines, correcting their alignment and preparing perfect glass stacks.
These systems represent the aimed alternative to the traditional handling equipment that if compared with the robotic solution do not achieve the same objectives of quality, safety, flexibility and reduced operational costs.
STAR designs and manufactures turn key Cold End equipment from the lehr to the warehouse, including different sections linked together by logical and mechanical handshake.

STAR SYSTEM

The proposed solution consists of a functionally independent processing line that incorporates the necessary cabling and driving modules to allow the full functional operations.
The proposal is for the following main operations:

- Inspection of the plates moving along the roller conveyor
- Pick up of the plate by one of the robots installed
- Palletizing of the plate on a metallic rack located on a rotating table
- Substitution of the full load rack with an empty one by the rotation of the rotating table.

Glass plates move on a roller conveyor with a variable speed depending on the characteristics of the current production.
The plates come from a portion of float line (typical net width 3.660 mm.) Depending on the sizes of the glass sheets arriving to the palletizing zone, the plates move in groups of 1 or 2 of equal patterns placed side by side in the way of the width of the conveyor.
The plate passes under the bridge where the inspection system, based on the use of CCD cameras with linear array, is located.
The main task of the vision systems is to detect the center of gravity position and its orientation in respect to the conveying direction for each plate.
Such information, beside the one continually provided by the conveyor that will be on purpose equipped with incremental encoder on roller, allows the control system to follow the movement of the center of gravity of each plate till the moment when one of the robots will pick it up on the fly synchronizing the speed of its tool with the one of the conveyor and correcting orientation faults of the plate.
Depending how the plates group is composed, the robots will take them alternatively.
However, every robot takes the plate from the conveyor without stopping it and palletizes it on a rack placed on one of its two rotating tables.
Each table automatically rotates when the rack is full-loaded (or after anticipated order of the operator), so to carry it out of the palletizing area where an operator can safely complete the packaging and unload the rack by fork-lift; at the same time, an empty rack will be carried inside the robot area.

THE GLASSES

- Max dimensions (mm): 3660 x 2700
- Range of thickness (mm): 1,6 x 12
- Stacking accuracy (mm): ± 3
- Plates mix: LES & SSS

THE INSPECTION SYSTEM

Its task is to detect the position and orientation of the glass plate moving along the float cold end conveyor fully synchronized, with the following features:

General
- Production data: dimensions, warning and reject thresholds, defects
- Communication: serial to robot
- User interface: friendly point and click, easy set up
- Bridge structure: heavy duty.

Technical specifications
- Cameras: 1 to 4 high resolution linear CCD cameras
- Defect reject of glass: +/- 2 mm
- Dimensions reject of glass: +/- 2 mm
- Ink marking reject of glass: 3 x 3 mm
- Max conveyor speed: up to 75 m/min
- Min conveyor speed 25 m/min
- Lighting system: heavy duty

Inspected defects
- Broken or badly cut plates
- Length and/or width out of tolerance
- Faults of squaring
- Rotated plates on the conveyor
- Exceeding or missing edges
- Rejected signs
- Absence of plates

The system requires the synchronization signal generated by an encoder on the conveyor.

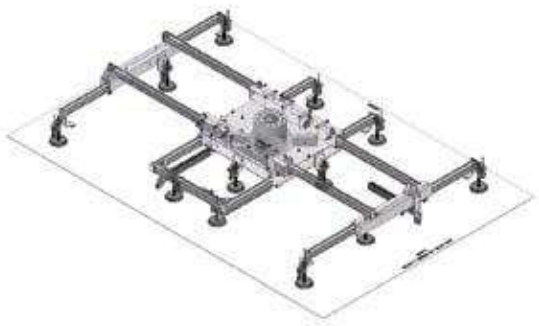
THE ROBOTIC CELL

Robots
- Brand: ABB Robots or other
- Payload: up to 500 kg

The cell
- Number of turning tables: 1 or 2
- Number of robots: from 2 to 16
- Cycle time (single plate): 8-12 sec

The rotating tables
- Max load: 3000 kg each side
- Switching time: 10 sec

The grippers
- Gripping: vacuum cups mounted on level compensators
- Single and double plate gripping
- Expandable arms to manage size range
- Manual or automatic change over
- Glass presence detection
- Vacuum presence detection
- Glass length detection



The cell managing system

One electronic unit, based on PLC, controls the functioning of every device of the cell.
Handshake signals are exchanged between the PLC, the vision system and the robots in order to manage the proper sequence.
Critical parameters are monitored and connected to alarms if process parameters are not met.

All the major components of the system can operate in either manual or automatic mode.
The system manages the cold end process including the following data:
- Robot status
- Number of plates in each rack
- glass destination: robot(s) or reject

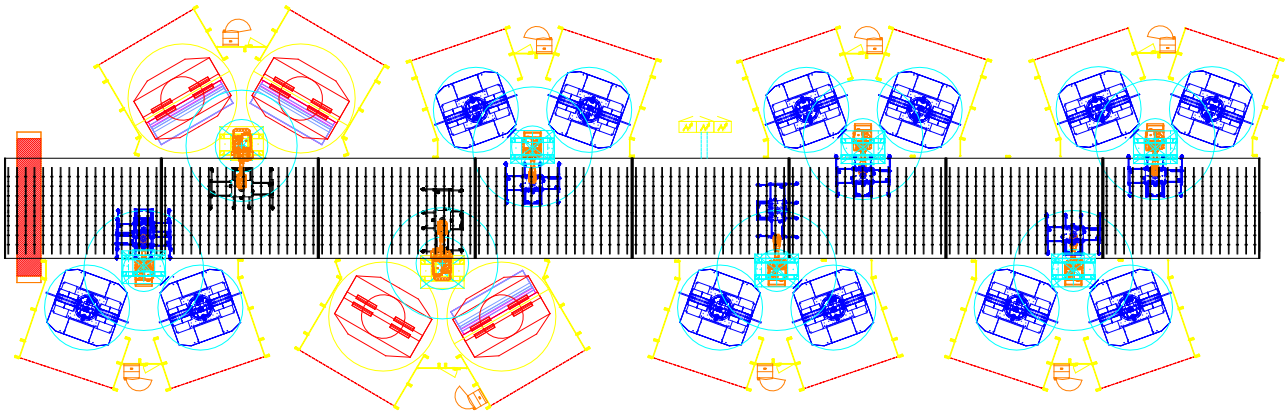
The operator, for each turning table, can select:
- glass size
- glass thickness
- rack type
- number of glasses
- order number

THE SAFETY SYSTEM

TThe 4 robots working areas must be protected by safety fences.
The fences, constituted by modular panels, start at 200 mm from the ground level and reach 2.200 mm.
Access to the protected area shall be possible through two types of gates:

Rotating tables loading/unloading zone: passage opened and protected by safety light curtain placed at the right distance from the moving area of the rotating table.
- Access to the robotic protected area shall be possible through doors fitted with controlled lock: they will be used for eventual maintenance operations on the equipment and/or at change over.

The system, based on safety relays, such as Pilz, guarantees a safety level 4.



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