Float Glass

The adjustment conveyor breaks the rounded edges of the glass sheet off along the longitudinal axis.

Photos: Grenzebach

Grenzebach Maschinenbau GmbH offers material logistics and processing technology solutions for the glass and construction materials industry and also develops plants for the manufacturing of solar panels. Since the mid-1970s, the company based in Hamlar, Germany, has developed and built machines and plants for cold-end float-glass production, covering essentially all process steps following the annealing lehr, all the way to warehouse storage. Because of the high product quality that can be achieved in this process, nearly all flat glass made today is produced in the float process. The so-called cold end of a float-glass plant comprises receiving and transporting the glass ribbon after annealing, cutting and breaking it into sheets, and stacking finished sheets for storage.

Consistently high product quality

The glass ribbon is transferred to the material handling equipment at the end of the annealing process. From there the glass is conveyed to the cutting area so it can be cut to a specified size. While measuring wheels check the speed of the moving glass ribbon, camera inspection systems above the production line monitor glass quality and provide information on defects (bubbles, traces of tin, etc.). The edges of the glass ribbon are measured by a camera system developed by Grenzebach. The information collected in this way guarantees a trouble-free production process and allows errors to be identified at an early stage.

A control system keeps track of customer job orders and generates the manufacturing data such as sheet size, quality, storage location, and number of sheets per stack frame. These data are shared with the optimization PC. Cutting patterns created on the PC are transferred by the optimization PC to the cutting line. The optimization of the cutting patterns ensures that as little refuse glass as possible is left over as cullet.

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Innovative Line Automation

By upgrading to the universal and future-proof Profinet Industrial Ethernet standard, the engineering specialist Grenzebach Maschinenbau has just the right equipment to meet demanding requirements in the float-glass industry.
Based on specified data, the cutting machines move their cutting wheels across the glass ribbon and score grooves along the direction of movement as well as at right angles. The glass is transported to the snapping rolls so the glass can be snapped along the scored lines. Before subsequent processing, the marks left by the top rollers are removed from the sheets. Shock rollers trim the glass edges. The cullet is transferred back for remelting. Conveyors transport the custom-cut glass sheets to the stacking devices.

**Redundant control of the transport line**

In order to ensure high availability in the cutting area, the heart of the Grenzebach float-glass line, redundant Cutting-Master controls communicate with Simotion controllers via Industrial Ethernet. The axis control via the Simotion system helps attain a high degree of precision based on an exact position control cycle and the highest repeat accuracy. Control of the feed encoders takes place directly from the integrated measurement encoders of the Simotion C240 controller. This prevents runtime delays caused by other electronic ballast. Grenzebach has coupled the longitudinal and lateral cutters of the line with a Simotion controller and the Sinamics S120 drive system networked via clock-synchronous Profibus DP. Thanks to its modular design, Sinamics S120 can be deployed in all areas of the line.

The conveyors are automated by two stand-alone controllers (Simatic S7 CPUs). In each area a Simotion C240 controller with the corresponding number of axes is integrated into the Sinamics S120 drive system. The applications in the C240 controller are responsible for the synchronization control, material transport, and machine positioning. The applications are initialized during power-up by means of a data telegram from the Simatic S7 control system (type of axis, gear ratio, etc.). There is also a central S7-300 F-CPU 317F-2PN/DP safety controller deployed throughout the line, which collects all emergency stop signals. When triggered, the safety program generates data telegrams and sends them to the drives, which are safely shut down. To enable the C240 and safety controllers to transfer this information to the drives, the new Shared Device function of the CU 320-2 is used. The CU 320-2 is used in the Sinamics S120 drive system as a shared device in the float-glass units and communicates with two controllers. The CU 320-2 receives motion instructions from a Simotion C240 controller as well as safety-relevant data telegrams from the central safety controller. Parallel processing makes it possible to commit only one CPU to both tasks. (For more information on the Shared Device function, see p. 22.)

Stacking machines are expected to have short cycle times, stack glass precisely, and handle the cut sheets with care. In order to meet these requirements, Grenzebach is equipping its 4-axis portals with Sinumerik 840D sl and Sinamics S120. The standard stackers have their own Simatic S7-300 safety controllers and Sinamics S120. In the future the stackers and 4-axis portals will be linked with the overall network using PN/PN couplers. Using Profinet allows data exchange across plant sections at any time, both in the stacker cells and throughout the transport line.

**Profinet creates new opportunities for industrial communication**

By deploying Profinet, Grenzebach GmbH is breaking new ground in line automation. The Industrial Ethernet standard Profinet has largely replaced most of the previously used Profibus technology for fieldbus communication, so that the drives and controllers used in float plants are now networked using this technology with a redundant fiber-optic ring. Networking the entire transport line with Profinet offers the advantage of reducing response times from 20 milliseconds to 10 milliseconds.