

# The Appropriate Frame

## Options for Overmolding of Car Glass Windows on Vertical Machines

The assembly by injection molding is not limited to plastic components among each other, also non-plastic components, such as wood, metal or glass can be assembled with plastic by injection molding to a finished component. The latter is increasingly used for mounting gaskets on automobile windows. The efficiency of this assembly process is largely determined by the efficiency of the glass pane manipulation. LWB Steinkl has more than 20 years of experience and presents the options.



The mounting of rubber or plastic frames on car windows is increasingly effected by overmolding in vertical injection molding machines with shuttle or rotary table clamping units (© LWB Steinkl)



The serial assembly of passenger cars on assembly lines, invented in 1902 by the American automobile pioneer Ransom Eli Olds (Oldsmobile, REO) and perfected by Henry Ford in 1913 would not have become a success story without the supply of assembly-friendly parts or assemblies. This applies unchanged, until today. An important sub-assembly are the glass windows, which are attached to the body by means of flexible "interfaces". The largest glass panes (front and rear windows or an optional roof glass) are

usually glued to the body. The movable windows in the doors are mounted together with the guides, which at the same time take over the sealing function.

But the fixed side windows, including elastic sealing and holding frames made of rubber or thermoplastic elastomer (TPE), are delivered to the assembly line to be snap-fitted into the body. The profiled executed window seal engages in the body panel with a mechanically strong and tight seat. The size range of these car windows is large, ranging from

the small triangular window in the A-pillar area to the rear side windows for 2-door sedans, coupes, or combi-cars and the slightly higher SUV and Van versions. As a lightweight alternative to glass panes polycarbonate panes are also used.

### Advantages of Vertical Machines during Insertion Processes

The production process for the assembly of a glass pane and a gasket by injection molding is straight forward.

A cleaned glass pane, treated with adhesion promoter if required, is inserted into an injection mold, fixed by vacuum suction, then either with TPE or rubber overmolded and the composite component then removed from the tool.

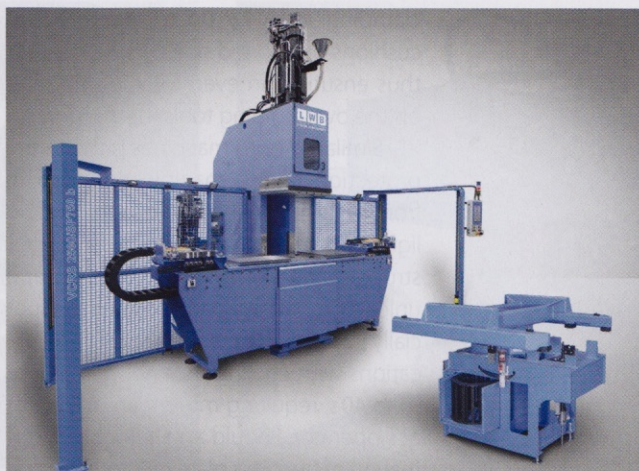
Not as easy as the injection molding process is the logistics for the components around the injection mold. Because the structural design of the window module often requires that with the glass pane also additional parts such as stiffening strips, hinges, etc., must be precisely positioned in the injection mold. The larger the glass pane and the higher the number of inserts, the less suitable are injection molding machines with horizontal clamping units. The reason is the limited accessibility to the clamping unit. In addition, with increasing part sizes and weights, the influence of gravity on the part manipulation has to be considered, i.e. constructive or organizational fall arresters must be provided.

The alternative are machines with vertical clamping units. They offer the required ample space for better accessibility to the tool area and enable part manipulation with a more easy control over the disturbing influence of gravity. LWB Steinkl has been building vertical machines for the injection molding of car glass modules for more than 20 years and has developed a modular component kit for this purpose. This allows to offer machines, tailored to the respective application, within short project lead times.

### **Tie-Barless C-Frame Machines for Small Glass Windows**

For the most basic case, the vertical VC-series-machines with C-frame clamping unit are available. Since the VC-series-machines are available with platens resp. heating plate sizes of 500 x 400 mm to 1,100 x 700 mm, they are well suited to frame small to medium sized car windows with thermoplastic or rubber-material. Compared to the size of the clamping area the clamping force, which ranges from 500 to 2500 kN, is of secondary importance for glass overmolding. Comparatively important is that the plasticizing/injection unit is injecting vertically from above and thus tools with standard layout with central nozzle can be used.

The compromise associated with the use of this machine is that the insertion of



**Fig. 1.** Series machines of the VC series with tie-barless C-frame clamping unit and vertical injection unit (here in thermoplastic design) can be upgraded to efficient production cells with shuttle or turntable modules and light curtain safety zones

(© LWB Steinkl)



**Fig. 2.** Vertical, bottom-closing C-frame machine with side-extended 2500 kN clamping unit in combination with turntable unit and horizontal injection unit (© LWB Steinkl)

the glass pane or the removal of the plastic/glass-composite-part requires a relatively long pause between two injection cycles. The therefore limited production efficiency can be increased by combining the standard machine with a shuttle table or, alternatively, with a rotary table, allowing for a parallel manipulation of glass panes and inserts to the injection molding cycle (Fig. 1).

### **C- and Gantry-Frame-Special-Machines for Two Glass Panes in One Production Cycle**

The next level of efficiency is the simultaneous overmolding of two glass panes (e.g., left and right side windows). In order to be able to position two tools next to each other, the tool clamping area must be extended in width. This can be solved in different ways:

- By a C-frame clamping unit in laterally extended version (Fig. 2) or
- by a Gantry-frame-clamping-unit in extended version (Fig. 3).

Both the C-frame- and the gantry-frame-machines can be realized in several sizes and clamping force levels, with or without a turntable module. Although both machine variants can be designed for nearly the same production output, they have some significant differences. Due to its technical concept, the C-frame-machine is taller than the gantry-frame-machine, so it must either be surrounded by a working platform or placed in a recessed foundation. But it offers the advantage of a three sides open and therefore freely accessible clamping unit.

The gantry-frame-machine with a clamping force of 3000 kN offers the advantage that the turntable (here with a diameter of 3000 mm) can be positioned very low, in this case with a surface height of 850 mm above ground level. With usually 300 mm high overmolding tools this results in an ergonomic advantageous inserting or removing glass pane height of just 1150 mm above the ground. Another advantage of the widened portal frame concept is the possibility to apply the »

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## Company Profile

Founded in 1962 by Alfred Steinl, **LWB Steinl GmbH & Co. KG** dealt from the beginning with tools and machinery for rubber processing. Today, the company, still managed by the Steinl family, is one of the world's leading manufacturers of rubber injection molding machines. The product portfolio covers the complete range of rubber and plastic injection molding machines, from the vertical C-frame-machine specifically designed for rubber and thermoplastic version via vertical 4-column or plate frame machines to horizontal machines in column and C-frame construction. In addition, so-called batch-off systems for mixing confectionery are also in the program.

The company currently employs about 250 people and manufactures about 500 machines per year, based in Altdorf near Landshut, Germany. In addition to the production site in Germany, a production plant in China is operative since 2009. 2017 with LWB Automation, a separate subsidiary for production automation had been opened in Germany.

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clamping force by up to four pressure cushions positioned side by side in a row, thus ensuring an even force distribution on the overmolding tools (Fig. 3).

Similar to both machines is the safety protection of the manipulation area in front of the clamping unit by surrounding light curtains. They allow for a non-obstructed and therefore fast loading and unloading of glass panes, which is especially important for fast-cycling TPE-applications with cooling times of only about 35 to 40 s, requiring more than one logistics operator. Should an alternative automation of the glass plate manipulation be up for discussion, then both machines offer the necessary freedom in the rotary table area.

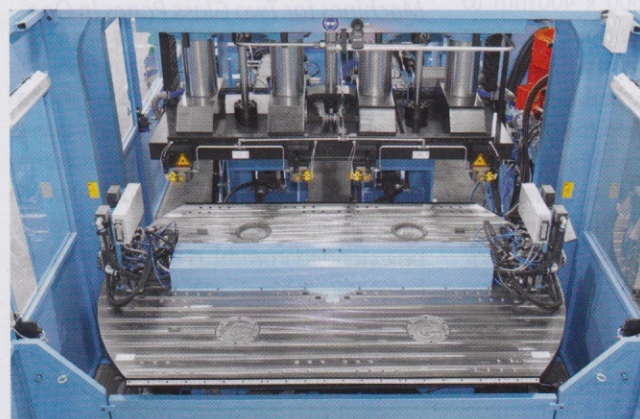
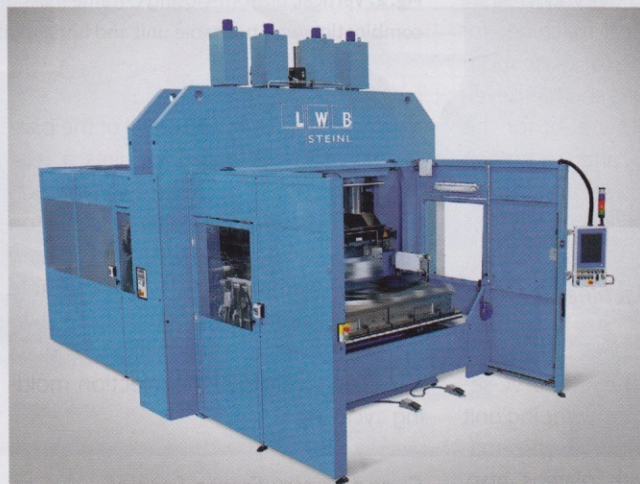
Different options exist regarding the technical execution for the simultaneous overmolding of both glass panes. On the C-frame machine, this is done via a single, correspondingly large-sized, injection unit in combination with a material distributor (cold or hot runner, depending on the material processed) to both mold cavities. On the pictured gantry-frame-machine, the injection is effected by two

parallel horizontal injection units (Fig. 3). They inject through the mold parting plane each cavity separately, but simultaneously. This has the advantage that less expensive tools without cold or hot runner system can be used.

## Ergonomics Champion 3-Tie-Bar-Machine

Practical experience has shown that each of the machine variants described above offers different possibilities, but also requires specific compromises depending on the specific type of glass/seal-assembly. The vertical C-frame series machines are relatively high because of their vertical injection units, the C-frame machines with extended clamping area require measures to facilitate loading and unloading, the gantry-frame-clamping-units complicate the lateral access to the clamping unit.

In order to be able to offer glass module manufacturers another alternative, LWB Steinl developed a ground-up-new machine concept for this purpose: the free-standing and therefore freely acces-

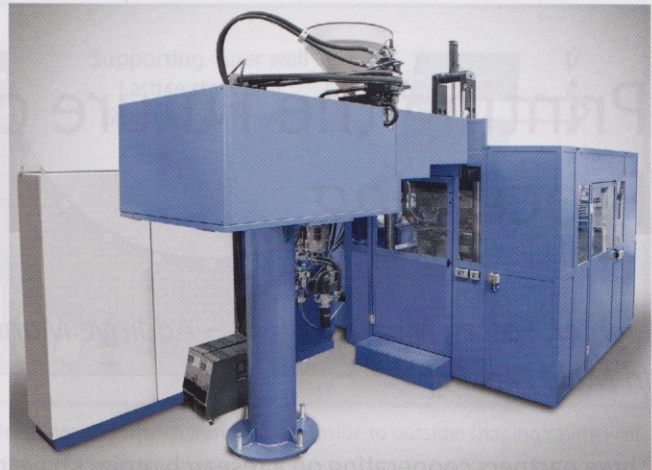


**Fig. 3.** Vertical, top-closing turntable type VRRS 3000/SP750t with two injection units for two tools simultaneously on a 3000 mm turntable. The total clamping area of 2200 x 700 mm (bottom) is at only 850 mm above ground level

(© LWB Steinl)



**Fig. 4.** Detailed view of the 3-tiebar-clamping-unit in combination with the 2-station turntable-module. The new machine concept offers maximum freedom for tool clamping and component handling in the workstation (© LWB Steinel)



**Fig. 5.** The "floating" overhead position of the plasticizing unit above the clamping unit creates the prerequisite for a tool area accessible from all sides (© LWB Steinel)

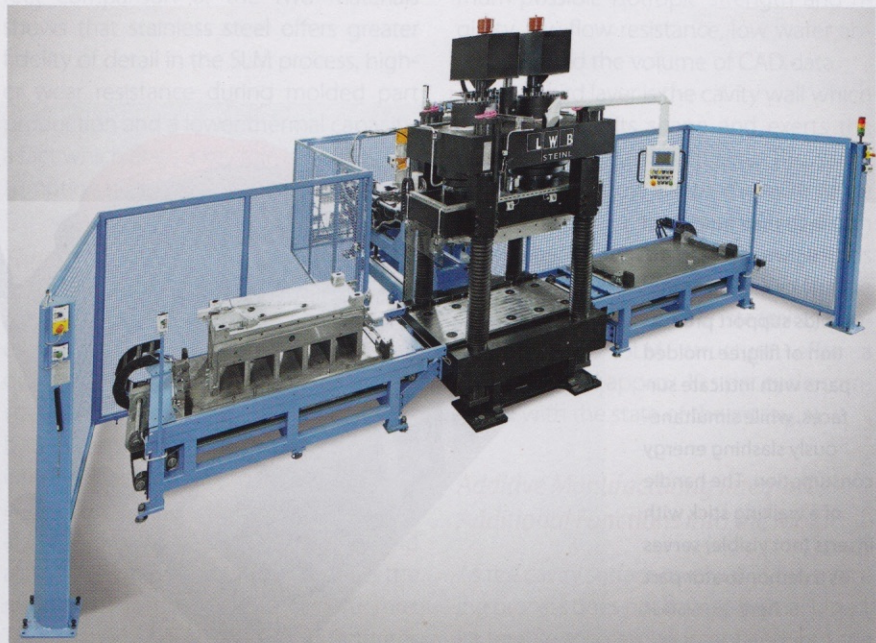
sible 3-column clamping unit with a horizontal "floating" plasticizing and injection unit, which injects centrally through the upper machine plate via a diverter (Figs. 4 and 5).

In addition to the free accessibility of the tool area, the new machine concept offers further advantages, in particular the low turntable-surface-level of just 1000 mm above the floor. The tool area is accessible for maintenance from all four sides, the operating area from three sides. The operating media and the electrical connections are not routed as usual from below via a rotary feedthrough to the tools, but easily accessible via a cable drag from above.

It is also worth mentioning that the machine hydraulics and the drive are positioned as a compact unit next to the clamping unit and therefore optimally accessible for maintenance. The horizontal plasticizing and injection unit keeps the total height of the production cell low, which is an operational advantage in halls with low height. Like the other machine types, the 3-column machine is also available in several sizes if required.

#### 4-Tie-Bar-Machine for Large Glass Sizes

For even larger glass panes and even larger tools, LWB Steinel has developed a vertical machine concept adapted to these dimensions. It consists of top-closing a 4500 kN clamping unit with a platen size of 2000 x 1000 mm and a horizontal 1400 cm<sup>3</sup> plasticizing and injection unit.



**Fig. 6.** Vertical large machine with the type designation VSRS 4500/3000 with 4-tiebar-clamping-unit (4500 kN), closing from above, horizontal injection unit and 2-station shuttle-table-system. The clamping surface of 2000 mm x 1000 mm offers the potential for the use of large and therefore heavy tools for large-format automotive glass panes (© LWB Steinel)

With 700 mm above the ground floor, the machine offers the precondition for an ergonomically favorable operating height with the large-size mold-tools. The clamping unit is combined with a left/right mold shuttle, which allows a large-part manipulation (Fig. 6).

#### Summary

Numerous car glass panel assembly projects completed over a period of more than 20 years have created a broad ex-

pertise in the requirements of this very specialized product niche. The focus was on the ergonomically favorable and therefore efficient manipulation of the bulky glass panes, sensitive to mechanical stresses. As numerous customer projects document, LWB Steinel can refer to references for each relevant production task. In addition, the group company LWB Automation, founded in 2017, is able to offer far-reaching automation solutions for parts logistics around the machine. ■