

Sealing and Thinking

Automotive Subcontractor Eldisy Develops Solutions for an Overlooked Group of Parts

Is everything standardized in the automotive industry? Yes, but ... complying with the standards involves a surprising amount of manual input and sometimes inspired improvisation. We visited a specialist for sophisticated sealing systems, barely an hour's drive from Wolfsburg, Germany, the city of VW.



Eldisy is a specialist in injection molded (right) and extruded (above) sealing systems. The former are often 2-component parts, while the latter are equipped variously with adhesive strips, flock or metal carriers to suit the requirement © Eldisy

Mexico of all places! The country that the new US president would like to impose punitive tariffs on – today rather than tomorrow. There, in Lagos de Moreno, automotive subcontractor Eldisy has set up a new branch factory that is due to come on stream round about now. Back at the parent company's headquarters in Gardelegen, Germany, CEO Elmar Stoffel puts it like this: "At least we're in good company: BMW and Mercedes are building close by and VW has long had a presence in Mexico." Not only that, but one of Eldisy's own customers to which it supplies sealing profiles for roof systems in Germany recently set up shop 50 miles away.

The name Eldisy is a German acronym that stands for elastomeric sealing systems and describes the product portfolio perfectly. This includes seals for vehicle doors and windows, hoods and tailgates, sliding roof systems, cabriolet roofs

and headlamps. Also in the range are sealing systems for domestic appliances, but these have played a minor role so far. Most applications are extruded ethylene-propylene-diene rubber (EPDM), while the rest are injection molded. Stoffel reckons that the relative ratio of the processed rubber to thermoplastic is about 90:10 in volume terms.

Mexico is Eldisy's third non-domestic site, after Poland and Slovakia, and management has plans for a further one in China. In Central America, the specialists for sophisticated automotive sealing systems are commencing injection molding production, which will be followed before year-end by an extrusion line. The subsidiary has thus adopted the opposite approach to the HQ in Germany's state of Saxony-Anhalt, where the company was originally set up in 2000 for extrusion and fabrication, but soon expanded its range of services in 2002 to include injection molding. »

The sealing elements for the side doors of the Porsche Panamera are molded as a pure TPE part

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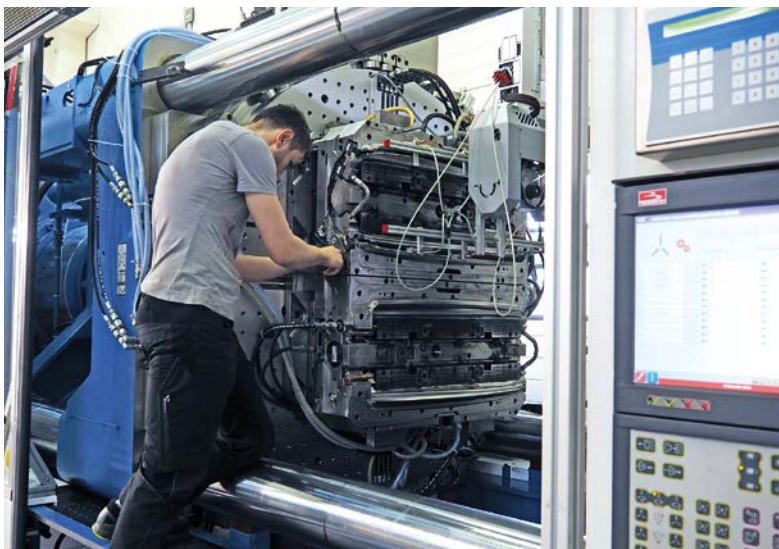


Flagship Project: Sole Supplier for Panamera Doors

“Our flagship injection molding project is the new Porsche Panamera,” says Stoffel. Eldisy manufactures the bulk of the body-side plastic parts for the sedan’s doors using 19 injection molds. “We are the sole supplier of the window tracks – that’s an accolade in itself,” says the graduate engineer, explaining the rather unusual circumstance for the automotive industry that the OEM has no back-up agreement with a second subcontractor.

In the Porsche, these window tracks, which are usually made of EPDM, are a two-component hard/soft plastic part. Although that makes pro-

The electrically driven turntable for the mold for the 2-component water-catching strips is mounted to the moving platen (© Hanser / C. Doriat)



duction more complicated, but leads to a weight reduction of 30%. “OEMs aren’t afraid to incur costs when there are weight savings to be made,” comments Plant Manager Dr. Detlef Scharge.

After injection molding, the parts are coated several times in a fully automated coating line, with the last coat being a lubricant to prevent the seal from squeaking in continuous use. The coating process is necessary because seals not only are functional parts, but also need to be visually and haptically appealing. One would expect nothing less from the auto industry. The final step then consists in attaching an adhesive tape to some of the elastic parts.

Tried Out in Germany

When buying two new injection molding machines in the summer of 2016, the managers at Eldisy took a strategic decision to bring a second supplier on board. Up to then, the company had sourced all five of its hydraulic dual-platen injection molding machines from the same maker. “For our site in Mexico, we wanted a rugged machine that had the simplest-possible controller and required minimal maintenance,” says Stoffel, describing the requirements list. The idea is to install a third, identical machine in Mexico in good time for production startup in April.

Following up on a recommendation, Stoffel turned to Billion, a French injection molding machine maker. “For us, having direct access to the decision-maker was something that we never had with the major companies – we always had to negotiate our way up through their sales hierarchies,” says the 56-year-old. The owner of Billion, Korbinian Kiesel, a Bavarian, repays the compliment: “We too find it easier to meet at this level, for we also have had similar sobering dealings with corporate structures on the customer side.” After a few meetings, the agreement between Eldisy and Billion was then merely a formality.

The chosen model, a hydraulic GM 2K H1300/3500-1000T, has 10,000 kN clamping force and a servo-electric turntable for the mold. “This triple-platen machine is almost half a meter longer than its two-platen counterpart, but has significant advantages,” says Kiesel, adding: “For one thing, the hydraulics are simpler. For another, comparatively little oil is in circulation overall and that makes for fast individual process steps and for an energy-efficient machine.”

Three Is Better than Two

To understand why that is, it might be instructive to take a look at the design. The clamping unit consists of three platens: a fixed and a moving platen, which bear the two halves of the mold, and the so-

called end platen, which has a supporting function. Movement and force transmission are decoupled by a locking mechanism. A hydraulic cylinder located between the end platen and the moving platen pushes the latter towards the fixed platen. Mold closing therefore proceeds over a long distance but requires little force (and a small amount of oil). The clamping force is built up by means of pressure pads in the center of the moving platen, i.e. over a short distance with a large force (or amount of oil). The clamping cylinder transmits the clamping force to the mold with a locking plate over four pillars.

Josef Lichtenberg, regional sales manager for Billion in Germany, describes the hydromechanical locking and the central force build-up through the end platen at the on-site meeting in Gardelegen as follows: "Because injection occurs diametrically opposite the pressure pad, we have an ideal force profile. This central force transmission and a generous guiding length on the moving platen, we have a very rigid system. This contrasts with a two-platen machine, where four pressure pads try to synchronize with several valves during each clamping process."

Plant manager Scharge adds, "As a result of these permanent switching operations, dual-platen machines are more delicate than ..." "...our rustic solution," interrupts Kiesel, laughing. He then adds, "Our machines with their triple-platen clamping unit have an average life expectancy of 19.6 years, which speaks to their ruggedness." For example, the tie-bars are mounted on Pertinax blocks, which take up the mold weight and transfer the load into the machine frame. This relieves the burden on the tie-bars and platen guides.

One of the first production parts made by the new machines were water-catching strips for the Audi Q5. These two-component parts are made

Korbinian Kiesel (left), owner of Billion, and Elmar Stoffel, CEO of Eldisy, appraise the quality of the water-catching strips (© Hanser / C. Doriat)



from glass-fiber-reinforced polypropylene (PP-GF30) and TPE and are attached to the side of the windshield where their job is to divert rainwater away and up to the roof gutter. Eldisy makes 14 different sizes of these parts for the Volkswagen Group alone (right/left in each case).

Part Design Induces Flash Formation

Initial experiences after the machines were commissioned were consistently positive: "A direct comparison by us showed that the Billion machine can produce the water-catching strips five to ten per cent faster than our dual-platen machines. That is naturally reflected in the number of output parts," says Scharge.

Eldisy's order for the machines also included the "Easyflow" software option. This program supports gentle filling of the material under a lower injection pressure by gradually increasing the clamping force build-up. A mold that breathes in this way has the advantage of allowing the air in the cavities to escape via the mold-parting line during injection. Consequently, a lower clamping force overall is sufficient. "That means less stress on the material, the mold and the machine, and leads to improved part quality," summarizes Josef Lichtenberg. To execute parallel movements such as clamping force build-up, injection, compression, the machine draws from the accumulator, which is constantly replenished by a small, economical servo-pump.

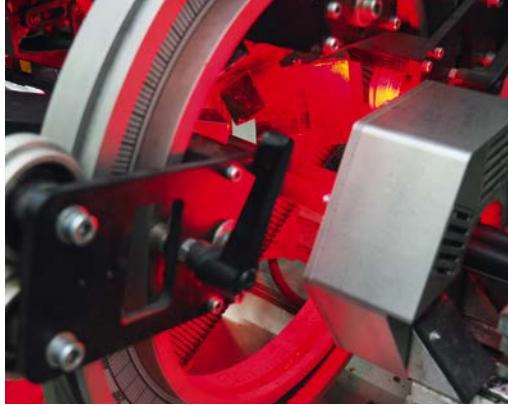
Aside from Easyflow, a so-called VNC viewer is integrated into the Dixit 3 machine control system. Virtual network computing allows the screen of a remote computer to be displayed on a local computer and vice versa so that commands can be sent from one to the other. Thus, Eldisy in Gardelegen is able to replicate any problems that »

Plant manager Dr Detlef Scharge (left) and Josef Lichtenberg, salesman for Billion, running through the remote diagnostics on the Dixit 3 machine control (© Hanser / C. Doriat)



The extrusion process is often combined with a coating process or the application of an adhesive strip

(© Hanser / C. Doriat, Eldisy)



might be experienced by the machine in Mexico and to activate the machines for Billion's remote maintenance service, as necessary. This is one way in which the automotive subcontractor reduces its own personnel expenses.

A striking feature of the injection molding of the water-catching strips is that the machine's clamping force is very high in relation to the projected area of the roughly 85-cm-long, narrow molded part. Scharge confirms this observation, "Normally, half that force would be enough, but because the part designers had hidden the injection point away at the worst possible spot from a flow point of view, namely at the end of the part, we have to use very high pressures so that the melt can negotiate the entire flow path through this small cross-section."

The parts have a small amount of TPE fluff when they exit the mold. Flash formation is hard to avoid, says the plant manager, because of the usual, albeit minimal, mold tolerances employed. An employee stationed right beside the machine removes the flash with a flame in a few seconds.

Freeform Process with a Host of Possible Error Sources

But this problem rooted in injection molding pales in comparison to the everyday vagaries of extrusion, i.e. which is the mainstay in terms of sales. Eldisy produces EPDM sealing profiles in different material combinations on four conventional extrusion lines. Sometimes these are coextruded with foam rubber, sometimes with an aluminum or wire carrier as insert and, if necessary, provided with an adhesive strip, lubricant coat and/or a flock application. There is also a TPE extrusion line. The final stage of the automated production lines, which are up to 170 meters long, is made up of machining steps such as stamping or cutting.

In a typical application, a free-form profile from the heated mold is cooled, coated, reheated to harden the coating, and then brought back to ambient temperature so that the adhesive tape can be applied prior to the assembly stage. Naturally enough, there are many error sources and cost factors at stake here. The first is that "every startup process costs, at a rough estimate, 1500 to 2000 euros," says Stoffel. While an injection molding process that uses defined settings is usually up and running after a few cycles, extrusion requires the involvement of experienced employees who have a good feeling for which knobs to turn and which given basic parameters need to be fine-tuned.

The employees have to monitor the process continuously, so that they can intervene straight away, if need be. Is vulcanization proceeding as it should? Is the cross-section of the profile from the extruder to the trimming station okay? When will the roll for the metal carrier run out? Was the coating mixed in time and are the nozzles still spraying

Company Profile

Eldisy GmbH develops and manufactures extruded sealing systems as well as single and multi-component injection molded parts for original equipment manufacturers (OEMs) and Tier 1 systems suppliers in the automotive industry. The products are used in various types of vehicles – from cars to commercial vehicles to trucks. The systems meet high functional requirements imposed on static and dynamic applications and are designed to contribute positively to the overall image of the vehicles. They are also used in industrial applications, such as windows, garage doors and electrical appliances.

Eldisy is part of the Vorwerk & Sohn Group of companies (including Vorwerk Autotec, Polybond, Vorwerk Drivetec, Polymer-Technik Elbe) and generated sales of around EUR 80 million in 2016.

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Service

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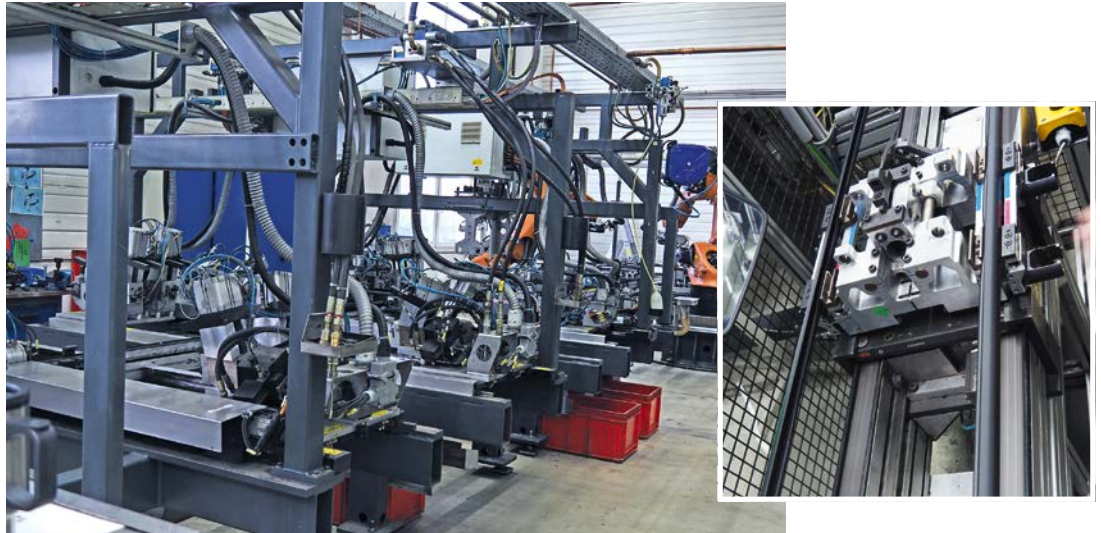
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Transfer line for fabricating the window shaft cover of the VW Polo. The entire process – punching, cutting, injection molding of the caps and bending – is performed fully automatically after manual insertion of the strip into the transfer carriage (right)

(© Hanser / C. Doriat)



correctly? “There are so many parameters to keep an eye on – and, if you don’t watch out, before you know it, you’ll wind up again with a few hundred meters of rejects,” says Stoffel. Not only that, he adds, the material has to be processed within a particular time frame, because rubber mixtures have a limited shelf life.

Curved Strips, Creatively Flexed

Couldn’t the much-vaunted “Industry 4.0” help here? Detlef Scharge’s response is immediate: “That would be great, but I don’t believe that extrusion can function as a self-regulating process. There are too many factors impacting the contour of the product.” And besides, how could anyone in the future ever devise a better way to apply a bead of adhesive for flock with greater accuracy than this: a brush attached above the line applies a bead of glue to the profile passing by underneath it. “Spray-gun application wouldn’t be accurate

enough,” says Scharge, explaining this unusual solution. The only problem here is, “You must take care to replace the brush before it hardens.”

Lest anyone be concerned: every working step is monitored and checked for compliance with the current standards imposed by the automotive industry. In the extrusion line, camera systems scan the surface of the sealing profiles; if they detect an error, the part is marked as NIO (not in order). The outer contours, too, are monitored and the machine gives a signal if certain parameters – such as the process itself or the air-conditioning – drift outside their tolerance range.

Quality assurance personnel regularly collect samples from the production process and take them to the laboratory to check parameters such as cross-section and pull-off force. This is essential for ensuring that all preconditions for further processing are met. For example, the budding window shaft seals for the VW Polo pass through a large transfer line. This entails clamping the extrudate to a transfer carriage that passes through various processing stations, where the part is punched and cut to size before caps are molded onto both ends. Finally, the straight strip is bent into the door shape of the Polo by a bending device.

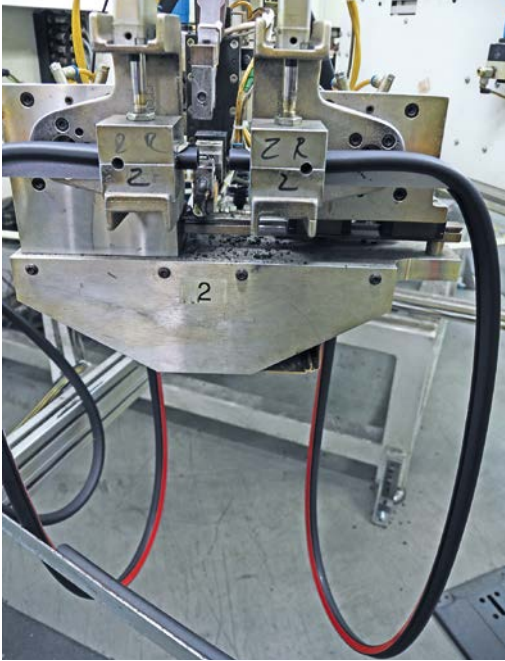
For the last step, which was necessitated by a design change by VW at short-notice, Eldisy again came up with a creative solution. “To bend a strip which already has caps at both ends to a given radius is not really technically feasible,” says Scharge. To do so, the upper side would need to be pulled and the lower side compressed. “To prevent folds from forming, the strip is placed on rollers and is slowly flexed without any heat input; the metal carrier inside the part is flexed along with it.” The entire transfer process runs fully automatically once the strip has been inserted.

Elmar Stoffel swats away the next obvious question: “In spite of the outlay here, this pro- ➤

Molding of EPDM corner moldings onto the frame seal of a windshield. The cycle time depends on the skill with which the operator inserts the extrudates and the heating time during rubber injection molding

(© Hanser / C. Doriat)





Butt joining of a door inner seal. The mold, which is loaded with a PE film adhesive and the extrudate, is lowered and the loose ends are joined to each other under infrared heaters (right)

(© Hanser / C. Doriát)

cess chain is still cheaper than injection molding the entire part." With an output of 18 to 20m/min and given the comparatively low cost of the die ring, extrusion is peerless when it comes to numbers of parts and unit costs. The transfer system, too, has a greater capacity than in injection molding.

High Manual Outlay

Sometimes, though, there is no getting around injection molding, or to be more precise: elastomer injection molding. For instance, the frame seal of the Porsche 911 windshield consists of three extrudates connected to each other in a vertical injection molding machine (manufacturer: LWB Steinl) by means of EPDM corner molds. So many steps are done by hand that this could almost be called a manufactory: one employee is responsible for positioning the profiles and inserts in the mold and removing the product, while another removes flash from the seal. "This is basically plastic processing as it was practiced 50 years ago," says Detlef Scharge. Is reproducibility not essential? "Of course these are quality products, but one way to look at

it is that each windshield frame really is unique," says the plant manager.

Delivery Deadline: Start of May

A worker is also needed for butt joining the loose ends of the door inner seal for the VW Touareg. The worker loads and unloads the workpiece carrier and removes the remnants of the previously inserted PE adhesive film; in between, the ends are automatically smoothed and welded with IR radiation to yield the finished sealing ring.

During the tour, I meet a group of Mexicans, who were trained in Gardelegen. CEO Stoffel is not fazed by the situation: "There is no reason to presume that the major OEMs will stop erecting factories in Mexico. Anyway, as a small supplier, we wouldn't be directly impacted by penalties, because our parts are either installed directly in Mexico or delivered to a factory in the USA and installed there. We will press ahead with what we are doing and will deliver the first parts in Mexico as planned at the start of May." ■

Dr. Clemens Doriát, editor



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