

ENGEL tie-bar-less technology boosts efficiency at Procter & Gamble

Space is Money

Vitality is one of the entry-level models among Oral-B's electric toothbrushes. The product is primarily sold in drugstores and discount stores and is exposed to correspondingly high price pressure. In terms of injection moulding the three-component hand pieces, this means achieving the required high quality with the maximum possible efficiency. In addition to the cycle time, the compactness of the production cell plays an important role. Only tie-bar-less ENGEL injection moulding machines can achieve this balancing act.

"The space the production cell requires is a purchase-deciding criterion for us," as Christian Rieb, equipment engineer at Procter & Gamble Manufacturing in Marktheidenfeld, Germany, explains. "The more compact the cell, the higher the output of our location." This is a rule that is also reflected in the internal purchasing guidelines, which, among other things, define the maximum dimensions that an injection moulding machine can have at Procter & Gamble Group plants. The compactness of the production cell is reflected in the unit costs. Productivity per unit of area is the key efficiency indicator.

The injection moulding and assembly plant in Marktheidenfeld is one hundred percent focused on oral hygiene. Electric tooth brushes for the Oral B brand are produced for the worldwide market there. Regardless of the model, the toothbrushes have one thing in common: the hand pieces are multi-component parts that combine hard and soft materials. The basic body consists of a thermoplastic. For a better grip, the base body is partially over-moulded with TPE. In addition, the touch controls, such as the on/off switch, are hidden under a sealed, waterproof elastomer surface.

Free space for the mould

Multi-component moulds generally have a larger volume than moulds for standard injection moulding, although the clamping force required for injection moulding is comparatively low due to what are typically small component surfaces. This discrepancy often leads to a larger injection moulding machine being used than the injection moulding process would actually need. At the end of the day, the large mould needs to fit into the mould mounting space on the clamping unit, and this leaves little room for manoeuvre in a classic injection moulding machine with tie-bars.

"It was clear to us that we could only achieve the required unit costs for the hand pieces of the latest generation Vitality with a tie-bar-less injection moulding machine," says André Tolksdorf, process engineer at Procter & Gamble Manufacturing. The hand pieces are now produced on a tie-bar-less ENGEL victory 400 with a clamping force of 4000 kN and an integrated ENGEL viper linear robot. "Without tie-bar-less technology, we would need an injection moulding machine with a clamping force of at least 10000 kN due to the size of the mould. But we don't have room for that," says Tolksdorf.

Because there are no tie bars in the way, the mould mounting platens on ENGEL victory machine can be fully used up to their very edges. This enables a particularly favourable mould to machine width ratio. In addition, the unimpeded access to the mould area facilitates the mounting and dismounting of the moulds. An advantage only offered by Austrian injection moulding machine manufacturer ENGEL. Thirty years ago at the 1989 K show, ENGEL presented the first tie-bar-less injection moulding machine, turning the industry on its head. "There are hardly any limits to creativity," as stresses Franz Pressl, product manager for the victory machines at ENGEL. "Product designers can work more freely, because they can develop cost-effective manufacturing processes, even for complex parts."

Compact arrangement of injection units

Procter & Gamble not only leverages this additional freedom for the mould, but also in terms of how the injection units are arranged. As Falk Boost, sales engineer at ENGEL Deutschland's Stuttgart branch, makes clear "This compact arrangement would have been inconceivable with tie-bars".

More efficient automation, better ergonomics

The latest generation basic Vitality's hand piece geometry is similar to that of its predecessor. However, the design of the TPE surfaces has been enhanced for even better ergonomics. The predecessor model is of particular importance, as this project saw the first tie-bar-less injection moulding machines arrive at the Marktheidenfeld plant in 2007. Even then, the focus was on space saving and a simple mould set-up, but also on efficient automation solutions. The production process looked completely different at the time. The multi-component process was implemented using transfer technology. But thanks to tie-bar-less technology, the robot was able to enter the mould area directly from the side without needing to work around interfering edges, and this shortened the handling time.

Tie-bar-less technology offers many benefits in terms of high efficiency, but Procter & Gamble still had reservations at the beginning. "The design principle breaks with everything that is taken for granted in a classic tie-bar machine," says Rieb. "Staff were concerned about their moulds and the repeatability of product quality. They could not imagine how the mould mounting platens could be kept parallel without tie-bars." So measurements were made. The various influencing factors of the mould, the set-up process and temperature control were simulated and tested, and the results were obvious at all times: excellent platen parallelism. "The topic has been off the table ever since," says Rieb. "We now run very sensitive precision products such as connecting rods for crankshafts with a POM component on tie-bar-less injection moulding machines."

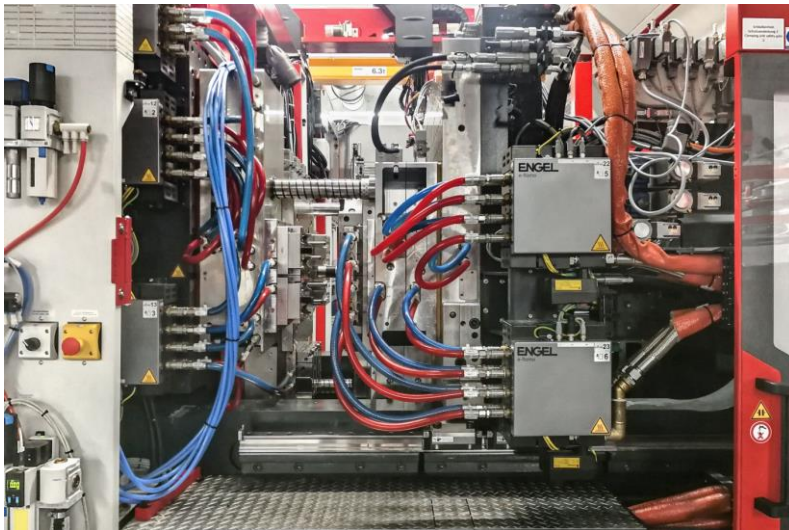
The feedback from the machine setters is also positive. "We clean the moulds every day. This is a more convenient and faster process without tie bars," as shift foreman Christian Dinkel emphasises.■

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Tie bar-less clamping unit

One special feature in the design of ENGEL's tie-bar-less injection moulding machines is their solid frame which ideally supports the clamping unit and avoids deflection even with heavy moulds. Thanks to three-point guide, the moving mould mounting platen keeps its orientation even while the mould is opening and closing. In contrast to other machine designs, the stationary platen is not connected with the frame at the bottom end, but instead to the

frame at the rear of the platen. This way it absorbs the machine's vibrations in a symmetric manner and remains parallel to the moving platen even during acceleration and deceleration. The central Flex-Link element allows the moving mould mounting platen to precisely track the mould during clamping force build-up so that the two mould halves remain parallel to each other throughout the entire injection moulding process. No matter whether the cavities are located at the centre or at the edge of the mould mounting platen, the force divider ensures that they are all exposed to exactly the same level of surface pressure. This guarantees a consistently high part quality for multiple cavity moulds, too.



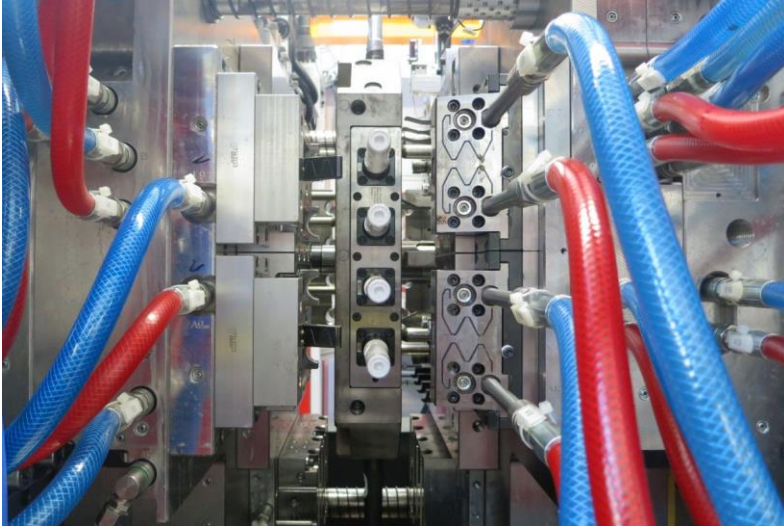
The large mould fully utilises the victory 400 injection moulding machine's platen face. Using a machine with tie-bars would have required a larger size with a minimum clamping force of 1000 tons, and the machine would have been far wider.



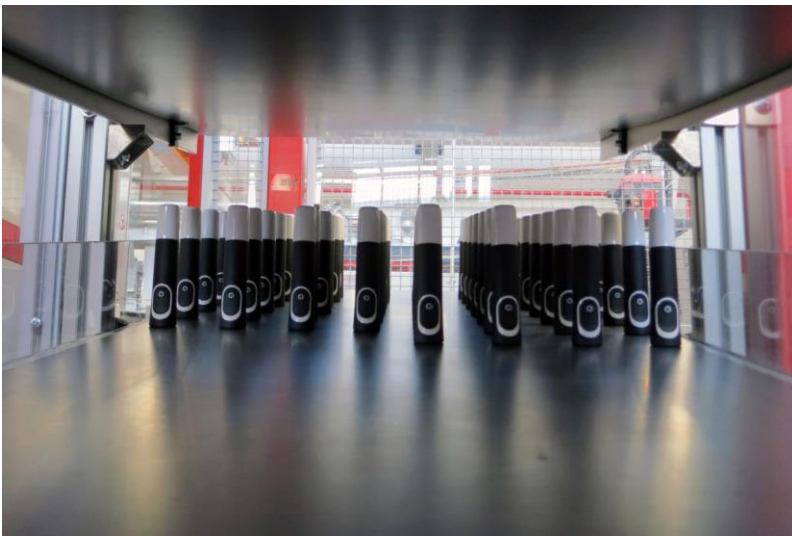
Producing the latest generation of the Vitality electric toothbrush's hand pieces (right) with the required efficiency is only possible using ENGEL tie-bar-less technology. Tie-bar-less injection moulding machines were already used for the predecessor model (left).



From entry-level to high-end models, up to 85,000 electric toothbrushes leave the P&G plant in Germany every day.



The hand pieces consist of three components. In multi-component injection moulding, the basic bodies are first moulded from white polypropylene. This is followed by two injection moulding steps with TPE.



The on/off switches in the hand pieces are hidden under a sealed, waterproof elastomer surface.



The moulds are cleaned every day. Tie-bar-less technology makes this manual work far more convenient and faster.



Setters Kai Lanig (left) and Christian Dinkel verifying the repeatably high component quality.



United in an efficiency mission: Christian Dinkel, André Tolksdorf and Christian Rieb from Procter & Gamble Manufacturing, Falk Boost from ENGEL Deutschland and Franz Pressl from ENGEL AUSTRIA (from left to right).

Pictures: ENGEL