

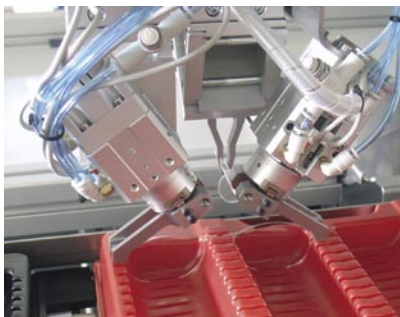
## Products in Action )))

Products:  
 Electric actuators  
 Air line actuators  
 Rotary gripper

Customer:  
**FOCUS ON VISION** Focus on Vision  
[www.focus-on-vision.org](http://www.focus-on-vision.org)

## Third World vision problems are closer to being solved

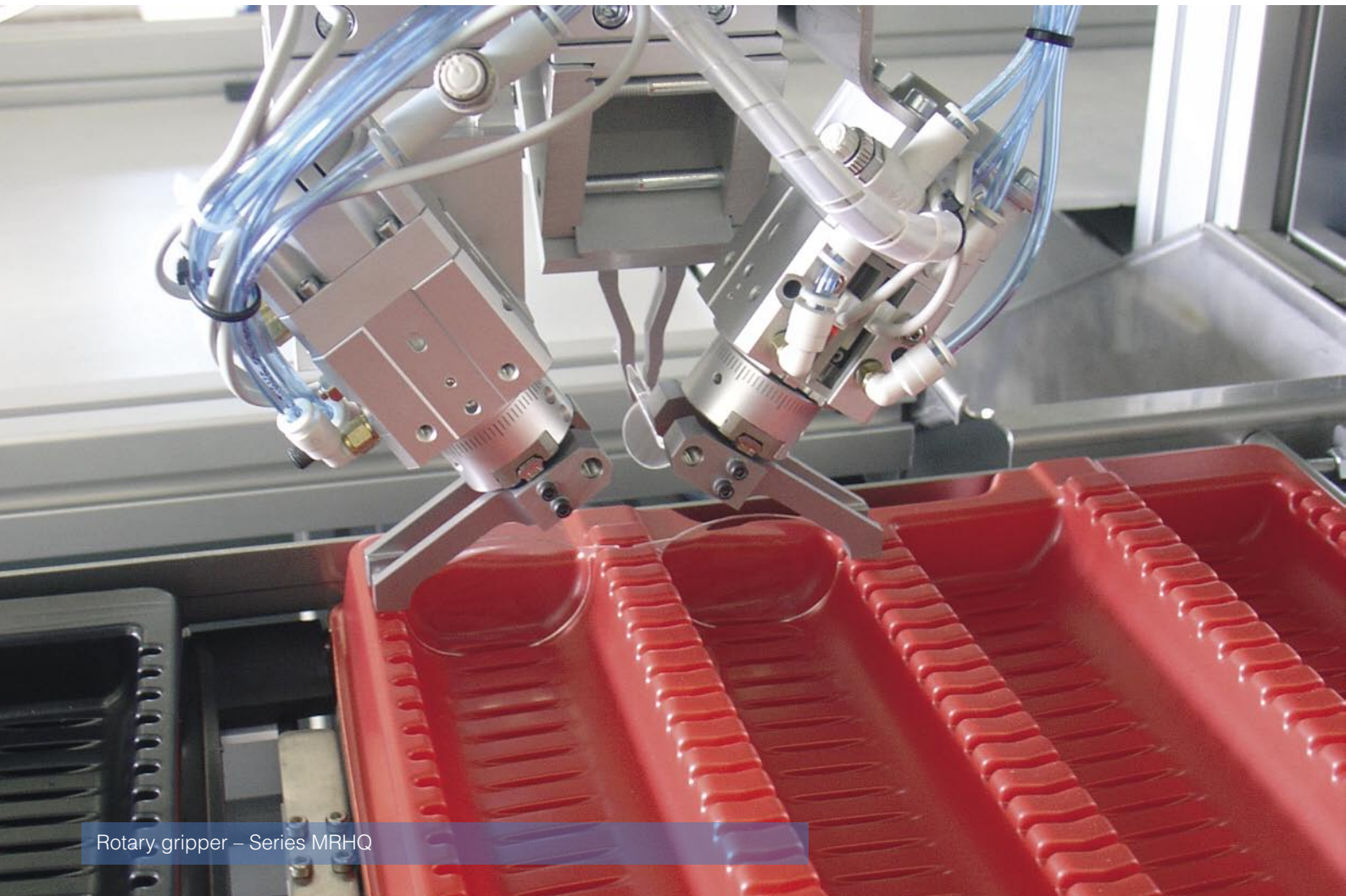
Whilst nearly half the population in developed countries wear glasses, this figure falls to just around 5% in Africa, where many people have no access to an optician or ophthalmologist, and would find it too expensive if these services were available. To help this situation, the Netherlands based foundation, Focus on Vision, launched a plan back in 2004 to design adjustable-strength spectacles which could be developed and manufactured for just such people.



During the next four years, with help from OTB, an inline production equipment company, Mecon, a Dutch engineering firm, ART (eur) BV, and SMC, the world's leading pneumatics company, Focus on Vision developed a lens-coating system to help achieve this goal. The coating system actually forms part of a complete assembly line which also consists of an injection moulding machine and a handling robot, enabling approximately 1 million adjustable-strength glasses to be manufactured each year using just one assembly line.

Said Jan in't Veld, co-founder and vice-chairman of Focus on Vision, "According to figures from the World Health Organisation, **some 1 billion people in low-income countries need glasses** but lack either an ophthalmic infrastructure or the money to pay for glasses."

The first glasses made have now been delivered to a number of developing countries, including Ghana and Tanzania, and shortly glasses will also go to Afghanistan and Botswana. Although the glasses are currently made in the Netherlands Jan in't Veld said that the aim in time is to set up assembly lines in the target countries themselves. "Whether this is feasible will depend on local circumstances. Before that happens, however, the system must be fully mature. In any case, the aim is to help as many vision-impaired people as possible in these countries.



Rotary gripper – Series MRHQ

### Five principles

Before the project started, Focus on Vision developed an agreed criterion of five key principles:

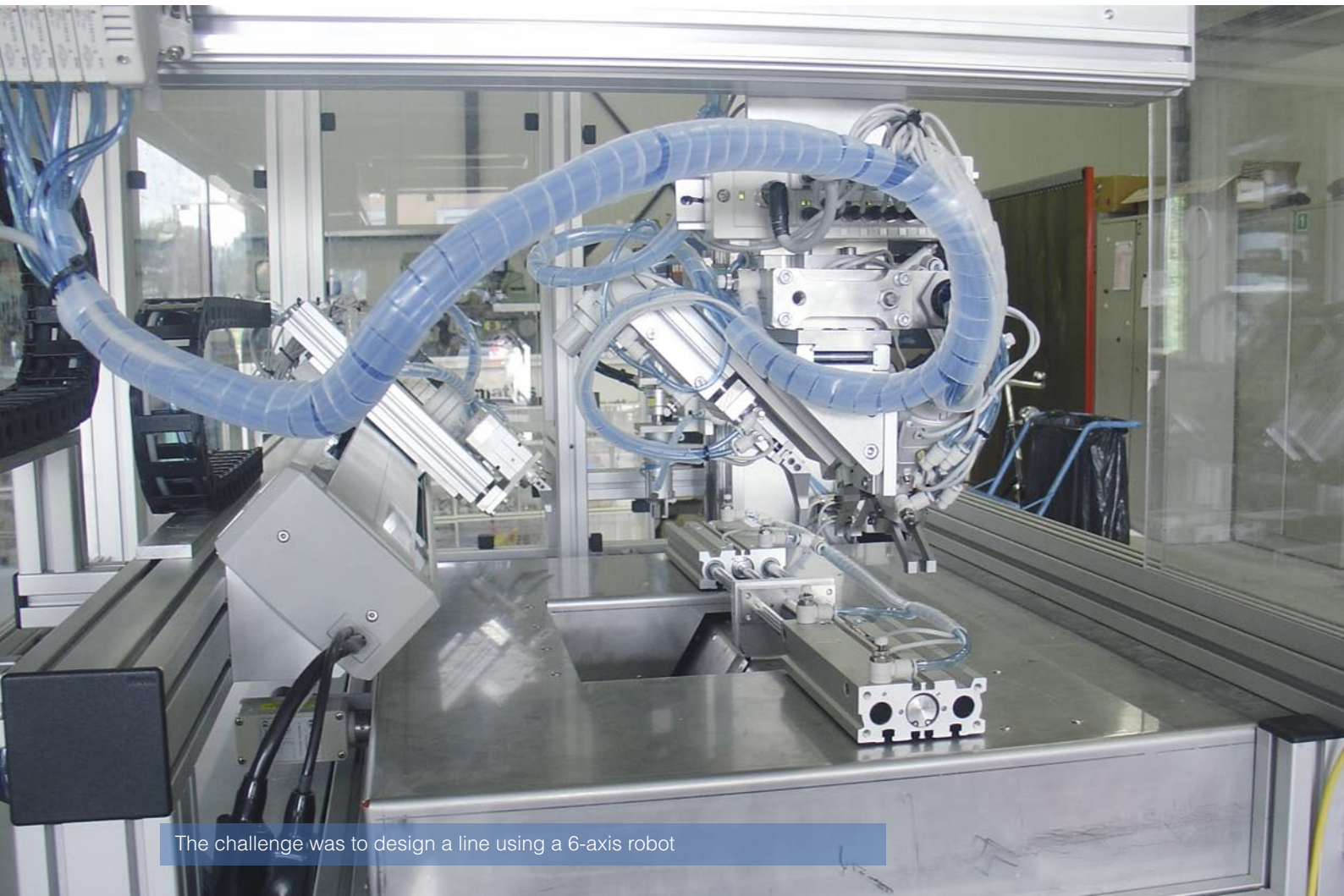
- the glasses must be adjustable by users themselves
- the parts must be able to be manufactured using standard industrial equipment
- the individual parts must be very simple
- the ex-machine price must be very low
- the glasses must win at least one design prize.

In 't Veld continued "All these principles have now been achieved. **The glasses have already won three design prizes** and we are now trying to achieve a maximum cost price of 1 euro each, to enable a selling price that represents a figure which is around three times the local minimum daily wage. This unit price also reflects the recognized and accepted world-wide standard charge for glasses, which is between 2.5 to 3.5 times the daily wage."

### Design

Four lenses are needed to manufacture 1 pair of glasses: two front and two rear lenses. The front lenses are identical for close-up or distance sight glasses, while the rear lenses are different. There is a small cog-wheel on each side of the glasses so the user can adjust the rear lens for optimal vision. Glasses for hyperopia (long-sightedness) can be adjusted by +0.5 to +4.5 dpt and glasses for myopia (short-sightedness) by -5 tot -1 dpt. This combination of lenses can solve both kinds of vision problems in 90% of all cases and for about 1 billion people who do not have access to an optician.

Nico van Wijnen, Director of toolmakers van Wijnen says: "**The hardest thing about designing these glasses was achieving the desired geometric accuracy** when injection moulding them, and obtaining a surface roughness of 2 to 3 nm. Compared to normal glasses, the geometric accuracy had to be twice as good because the glasses had



The challenge was to design a line using a 6-axis robot

to be adjustable. The moulding was quite an art in this case. Besides the fact that the liquid polycarbonate had to be moulded from the side, it also had to be a specific thickness. The middle part of the lens had to be a maximum 0.4 mm thick and the outer edges a maximum 1.2 mm. It was a difficult job because liquid plastic always chooses the easiest path and any air inclusions and flow lines also had to be eliminated as much as possible. Finally, after nearly 2 years of research, we have succeeded in developing a mould for the injection moulding machine where the internal cavity pressure is 100% across the entire glass, he concluded.”

#### **Children’s glasses for myopia**

**Some 10% of all children in the world are born with a refractive abnormality called myopia** (short-sightedness). In most cases, the abnormality only appears during puberty, resulting in them needing ‘distance’ glasses. Focus on Vision will soon be launching glasses for these children.

#### **Production**

“Our current injection moulding machine is capable of producing 2 million shots (each shot is a pair of lenses) per year. The manufacture of 1 pair of glasses involves 2 shots, or 4 lenses. The cycle time for moulding one pair of lenses is about 10 seconds. Working at the same speed, the handling robot transfers the finished products from the injection moulder and places them on the lens-coating line.

The primary challenge for Mecon was to design a line using a 6-axis robot to meet all requirements within the specified budget. Frank Schuiling, Key Account Manager at SMC Pneumatics said, “By making smart design choices, and by working closely with Mecon we succeeded in finding a more efficient way of quickly constructing a machine at the right price. This has manifested itself in a line that has two accurate electric X axes, with the first at an angle of 45° so Y and Z movement can be performed as a single movement.”



Gripper + Rotary gripper – Series MHZ2 + MRHQ

Roland Mulder, Project Manager at Mecon added, “Interestingly the line actually consists of four stations: coating, exposure and curing with a cutting station cutting off the lenses, and placing them in trays at the end. **A pneumatic gripper at the first station is used to give the two lenses an anti-scratch and anti-reflection coating.** To give you an idea ... this coating costs 80 cents to 1.60 euros for a standard pair of glasses.”

Because this made the cost of the glasses far too high, In 't Veld travelled to optical manufacturers throughout the world looking for an alternative solution that could meet the required budget target. However, a solution was closer to home as expected. SMC's Schuiling explains, “After applying the coating as thinly as

possible, the lenses are transferred to the exposure station using SMC electric actuators. At this station, which is closed by pneumatic guide cylinders, the lenses are cured in an inert environment using ultraviolet light. That's 1.2 kW light. After curing, the lenses are removed using a rotating pneumatic gripper and passed to a gripper unit specially developed by Mecon. This unit, which consists of SMC standard rotation and parallel grippers, separates the lenses from the mould branch in a single movement. At the final station, the lenses are placed in a 60-position tray.”

#### The next steps

Although this machine is the forerunner of future revolutionary development in the global lens

industry, the glasses it makes cannot be purchased on the European market. But according to In 't Veld, “We expect to launch a range of sunglasses based on this design in Europe at the start of 2010 and the money they bring in will be used for the further development of the FocusSpec and the logistics of local manufacturing operations. **However, our ultimate goal still remains the same “To bring good vision to those who need it.”**”

#### SMC Corporation [Europe]

<http://www.smc.eu>

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