Blockless Edging Technology

Thomas W. Pfleging, Product Management Edging
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The aim of this document is comparing conventional and blockless edging to show how blockless edging can improve the industrial edging process in terms of costs, times and quality. Any given information is not binding, can and will be changed without further notice. In case of further questions get in contact with the owner of the document (thomas.pfleging@satisloh.com).

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INTRODUCTION

Blockless edging technology was first introduced in 1999. The driving force behind this new technology was the shift from in-house, retail store finishing to industrial production by lens manufacturers, wholesale labs and large retail chains with centralized labs.

In addition new coatings on lenses, in particular hydrophobic and super-hydrophobic coatings, created new challenges. Due to these new coatings conventional tabletop edgers needed to slow down, lowering an already low productivity even further.

With the introduction of industrial edgers such as Satisloh's ES-2 / ES-3 edging a perfectly fitting pair of lenses became less of a challenge. Due to this new concept and new industrial strength technology productivity, quality, repeatability and first fit ratio improved tremendously. The challenge to edge coated lenses still existed though. Process times of those lenses take much longer.

1. Standard Blocking Process:

Conventional edging requires blocking pads and adhesive pads.

Adhesive pads come on a roll of either 1000 or 2000 pieces. They are peeled off and applied to the block piece. It must be noted that these pads have a limited shelf life. This means they loose stickiness over time. Adhesive pads are applied to the front surface (convex side) of the lens.

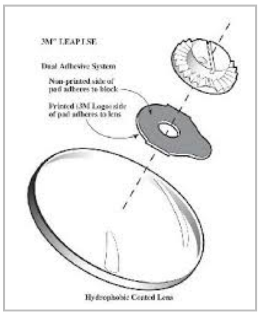
Different adhesive pads are available for different lens materials and coatings, making blocking a highly complex task. Having to choose different adhesive pads for different materials creates room for error, resulting in potential lens breakages.

For super-hydrophobic lenses manufacturers supply an additional pad to avoid slippage. This anti slip pad, sometimes referred to as ricky pad, is applied to the lens between the actual adhesive pad and the block piece.

The pad is a thin layer with special adhesive features. The shelf life is even shorter than that of regular adhesive pads. Some manufactures, such as Essilor apply a topcoat to the lenses. The topcoat takes the role of the anti slip pad and avoids slippage. After the lens is edged the coat can simply be wiped off.

Another part of the production process is the block piece. Most block pieces have one curvature. They are semi-flexible and adjust to different front curves of lenses. Using standard block pieces also creates room for error. The bigger the difference between lens curve and block piece curve chances for breakages due to insufficient block coverage increases.

To apply adhesive pad and block piece to the lens a blocking device is needed.



It can be a manual or automatic device. Layout and decentration are done at the blocker. Once blocked, either in the optical center or geometrical center of the final shape, the lens is placed into the edger either manually or automatically in case of industrial, automated equipment such as ES-4 or ES-5.

After edging block piece and pad or pads must be taken off the lens. Any residue from the adhesive pad must be cleaned. This is a labor intensive task. Depending on the type of pad (degree of stickiness) removing the block piece and the pad creates a potential for scratching the lenses or damaging coatings.

Most of all it is labor intensive requiring personnel not only for removing pads, block pieces and any residue but also for preparing the lenses for edging. A minimum of 2 people is required for such tasks, obviously depending on the volume of jobs per shift and day.

Resulting in much higher production costs adding to the cost of a job or reducing margin when pricing the product to customers.

Based on 100.000 lenses per year savings add up as follows

- Labor: 4 people blocking / deblocking: ~ EUR 120.000
- Consumables: block piece / adhesive pads: ~ EUR 10.000
- Lower breakage (average lens price of EUR 15): ~ EUR 40.000

2. Blockless Process

The idea of blockless edging is to address industrial edging, eliminate steps preparing the lens and cleaning it after edging. Additional important benefits are:

- Avoid human error
- Fully automate the process
- Improve productivity and efficiency
- Deliver consistent and reproducible quality
- Reduce cost, improve margin

Blockless systems combine automatic layout, decentration as well as quality inspection. It consists of a robotic loading device and a lens inspection system (LIS).

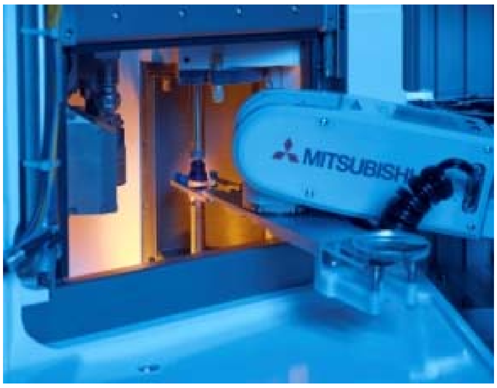
Some of the challenges of the first system were poor recognition of PAL and / or polarized lens. Low powered single vision lenses and prismatic lenses also created problems, making the system only partially fit for a use in a high production lab.

Current blockless systems, such as the ES-5, work flawlessly. Issues as stated above have been addressed and solved due to much improved camera systems as well as faster more powerful processors.

Blockless systems eliminate steps in the production sequence, reducing labor as well as speed up job processing:

- Preparing lenses for blocking
- Lay-out and decentration of lenses
- Applying adhesive pads
- Potentially applying a second anti-slip pad
- Removing block piece and adhesive pads
- Cleaning lenses, removing any residue from adhesive pads

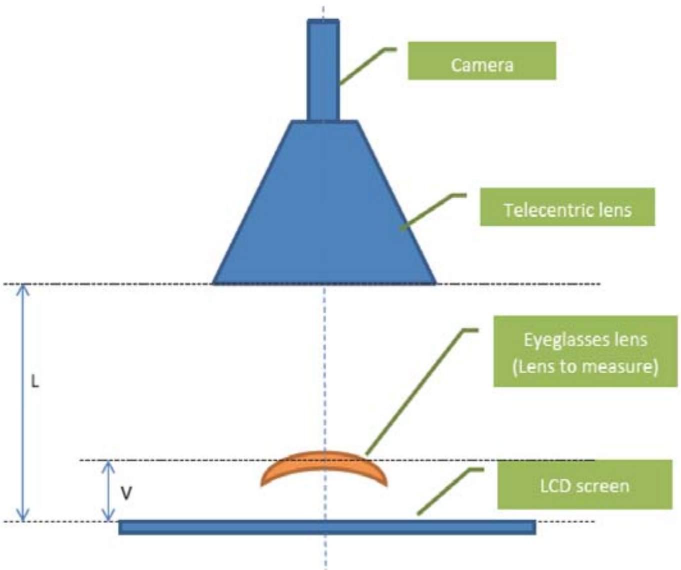
The robotic loading device has a loading arm with two parts. The suction cup part is for picking up the lens from the job tray, the gripper to pick the lens after edging returning it to the tray.



2.1 RX Measurement

Power Measurement System

1. System description



- The system is made of:
- One camera
- One Telecentric lens 0.08X
- One Eyeglasses lens
- One LCD screen
- L = ~140mm
- V = ~50mm

The system measures optical power (in diopters) of any lens loaded in the system, even if crucial lens information is missing.

Working range:

- Power range: -10.00 diopters to +8.00 diopters.
- Front and back curve: -20 to +20 diopters.
- Center thickness: 0 to 40mm.
- Lens diameter: 70 to 90mm.
- Type of lenses: Single vision, Multifocal, Progressive lenses, Prismatic lenses as well as Polarized lenses.

Values are compared to the information send by the LMS system (Lab Management System).
If a lens is out of tolerance it will be rejected saving valuable time, avoiding breakage. After comparing RX values the system also checks if lenses have been swapped between right and left. In that case the Lens Inspection System (LIS) automatically swaps the edging sequence between right and left.

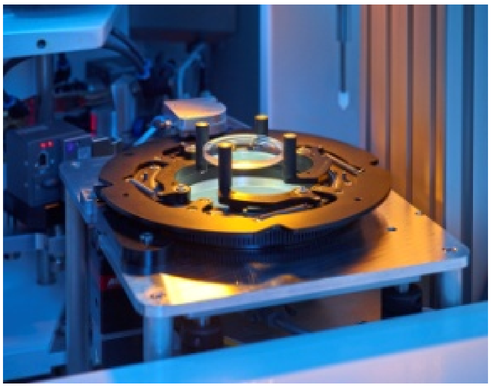
2.2 Layout detection

The LIS turns the lens into the correct position. Optical center and axis orientation are calculated based on the RX and the customer's individual information (i.e. PD or seg height) send by the LMS. The LIS also checks if the blank size of the lens is sufficient. The overlay function shows the shape of the edged lens in relation to the blank size. In case of single vision lenses it rotates the lens if necessary by 180 degrees.
This is especially important for low powered single vision lenses where the optical center might be offset to the edge of the lens.

Progressive Addition Lenses (PAL) are easily detected by using engravings as reference points for measuring RX values as well as layout.
New designs can be taught and added to the database in easy steps.

2.3 Lens Loading

After measuring the lens is picked up from the LIS by suction cup holders and placed into the edging chamber. The clamping device, consisting of a special material to hold the lens in place, rotates in position based on decentration and layout information.



Once the edging cycle is completed the gripper picks up the lens. The lens is briefly tilted to remove any excess water residue. The loading arm rotates outside the edging chamber and loads the next lens into the clamping system. Once done the gripper drops the finished lens back into the job tray.

The next tray is put into position for the loading arm to pick the next lens to be measured by the LIS.

The cycle time of lens measurement is timed based on the edging cycle. Measuring, decentering and layout of lenses are shorter than the edging cycle, meaning the robot will always wait for the lens to be finished rather than the other way around.

Jobs are processed continuously without delay between different jobs. When the last lens of a job is processed the machine moves to the next job tray without interruption.

Productivity and throughput are kept at a maximum.

3. Advantages

Lens preparation time is kept to a minimum. Breakages due to wrong lenses are also kept to a minimum.

Avoiding steps such as applying pads and block pieces reduces production time.

Quality and repeatability is improved as well.

Clamping system of blockless edgers automatically adjust to the front curvature of the lens, therefore improving holding the lens in the correct position.
Slippage or off-axis errors are reduced significantly compared to conventionally blocked lenses.

The fully automated process eliminates human error. Quality control is vastly improved applying the same procedure and guidelines for every lens, adding consistency and repeatability to the production process.

Deblocking and cleaning of lenses are a thing of the past, eliminating another step in the work flow.

Lenses are ready for mounting or in case of remote edging shipping almost immediately after edging without adding another labor-intensive task.

4. Recommended jobs

Not all jobs should be run through the blockless edging system. The focus of such a system is productivity and standardized production. Specialty edgers like i.e. the ES-curve should process any job slowing down productivity or jobs requiring special attention. Such jobs are high base curves (over 9dpt,) and special bevels such as step bevels for i.e. sports glasses.

5. CONCLUSION

Blockless systems clearly take industrialization of edging to the next level.

Financial benefits:

- Significantly reduced labor cost
- Elimination of production steps
- Reduced consumable cost (i.e. block pieces, adhesive pads)
- Less peripheral equipment (elimination of blocker)
- Improved yield
- Less breakage

Production / work flow benefits

- Fewer process steps
- Less complexity
- Improved quality
- Less errors, mainly human errors
- Consistent quality
- Faster process times

Technical benefits

- Higher accuracy
- Automatic lay-out and decentration of almost all lenses
- Quality inspection
- Lens inspection
- Automatic recognition of PAL's

Recently introduced blockless systems such as the ES-5 enable labs to consistently edge lenses at lower cost, faster process times, consistent quality and less breakage.

Blockless systems reduce the complexity of the production process, automating steps while improving quality by using the latest technology.