

Automatic inspection and packing of glass tableware

Manual inspection and packaging of glass tableware is perhaps the most common method among manufacturers. However, rising labour costs and growing production speeds are making automatic inspection more necessary. Klaus Pötting* explains the function and benefits of an automatic inspection system.

Today, a fully automatic inspection and packaging of glasses is rather the exception. With most manufacturers, the glasses are examined by people and sorted manually. With line speeds of 20 to 40 items per minute, this is both possible and reliable. However, the rising cost of labour and increasing production speeds are making an automatic system more necessary.

Athena Engineering & Construction has developed such a system, which could make manual inspection and packing superfluous.

Lehr unloading

Successful grasping of the produced glass article is crucial to unloading from the Lehr belt. The possibility for bridging a disturbance on the inspection or packaging line should be prepared for.

A required condition for undisturbed unloading is also the flawless loading of the Lehr and the correct adjustment of the glass articles on the Lehr belt. Then efficient packaging can begin at the stacker. Three different mechanisms, which have proved effective in practice over many years, are detailed as follows.

a) Vibration plate

Here, the glasses accumulating from the Lehr belt are led away. The vibration is so tuned that the articles are accelerated faster than the Lehr belt speed on a cross conveyor. This is an easy solution, reliable for safe standing items. The items' organisation on the Lehr belt can

be random. A jam accumulating possibility must be planned separately.

b) Axis portal

With a long gripper arm, a complete row of glasses is taken from the Lehr belt and put down directly on the conveyor. In this installation, contact is not made between articles; they are put down with spaces in between on the continuing conveyor. This unit can use the free end of the Lehr belt as a jam table and bridge



a certain time (approximately 30 minutes) without wide transport. If the end of the Lehr belt is full, this system, by swift evacuation, clears this 'traffic jam' until the free end is empty again.

c) Robots

As with the axis portal, a robot sets a series of glasses from the Lehr belt down on the conveyor. The same advantages

of an axis portal - jam accumulation and minimal article contact - are offered plus the ability to set down the glass row at high speed on the conveyor belt. Even narrow and tall articles can be transported at high production speeds. By synchronised 'tracking', the relative speeds can be adapted.

Fully automatic inspection

Athena Engineering & Construction, a specialist in tools and machinery for hollow glassware, has developed a system whereby the items on the conveyor belt must neither be stopped nor moved. Glasses are examined geometrically and optically for mistakes 'on the run' at a speed of up to 140 articles/minute.

This inspection system requires a total of five or six cameras and a very efficient analysing computer. However, it saves the user individual tools for different items, time-consuming job changes, process problems from off-centre or fallen articles and damage by contact during the check. The advantage of this solution is that there are virtually no adjustments to make and thus minimal disturbances during production.

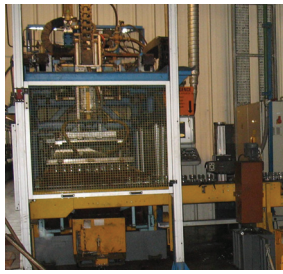
Dimensional faults

Under dimensional faults, defects which are measurable in millimetres include the following:

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▲ Vibration plate with single liners.



▲ X, Z-axis portal.



▲ Robot system.

- Height and diameter, both for several levels
- Glass thickness (wall thickness)
- Ovality, not fully blown items
- Axis faults (slanted)
- Slanted or uneven rim.

The tolerance of the single measuring values must be adapted to high standards. The principle should be 'as good as necessary', or else too many glasses would be sifted out. With heights and large diameters, a tolerance of +/- 1 mm can be permitted, while at special areas such as the rim, a tolerance of +0.1 mm can meet the limit. These parameters, with their respective tolerance fields, can be programmed for every item individually and, with resumption of production, immediately retrievable.

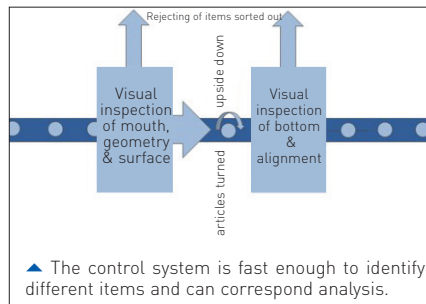
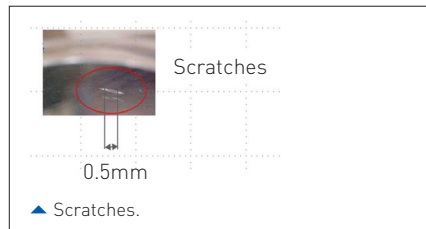
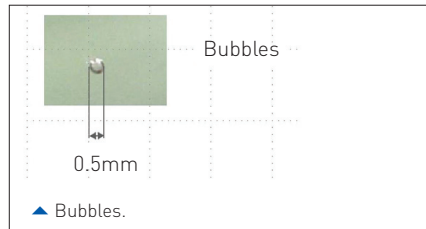
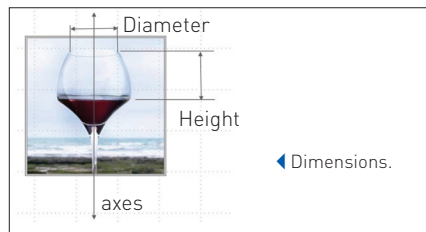
Surface defects

Surface defects are optical failures which disturb the overall image or even the function of the article. These include:

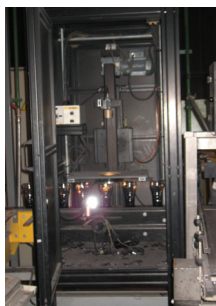
- Cracks, breaks, broken edges
- Scratches, abrasion
- Bubbles, stones
- Cords, shear marks, mat fields.

For bubbles and scratches, a standard limit of <0.5mm has been adopted over the years. For some technical applications, stones may lead to total failure of the entire item under thermal influences and therefore must be detected in sizes of only a few 1/100ths of a millimetre.

On the belt, the items are transported through the inspection cabins. Without any contact they are measured and inspected. Behind each cabin, two short conveyors are designed, where the defective items are 'parked', to allow the



▲ The control system is fast enough to identify different items and can correspond analysis.



▲ The glasses, directly from production or decoration, are collected by the main robot and are put in their place in the box.



operator to inspect them.

It is even possible to inspect different articles on one conveyor, although the height should be comparable in order to use the same mechanical adjustment. The control system is fast enough to identify the different items and to make the corresponding analysis. Such a line is suitable for manufacturers of lot sizes below 100,000 pieces/day.

Hot end inspection

A hot end visual inspection system can be installed directly behind the forming machine. The cameras are protected in their own casing against heat and contamination, but besides this, the working principle is the same in one cabin.

On the machine belt, the items are pre-inspected before entering thelehr. The operator receives a message, regarding which defect appears where and how often. Therefore, only 'good' items are loaded into thelehr. A benefit of this feature is the fast detection of appearing defects.

Packing

In most cases the glasses are packed after inspection for delivery or internal transportation, on standard EURO pallets.

Here, rows of glasses are taken with a long gripper beam or suction bar and placed on the pallet or intermediate carton. Glasses and intermediate bottoms are individually grouped according to each item's demand.

For decorated articles or for special demands, some items might be packed into carton boxes. This requirement can be met by the central robot with additional machinery or accessories.

Summary

For the majority of the production process, Athena Engineering & Construction's fully automatic packing line with visual inspection is designed to achieve smooth production without manual interference.

Efficient job changes with high precision and repeatability summarise the advantages of this equipment. ■

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