

Easily integrated complete packaging inspection for toothpaste tubes with In-Sight

Everyone knows that toothpaste helps you maintain you healthy, clean teeth. But is the toothpaste you're using to clean your teeth safe? It is only in recent years that vision systems have been used to check whether toothpaste packaging is clean and safe before toothpaste tubes are filled. Previously, filling systems that were not equipped with a visual checking system could not guarantee that no particles of dirt from the preliminary tube production stage would be inside the tube after the filling and sealing process. German company, IWK Verpackungstechnik GmbH, relies on vision systems from Cognex in its latest packing machine: the TFS 80-6 for 19mm to 40mm wide tubes. During the course of the filling process, the Cognex In-Sight cameras check that the tubes are round, clean and firmly sealed. In-process inspection has allowed the number of cameras to be reduced from six conventional units previously to just two In-Sight cameras per checking station.

Five hundred tubes per minute

With a capacity of up to 500 tubes per minute, the high-performance TFS 80-6 production line inspects, fills and seals toothpaste tubes in record time. Based on the needs of a single person using their toothpaste sparingly, a minute's production would be enough for a lifetime of teeth cleaning! In contrast to conventional tube filling machines which operate using a turntable, the TFS 80-6 has a conveyor circuit with a diagonal layout. With the process lines positioned at a 90° angle to each other, the tubes are picked up horizontally; cleaned, filled, and sealed vertically; and then placed back down horizontally on a conveyor belt which takes them to a cartoning machine for final packaging.

The packaging materials are required to be high quality because the speed the machine operates. Even though high-quality materials are used, there can still be contamination by small dirt particles; tubes may be deformed when the outer packaging is applied; or there may be faulty seals at the base of the tube. To ensure that their production processes are fault-free, IWK collaborated with Octum Electronic GmbH, a member of the Cognex specialist partner integrator network, to install two In-Sight 5100 and 5400 cameras on each of three inspection stations. Each camera monitors a set of parallel conveyer rows with offset tube holders.

Complete inspection: print position, cap and tube shape

During the first operation step, a six-axis robot with an expanding gripper arm takes the tubes out of the boxes they are delivered in and places them into the tube holders of the conveyor system with the open base of the tube pointing upwards. The robot arm is equipped with a special tool with pins which fits precisely into the partition in the box and picks up two arrows—a total of 30 tubes each time. The screw cap is already in place at the top of the tube and the lower end is open for the filling procedure. The conveyor system moves the tubes clockwise towards the cleaning and filling station. Before they reach the cleaning and filling station, a scanner checks that the tubes are aligned correctly so that the printing is in the correct position when the base is sealed

later. Two successive inspection stations check that the tubes are round in shape and clean before they go through cleaning and filling stage.

Two In-Sight 5100 cameras installed above the conveyor and the work areas evaluate the tube ground coat, the shoulders of the tube and the inside of the tube cap during the particle check. The cameras detect foreign bodies based on the contrast to their surroundings. A red, ring-shaped LED light illuminates the inside of the tube from above. Any undesired particles cast a shadow that is detected by the Cognex cameras making it possible to detect objects which are the same color as the tube itself.

During the subsequent tube roundness check, another two In-Sight 5100s check whether the tubes are of the required shape. If the tubes do not have the specified roundness, the nozzles stay at the edge during the cleaning and filling process and ram the packages into the tube holders. The high-performance technology from Cognex ensures that the nozzles enter the tubes accurately to within a tolerance of three millimetres. The checking procedure takes place without the need for an additional operation step during the process. The individual cameras receive a trigger for every tube and record pictures of the packages as they move past. If a tube is out-of-round or outside of the tolerance range, it is identified as faulty and is not filled. Further on in the process, the TFS 80-6 seals the tube and ejects it from the production line.

Seal verification

After cleaning and filling, the laminated plastic tubes are sealed with hot air. The ends of the tube are heated by hot air at a temperature of 380 to 450°C and are then pressed together by cooled stamping jaws. The seal is either stamped smooth or in a corrugated pattern and may feature a serial number or code. Defects can occur at this stage of the packaging process. For example, if a knife becomes blunt and can no longer cut off the ends of the tubes correctly, the seal will be left with rough edges. In the trimming station, two In-Sight 5400 cameras thus make sure that all faulty packages are detected without fail. The cameras also check the seal itself. If the seal is not complete or if the printing is not properly aligned with the specified parameters, the faulty tube is ejected from the process.

The Cognex advantage: saving time and reducing overall costs

The In-Sight cameras are networked to a central panel PC which records all of the images of faulty pieces. This makes it possible to detect faults quickly without having to recheck the actual item of packaging that has already been ejected from the process. The packaging process of IWK is thus very reliable in terms of the quality standards achieved.

One outstanding advantage of Cognex vision systems is their integrated structure, which the automation specialists of Octum Electronics GmbH have customized for IWK. Whereas conventional packaging machines require a separate step for inspection, resulting in time delays, the Cognex technology installed by Octum Electronics is integrated directly into the production process thus saving time and reducing overall costs. This is because a machine with a separate checking module would require one camera for each tube. With six tubes being processed in each filling step, a total of six cameras would be required for each checking station and a total of 18 cameras would be required for three stations. The Octum/Cognex system is capable of meeting the

inspection requirements with just six cameras over three inspection stations, thus maximizing process reliability and optimizing product quality.

About Cognex

COGNEX designs, develops, produces and sells machine-based vision systems and computers which allow machines to see "intelligently". Cognex is the world's leading supplier of machine-based vision systems, with over 450,000 systems already supplied, corresponding to a cumulative turnover of over \$2.5 billion since the company was founded in 1981. The Modular Vision Systems Division of Cognex is based in Natick, Massachusetts, and specialises in machine-based vision systems used in the automated production and quality assurance of individual parts. The Surface Inspection Systems Division headquartered in Alamenda, California, concentrates on the high-speed surface inspection of sheet product made of metal, paper and plastic. In addition to the headquarters in Natick, Massachusetts, there are other subsidiaries in North America, Japan, Europe and South-East Asia. Further information can be found on our website at <http://www.cognex.com>.
