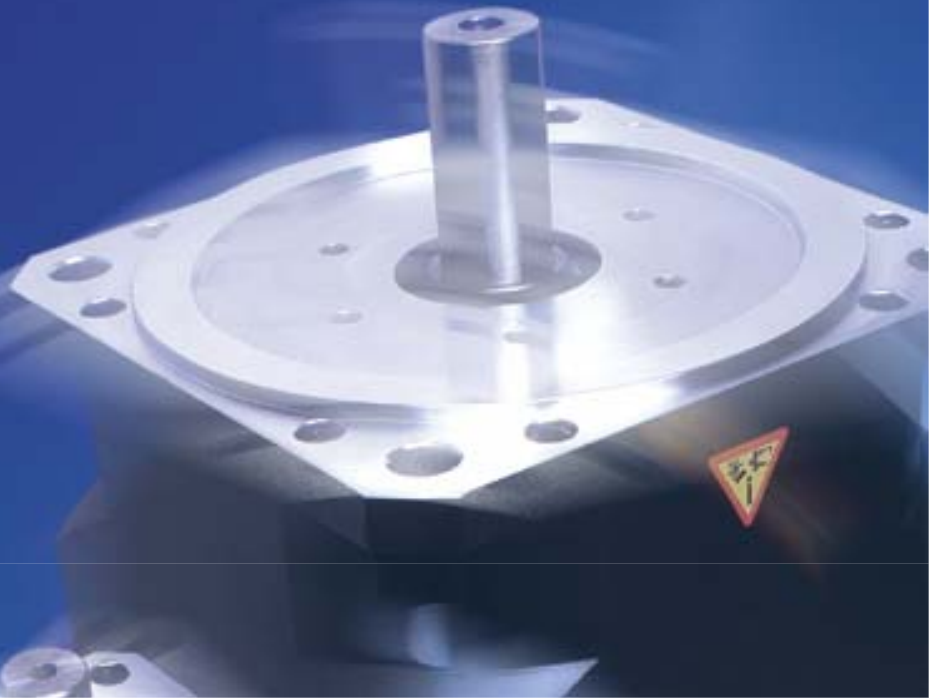


In India, the seventh largest country with 3,288,000 km<sup>2</sup> and after China the most heavily populated nation in the world, the demand for household appliances is steadily growing. The function of these products depends heavily upon electric motors, which set the devices in motion and keep them running. The motion created by electric motors is mainly possible due to wound coils which are manufactured in a precisely executed process. One company specializing in the production of the machines which manufacture these coils is the Indian Joint-Venture company Statomat Special Machines India, based in Mumbai.



# Moving

Air conditioners, pumps, refrigerators, CD players— essentially all technical devices – each uses electric motors. Automated coil winding machines are necessary for the motor manufacturers to guarantee the reliability of these devices. To stay ahead of the competition, a fast coil winding machine with precise operation is a must.

Stomat Special Machines India Pvt Ltd is among the leaders in this market segment. The company is part of an international conglomerate, lead by Elmotec Statomat Vertriebs GmbH, Germany. Other locations include the UK, Brazil and the USA. Statomat India, as Joint-Venture partner, serves the entire Indian market with machines manufactured in India and offers service and support for machines from their overseas partner companies.

The core business of Statomat is the development and production of coil winding, vertical winding and slot insulation machines for making the stator in electric motors.

### Complex Stator Structure

The stator is the heart of an electric motor and is made up of thin plates

clamped together to form a stack of plates bound by rivets. Once the stack has been made, the coil is added through a several-step process. First this stack is covered with an insulating paper in the inner side of winding slots using the slot insertion machine. The motor coil is then wound by the vertical winding machine according to specifications. The coil is inserted into the insulated stator by the coil insertion machine. Another piece of insulation paper is then inserted to the inner side of the stator so that the coil is placed between two pieces of insulation paper.

Stators are then passed through a forming machine, which gives proper shape to the coil. Before the stator can be used in an electric motor the coil is passed to a lacing machine in the final process step where it is properly laced with insulating thread.

The primary machines required for manufacturing motor stators are developed and manufactured by Statomat India. Until the year 2000, Statomat was manufacturing the machines with an induction motor as main motor and one servo drive with a lower speed range. This led to several difficulties when

converting from one type of winding to another since the equipment settings were dependant on the operator's skills, resulting in varied quality each time. Since the beginning of 2000, Statomat India has relied on B&R exclusively for servo technology to control and maintain repetition accuracy in paper length, number of windings, layers of coil and insertion distance. With a complete solution from B&R, flexibility and simplicity is the key to success when changing the machines to another type of coil and quality variation is a thing of the past. Therefore, it's no surprise that Statomat has sold their coil winding, coil insertion & slot insulation machines to almost all of the major home appliance manufacturing companies in India.

### High-speed coil winding

The 5-axis vertical winding machine prepares the coil assembly. Of the five axes – each equipped with an ACOPOS servo drive – two are used as rotary axes and three as ball screw axes. Coils with two to eight poles are produced, whereby each pole can have between one and six steps and any combination can be selected. Alternative windings and winding



*“That we today supply coil winding, insertion and insulation machines for all major appliance manufacturers in India was only possible due to proactive support from B&R India.”*

**C. G. Naik**  
General Manager Statomat India

directions can be selected using the 5.7” B&R panel.

The most critical operation in this machine is to control step jump within one revolution of the flyer to maintain the specified number of windings on each step of each pole. This is achieved with the help of CAMCON, an innovative function in the ACOPOS servo drives, and an AC130 plug-in module. This is such a critical part of the system because the flyer moves forward as well as reverse, and the number of steps in a coil can be configured. Furthermore, the flyer moves at 3,000 RPM, which means the winding turn has to be accomplished in just 20ms. Another critical point involves following the sequence of operations. In case of a machine stop, it must be possible to resume the process at the exact point where the machine was stopped. For this reason, it must be possible to accurately trace the last step which was executed.

### Exact paper guidance

The slot insulation machine consists of one main motor controlled via the digital outputs of the PLC. A cam profile controls the paper cutter and feed. Two cams placed on this cam profile generate trigger inputs for two servos. One servo carries out the cut-to-length operation and the other handles the feed. All operations are carried out in 500ms, which separates this machine from the rest on the market.

### Precise coil insertion

The coil insertion machines are used to perform the final stage of applying the coil to the stator. This machine takes the insulated stator from slot insulation machine and the coil from the vertical winding machine. Cuff supports pull the pre-wound coil onto the stator. Insulation paper is also inserted to the inner side of the stator in the same machine

cycle. The particular challenge in this procedure is accurate insertion at a very high speed.

### Partnership with B&R

“That we today supply coil winding, insertion and insulation machines for all major appliance manufacturers in India was only possible due to proactive support from B&R India. The fact that we go to B&R for all of these highly accurate machines proves that there is an automation supplier in India who can meet all technical demands. The after sales service & support has created a strong bond between our companies. We hope this partnership will continue to grow in the future – specifically with coming machines such as the lacing machine”, states C.G. Naik, General Manager at Statomat, optimistically about the future. [a](#)

[www.statomat.com](http://www.statomat.com)



**top:**  
Vertical winding machine, which winds coils at 3,000 RPM. Configuration changes are made using the panel.

**bottom:**  
ACOPOS servo drives ensure the necessary precision required for the winding process.