

Flexible Assembly. Because many products come in all kinds of variants, it is often necessary to employ several machines for automated assembly. An assembly line for brake valves shows that things do not have to be like that.

One Assembly Line for Many Product Types



Fig. 1. Parts assembly takes place inside the plant, while parts handling takes place outside

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Many manufacturers fear that automating assembly work involving a great many variants will lead to a high error rate and so arrange for their products to be assembled manually. A mechanical method would, however, be far more favorable from the point of view of economics, quality and reproducibility.

This thinking induced one of the customers of B. Grauel International B.V., Helmond, Netherlands, to commission an assembly line that pieces together the valves of ABS braking systems for automotive construction. The various valves consist of housing, rubber stopper, compression spring, steel bushing, sealing ring and O-ring. The drawback: there are six-part valve that come in nine different variants, and all have to be fully automatical-

ly assembled and tested on just one machine. In order to perfect this difficult task, the technicians and developers at Grauel decided to divide the assembly machine into a handling and an assembly section (Fig. 1).

Modular Machine Concept

The handling section begins with a bulk material bunker, which contains all the various valve housings. These are transported from there on an endless loop that is quadratic and consists of four conveyor belts. These are driven separately in order that the parts may be separated by the different speeds. Suspended above the second belt is a camera that recognizes fully automatically the product type and the position of the housing in 3-D. This information is passed to a six-axis robot, which uses a gripper to pick up the product concerned, align it and then place it on a product carrier in the machine's assembly section.

The heart of the assembly machine is a horizontal linear conveying system (LCS), on both sides of which work stations are placed. The conveying system consists of a precisely manufactured aluminum chain (pitch 125 mm) and a chain guide of high-grade steel (Fig. 2). The system is driven by a servo motor. As there are nine different product types, it was agreed to work with six different, fixed product carriers. A change set was made for the three remaining variants that are produced in lower volumes. With the aid of the LCS, the product carriers mounted on the chain links can be positioned without locking to the nearest 0.05 mm at that work station which corresponds to a certain product type.

The machine removes the compression springs from a container to prevent the



Company Profile

B. Grauel International B.V., Helmond, Netherlands, and **B. Grauel GmbH**, Berlin, Germany, belong to the Dutch AAE Group and manufacture customized, turn-key printing and assembly machines. Manufacturing of the machines takes place in the Netherlands, since enormous location advantages are obtained in the Eindhoven region due to a dense network of high-tech companies. This is also one reason why Grauel and the Dutch parent company AAE B.V., Helmond, bundled their forces to concentrate on the development and production of state-of-the-art production lines.

Today the company, which employs approximately 130 staff, makes machine components for flexible, modular production systems, for example oscillating and linear conveyors, assembly units and handling systems, in addition to printing machines.

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