

High Capacity Precision Casting

If electronic assemblies are to be manufactured in large quantities in Germany rather than in countries with low wage levels, then a high degree of production automation and a minimum staff requirement are a must. This applies also to protective coating and casting lines for such assemblies. The following article refers to a casting line for safety assemblies which have life-saving functions in motor cars, and which are cast-coated in order to protect them against high weather-related humidity.

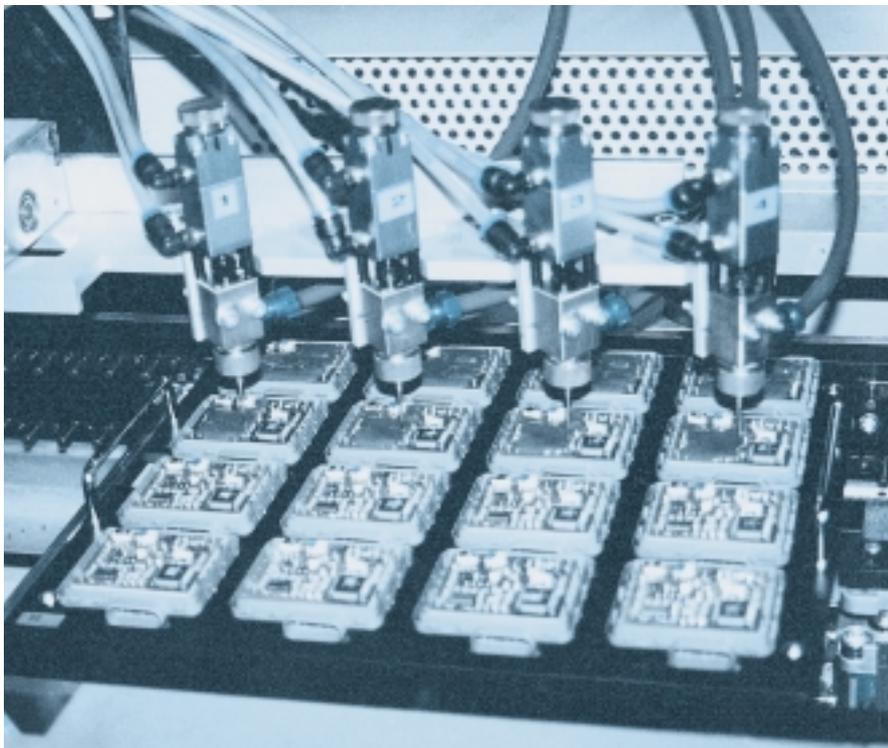


Figure 1: Coating station with assemblies and application jets

What the assembly production people demand from the equipment supplier is put into a few words: Electronic assemblies are partially to be cast-coated, the casting compound has to be hardened and then to be cooled. The throughput shall be at least 8.000 units in 24 hours, and for the operation of the equipment not more than one person may be employed. In addition, the available floor space within the production hall is limited.

Casting compound and coating process

It is a known fact that in a door of a

motor car extreme climatic conditions prevail. The electronic assemblies which are installed there require protection in form of a first-class coating material. If standard coatings such as various coating resins show signs of imperfect protection already during tests, then the only way to protect the assemblies is by cast-coating. In the present case, the ideal protective coat has been determined in a number of preliminary tests. It is a one-component, solvent-free dispersion which arrives at its final application characteristics through polyaddition caused by heat. Unlike other common solvent-

free two-component resins, this product permits a homogeneous and even coating at the edges and pins. During application it has the advantage, that jelling and hardening only start at a certain temperature level which will never be reached outside a jelling and hardening plant.

The rheology of this casting and coating resins creates, however, a problem during application. The low viscosity of the product allows a perfect coating and shows a perfect adhesion, yet it tends to flow beyond the borders onto surfaces which should not be coated. When increasing the viscosity the disadvantage of overflow can be eliminated, yet as a result of this, problems with coating and flooding of complicated assembly mountings appear. The compound with a higher viscosity does not enter the numerous gaps between boards and components. A coating in two steps with 2 compounds having different viscosities became unavoidable.

Using a compound with high viscosity, a wall is created. The resulting pond is then filled with low viscosity compound. Both, wall compound and filling blend perfectly. Due to the required high throughputs, the "dam building" and the filling have to be done online in 2 different stations. (Figure 3).

Figure 1 shows a coating station with assemblies and application jets. The assemblies travel in carriers in rows of 4. To achieve a high throughput, all 4 assemblies are coated at the same time. Each coating station disposes of its own control program. This is necessary as the separate dam building and filling operations show. Should this program some day no longer be used due to change in assemblies, then by simply changing

the program this double coating station can lead to double the standard throughput.

Casting compound jelling and hardening

For the heat transfer to the black surfaces of the casting compound, IR radiation offers itself, as black surfaces absorb such radiation at close to 100%. The plastic housings to be found on the electronic assemblies appear to the medium-wave IR radiation also as black, and are therefore endangered. The housing surface should by no means pick up as much radiation as to deform itself or burn. Of no danger in such heating tasks is hot air convection. A higher temperature than the set one does not appear anywhere at the assembly. Higher heat transfer values are

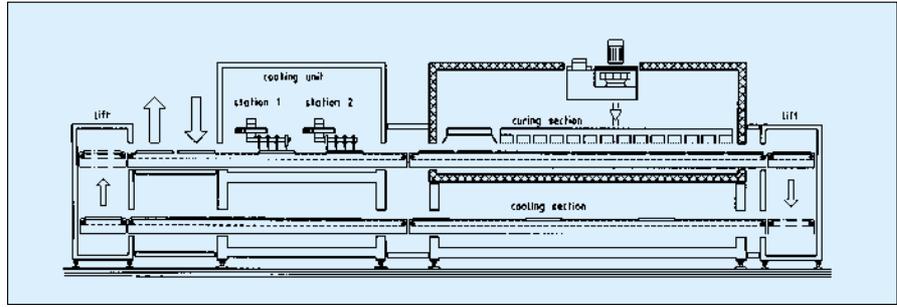


Figure 2: The upper operating level has been connected to the lower return level by 2 vertical lifts

only possible when the hot air has contact to surfaces and edges at a very high velocity. For liquid coatings, however, high air velocities at the jets are not desirable. An acceptable combination of processes and the shortest possible process time can be achieved by combining IR radiation at the infeed, and convection at the reaction sec-

tion of the curing plant. IR radiation at medium-wave level produces a skin on the coating, which cannot be disturbed by the air flow coming from the jets. A short process cycle also means short jelling and hardening plants and consequently limited space requirement.

Plant operation and closed circuit

The demand for one-man plant operation can only be met if the carriers with their assemblies travel through the plant in a closed circuit. To create this closed circuit, the empty space underneath the coating as well as the jelling and hardening plants is used for the return conveyor. The upper operation level is connected to the lower one by 2 vertical lifts. (Figure 2). The return conveyor also serves as cooling zone. As suitable conveyor, a single roller chain with pins has been used. To allow the pin-roller conveyor with loaded carriers to operate continuously and collision-free at 2 levels, the conveyors at both levels are separated. The speeds of both conveyors can be controlled independently. Assembly carrier movements and stops are controlled by sensors.

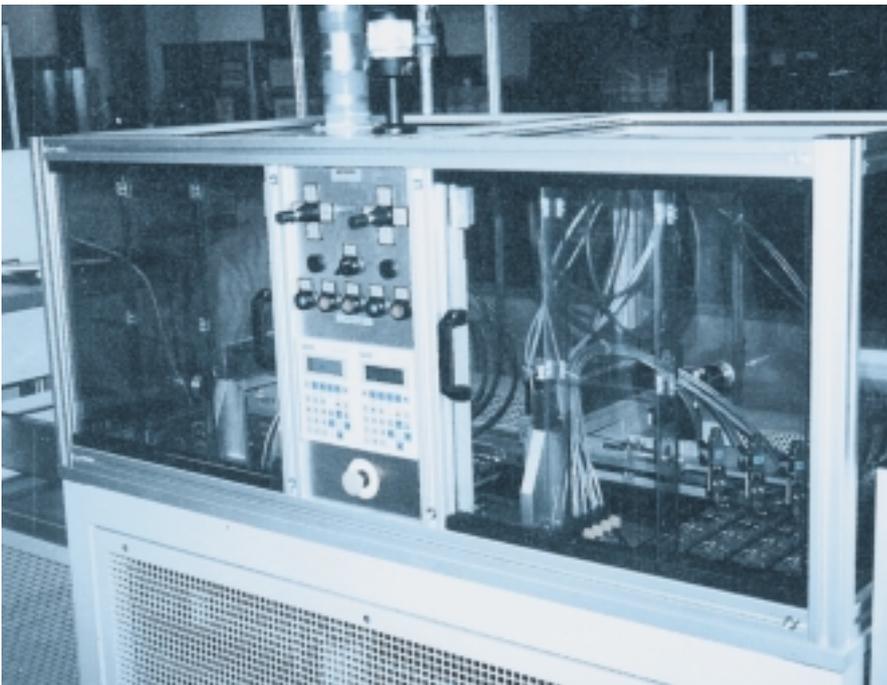


Figure 3: Dam building and filling stations online

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