Online Casting Technology - made to measure

Whenever and wherever electronic assemblies are exposed to extreme conditions, and whenever common protective coats are no longer sufficient to offer the necessary protection, casting compounds are to be used. Such extreme conditions are temperatures fluctuations and high humidity. To these conditions, automobile electronics are exposed which are often placed under the hood or in doors without any particular housing. Protecting such assemblies by applying automatic casting and hardening technologies at high throughput rates is a challenge for any engineering company and/or equipment manufacturer. The following describes one solution of this task.

The working principle of the equipment engineered by GTL KNÖDEL and presented in this article, is such that the electronic assemblies are coated online with casting compound. A handling unit lifts the coated assemblies from a conveyor and places them onto the crossbar conveyor of the gelling and hardening plant. Depending on their dimensions, the assemblies are taken over by the crossbar conveyor individually or in multiples. In the gelling and hardening plant, the casting compound is heated, hardened and cooled. Upon completion of this process, the cross bar conveyor returns each assembly or assembly block to the same position where it was picked up. The handling unit not only feeds the gelling and hardening plant with coated, yet unhardened assemblies or blocks, but also returns them onto the same spot within the production line where they were located before the treatment. The production step for each assembly can be up to 9 seconds. If need be, special assembly carriers are used for the passage through the gelling and hardening plant.

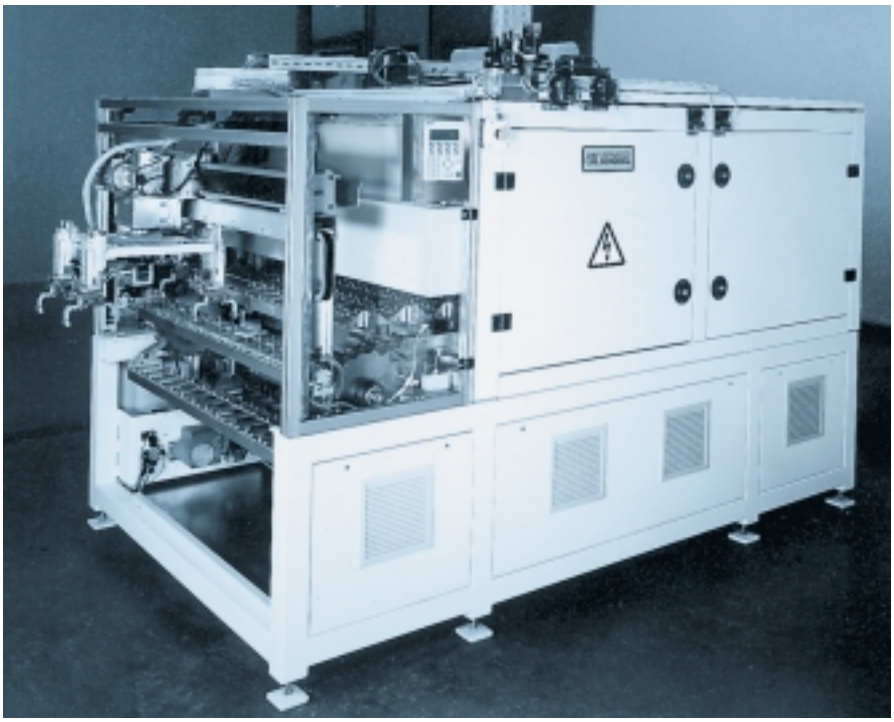

Figure 1: Gelling and hardening plant

Gelling and hardening of casting compounds

As casting compounds, one or two-component PU resins are used. Gelling and hardening takes place at temperatures between 85 and 105 °C. The residence time varies between 10 and 15 minutes. The lower the temperature, the longer is the residence time. Heat transfer to reach the reaction temperature is effected by hot air convection. Whenever the shape and dimensions of the assembly permit, the use of targeted IR radiation would be sensible, as it allows the reduction of the heat-up and the total processing time.

Equipment and operation

The gelling and hardening plant (Figure 1) comprises the sections shown below (Figure 2). The drawing also helps to understand the plant operation.

➨ The handling system works alternately, as it picks up freshly coated electronic assemblies from the production line and transfers them to the crossrod conveyor, it conveys assemblies with hardened coats from the crossrod conveyor back to the production line.

➨ Handling the assemblies is done by a rotory-type gripper which is placed onto the table of the servo-motor driven Y-linear axis. Turning is effected by a gearmotor. At each end of the turn-

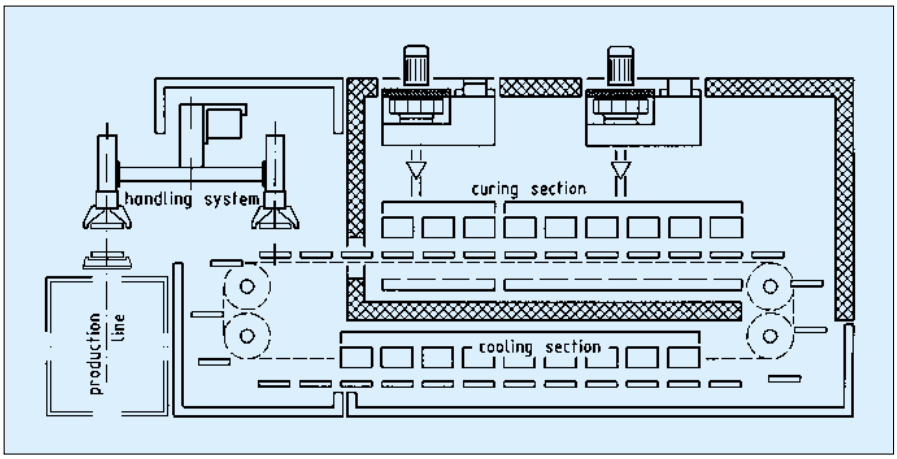

Figure 2: Working principle of a gelling and hardening plant

table is a Z-axis with gripper. In case of very short cycle times, a twin gripper instead of the single unit can be attached to either end of the support. This rotary gripper system allows the simultaneous exchange of untreated and completed assemblies between production line and gelling and hardening plant. Only with this mode of operation is it possible to achieve short cycle times and high throughputs of e.g. 400 assemblies per hour or 8000 assemblies per day.

➨ The crossrod conveyor comprises 2 special roller-flight chains, equipped with crossrods the shapes of which are determined by the assemblies or the assembly carriers.

➨ The gelling and hardening zone is separated into a heat-up and a temperature holding section. The heat transfer is by hot air convection. The hot air enters from jet boxes situated along both sides of the conveyor. The air exits are aerodynamically engineered so that an even air contact with the assemblies and a highest possible heat transfer at lowest possible air quantities are achieved. Both, heat-up section and temperature holding section are controlled separately and infinitely. The same applies to temperature and air velocity. This allows best possible settings according to predetermined heat-up and hardening conditions.

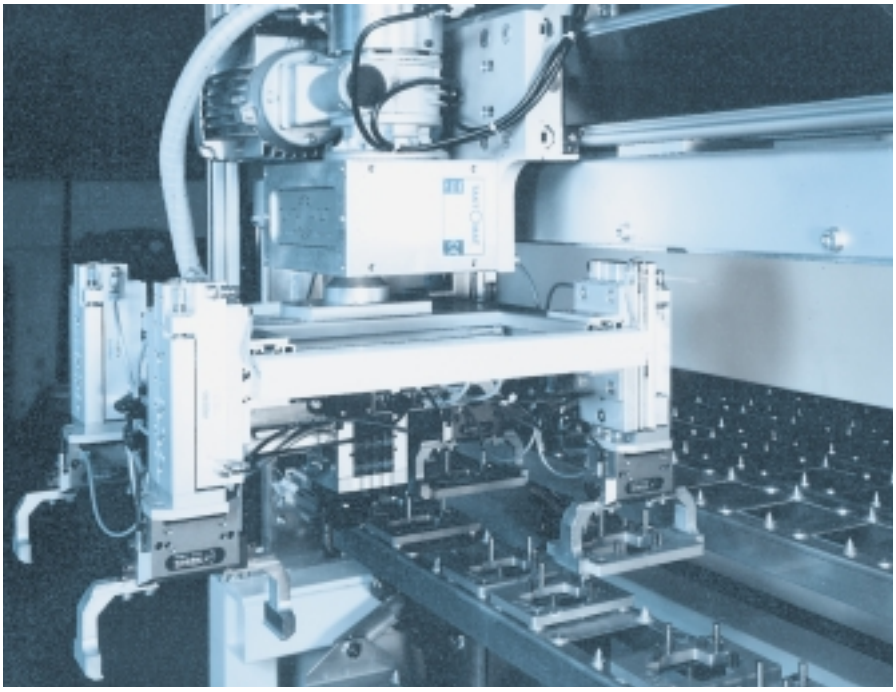

Figure 3: Rotory-type handler with twin gripper

➨ The cooling zone is located underneath the gelling and hardening zone. Heat transfer is effected by convection, either by applying a fresh air/exhaust air system using ambient air, or by circulated air which gives off its heat when passing a water cooler.

➨ When integrating the plant into a production line for online operation, then the cooling section will be located downstream from the gelling and hardening zone.

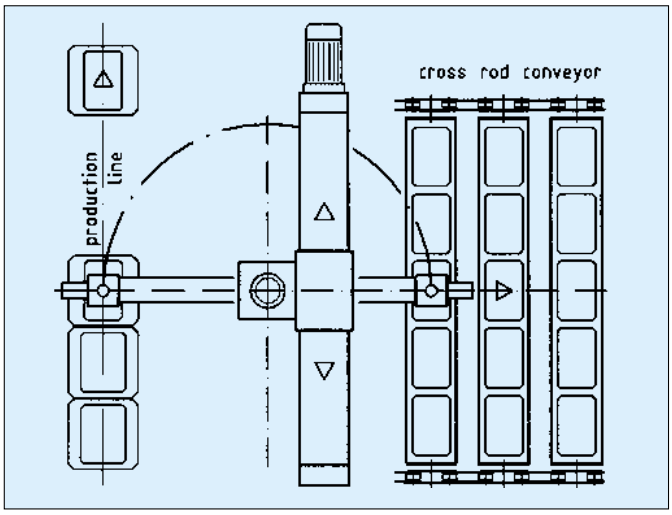

Figure 4: Rotory-type handling principle

Final remarks

Plants like to aforementioned are rarely standardized. To the regret of the engineering companies, they have to be especially engineered in order to meet the requirements of both, shape and dimensions of the assemblies, of throughput and of the way the plant can be integrated into a production line. The trend to reduce the electronic assemblies in size does not automatically lead to a reduction in size of the necessary equipment - much to the disappointment of the customer. Required heat and material transfers demand certain air quantities with respective cross sections of flow as well as certain motor sizes and insulation thicknesses. Easy service and maintenance can only be offered when disposing of lots of room.

A low price and a short delivery time can only be offered, if many existing equipment sections can be used. An ergonomic and stylish design does not only demand a lot of money, but also know how and initiative from the engineering team. These efforts are often handicapped by limited space. In the end, functionality controls the appearance of the plant.

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