IN-DEPTH PROCESS EXPERTISE BASED ON EXTENSIVE EXPERIENCE OF PLANT DESIGN AND IMPLEMENTATION.
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Improving the fuel and resource efficiency of road vehicles can help to drive down global carbon emissions. One approach is to reduce weight by incorporating automotive components made from lighter materials.

Lightweight construction entails the use of high-strength steels, plastics, aluminum sheet, composites, and aluminum castings, die-castings and forgings. Components subject to high stress, such as chassis, body and engine parts, as well as wheels, are, for example, manufactured from aluminum alloys.

Aluminum components must undergo heat treatment to improve their mechanical properties. There are generally three process stages: solution annealing, quenching, and aging.

For more than 30 years, the name Eisenmann has been synonymous with end-to-end solutions, outstanding quality, and maximum reliability in the heat treatment of lightweight components for the automotive industry.

Features of Eisenmann heat treatment plants
- Precise temperature control
- Outstanding uptime
- Low operating costs
- Extremely high environmental and safety standards
**Solution annealing**
Solution annealing takes place just below the melting point of the aluminum alloy. At a high temperature and a correspondingly high diffusion rate, the alloying elements are uniformly dispersed throughout the aluminum solid solution.

**Quenching**
Quenching (rapidly cooling) the supersaturated solid solution ‘freezes in’ the homogeneity obtained by solution treatment and prevents the dissolved alloying elements from precipitating out.

Selection of the quenchant depends on the component’s properties and sensitivity to distortion, and on the required quenching rate. The following can be employed:
- Water
- Aqueous polymer
- Air

**Aging**
During aging, precipitation processes in the supersaturated solid solution impart the necessary hardness to the material. This stage concludes the heat treatment process.

A cooling zone can be integrated downstream of aging to cool the components in preparation for further production processes.

A wide range of factors must be taken into account in planning and implementing tailored heat-treatment plants. Design, project implementation, and sales professionals from Eisenmann work closely with the customer to develop the ideal solution.

**Key factors determining plant design**
- Throughput
- Component geometries
- Space available at the designated installation site, and room height
- Process requirements
Roller plants are among Eisenmann’s most long-established offerings. They are the system of choice for many production scenarios, and more than 60 have been installed to date.

Aluminum wheels are transported through the multilevel plants on roller conveyors. All conveyor drives and bearings can be easily accessed from the exterior of ovens and furnaces. Baskets are not required to carry the wheels.

The standard Eisenmann plant layout has a small footprint: the aging oven and the solution annealing furnace are vertically stacked, with the quench tank directly below the output end of the annealing furnace.

When a plant is populated with wheels of multiple sizes, wheel-size detection at the input end ensures a suitable loading pattern with a varying number of wheels per row.
Key benefits of a roller plant
- No baskets required to convey wheels
- Internal heat recovery from the exhaust air of the solution annealing furnace
- Small footprint with stacked furnaces
- Various plant layouts possible

Optional plant components
- Gas-fired or electric ovens and furnaces
- Cooling zone downstream of aging oven
- Rinsing device for polymer quenching

Configuration of ovens and furnaces in line with available space
- Stacked
- Adjacent
- In line

Quenchants
- Water
- Aqueous polymer
Eisenmann’s push-through plant was specially designed for the production of wheels with a reference size of 20 inches. It is characterized by a larger load width (3,650 mm) sufficient for six 20-inch wheels per row, and reduced energy consumption.

The wheels are conveyed through the plants on stackable trays. Push-through plants differ from other types in one key respect: After solution annealing, only the wheels are quenched, and not the trays.

After quenching, the wheels are tilted to drain off residual water. This reduces the rinsing required when polymer quenchants are employed. A robust pusher system is used to convey the trays through the solution annealing furnace. A pawl conveyor moves them through the aging oven.

After they have been aged, the wheels can optionally be cooled down again in preparation for downstream production processes.

Key benefits of push-through plants
- Low energy consumption
- Small footprint
- Internal heat recovery from the exhaust air of the solution annealing furnace
- Minimal pit depth (600 mm) for quench tank
- Trays are not quenched and therefore retain their shape
- Energy stored in trays serves as a source of heat in the aging oven
Configuration of ovens and furnaces in line with available space
- Stacked
- Adjacent
- In line

Quenchants
- Water
- Aqueous polymer

Optional plant components
- Gas-fired or electric ovens and furnaces
- Cooling zone downstream of aging oven
- Rinsing system for polymer quenching
PAWL-CONVEYOR PLANTS FOR ALUMINUM COMPONENTS

It is often necessary to heat-treat components on trays. For this purpose, the trays are stacked.

The plants are equipped with pawl-conveyors, which push and pull the trays by means of rods. This robust conveyor system is extremely reliable and requires few moving parts and few openings in the oven and furnace walls.

Partition doors can be optionally installed in convection ovens to insulate zones from each other, and to create multiple temperature zones. Because pawl-conveyors are used, and the fans are built into the oven ceilings, very little space is required at the sides of the ovens. As a result, they can be configured in a factory hall in a variety of ways: adjacent, in line, or in a U-shaped layout.

Air or water quenching systems can be installed downstream of a solution annealing furnace. It is also possible to combine both methods in one plant.

At the air-quenching stage, the trays are unstacked and conveyed through the process one by one. Quenching each tray separately increases process stability, and the installed electric power in the air-quenching zone can be reduced.

The modular design of Eisenmann’s ovens and furnaces makes it possible to configure made-to-measure heat-treatment plants. Solution annealing, quenching and aging systems can be supplied separately or in combination.

Key benefits of pawl-conveyor plants
- Highly flexible, suitable for processing components of many types
- Precise temperature control
- Multiple zones with differing temperatures can be created using partition doors
- High process stability, with air quenching performed one tray at a time
- Internal heat recovery from the exhaust air of the solution annealing furnace
- Air and water quenching can be combined in one system
- Various plant layouts are possible
Configuration of ovens and furnaces in line with available space
- Adjacent
- In line

Quenchants
- Air
- Water

Input end of a solution annealing furnace.