Rolled Aluminium Products Must Meet High Quality Standards to Satisfy Body Panel Requirements in the Automotive Industry.

As a premium manufacturer of rolled aluminium products for various markets and applications, AMAG has got the expertise to develop and improve existing and new product applications and production processes, which most notably resulted in the successful qualification of AMAG’s automotive body panel grade (EN AW-6016) at AUDI.

The quality requirements automotive manufacturers set for body panels include a large number of criteria that are tested and evaluated in detail during an extensive material approval process. Materials for lightweight construction in automotive engineering must meet complex requirements. A key requirement is the reduction of fuel consumption and consequently, the reduction of CO₂ emissions, which is met by using aluminium alloys to reduce the weight of the car compared to steel.

AMAG is a qualified supplier of body panels in accordance with TL094 to AUDI.

But just being “lightweight” is not enough for a material to be used in a car. It is essential to combine excellent formability with extremely high strength at the final part. Additionally, decorative requirements should be met which need a perfect material surface.

6xxx-series alloys are strain-hardened by a deformation process (e.g., deep drawing) to increase their strength, which is further increased by the thermal treatment provided during body paint bake hardening. As the paint bake hardening time is very short (just a few minutes), the material must rapidly gain strength at low temperatures.

AMAG’s body panel grade meets all these requirements. It is of type EN AW-6016 alloy, which is a heat-treatable AlMgSi alloy of the 6xxx series.

Moreover, automotive designers are demanding ever-higher strengths to generate greater potential for lightweight construction. In general, an increase in strength involves a loss of ductility (formability). Automotive manufacturers, however, consider excellent formability of sheet products a basic requirement because the automotive design must meet ever-increasing demands (e.g., sharp edge design). These conflicting goals should be balanced and require thorough knowledge of the interaction between material composition, production process and properties.

State-of-the-art testing laboratories (material testing, metallography, formability tests) and capabilities for almost completely mapping the industrial production process (casting, rolling, heat treatment) on a laboratory scale and by simulation make AMAG a competent contact for alloy and process design.

AMAG’s formability is internally evaluated in detail. For example, formability tests (using a cross die; Fig. 1), Erichsen tests, hole expansion tests, forming limit analyses and bending tests are performed to develop and optimize the body panel quality.

In addition to having the required mechanical-technological properties, aluminium body panels must be highly corrosion-resistant, easy to join, and provide a high surface quality. Compared to non-heat-treatable 5xxx-series alloys, which are preferably used in interior body panels, naturally aged 6xxx-series alloys in the T4 temper (as-delivered) are free of Lüders’ lines and thus meet the automotive manufacturers’ high surface quality demands.

In AlMgSi alloys, the surface may be roughened as a result of the rolling texture caused by forming across the rolling direction; this phenomenon is called “roping.” For body panels, roping would be a criterion for rejection. Roping is completely eliminated by using a specific thermomechanical production route (Fig. 2).

At AMAG, any mechanical damage (e.g., scratches or dents that can be felt) are detected by an automatic surface inspection system and, if necessary, discarded from the process.

Furthermore, it is highly crucial to quality to appropriately combine surface structure and coating to enable the customer to process the product. The interaction between surface roughness (Electro-Discharge Texturing (EDT) or mill-finish (MF) surface), quantities, types and distribution of lubricants, in addition to the tool surface, are the key factors of the tribological system during forming. The smallest variations of these parameters can result in defects during the forming of complex body panel parts.

In addition, European automotive manufacturers demand stable, reproducible sheet surfaces to achieve optimum adhesive and welding properties and perfect painting results.

AMAG has a state-of-the-art passivation line for strips.

During coil passivation, the natural oxide layer of the aluminium products is replaced by an artificial barrier layer, which provides a good surface for durable adhesively bonded joints and reduces the electrical resistance during welding.

This is why we are sure TL094 is the first of a number of future qualifications of AMAG’s body panel grades for automotive applications.