

# Highly Workable, 590-980 MPa Class Galvannealed Steel Sheet for Automobiles

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High tensile strength steel sheets are becoming indispensable for automobile body frames as the requirements become stronger both for the strengthening of body structures to meet collision regulations, and for weight reduction for environmental conservation. Notably, high tensile strength galvannealed steel sheets have been used rapidly for parts that require corrosion resistance (Figure 1). Lately, there is a strong requirement for high tensile strength steel sheets having superior workability for body members, such as lower pillars. Reinforcement require thickness along with workability.

In response to such requirements, Kobe Steel developed a series of 590-980MPa class galvannealed steel sheets with high workability, which can have substantial thickness (Table 1).

The steel sheets are either DP steel sheets mainly comprising Ferrite + Martensite, or TRIP steel sheets mainly comprising Ferrite + Bainite + Retained Austenite. Both the steels are designed (1) to have homogeneous microstructures; (2) to inhibit precipitation of carbide; (3) to maintain ferrite phase as much as possible to ensure ductility; and (4) that the ferrite phase itself is solution hardened to prevent local degradation of stretch flangeability.

Silicon (Si) plays a major role in the alloy design, because the element stabilizes ferrite and exhibits significant solution hardening. Conventional galvannealed steel sheet was unable to adopt silicon because the element brings an adverse effect on coating. The newly developed steel employs a special surface preparation technology to enable the addition of silicon. On the other hand, the microstructure is controlled in the manufacturing process so that a homogeneous multi-phase structure is obtained regardless of the sheet's thickness. The heat cycle of homogenization and cooling is optimized to increase the volume fraction of ferrite.

The developed steel sheets have been tested by automakers in Japan and overseas, and have been approved to be used for new models starting 2007.

## Features

- 1) High workability  
Workability up to 1.3 times higher than our conventional steel sheet (highest level in the world) has been achieved as a result of Si addition (e.g. 780, 980MPa class steel sheets, Figure 2).
- 2) Wide sheet size range  
Raw cold-rolled sheets with up to 3.2mm thickness have been developed.

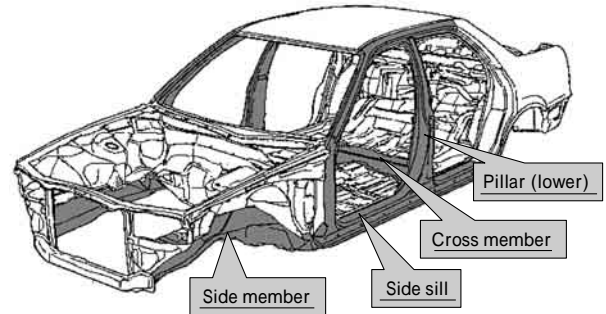


Fig. 1 Major parts to which galvannealed steel sheets are applied

Table 1 Mechanical properties of the developed steel sheets

Strength class	Type	Yield strength (MPa)	Tensile strength (MPa)	Elongation (%)
590(MPa)	DP	350	630	29
780(MPa)	DP	480	810	21
980(MPa)	DP	650	1,030	16
780(MPa)	TRIP	450	800	29

\* JIS type 5 test piece, thickness: 1.2mm

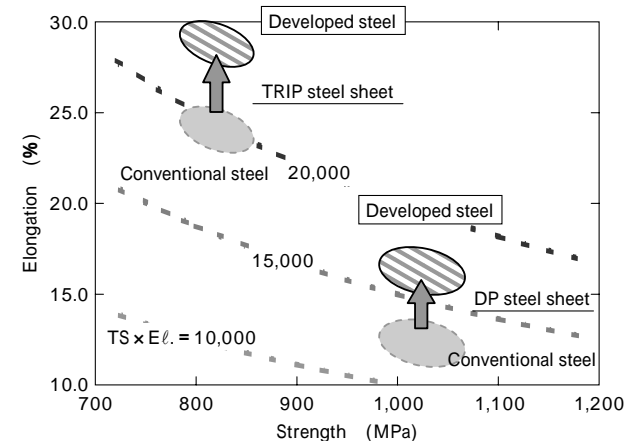


Fig. 2 Strength / Elongation balance of newly developed steel sheets