

HOT DIP GALVANNEALED STEEL



Construction

Auto Body Panels

Electrical Enclosures



HOT DIP GALVANNEALED STEEL, known as ZINCGRIP® GA Steel, is continuously coated on both sides with a zinc-iron (Zn-Fe) alloy. Galvannealed steel is a specialized variation of galvanized steel where induction heating is used to alloy the zinc coating with the steel to create a zinc-iron coating. The hot dip process, pioneered by AK Steel, provides a tight metallurgical bond between the steel and coating. This process results in a material with the strength and formability of steel plus the corrosion protection of the zinc-iron coating. Zinc protects the base metal by providing a barrier to corrosive elements and also by the sacrificial nature of the coating.

ZINCGRIP GA Steel is available with special surface finishes, tailored for specific applications, and in a variety of base metal grades and coating weights. ZINCGRIP GA Steel is widely used in many applications in automotive and general manufacturing.

HOT DIP GALVANNEALED STEEL

Product Description

PRODUCT FEATURES

CORROSION RESISTANCE

The zinc coating protects the base metal by providing a barrier to corrosive elements and also by the sacrificial nature of the coating. Ultimate service life depends on coating thickness and the severity of the environment.

EXCELLENT SURFACE APPEARANCE

ZINCGRIP GA Steel is available as EXTRASMOOTH™ or ULTRASMOOTH® for the most demanding surface critical applications.

FORMABILITY

ZINCGRIP GA Steel can be used to produce parts containing simple bends to parts with deep drawing requirements.

PAINTABILITY

ZINCGRIP GA Steel is readily paintable provided proper pre-treatment is performed.

WELDABILITY

ZINCGRIP GA Steel can be joined using a variety of accepted welding practices. Its spot weldability is improved over free zinc coatings.

COATING CHARACTERISTICS

The hot dip coating process assures a tightly adherent, uniform coating of zinc on both sides of the product. The strip passes through an induction furnace after the coating pot to allow the iron from the base metal to further diffuse into the zinc creating a zinc-iron alloy layer. The coating is nominally 8 – 13% iron. Precise temperature control provides sufficient ductility in the coating to permit normal fabrication practices without incurring significant coating damage or powdering. Coating designation at A40 and higher may not be suitable for higher forming applications due to the inherent attributes of the coating.

ZINCGRIP GA Steel has a matte gray surface with no spangle which provides a good base for painting. For best results, the surface should be carefully cleaned with an alkaline cleaner, however in some cases, cleaning by a solvent may be acceptable. Cleaning should be followed by a pre-treatment prior to painting.

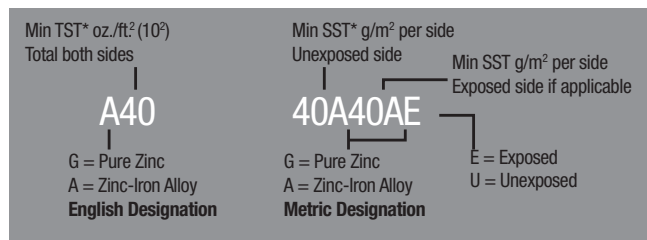
ZINCGRIP GA Steel coatings are specified in several coating weight categories as shown in Table 1. The differences in designation are explained by the diagram in Figure 1. A schematic of the coating cross section is shown in Figure 2. For coating weights not listed, contact your AK Steel sales representative.

TABLE 1 – COATING WEIGHT

| Coating Designation | Coating Weight Min. | |
|---|---------------------|------------------|
| | oz./ft ² | g/m ² |
| Triple Spot Designation (Total Both Sides) | | |
| A01 | No Min. | No Min. |
| A20 | 0.20 | 61 |
| A30 | 0.30 | 92 |
| A40 | 0.40 | 122 |
| A50 | 0.50 | 153 |
| A60 | 0.60 | 183 |
| Single Spot Designation (Single Side) | | |
| 45A/45A | 0.15/0.15 | 45/45 |
| 60A/60A | 0.20/0.20 | 60/60 |

For other coating weights, please inquire.

FIGURE 1 – COATING DESIGNATION



*TST/SST = Triple Spot Test/Single Spot Test as defined by ASTM A924.

FIGURE 2 – COATING CROSS SECTION



Layers not shown to scale.



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Product Description

SURFACE PROTECTION AND LUBRICATION

To prevent staining in transit and storage, ZINCGRIP GA Steel should be coated with a protective oil. The mill can apply a mineral oil with a rust preventative combination, a preapplied press forming lubricant, a mill-applied phosphate coating or a chemical treatment (with or without oil). A chemical treatment is not recommended if the product will be painted unless proper surface preparations are taken. Specific chemical treatment requirements, such as RoHS, must be clearly indicated and reviewed.

FORMABILITY AND MECHANICAL PROPERTIES

The formability of all steel products is a result of the interaction of many variables. These variables include: the mechanical properties of the steel, the forming system (tooling) used to manufacture parts, and the lubrication used during forming. Of these three, AK Steel can directly affect the mechanical properties of the steel having tight control over chemical composition, hot rolling parameters, the amount of cold reduction, in-line annealing time and temperature, and the amount of additional processing will allow the production of high quality ZINCGRIP GA Steel to meet customers' requirements.

COMMERCIAL STEEL (CS)

Commercial Steel Type B (CS Type B) and Forming Steel Type B (FS Type B) should be used for moderate forming or bending applications. These products are produced from aluminum-killed continuously cast slabs and unless otherwise specified, have a carbon content of 0.02 – 0.15%C and 0.02 – 0.10%C respectively. To prevent the occurrence of fluting or stretcher strains during forming or processing, both products must be ordered as EXTRASMOOTH. These products are subject to aging and the temper rolling effect is temporary.

DEEP DRAWING STEEL (DDS)

For more stringent forming applications, Deep Drawing Steel (DDS), should be ordered. DDS has a controlled carbon content less than 0.06%C and is produced in such a manner that parts formed from DDS steel should not exhibit stretcher strain.

EXTRA DEEP DRAWING STEEL (EDDS)

Extra Deep Drawing Steel or Extra Deep Drawing Steel Plus (EDDS+) should be ordered for the most demanding forming applications. These steels, also known as Interstitial Free (I-F) steel, are produced from vacuum degassed less than 0.010%C, stabilized grades. EDDS+ has the lowest carbon content available and has been specially formulated to be AK Steel's most ductile product.

For high strength applications, ZINCGRIP GA Steel is available as Structural Steel (SS) or High Strength Low Alloy Steel (HSLAS). Bake Hardenable (BH), Dent Resistant (DR) and Dual Phase (DP) Steels are also available.

Typical mechanical properties are shown in Table 2, page 3.

SPECIFICATIONS

ZINCGRIP GA Steel is produced in conformance to the following specifications:

| | |
|-----------|---|
| ASTM A653 | Base metal chemistry, grades and coatings |
| ASTM A924 | General requirements and tolerances |

For any specifications not listed here, contact your AK Steel sales representative.

OUTSIDE PROCESSING

Tailored blanks, tension leveling, re-squaring, slitting, cut-to-length, and coil coating are just some of the services AK Steel can provide through arrangements with outside processors.

TECHNICAL ASSISTANCE

AK Steel's technical representatives can provide you with more detailed information concerning this product. They also are available to assist you in reviewing any welding, forming, painting, or other material selection issue.

MILL LIMITS*

ZINCGRIP GA Steel are available in thicknesses from 0.018 – 0.100 in. (0.46 – 2.54 mm), and widths up to 80 in. (2032 mm) depending on dimensions and product quality. For sizes outside of these limits, please contact your AK Steel sales representative.

The standard coil inner diameter is 24 in. (609 mm).

**Please inquire for Hot Rolled substrate capability.*



HOT DIP GALVANNEALED STEEL

Tables

TABLE 2 – TYPICAL MECHANICAL PROPERTIES – STANDARD GRADES

| Quality Designation | Description | YS | | UTS | | Min. Elong. % | n-Value | r _m |
|---------------------------------------|--|------|-----|------|-----|---------------|---------|----------------|
| | | ksi. | MPa | ksi. | MPa | | | |
| Commercial Steel (CS Type B) | May be moderately formed. A specimen cut in any direction can be bent flat on itself without cracking. | 38 | 265 | 50 | 345 | 37 | – | – |
| Deep Drawing Steel (DDS) | DDS may be used in drawing applications. | 26 | 179 | 46 | 317 | 40 | 0.23 | 1.5 |
| Extra Deep Drawing Steel (EDDS) | Interstitial Free (I-F) steels are made by adding titanium and/or niobium to the molten steel after degassing and offer excellent drawability. | 24 | 165 | 45 | 310 | 43 | 0.23 | 1.6 |
| Extra Deep Drawing Steel Plus (EDDS+) | | 22 | 152 | 44 | 301 | 48 | 0.24 | 1.6 |

Typical properties produced by AK Steel for these grades.

Commercial Steel, Deep Drawing Steel, and Extra Deep Drawing Steel are designations described in the ASTM specifications for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process A653/A653M. Each of these steel designations is associated with unique requirements for chemical composition and with non-mandatory, typical mechanical properties. All properties are tested per ASTM A370.

TABLE 3 – ASTM SPECIFIED PROPERTIES – HIGHER STRENGTH GRADE

| Quality Designation | Product Details | Min. YS | | Min. UTS | | Min. Elong. % |
|---------------------------------------|-----------------|---------|-----|----------|-----|---------------|
| | | ksi. | MPa | ksi. | MPa | |
| Structural Steel (SS) | 33 | 33 | 230 | 45 | 310 | 20 |
| | 37 | 37 | 255 | 52 | 360 | 18 |
| | 40 | 40 | 275 | 55 | 380 | 16 |
| | 50 Class 1 | 50 | 340 | 65 | 450 | 12 |
| High Strength Low Alloy Steel (HSLAS) | 40 | 40 | 275 | 50 | 340 | 22 |
| | 50 | 50 | 340 | 60 | 410 | 20 |
| | 50 (HSLAS-F) | 50 | 340 | 60 | 410 | 22 |
| | 55 Class 2 | 55 | 380 | 65 | 448 | 18 |
| | 60 | 60 | 420 | 70 | 482 | 16 |

The following qualities are available to various customer or industrial requirements.

TABLE 4 – OTHER AVAILABLE GRADES

| Bake Hardenable (BH) grades offer good formability with increased strength from work hardening and subsequent paint/bake cycle. | Dent Resistant (DR) grades offer good formability with increased strength from a high work hardening rate. | Dual Phase (DP) |
|---|--|--|
| BH 180 BH 210 BH 220 BH 240 BH 250 BH 260 | DR 180 DR 190 DR 210 | DP 590 DP 600 DP 780 DP 800 DP 980 |

For strength levels not listed, please inquire.



HOT DIP GALVANNEALED STEEL

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TABLE 5 – ENGINEERING PROPERTIES

| | |
|----------------------------------|---|
| Young's Modulus of Elasticity | 200 x 10 ³ MPa at 20 °C |
| Density | 7.87 g/cm ³ at 20 °C |
| Coefficient of Thermal Expansion | Low-Carbon/HSLAS: 12.4 µm/m/°C in 20 – 100 °C range I-F Steel: 12.9 µm/m/°C in 20 – 100 °C range |
| Thermal Conductivity | Low-Carbon/HSLAS: 89 W/m°C at 20 °C I-F Steel: 93 W/m°C at 20 °C |
| Specific Heat | 481 J/kg/°C in 50 – 100 °C range |
| Electrical Resistivity | 0.142 µΩ•m at 20 °C |



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AK Steel Corporation
9227 Centre Pointe Drive
West Chester, OH 45069
844.STEEL99 | 844.783.3599

www.aksteel.com
sales@aksteel.com

AK Steel is a leading producer of flat-rolled carbon, stainless and electrical steel products, primarily for the automotive, infrastructure and manufacturing, electrical power generation and distribution markets. Through its subsidiaries, the company also provides customer solutions through carbon and stainless steel tubing products, die design and tooling, and hot and cold stamping. Headquartered in West Chester, Ohio (Greater Cincinnati), the company employs approximately 9,200 men and women at manufacturing operations across seven states (Alabama, Indiana, Kentucky, Michigan, Ohio, Pennsylvania and West Virginia), as well as Canada and Mexico. Additional information about AK Steel is available at www.aksteel.com.

The information and data in this document are accurate to the best of our knowledge and belief, but are intended for general information only. Applications suggested for the materials are described only to help readers make their own evaluations and decisions, and are neither guarantees nor to be construed as express or implied warranties of suitability for these or other applications.

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