

Electrogalvanized STEELS



AK Steel's Electrogalvanized Steel products, called ZINCGRIP® ELECTRASMOUTH, offer superior surface quality and high corrosion resistance, plus excellent formability and paintability, for automotive exterior panels and other exposed applications where these attributes are critical.

Pure zinc coatings applied to AK Steel's top quality cold rolled sheet steel deliver both galvanic and barrier protection against rust formation. Even when damaged, such coatings continue to shield the base metal from rust by corroding preferentially before the steel.

ZINCGRIP ELECTRASMOUTH Steels are available in a variety of base metal grades and coating weights, including differentially coated.

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 ELECTRASMOUTH Steels have a very uniform appearance suitable for the most demanding surface critical applications.

■ Formability

ZINCGRIP ELECTRASMOUTH Steels can be used to produce parts containing simple bends to parts with extreme deep drawing requirements.

■ Paintability

ZINCGRIP ELECTRASMOUTH Steels are readily paintable provided proper pretreatment is performed.

■ Weldability

ZINCGRIP ELECTRASMOUTH Steels can be joined using a variety of accepted welding practices.

PROCESS

ZINCGRIP ELECTRASMOOTH Steels are produced by the Gravitel® process. Vertical electroplating cells are used to apply zinc to one or both sides of the steel substrate.

The continuous process consists of surface preparation, plating, oiling and inspection. Surface preparation is essential to assure good coating adhesion. It consists of spray alkaline cleaning, brushing, electrolytic alkaline cleaning, and sulfuric acid surface activation.

In the plating section, current is passed through the strip which is

immersed in an aqueous solution containing zinc ions. As a result, the zinc is uniformly electrolytically deposited onto the steel substrate. The thickness of the deposit is constantly monitored by an on-line x-ray coating weight gauge.

After plating, a uniform application of rust preventative oil or prelube is electrostatically deposited on the strip. A visual inspection is made of every coil to insure surface quality.

COATING CHARACTERISTICS

The electrogalvanized coating is 99.99% pure zinc and is available in a variety of coating weights including one side, two side, and differentially coated. Due to the nature of the electrogalvanizing process, the zinc coating is uniformly applied throughout the coil. A schematic of the coating cross section is shown in Figure 1*.

ZINCGRIP ELECTRASMOOTH Steels can be specified in a wide range of coating weight categories as shown in Table 1. Please note that coatings are specified using SI units (metric). The coating designation is explained by the diagram in Figure 2.

FIGURE 1 – COATING CROSS SECTION



* Layers not shown to actual size.

FIGURE 2 – COATING DESIGNATION

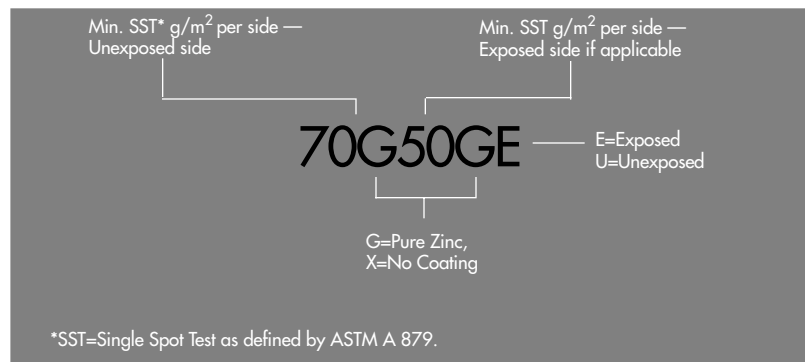


TABLE 1 – COATING WEIGHT

Coating Designation	Coating Weight Min.	
	(Inch-Pound) oz/ft ²	(SI) g/m ²
20G/20G	.07/.07	20/20
30G/30G	.10/.10	30/30
40G/40G	.13/.13	40/40
50G/50G	.16/.16	50/50
60G/60G	.20/.20	60/60
70G/70G	.23/.23	70/70
90G/90G	.29/.29	90/90
98G/98G	.32/.32	98/98
30G/00X	.10/0	30/0
60G/00X	.20/0	60/0
70G/00X	.23/0	70/0
98G/00X	.32/0	98/0

Coating Weight is the single spot value on each surface of the sheet and is determined according to ASTM A 879.

SURFACE PROTECTION AND LUBRICATION

To prevent rusting in transit and storage, it is recommended that ZINCGRIP ELECTRASMOOTH Steel be supplied with a protective oil. Rust preventative oil is a combination of a rust preventative and a mineral oil. In some cases, a pre-applied press forming lubricant can be supplied which provides uniform lubrication

and eliminates housekeeping problems associated with at-press lubrication. A dry film (acrylic/polymer) lubricant can also be supplied by further processing ZINCGRIP ELECTRASMOOTH Steel through a coil coating facility. These specialty organic coatings are easily removed with a mild alkaline cleaner.

FORMABILITY AND MECHANICAL PROPERTIES

The formability of all steel products is a result of the interaction of many variables, the main ones being 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 only directly affect the mechanical properties of the steel. Tight control over chemical composition, hot rolling parameters, amount of cold reduction, annealing time and temperature, and the amount of tempering allows the production of high quality ZINCGRIP ELECTRASMMOOTH Steels to meet customers' requirements.

The surface of ZINCGRIP ELECTRASMMOOTH is different from other steels because the pure zinc coating is soft. The interaction of this surface and the forming tool can cause friction and the transfer of small flakes of zinc to the punch. For this reason, a good lubricant and hard tooling should be used when forming ZINCGRIP ELECTRASMMOOTH. ZINCGRIP ELECTRASMMOOTH is available with a number of pre-applied lubricants including prelubes and temporary solid film organic coatings.

ZINCGRIP ELECTRASMMOOTH is available in a variety of base metals. Commercial Steel (CS Type B) should be used for moderate forming or bending applications. CS products are produced from aluminum-killed

continuously cast slabs and unless otherwise specified, have a carbon content of less than 0.15%. To prevent the occurrence of fluting or stretcher strains during forming, CS products are tempered as a normal step in the mill processing.

For more severe forming applications, Drawing Steel (DS Type B), should be ordered. DS Type B has a controlled carbon content (<0.06%) and is produced in such a manner that parts formed from DS Type B steel should not exhibit stretcher strain.

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

Typical mechanical properties are shown in Table 2. The n-value, i.e. strain hardening exponent, has been shown to correlate with stretch forming behavior, while the r-value, r_m , is a measure of deep-drawing capability.

For high strength or structural applications, ZINCGRIP ELECTRASMMOOTH Steel is also available in yield strengths up to 50 ksi (345 MPa) as shown in Table 3.

TABLE 2 – TYPICAL MECHANICAL PROPERTIES – STANDARD GRADES

Quality Designation	Description	YS		TS		Elong. %	"n"	"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.	31	214	48	331	40	0.19	1.6
Drawing Steel (DS Type B)	DS Type B may be used in drawing applications.	28	193	46	317	44	0.22	1.8
Extra Deep Drawing Steel (EDDS)	Interstitial Free (I-F) steels are made by adding titanium to the molten steel after degassing and offer excellent drawability.	26	176	46	317	45	0.23	1.9
Extra Deep Drawing Steel Plus (EDDS+)	Interstitial Free (I-F) steels are made by adding titanium to the molten steel after degassing and offer excellent drawability.	25	169	45	310	46	0.24	1.9

.0275 - .035 inches sheet thickness. Typical properties produced by AK Steel for these grades.

Commercial Steel, Deep Drawing Steel and Extra Deep Drawing Steel are designations of the various steels described in the ASTM specifications. Each of the steel sheet designations is associated with unique requirements for chemical composition and with non-mandatory, typical mechanical properties. All properties are tested per ASTM A 370.

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TABLE 3 – TYPICAL MECHANICAL PROPERTIES – HIGHER STRENGTH GRADES

Quality Designation	Description	Min. YS		Min. UTS		Min. Elong.	"n"	"r _m "
		ksi	MPa	ksi	MPa	%		
High Strength Low Alloy Steel (HSLAS)	FORMABLE 40K/SAE J1392 040 XLK or 040 YLK	40	280	55	380	25	–	–
	FORMABLE 50K/ASTM A 607 HSLAS Grade 50 Type 1/SAE J1392 050 XLK	50	345	65	450	20	–	–
	FORMABLE 50 K/ASTM A 607 HSLAS Grade 50 Type 2/SAE J1392 050 XLK	50	345	60	415	20	–	–
Bake Hardenable (BH 180)	Bake Hardenable steels offer good formability and an increase in strength after paint bake.	28	193	43	296	43	.20	1.7
Bake Hardenable (BH 210)	Bake Hardenable steels offer good formability and an increase in strength after paint bake.	35	238	51	352	38	.20	1.8
Dent Resistant 180 (DR 180)	Compared to DS Type B, DR steels have a higher initial YS which contributes to increased strength after forming.	31	214	53	365	38	.20	1.7
Dent Resistant 210 (DR 210)	Compared to DS Type B, DR steels have a higher initial YS which contributes to increased strength after forming.	33	228	52	359	36	.20	1.8

Note: Values for Bake Hardenable and Dent Resistant grades are typical, not minimums.

CORROSION RESISTANCE

The electrogalvanized coating provides galvanic as well as barrier protection. When dissimilar metals are used together, a galvanic couple is established and the more active metal will corrode preferentially to the less active metal. ZINCGRIP ELECTRASMMOOTH Steels use this principle to increase the corrosion resistance of the uncoated

base steel. The zinc coating is more active than the steel base metal. Therefore, in environments where the steel would normally rust, the zinc offers electrochemical protection. Even if the zinc coating is scratched and the steel is exposed, this electrochemical protection remains. As the zinc coating weight is increased, so is

the corrosion resistance. Painted ZINCGRIP ELECTRASMMOOTH Steels perform very well in salt spray tests, warm salt water immersion tests, and outdoor and cyclic corrosion tests. They are an excellent choice for exposed outdoor applications.

PAINTABILITY

ZINCGRIP ELECTRASMMOOTH is particularly well suited for applications where a high quality paint finish is required.

Prior to painting, the steel should be cleaned with a mild alkaline cleaner in order to insure the removal of organic contaminants. After cleaning, a zinc

phosphate pre-treatment immediately prior to painting is recommended to enhance paint adhesion and corrosion resistance.

Coil coated ZINCGRIP ELECTRASMMOOTH is also available through AK Steel's arrangements with outside processors. In this case, the electrogalvanized substrate is coated

in coil form with a wide range of specialty organic systems. These systems can be tailored to meet the customers' specific needs. Coil coating options include pre-treating or pre-priming and the application of dry-film lubricants.

APPLICATIONS

Electrogalvanized Steels are best suited for applications where surface finish, corrosion resistance, or both are critical. Examples of such applica-

tions include automotive, appliance, agricultural equipment, and architectural products.

SPECIFICATIONS

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

ASTM A 366	Commercial Steel	ASTM A 715	HSLA
ASTM A 568	General	ASTM A 879	Coating weight designation
ASTM A 607	HSLA	ASTM A 917	General requirements
ASTM A 611	Structural Steel	ASTM A 969	Extra Deep Drawing Steel
ASTM A 620	Drawing Steel	SAE J1392	HSLA

For any specifications not listed here, contact your AK Steel Sales or Technical Representative.

ENGINEERING PROPERTIES

TABLE 4

Young's Modulus of Elasticity	200 x 10 ⁶ MPa at 20°C
Density	7.87 g/cm ³ at 20°C
Coefficient of Thermal Expansion	Low-Carbon/HSLA: 12.4 μm/m/°C in 20°C to 100°C range I-F Steel: 12.9 μm/m/°C in 20°C to 100°C range
Thermal Conductivity	Low-Carbon/HSLA: 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°C to 100°C range
Electrical Resistivity	0.142 μΩm at 20°C

OUTSIDE PROCESSING

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

MORE INFORMATION/
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 solving any welding, forming, painting, or other material selection issue.

MILL LIMITS

ZINCGRIP ELECTRASMOOTH Steel is generally available in thicknesses from 0.017" (0.43 mm) to 0.075" (1.90 mm), and widths up to 75" (1904 mm) depending on thickness. For sizes outside these limits, please inquire.



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Data referring to mechanical properties and chemical analyses are the result of tests performed on specimens obtained from specific locations of the products in accordance with prescribed sampling procedures; any warranty thereof is limited to the values obtained at such locations and by such procedures. There is no warranty with respect to values of the materials at other locations.

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