

COLD ROLLED

STEELS



Automotive

Appliances

Construction

Lighting

Office Furniture



COLD ROLLED STEELS provide excellent thickness and flatness tolerances, surface finish, and press formability. AK Steel manufactures the following low and ultra-low-carbon grades to meet a variety of customer formability requirements: Commercial Steel (CS Type B), Drawing Steel (DS Type B), Extra Deep Drawing Steel (EDDS), and Extra Deep Drawing Steel Plus (EDDS+). AK Steel also produces High Strength Low Alloy Steel (HSLAS) and Structural Steel (SS) grades for those applications that require specified strength levels. Cold Rolled Steels can also be specified as Dent Resistant (DR) or Bake Hardenable (BH) for applications that require dent resistance after forming and painting. Each grade can be processed with several surface finishes depending on customer requirements.

COLD ROLLED STEELS

Product Description

PRODUCT FEATURES

EXCELLENT SURFACE APPEARANCE

Cold Rolled Steels have manufacturing controls in place assuring consistent surface quality to satisfy customer requirements.

FORMABILITY

Cold Rolled Steels can be used to produce parts with forming, ranging from simple bends to extreme deep drawing requirements.

PAINTABILITY

Cold Rolled Steels, due to stringent surface roughness controls, are readily paintable using an appropriate paint system.

WELDABILITY

Cold Rolled Steels can be joined using accepted welding practices.

SURFACE FINISH

Cold Rolled Steels are manufactured with a matte finish obtained by rolling with specially roughened rolls on the cold mill and the temper mill. This finish helps to maintain effective lubrication during metal forming and improves the appearance of painted surfaces. Additionally, non-standard finishes are available.

SURFACE PROTECTION AND LUBRICATION

To prevent rusting in transit and storage, Cold Rolled Steels are supplied with a rust protective oil film or press forming lubricants. AK Steel will apply a rust preventative oil unless otherwise specified.

FORMABILITY AND MECHANICAL PROPERTIES

The formability of all steel products is a result of the interaction of many variables. The variables include: the mechanical properties of the steel, the forming system (tooling) used to manufacture parts, and the lubrication used during forming. AK Steel can 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 temper rolling allow the production of high-quality Cold Rolled Steel products to meet customer requirements.

COMMERCIAL STEEL (CS)

Commercial Steel (CS Type B) should be used for moderate forming or bending applications. CS Type B products are produced from aluminum killed continuously cast slabs and, unless otherwise specified, have a carbon content of less than 0.15%C.

To minimize the occurrence of fluting or stretcher strains during forming, CS products are temper rolled as a normal step in the mill processing.

DRAWING STEEL (DS)

For more severe forming applications, Drawing Steel Type B (DS Type B) should be ordered. DS Type B has a controlled carbon content of less than 0.08%C and is produced in such a manner that parts formed from DS Type B Steel should not exhibit stretcher strain.

DEEP DRAWING STEEL (DDS)

Deep Drawing Steel (DDS) is typically produced as low carbon steel with a max carbon of 0.06%C, Interstitial Free (I-F) steel is also allowed at producer's discretion but is not required. This type of steel should be ordered for applications that require the most consistent type of low carbon steel.

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) steels are produced from a vacuum degassed, stabilized grade.

For high strength or structural applications, Cold Rolled Steels are also available in yield strengths up to 60 ksi. (410 MPa) as shown in Table 2, page 3.

Cold Rolled Steels can also be specified as Dent Resistant (DR) or Bake Hardenable (BH) for applications that require dent resistance after forming and painting; see Table 3, page 3.

Typical mechanical properties are shown in Table 1, page 3.

The n-Value, i.e. strain hardening exponent, has been shown to correlate with stretch forming behavior, while the r_m is a measure of deep-drawing capability.

PRESS HARDENABLE STEELS (PHS)

Press Hardenable Steel (PHS), commonly referred to as Mn22B5 or 15B22, is available as Cold Rolled full hard or annealed and tempered. This material is used in hot stamping applications to achieve final ultimate tensile strength approaching 1500 MPa.



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Product Description

PAINTABILITY

Cold Rolled Steels can be readily painted using a variety of paint systems provided proper care is taken in preparing the material. Prior to painting, the surface should be carefully cleaned with either a solvent or alkaline cleaner. Cleaning should be followed by a pre-treatment prior to painting. Zinc (Zn) or iron phosphates give good results on Cold Rolled Steels. Mild abrasion prior to pretreating may also be used to enhance mechanical bonding of the paint.

Cold Rolled Steels can be supplied as pre-painted or pre-primed through AK Steel's arrangements with outside coil coaters.

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 μΩm at 20 °C

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.

SPECIFICATIONS

Cold Rolled Steels are produced in conformance to the following specifications:

ASTM A1008	CS/DS/DDS/EDDS/SS/HSLAS/DR/BH
ASTM A568	General
ASTM A794	CS Carbon (0.16 – 0.25%)
SAE J1392	HSLAS/SS
SAE J2340	HSLAS/DR/BH/RA
SAE J2329	CS/DS/DDS/EDDS
SAE J403	General
Press Hardenable	Full Hard and Annealed/Tempered Rolled

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

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 addressing any welding, forming, painting, or other material selection issue.

MILL LIMITS

Cold Rolled Steels are available in thicknesses from 0.015 – 0.135 in. (0.381 – 3.429 mm), and widths to 80 in. (2032 mm), depending on dimensions and product quality.

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

Thickness, width, and flatness tolerances are covered in ASTM A568.



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Tables

TABLE 1 – TYPICAL MECHANICAL PROPERTIES – STANDARD GRADES

Quality Designation	Description	YS		UTS		% Elong. in 2"	Rockwell Hardness	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.	29	200	46	317	39	B42	–	–
Drawing Steel (DS Type B)	Type B is made by adding aluminum to the molten steel and may be used in drawing applications.	25	172	44	303	43	B37	0.22	1.6
Extra Deep Drawing Steel (EDDS)	Interstitial Free (I-F) steels are made by adding titanium and/or niobium to the molten steel after vacuum degassing and offer excellent drawability.	21	145	42	303	45	B30	0.23	1.7
Extra Deep Drawing Steel Plus (EDDS+)	Interstitial Free (I-F) steels are made by adding titanium and/or niobium to the molten steel after vacuum degassing and offer excellent drawability.	20	138	42	296	46	B30	0.25	1.8

Typical properties produced by AK Steel for these grades.

These are ordered by the appropriate ASTM Specification, A1008, which contain typical mechanical properties and required chemical compositions.

TABLE 2 – ASTM SPECIFIED PROPERTIES

Quality Designation	Description	Min. YS		Min. UTS		Min. Elong. %
		ksi.	MPa	ksi.	MPa	
Structural Steel (SS)	Grade 25	25	170	42	290	26
	Grade 30	30	205	45	310	24
	Grade 33 Type 1 & 2	33	230	48	330	22
	Grade 40 Type 1 & 2	40	275	52	358	20
	Grade 80 (Full Hard Only)	80	550	82	565	–
High Strength Low Alloy Steel (HSLAS)	Grade 40/SAE J1392 040 YLK	40	280	55	380	25
	Grade 40/SAE J1392 040 XLK	40	280	50	340	25
	Grade 45 CL 1/ SAE J1392 045 YLK	45	310	60	415	22
	Grade 45 CL 2/ SAE J1392 045 XLK	45	310	55	380	22
	Grade 50 CL 1/ SAE J1392 050 YLK	50	340	65	450	20
	Grade 50 CL 2/ SAE J1392 050 XLK	50	340	60	410	20
High Strength Low Alloy Steel (HSLAS-F)	Grade 50	50	340	60	410	22
	Grade 60	60	410	70	480	16

TABLE 3 – SAE SPECIFIED PROPERTIES

Quality Designation	Description	Min. YS	Min. UTS	n-Value
		MPa	MPa	
Bake Hardenable 180	SAE J2340 Type 180B	180	300	0.19
Dent Resistant 210	SAE J2340 Type 210A	210	330	0.19
Bake Hardenable 210	SAE J2340 Type 210B	210	320	0.17
Recovery Annealed 830	SAE J2340 Type 830R	830	860	–



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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.

Data referring to material properties 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.