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# Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable[1]

This standard is issued under the fixed designation A 1008/A 1008M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

## 1. Scope*

1.1 This specification covers cold-rolled, carbon, structural, high-strength low-alloy, high-strength low-alloy with improved formability, solution hardened, and bake hardenable steel sheet, in coils and cut lengths.

1.2 Cold rolled steel sheet is available in the designations as listed in 4.1.

1.3 This specification does not apply to steel strip as described in Specification A 109/A 109M.

1.4 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other.

## 2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 109/A 109M Specification for Steel, Strip, Carbon (0.25 Maximum Percent), Cold-Rolled

A 366/A 366M Specification for Commercial Steel (CS) Sheet, Carbon (0.15 Maximum Percent) Cold-Rolled[3]

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products

A 568/A 568M Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for

A 620/A 620M Specification for Drawing Steel (DS), Sheet, Carbon, Cold-Rolled[3]

A 941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

E 517 Test Method for Plastic Strain Ratio ***r*** for Sheet Metal

E 646 Test Method for Tensile Strain-Hardening Exponents (n -Values) of Metallic Sheet Materials

## 3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of other terms used in this specification, refer to Terminology A 941.

3.1.2 *stabilization*—addition of one or more nitride- or carbide-forming elements, or both, such as titanium and columbium, to control the level of the interstitial elements of carbon and nitrogen in the steel.

3.1.2.1 *Discussion*—Stabilizing improves formability and increases resistance to aging.

3.1.3 *vacuum degassing*—process of refining liquid steel in which the liquid is exposed to a vacuum as part of a special technique for removing impurities or for decarburizing the steel.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *aging*—loss of ductility with an increase in hardness, yield strength, and tensile strength that occurs when steel that has been slightly cold worked (such as by temper rolling) is stored for some time.

3.2.1.1 *Discussion*—Aging increases the tendency of a steel to exhibit stretcher strains and fluting.

[1] This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.19 on Steel Sheet and Strip.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Withdrawn.

***A Summary of Changes section appears at the end of this standard.**

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3.2.2 *bake hardenable steel*—steel in which significant aging is realized when moderate heat treatment, such as that used for paint baking, follows straining or cold working.

3.2.3 *solid-solution hardened steel or solution hardened steel*—steel strengthened through additions of elements, such as Mn, P, or Si, that can be dissolved within the crystalline structure of steels.

3.2.3.1 *Discussion*—Alloying elements that form a solid-solution with iron provide strengthening as a result of local distortions in atomic arrangements, which arise as a result of the mismatch between the atomic sizes of such elements and that of iron.

## 4. Classification

4.1 Cold-rolled steel sheet is available in the following designations:

4.1.1 Commercial Steel (CS Types A, B, and C),

4.1.2 Drawing Steel (DS Types A and B),

NOTE 1—CS Type B and DS Type B describe the most common product previously included, respectively, in Specifications A 366/A 366M and A 620/A 620M.

4.1.3 Deep Drawing Steel (DDS),

4.1.4 Extra Deep Drawing Steel (EDDS),

4.1.5 Structural Steel (SS grades 25[170], 30[205], 33[230] Types 1 and 2, 40[275] Types 1 and 2, 50[340], 60[410], 70[480], and 80[550]).

4.1.6 High-Strength Low-Alloy Steel (HSLAS, in classes 1 and 2, in grades 45[310], 50[340]. 55[380], 60[410], 65[450], and 70[480] in Classes 1 and 2), and

4.1.7 High-Strength Low-Alloy Steel with Improved Formability (HSLAS-F grades 50[340], 60[410], 70[480], and 80[550]).

4.1.7.1 HSLAS-F steel has improved formability when compared to HSLAS. The steel is fully deoxidized, made to fine grain practice and includes microalloying elements such as columbium, vanadium, zirconium, etc. The steel shall be treated to achieve inclusion control.

4.1.8 Solution hardened steel (SHS), and

4.1.9 Bake hardenable steel (BHS).

4.2 When required for HSLAS and HSLAS-F steels, limitations on the use of one or more of the microalloy elements shall be specified on the order.

4.3 Cold-rolled steel sheet is supplied for either exposed or unexposed applications. Within the latter category, cold-rolled sheet is specified either "temper rolled" or "annealed last." For details on processing, attributes and limitations, and inspection standards, refer to Specification A 568/A 568M.

## 5. Ordering Information

5.1 It is the purchaser's responsibility to specify in the purchase order all ordering information necessary to describe the required material. Examples of such information include, but are not limited to, the following:

5.1.1 ASTM specification number and year of issue;

5.1.2 Name of material and designation (cold-rolled steel sheet) (include grade, type, and class, as appropriate, for CS, DS, DDS, EDDS, SS, HSLAS, HSLAS-F, SHS, or BHS) (see 4.1);

5.1.2.1 When a type is not specified for CS or DS, Type B will be furnished (see 4.1);

5.1.2.2 When a class is not specified for HSLAS, Class 1 will be furnished (see 4.1);

5.1.2.3 When a type is not specified for SS 33 [230] and SS 40 [275], Type 1 will be furnished (see 4.1);

5.1.3 Classification (either exposed, unexposed, temper rolled, or annealed last) (see 4.3);

5.1.4 Finish (see 9.1);

5.1.5 Oiled or not oiled, as required (see 9.2);

5.1.6 Dimensions (thickness, thickness tolerance table (see 5.1.6.1), width, and whether cut lengths or coils);

5.1.6.1 As agreed upon between the purchaser and the producer, material ordered to this specification will be supplied to meet the applicable thickness tolerance table shown in Specification A 568/A 568M;

NOTE 2—Not all producers are capable of meeting all the limitations of the thickness tolerance tables in Specification A 568/A 568M. The purchaser should contact the producer regarding possible limitations prior to placing an order.

5.1.7 Coil size (must include inside diameter, outside diameter, and maximum weight);

5.1.8 Copper bearing steel (if required);

5.1.9 Quantity;

5.1.10 Application (part identification and description);

5.1.11 Special requirements (if required), and

5.1.12 A report of heat analysis will be supplied, if requested, for CS, DS, DDS, and EDDS. For materials with required mechanical properties, SS, HSLAS, HSLAS-F, SHS, and BHS, a report is required of heat analysis and mechanical properties as determined by the tension test.

NOTE 3—A typical ordering description is as follows: ASTM A 1008-XX, cold rolled steel sheet, CS Type A, exposed, matte finish, oiled, 0.035 by 30 in. by coil, ID 24 in., OD 48 in., max weight 15 000 lbs, thickness tolerance Table 18 of Specification A 568/A 568M, 100 000 lb, for part No. 4560, Door Panel.
or:
ASTM A 1008M-XX, cold-rolled steel sheet, SS grade 275, unexposed, matte finish, oiled, 0.88 mm by 760 mm by 2440 mm, thickness tolerance Table A1.15 of Specification A 568/A 568M, 10 000 kg, for shelf bracket.

## 6. General Requirements for Delivery

6.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification A 568/A 568M unless otherwise provided herein.

## 7. Chemical Composition

7.1 The heat analysis of the steel shall conform to the chemical composition requirements of the appropriate designation shown in Table 1 for CS, DS, DDS, and EDDS and in Table 2 for SS, HSLAS, HSLAS-F, SHS, and BHS.

7.2 Each of the elements listed in Table 1 and Table 2 shall be included in the report of the heat analysis. When the amount of copper, nickel, chromium, or molybdenum is less than 0.02 %, report the analysis as <0.02 % or the actual determined value. When the amount of vanadium, columbium, or titanium is less than 0.008 %, report the analysis as <0.008 % or the

**TABLE 1 Chemical Composition[A]**
**For Cold Rolled Steel Sheet Designations CS, DS, DDS, and EDDS**

| | % Heat Analysis, Element Maximum Unless Otherwise Shown | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Designation | C | Mn | P | S | Al | Si | Cu | Ni | Cr[B] | Mo | V | Cb | Ti[C] | N | B |
| CS Type A[D,E,F,G] | 0.10 | 0.60 | 0.030 | 0.035 | . . . | . . . | 0.20[H] | 0.20 | 0.15 | 0.06 | 0.008 | 0.008 | 0.025 | . . . | . . . |
| CS Type B[D] | 0.02 to 0.15 | 0.60 | 0.030 | 0.035 | . . . | . . . | 0.20[H] | 0.20 | 0.15 | 0.06 | 0.008 | 0.008 | 0.025 | . . . | . . . |
| CS Type C[D,E,F,G] | 0.08 | 0.60 | 0.10 | 0.035 | . . . | . . . | 0.20[H] | 0.20 | 0.15 | 0.06 | 0.008 | 0.008 | 0.025 | . . . | . . . |
| DS Type A[E,I] | 0.08 | 0.50 | 0.020 | 0.030 | 0.01 min | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.008 | 0.008 | 0.025 | . . . | . . . |
| DS Type B | 0.02 to 0.08 | 0.50 | 0.020 | 0.030 | 0.02 min | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.008 | 0.008 | 0.025 | . . . | . . . |
| DDS[F,G] | 0.06 | 0.50 | 0.020 | 0.025 | 0.01 min | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.008 | 0.008 | 0.025 | . . . | . . . |
| EDDS[J] | 0.02 | 0.40 | 0.020 | 0.020 | 0.01 min | . . . | 0.10 | 0.10 | 0.15 | 0.03 | 0.10 | 0.10 | 0.15 | . . . | . . . |

[A] Where an ellipsis (. . .) appears in the table, there is no requirement, but the analysis result shall be reported.
[B] Chromium is permitted, at the producer's option, to 0.25 % maximum when the carbon content is less than or equal to 0.05 %.
[C] For steels containing more than 0.02 % carbon, titanium is permitted to 0.025 %, provided the ratio of % titanium to % nitrogen does not exceed 3.4.
[D] When an aluminum deoxidized steel is required for the application, it is permissible to order Commercial Steel (CS) to a minimum of 0.01 % total aluminum.
[E] Specify Type B to avoid carbon levels below 0.02 %.
[F] It is permissible to furnish as a vacuum degassed or chemically stabilized steel, or both, at the producer's option.
[G] For carbon levels less than or equal to 0.02 %, it is permissible to use vanadium, columbium or titanium, or a combination thereof, as stabilizing elements at the producer's option. In such cases, the applicable limit for vanadium or columbium shall be 0.10 % max. and the limit on titanium shall be 0.15 % max.
[H] When copper steel is specified, the copper limit is a minimum requirement. When copper steel is not specified, the copper limit is a maximum requirement.
[I] If produced utilizing a continuous anneal process, stabilized steel is permissible at the producer's option, and Footnotes F and G apply.
[J] Shall be furnished as a vacuum degassed and stabilized steel.

**TABLE 2 Chemical Composition[A]**
**For Cold Rolled Steel Sheet Designations SS, HSLAS, HSLAS-F, SHS, and BHS**

| | % Heat Analysis, Element Maximum Unless Otherwise Shown | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Designation | C | Mn | P | S | Al | Si | Cu[B] | Ni | Cr | Mo | V | Cb | Ti | N |
| SS:[C] | | | | | | | | | | | | | | |
| Grade 25 [170] | 0.20 | 0.60 | 0.035 | 0.035 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.008 | 0.008 | 0.025 | . . . |
| Grade 30 [205] | 0.20 | 0.60 | 0.035 | 0.035 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.008 | 0.008 | 0.025 | . . . |
| Grade 33 [230] Type 1 | 0.20 | 0.60 | 0.035 | 0.035 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.008 | 0.008 | 0.025 | . . . |
| Grade 33 [230] Type 2 | 0.15 | 0.60 | 0.20 | 0.035 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.008 | 0.008 | 0.025 | . . . |
| Grade 40 [275] Type 1 | 0.20 | 0.90 | 0.035 | 0.035 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.008 | 0.008 | 0.025 | . . . |
| Grade 40 [275] Type 2 | 0.15 | 0.60 | 0.20 | 0.035 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.008 | 0.008 | 0.025 | . . . |
| Grade 50 [340] | 0.20 | 0.70 | 0.035 | 0.035 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.008 | 0.008 | 0.025 | . . . |
| Grade 60 [410] | 0.20 | 0.70 | 0.035 | 0.035 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.008 | 0.008 | 0.025 | . . . |
| Grade 70 [480] | 0.20 | 0.70 | 0.035 | 0.035 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.008 | 0.008 | 0.025 | . . . |
| Grade 80 [550] | 0.20 | 0.60 | 0.035 | 0.035 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.008 | 0.008 | 0.025 | . . . |
| HSLAS:[D] | | | | | | | | | | | | | | |
| Grade 45 [310] Class 1 | 0.22 | 1.65 | 0.04 | 0.04 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.005 min | 0.005 min | 0.005 min | . . . |
| Grade 45 [310] Class 2 | 0.15 | 1.65 | 0.04 | 0.04 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.005 min | 0.005 min | 0.005 min | . . . |
| Grade 50 [340] Class 1 | 0.23 | 1.65 | 0.04 | 0.04 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.005 min | 0.005 min | 0.005 min | . . . |
| Grade 50 [340] Class 2 | 0.15 | 1.65 | 0.04 | 0.04 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.005 min | 0.005 min | 0.005 min | . . . |
| Grade 55 [380] Class 1 | 0.25 | 1.65 | 0.04 | 0.04 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.005 min | 0.005 min | 0.005 min | . . . |
| Grade 55 [380] Class 2 | 0.15 | 1.65 | 0.04 | 0.04 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.005 min | 0.005 min | 0.005 min | . . . |
| Grade 60 [410] Class 1 | 0.26 | 1.65 | 0.04 | 0.04 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.005 min | 0.005 min | 0.005 min | . . . |
| Grade 60 [410] Class 2 | 0.15 | 1.65 | 0.04 | 0.04 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.005 min | 0.005 min | 0.005 min | . . . |
| Grade 65 [450] Class 1 | 0.26 | 1.65 | 0.04 | 0.04 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.005 min | 0.005 min | 0.005 min | [E] |
| Grade 65 [450] Class 2 | 0.15 | 1.65 | 0.04 | 0.04 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.005 min | 0.005 min | 0.005 min | [E] |
| Grade 70 [480] Class 1 | 0.26 | 1.65 | 0.04 | 0.04 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.16 | 0.005 min | 0.005 min | 0.005 min | [E] |
| Grade 70 [480] Class 2 | 0.15 | 1.65 | 0.04 | 0.04 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.16 | 0.005 min | 0.005 min | 0.005 min | [E] |
| HSLAS-F:[D] | | | | | | | | | | | | | | |
| Grade 50 [340] and 60 [410] | 0.15 | 1.65 | 0.020 | 0.025 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.005 min | 0.005 min | 0.005 min | [E] |
| Grade 70 [480] and 80 [550] | 0.15 | 1.65 | 0.020 | 0.025 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.16 | 0.005 min | 0.005 min | 0.005 min | [E] |
| SHS[F] | 0.12 | 1.50 | 0.12 | 0.030 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.008 | 0.008 | 0.008 | . . . |
| BHS[F] | 0.12 | 1.50 | 0.12 | 0.030 | . . . | . . . | 0.20 | 0.20 | 0.15 | 0.06 | 0.008 | 0.008 | 0.008 | . . . |

[A] Where an ellipsis (. . .) appears in the table, there is no requirement but, the analysis shall be reported.
[B] When copper is specified, the copper limit is a minimum requirement. When copper steel is not specified, the copper limit is a maximum requirement.
[C] Titanium is permitted for SS designations, at the producer's option, to 0.025 % maximum, provided the ratio of % titanium to % nitrogen does not exceed 3.4.
[D] HSLAS and HSLAS-F steels contain the strengthening elements columbium (niobium), vanadium, titanium, and molybdenum added singly or in combination. The minimum requirements only apply to the microalloy elements selected for strengthening of the steel.
[E] The purchaser has the option of restricting the nitrogen content. It should be noted that, depending on the microalloying scheme (for example, use of vanadium) of the producer, nitrogen may be a deliberate addition. Consideration should be made for the use of nitrogen binding elements (for example, vanadium, titanium).
[F] For carbon levels less than or equal to 0.02 % vanadium, columbium, or titanium, or a combination thereof, are permitted to be used as stabilizing elements at the producer's option. In such cases, the applicable limit for vanadium and columbium shall be 0.10 % max., and the limit for titanium shall be 0.15 % max.

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actual determined value. When the amount of boron is less than 0.0005 %, report the analysis as <0.0005 % or the actual determined value.

7.3 Sheet steel grades defined by this specification are suitable for welding if appropriate welding conditions are selected. For certain welding processes, if more restrictive composition limits are desirable, they shall be specified at the time of inquiry and confirmed at the time of ordering.

## 8. Mechanical Properties

8.1 *CS, DS, DDS, and EDDS*:

8.1.1 Typical nonmandatory mechanical properties for CS, DS, DDS and EDDS are shown in Table 3.

8.1.2 The material shall be capable of being bent, at room temperature, in any direction through 180° flat on itself without cracking on the outside of the bent portion (see Section 14 of Test Methods and Definitions A 370).

8.1.3 Sheet of these designations except for EDDS are subject to aging dependent upon processing factors such as the method of annealing (continuous annealing or box annealing), and chemical composition. For additional information on aging, see Appendix X1 of Specification A 568/A 568M.

8.1.4 EDDS steel is stabilized to be nonaging and so is not subject to stretcher strains and fluting. Other steels are processed to be nonaging; please consult your supplier.

8.2 *SS, HSLAS, HSLAS-F, SHS, and BHS*:

8.2.1 The available strength grades for SS, HSLAS and HSLAS-F are shown in Table 4.

8.2.2 The available strength grades for SHS and BHS are shown in Table 5.

8.2.3 *Tension Tests*:

8.2.3.1 *Requirements*—Material as represented by the test specimen shall conform to the mechanical property requirements specified in Table 4. These requirements do not apply to the uncropped ends of unprocessed coils.

8.2.3.2 *Number of Tests*—Two tension tests shall be made from each heat or from each 50 tons [45 000 kg]. When the amount of finished material from a heat is less than 50 tons [45 000 kg], one test shall be made. When material rolled from heat differs 0.050 in. [1.27 mm] or more in thickness, one tension test shall be made from the thickest and thinnest material regardless of the weight represented.

8.2.3.3 Tension test specimens shall be taken at a point immediately adjacent to the material to be qualified.

8.2.3.4 Tension test specimens shall be taken from the full thickness of the sheet.

8.2.3.5 Tension test specimens shall be taken from a location approximately halfway between the center of the sheet and the edge of the material as rolled.

8.2.3.6 Tension test samples shall be taken with the lengthwise axis of the test specimen parallel to the rolling direction (longitudinal test).

8.2.3.7 *Test Method*—Yield strength shall be determined by either the 0.2 % offset method or the 0.5 % extension under load method unless otherwise specified.

8.2.3.8 Bake hardenable steel shall conform to bake hardening index requirements included in Table 5 for the grade specified. The method for measuring the bake hardening index is described in Annex A1. Bake hardenable steel shall exhibit a minimum increase in yield strength of 4 ksi [25 MPa] as based on the upper yield point or 3 ksi [20 MPa] as based on the lower yield stress, after a prestrained specimen has been exposed to a standard bake cycle (340°F [170°C]) for 20 min.

8.2.4 *Bending Properties*:

8.2.4.1 The suggested minimum inside radii for cold bending are listed in Appendix X1 and is discussed in more detail in Specification A 568/A 568M (Section 6). Where a tighter bend radius is required, where curved or offset bends are involved, or where stretching or drawing are also a consideration, the producer shall be consulted.

## 9. Finish and Appearance

9.1 *Surface Finish*:

9.1.1 Unless otherwise specified, the sheet shall have a matte finish. When required, specify the appropriate surface texture and condition. For additional information, see the Finish and Condition section of Specification A 568/A 568M.

For additional information see "Finish and Condition" section of Specification A 568/A 568M.

9.2 *Oiling*:

9.2.1 Unless otherwise specified, the sheet shall be oiled.

9.2.2 When required, specify the sheet to be furnished not oiled (dry).

**TABLE 3 Typical Ranges of Mechanical Properties[A] (Nonmandatory)[B] For Cold Rolled Steel Sheet Designations CS, DS, DDS and EDDS**

| Designation | Yield Strength[C] | | Elongation in 2 in. [50 mm] %[C] | $r_m$ Value[D] | *n*-Value[E] |
|---|---|---|---|---|---|
| | ksi | MPa | | | |
| CS Types A, B, and C | 20 to 40 | [140 to 275] | ≥30 | [F] | [F] |
| DS Types A and B | 22 to 35 | [150 to 240] | ≥36 | 1.3 to 1.7 | 0.17 to 0.22 |
| DDS | 17 to 29 | [115 to 200] | ≥38 | 1.4 to 1.8 | 0.20 to 0.25 |
| EDDS | 15 to 25 | [105 to 170] | ≥40 | 1.7 to 2.1 | 0.23 to 0.27 |

[A] These typical mechanical properties apply to the full range of steel sheet thicknesses. The yield strength tends to increase, the elongation decreases and some of the formability values tend to decrease as the sheet thickness decreases.

[B] The typical mechanical property values presented here are nonmandatory. They are provided to assist the purchaser in specifying a suitable steel for a given application. Values outside of these ranges are to be expected.

[C] Yield Strength and elongation are measured in the longitudinal direction in accordance with Test Methods and Definitions A 370.

[D] Average plastic strain ratio ($r_m$ value) as determined by Test Method E 517.

[E] The strain hardening exponent (n-value) as determined by Test Method E 646.

[F] No typical properties have been established.