

Guide to Material Specifications for Metal DSM-01

1.0 Scope

- 1.1 This document defines the format for IMMI material specifications written for steel and establishes guidelines for several use issues.

2.0 Purpose

- 2.1 To define a standard specification for IMMI material specifications.

3.0 References

- 3.1 Standard Specification for Steel Bars, Carbon and Alloy, Hot-Wrought and Cold-Finished, General Requirements for ASTM A29.
- 3.2 Standard Specification for Steel, Strip, Carbon, Cold-Rolled, ASTM A109.
- 3.3 Standard Specification for Steel, Sheet and Strip, Alloy, Hot-Rolled and Cold-Rolled, General Requirements for ASTM A505.
- 3.4 Standard Specification for Steel, Sheet and Strip, Alloy, Hot-Rolled and Cold-Rolled, Regular Quality and Structural Quality, ASTM A506.
- 3.5 Standard Specification for Steel, Carbon (0.15 maximum percent), Hot-Rolled Sheet and Strip Commercial Quality, ASTM A569.
- 3.6 Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements, ASTM A568.
- 3.7 Standard Specification for Steel, Strip, High-Carbon, Cold-Rolled, Spring Quality, General Requirements for ASTM A682.
- 3.8 Standard Specification for Steel, Strip, High-Carbon, Cold-Rolled, ASTM A684.
- 3.9 Standard Specification for Steel Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled, and Steel Sheet, Cold-Rolled, High-Strength, Low-Alloy, with Improved Formability, ASTM A 715.
- 3.10 Standard Specification for Steel, Strip, Carbon and High-Strength, Low-Alloy, Hot-Rolled, General Requirements fo, ASTM A749.
- 3.11 Standard Practice for Determining the Inclusion Content of Steel, ASTM E45.
- 3.12 Standard Test Methods for Determining Average Grain Size, ASTM E112.
- 3.13 Standard Practice for Numbering Metals and Alloys (UNS), ASTM E527.
- 3.14 SAE Numbering System for Wrought or Rolled Steel, SAE J402b.
- 3.15 Chemical Compositions of SAE Carbon Steels, SAE J403g.
- 3.16 Chemical Compositions of SAE Alloy Steels, SAE J404h.
- 3.17 Steel High-Strength, Hot-Rolled Sheet and Strip, Cold-Rolled Sheet and Coated Sheet, SAE J1392.

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4.0 Description Format

- 4.1 The description is an alpha numeric characterization of the material which has significance in that it identifies the AISI number for the material, its final processing, quality, temper and surface condition.
- 4.2 The description is of the format ABCDEFG where the characters have the following significance.
 - 4.2.1 A is the AISI standard designation for the material as defined in SAE J403g or SAE J404h.
 - 4.2.2 B is the designation of final processing.
 - 4.2.2.1 CR designates cold-rolled.
 - 4.2.2.2 HR designates hot-rolled.
 - 4.2.2.3 1P designates hot-rolled followed by one pass cold-rolled.
 - 4.2.2.4 CRG designates CRS followed by additional pass or passes for gage control.
 - 4.2.3 C is the designation of the product form.
 - 4.2.3.1 BR designates bar.
 - 4.2.3.2 PL designates plate.
 - 4.2.3.3 SH designates sheet.
 - 4.2.3.4 ST designates strip.
 - 4.2.3.5 TV designates tube.
 - 4.2.4 D is the designation of the material quality.
 - 4.2.4.1 CQ designates commercial quality.
 - 4.2.4.2 DQ designates drawing quality.
 - 4.2.4.3 DQSK designates drawing quality special killed.
 - 4.2.4.4 MQ designates merchant quality.
 - 4.2.4.5 SQ designates special quality.
 - 4.2.4.6 FQ designates forming quality.
 - 4.2.5 E is the designation of the temper.
 - 4.2.5.1 T1 designates No. 1 hard temper.
 - 4.2.5.2 T2 designates No. 2 half hard.
 - 4.2.5.3 T3 designates No. 3 quarter hard.
 - 4.2.5.4 T4 designates No. 4 skin rolled.
 - 4.2.5.5 T5 designates No. 5 dead soft.
 - 4.2.5.6 AN designates annealed.
 - 4.2.5.7 SA designates spheroidize annealed.
 - 4.2.5.8 A designates annealed.
 - 4.2.5.9 AA designates annealed.
 - 4.2.5.10 AR designates as rolled.
 - 4.2.5.11 DSA designates double spheroidized.
 - 4.2.5.12 FH designates full hard.
 - 4.2.5.13 IN designates intermediate hardness.

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4.2.5.14 SO designates soft annealed.

4.2.6 F is the designation of surface condition.

4.2.6.1 AR designates as rolled.

4.2.6.2 PO designates pickled and oiled.

4.2.6.3 S1 designates dull.

4.2.6.4 S2 designates bright.

4.2.6.5 S3 designates luster.

4.2.6.6 SP designates pickled.

4.2.7 G is the designation of edge condition

4.2.7.1 No. 1 designates round edge.

4.2.7.2 No. 2 designates natural mill edge.

4.2.7.3 No. 3 designates approximate square edge by slitting, not filing.

4.2.7.4 No. 4 designates round edge produced by edge rolling.

4.2.7.5 No. 5 designates approximate square edge by rolling or filing after slitting.

4.2.7.6 No. 6 designates square edge produced by edge rolling.

5.0 Material Specification Code

5.1 The material specification code is a two digit numerical assignment to represent the material specification in the cost identifier field of the Item Master which is originated and maintained in the business system's data base. The numbers are assigned in the order in which the material specifications are written. The number of digits are limited to two because of space available in the field.

6.0 Material Group

6.1 The material group is a generic description of the material which verbally indicates the carbon level and alloy if present.

7.0 Material

7.1 This is the AISI numerical designation for the material as found in the Standard Practice for Numbering Metals and Alloys, ASTM E547.

8.0 Quality

8.1 Quality is a two to four letter designation to identify the type of manufacturing operations used to make the material. It usually limits the uses of the steel. As an example, commercial quality steels are very economical but are not killed and, therefore, not heat treatable. Selection of a quality level for a new specification requires a thorough knowledge of the manufacturing processes to which the material will be subjected, the finished parts end use, and coordination with the supplier and steel source. It is also suggested that a similar part be reviewed as a reference.

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A list of the current designations and descriptions is as follows:

Material Group	Quality
Alloy Steel	CQ - Commercial Quality
Alloy Steel	DQ - Drawing Quality
Alloy Steel	DQSK - Drawing Quality Special Killed
Alloy Steel	MQ - Merchant Quality
Alloy Steel	SQ - Special Quality
High Carbon Steel	CQ - Commercial Quality
High Carbon Steel	DQ - Drawing Quality
High Carbon Steel	DQSK - Drawing Quality Special Killed
High Carbon Steel	MQ - Merchant Quality
High Carbon Steel	SQ - Special Quality
High Strength Steel	D - Dual Phase Grade
High Strength Steel	S - Structural Quality
High Strength Steel	SQ - Special Quality
High Strength Steel	W - Weathering Steel
Low Carbon Steel	CQ - Commercial Quality
Low Carbon Steel	DQ - Drawing Quality
Low Carbon Steel	DQSK - Drawing Quality Special Killed
Low Carbon Steel	MQ - Merchant Quality
Low Carbon Steel	SQ - Special Quality

9.0 General Specification

- 9.1 This designates the applicable standards and specifications that apply to the material specification being written. These should include ASTM designations where possible.

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10.0 Additional Specification

10.1 These are industry standard specifications detailing required characteristics not included in the general specifications.

11.0 Exception

11.1 This is used to further qualify additional requirements which are deletions or exceptions from a standard specification.

12.0 Grain Size

12.1 Grain size refers to the prior austenitic grain size as determined by indirect methods of either a microscope or fracture. It affects machining, forming, blanking and heat treating and sometimes, in conflicting directions. Experience is a good guide for determining the desired grain size as well as similarly processed parts. The supplier and the steel manufacturer should also be involved in this phase of determining the specification.

13.0 Grain Note

13.1 The grain note defines the acceptable grain shape and distribution. The specification used to measure the grain size should also be noted.

14.0 Finish Method

14.1 This defines the final rolling process used to reduce the cross sectional area of the metal stock, or shape the metal product.

15.0 Temper

15.1 This defines the level of the reheating of the steel for the purpose of decreasing hardness and increasing toughness. It can be defined by describing the carbon form produced during the annealing process, spheroidize annealed is an example, or by the hardness level achieved by the degree of rolling, quarter hard is an example. Examples are shown in the following table.

15.1.1 No. 1 Hard – For stamping or punching flat pieces requiring rigidity and strength.

15.1.2 No. 2 Half Hard – For simple blanking operations. Will bend at sharp right angle across the grain (direction of rolling).

15.1.3 No. 3 Quarter Hard – Will bend flat on itself across the grain. Takes some bending with the grain.

15.1.4 No. 4 Pinch Pass or Skin Rolled – For tubing, molding, some deep drawing. Will bend both ways of the grain.

15.1.5 No. 5 Dead Soft – For deep drawing and difficult forming. Extremely soft, it will bend flat on itself both ways of the grain.

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Material Group	Temper Number	Temper Description	Hardness for .25 >T>.07
Alloy Steel	AN - Annealed	CRS, Alloy Bar	85 HRB Max
Alloy Steel	AR - As Rolled	CRS	
Alloy Steel	SA - Spheroidize Annealed	CRS	
High Carbon Steel	A	For applications requiring cold forming. It is produced to give a microstructure favorable to cold forming.	Per ASTM A684/684M, Figure 2
High Carbon Steel	AA - Annealed	For modified steel composition.	HRB 76 Max
High Carbon Steel	FH - Full Hard	For flat applications. It is produced to minimum hardness.	Per agreement between IMMI & producer.
High Carbon Steel	IN - Intermediate Hardness	For applications when unique hardness range is agreed to per agreement between IMMI and producer.	HRB 90 Max
High Carbon Steel	SA - Spheroidize Annealed	For applications requiring cold forming. It is produced to give a microstructure favorable to cold forming.	Per ASTM A684/684M, Figure 2
High Carbon Steel	SO - Soft Annealed	For applications requiring moderate cold forming. It is produced to a max hardness.	Per ASTM A684/684M, Figure 1
High Strength Steel	TT - Not Specified	Temper not designated for this material.	This material is specified by yield strength
Low Carbon Steel	T1 - No. 1 Hard	For stamping or punching flat pieces requiring rigidity and strength.	HRB 84 Min
Low Carbon Steel	T2 - No. 2 Half Hard	For simple blanking operations. Will bend at sharp right angle across the grain (direction of rolling).	70-85 HRB
Low Carbon Steel	T3 - No. 3 Quarter Hard	Will bend flat on itself across the grain. Takes some bending with the grain.	60-75 HRB
Low Carbon Steel	T4 - No. 4 Skin Rolled	For tubing, molding, and some deep drawing. Will bend both ways of grain.	HRB 65 Max
Low Carbon Steel	T5 - No. 5 Dead Soft	For deep drawing and difficult forming. Will bend flat on itself in any direction.	HRB 55 Max

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16.0 Surface Condition

- 16.1 The surface condition defines the finish of the surface produced by the final treatment. Bright, dull and as rolled are examples of the surface conditions used. A list of current designations and descriptions are as follows.

Material Group	Surface Condition	Material Group	Surface Condition
Alloy Steel	AR - As rolled	High Strength Steel	PO - Pickled & oiled
Alloy Steel	S1 - Dull	High Strength Steel	S1 - Dull
Alloy Steel	S2 - Bright	High Strength Steel	SP - Pickled
Alloy Steel	S2 - Luster	Low Carbon Steel	PO - Pickled & oiled
High Carbon Steel	S1 - Dull	Low Carbon Steel	S1 - Dull
High Carbon Steel	S2 - Bright	Low Carbon Steel	S2 - Bright
High Carbon Steel	S3 - Luster	Low Carbon Steel	S3 - Luster
High Strength Steel	AR - As rolled	Low Carbon Steel	SP - Pickled

17.0 Hardness

- 17.1 Hardness defines the resistance of metal to plastic deformation usually by indentation.

18.0 Edge Condition

- 18.1 The edge conditions are defined:
- 18.1.1 No.1 Perfect square or rounded edge.
 - 18.1.2 No. 2 Natural mill edge.
 - 18.1.3 No. 3 Approx. square edge by slitting, not filed.
 - 18.1.4 No. 4 Round edge produced by edge rolling.
 - 18.1.5 No. 5 Approx. sq. edge by rolling or filling after slitting.
 - 18.1.6 No. 6 Square edge produced by edge rolling.

19.0 Fitness for Use

- 19.1 This identifies the processes of manufacturing and the end product for which the material will be used as a reference for the material supplier to ensure the proper material will be furnished. Examples are shown below. Delete or add applicable operations.

Bar - This material must be fit for machining, heat treating and plating processes. The end product will be utilized in an occupant restraint system.

Plate - This material must be fit for blanking, forming and plating processes. The end product will be utilized in an occupant restraint system.

Sheet - This material must be fit for blanking, forming, heat treating and plating processes. The end product will be utilized in an occupant restraint system.

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Strip - This material must be fit for blanking, forming, heat treating and plating processes. The end product will be utilized in an occupant restraint system.

Tube - This material must be fit for plating processes. The end product will be utilized in an occupant restraint system.

20.0 Material Form

20.1 The material form defines the final form of the material; bar, plate, sheet and tube are examples.

21.0 Chemistry

21.1 Chemistry defines the acceptable levels of the elements that are combined to make the material.

22.0 Microstructure

22.1 The microstructure defines the structure for the metal as revealed by microscopic observation at a magnification greater than ten diameters.

23.0 Comments

23.1 This space is used to add any additional information pertinent to the specification, which is not covered above.