

Chapter 10

Steel Material Data¹

SUMMARY

Rationalization - The change to metric steel sizes opens up a tremendous opportunity for USA industry to rationalize on fewer steel sheet, plate, wire, bar, tube and section sizes. Some companies have shown remarkably good results when rationalizing, steel plates, for example, from 19 inch sizes to 8 metric sizes. Again, the use of the preferred metric sizes shown in Table 4-1 is the key tool to use.

The preference ratings - F for first choice, S for second choice, and T for third choice - are used in the referenced standards to promote usage of fewer sizes. Little rationalization of sizes is achieved in a company if one freely selects from all first-choice sizes listed in the steel tables.

¹The World Ferrous Materials Index is given on p. 470 of this chapter.

INTRODUCTION

The American National Standards Institute issued American National Standard ANSI B32.100 Preferred Metric Sizes for Flat, Round, Square, Rectangular, and Hexagonal Metric Products. References to the following proposed and approved standards, which are in complete agreement with the applicable ISO standards, are also included.

ANSI B32.200 Preferred Metric Sizes for Round, Square, and Rectangular Tubular Metal Products Other Than Pipe, and the ANSI B32.300 Preferred Metric Sizes for Equal and Unequal Leg Angles, T- and Channel-Sections, IPN- and Wide Flange-Beams Structural Steel.

Major steel-producing countries, such as Japan, Germany, France, and Italy, have produced steel material dimensioned to metric modules for a number of years. The national standards² for steel sizes reflect the available commercial sizes in the above countries. The European countries just listed have developed coordinated EURONORM steel standards issued by the European Coal and Steel Community. Since 1955, approximately 100 EURONORM standards have been published in German, French, Italian, and Dutch. These standards are available from Beuth Verlag GmbH, Burggrafenstrasse 6 D-1000 Berlin 30, Germany. A number of these EURONORM standards have now been modified and published as new ISO or EN standards.

²For information about the term "standard" as used in this book, please see p.12.

description of tables — The steel material dimension tables list standard metric sizes produced in major countries already using the metric system. The ISO and ANSI standards are also shown.

Linear dimensions, section areas, and mass per length or area are shown in SI units.

The left column in the tables marked ISO, ANSI, or DIN indicates the preference rating in the standard from which the metric sizes are chosen. On the right side of the tables, national standards for the applicable products are listed with their specified preference rating.

The tolerances in the tables are given in millimeters, and they are either ISO, EURONORM, or national standard tolerances selected from the ISO system of limits and fits. Steel materials produced to the latter tolerances are standard in all major countries including USA (ANSI B32.100).

All conversions and calculations are processed by a computer with the data shown rounded off to the nearest number in each case. The computer exponential E-format was selected to cover a wide range of steel sizes and at the same time to present an accuracy to three significant digits for all numbers shown. The maximum error range is from 0.5 to 0.05%.

Some typical examples of the use of E-format are as follows:

Computer Listing	Decimal Value
0.427E - 01 = 0.427 x 10 ⁻¹	= 0.0427
0.628E + 00 = 0.628 x 10 ⁰	= 0.628
0.243E + 01 = 0.243x 10 ¹	= 2.43
0.962E + 03 = 0.962 x 10 ³	= 962

The standard density for steel used in ISO and national standards outside Canada and the USA is 1 m³ steel, which has a 7850 kg mass. The standard density factor for steel in the USA is 0.2833 lb/in³, and it differs from the ISO standard by approximately 0.1%. The mass per unit shown in the steel material tables is calculated using the ISO density factor. The conversion factor 2.767990E + 04 was used to compute the pound per cubic inch equivalent. One cubic meter steel has 7842 kg mass using the USA density factor and 7850 kg mass with the ISO factor.

WORLD SHEET METAL STANDARDS

Thicknesses. The following discussion is intended to assist the designer in his or her choice of metric sheet metal sizes and qualities anywhere in the world. Standard thicknesses for hot-rolled steel sheets are shown in Table 10-1A and for cold-reduced sheets in Table 10-2A.

ANSI B32.100 is a recently released standard drafted by the author, and it is recommended the first choices shown in the USA column be chosen if possible. Use the Preferred Sizes in Table 4-1 p. 75 when selecting among all the third choices shown in the material tables. Most of the above thicknesses are available worldwide.

Material. A worldwide comparison of the designations used for hot-rolled and cold-rolled steels is shown in Tables 10-42A and B. The ISO, EURONORM, and national standards for each product are also given for easy reference to further details.

Make the material selection from Table 10-42A for hot-rolled and Table 10-42B for cold-rolled steel sheets. Note the ISO standard number where the desired steel grade is specified, and use it to find the appropriate ISO tolerance for the product. When steel is specified to other national standards, specify tolerances and steel grades as shown in that standard.

Tolerances. The tolerances for sheet metal are specified in a number of ISO standards and shown in Tables 10-1B through 1H for hot-rolled and in Tables 10-2B through 2E for cold-rolled material. The specific ISO standard number where the tolerances are specified are shown with the table title in parenthesis.

Coatings. Select the desired ISO coating grade from the Tables 10-42E through 10-42K or the national standard used to specify the steel sheet product.

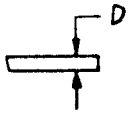
Order Example. For hot-rolled steel sheets the desired thickness is selected from Table 10-1A, ISO standard number and qualities from Table 10-42A, tolerances from Table 10-1B through 10-1H, and coating from Table 10-42E through 10-42K. A typical example of designation of steel sheet 2 mm thick X 1200 mm wide X 2440 mm long to steel grade HR235, class D (D = CS Special Killed) and tolerance ± 0.17 mm, as specified in ISO 4995, is as follows: "International Standard 4995, hot-rolled steel sheet, structural quality, grade HR235 class D, 2 x 1200 X 2440 mm, 40000 kg, for part No. 2345, roof support, mill edge, furnish report of mechanical properties, maximum lift 4000 kg."

For cold-rolled steel sheets, the desired thickness is selected from Table 10-2A, ISO standard number and material qualities from Table 10-42B, tolerances from Table 10-2B through 2E, and coating from Table 10-42E through 42K. A typical example of designation of cold-rolled steel sheet 1 mm thick X 700 mm wide and 1800 mm long to the steel grade CR220 class B (rimmed or nonrimmed) and tolerance ± 0.09 mm, as specified in the ISO standard, is as follows: "International Standard 4997, cold-rolled steel sheet, structural quality, grade CR220 class B, 1 X 700 X 1800 mm, 40 000 kg, for part No. 3456, seat frame — unexposed, furnish report of mechanical properties, maximum lift 4000 kg."

WORLD STEEL PLATE STANDARDS

Thicknesses. The standard steel plate thicknesses in most of the major steel-producing countries are shown in Table 10-3A. Although some differences exist in the various material standards, the first-choice sizes in the ANSI B32.100 standard should be available worldwide. You will note the few thicknesses considered first choice in the German DIN 1543 standard.

TABLE 10-1A HOT-ROLLED STEEL SHEET AND STRIP THICKNESSES (ANSI B32.100)



SIZE		MASS kg/m ²	USA	AUSTRAL	JAPAN	FRANCE	UK	GERMANY	ITALY
ANSI B32.100	D mm		ANSI B32.100	AS 1594	JIS G3193	NF A46-501	BS 1449	DIN 1016	UNI
F	1	7.85	F	F		F	F	F	F
T	1.1	8.63	T	S					
S	1.2	9.42	S	F	F	1.25F	F		
T	1.4	11.0	T	S	F				
T	1.5	11.8	T			F		F	
F	1.6	12.6	F	F	F		F		
T	1.7	13.7	T			F		F	
T	1.8	14.1	T	S	F				
S	2	15.7	S	F	F	F	F	F	
T	2.2	17.3	T, 2.3T	S	2.3F	2.25F			
F	2.5	19.6	F	F	F	F	F	F	
T	2.8	22.0	T	S	F, 2.6S				
S	3	23.5	S	F	2.9S	F	F	F	
T	3.2	25.1	T		F				
T	3.5	27.5	T	S		F			
T	3.8	29.8	T		3.6F				
F	4	31.4	F	F	F	F	F	F	
	4.2	33.0							
T	4.5	35.3	T	S	F	F			
	4.8	37.7				4.75F			
S	5	39.2	S	F	F	F	F	F	
T	5.5	43.2	T	S	5.6F				
F	6	47.1	F	F	F	F	F	F	
T	7	54.9	T	S	F, 6.3F	F			
S	8	62.8	S	F	F	F	F	F	
T	9	70.6	T	S	F				
F	10	78.5	F	F	F		F	F	
T	11	86.3	T		F				
S	12	94.2	S		F		F	12.5F	

NOTES:

1. Mass is calculated on the basis of density of steel of 7.85 kg/dm³.
2. The size is national standard as indicated; F = First Choice; S = Second Choice; T = Third Choice; Number = Other Size.
3. Tolerances are shown in Tables 10-1B-10-1H.