Sheet Steel Facts 10

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Sheet Steel Gauges and Thicknesses

Introduction

Within the construction industry there is often confusion over gauges, gauge numbers and the related thickness. The industry has been trying to move away from gauge numbers, without complete success. The following information will show why sheet steel products should be specified to the decimal thickness.

Manufacturers' Standard Gauge For Steel Sheets

The most common gauge system used in Canada for structural sheet steel products is the Manufacturers' Standard Gauge (MSG). The MSG for steel sheets was developed having a DEFINITE THICKNESS equivalent for each gauge number. In the standard gauge system the density of steel is taken as 489.6 lbs/ft^3, or 40.80 lbs/ft^2/in. However, since sheet weights are calculated on the basis of specified width and length, with all shearing on the over side, and also since sheets are somewhat thicker at the centre than they are at the edges, a further adjustment was made to obtain a closer approximation for inter-changeability between weight and thickness. Over a long period of time this value for sheets has been found to be close to 2.5 per cent heavier than 40.80 lb/ft^2/in. A figure of 41.820 lb/ft^2/in is the one commonly used to express the relationship between weight and thickness for steel sheet.

The Galvanized Sheet Gauge

The Galvanized Sheet Gauge is an older system used primarily by the trades consuming non-structural galvanized steel and is a measure of the zinc coated sheet thickness. It was developed in the early days of galvanizing before sophisticated wipers were available and, consequently, zinc thicknesses were thicker than today. The GSG system was used on some of the older gauge charts published years ago that unfortunately still seem to get used even today.

Thickness Definitions

There are a number of terms used for sheet steel products that need to be explained because they will affect the thickness of product that could be delivered to the job site.

Nominal Thickness: When sheet steel is produced by the steel companies it is manufactured to a target or "nominal" thickness. As with all manufacturing processes, variations in the final thickness of the sheet are unavoidable. However, the thickness is controlled very tightly to ensure that it does not fall below the minimum thickness (as described below).

Base Steel Thickness: The thickness of the sheet steel material without any coatings.

Coated Thickness: The thickness of the steel sheet including any metallic coatings (i.e. zinc or aluminum-zinc alloy) and paint coatings.

Design Thickness: The design thickness is the thickness of the base steel only, and is used by the engineer to determine the structural properties of the cold formed product. This is the thickness that a manufacturer will list in their product catalogues and load tables.

Minimum Thickness: The minimum thickness of structural sheet steel building products delivered to the job site will be the design thickness minus the maximum allowable under-tolerance specified by the CSA-S136 Standard or the material specification, whichever is the more restrictive. The minimum thickness allowed by the CSA-S136 Standard is 95% of the design thickness.

Gauge Number And Decimal Thickness

Table 1 shows the relationship between the MSG numbers, the nominal or design thickness, and the minimum thickness based on the CSA-S136 Standard.

Table 1: MSG Sheet Steel Gauge Numbers and Thickness

Gauge Number	Minimum Base Steel Thickness (95% of Design Thickness)		Design Thickness (Nominal Base Steel Thickness)	
	inches	mm	inches	mm
8	0.1562	3.967	0.1644	4.176
10	0.1278	3.245	0.1345	3.416
12	0.0994	2.524	0.1046	2.657
13	0.0852	2.164	0.0897	2.278
14	0.0710	1.802	0.0747	1.897
15	0.0639	1.624	0.0673	1.709
16	0.0568	1.443	0.0598	1.519
18	0.0454	1.153	0.0478	1.214
20	0.0341	0.866	0.0359	0.912
22	0.0284	0.721	0.0299	0.759
24	0.0227	0.577	0.0239	0.607
26	0.0170	0.432	0.0179	0.455
28	0.0142	0.359	0.0149	0.378
29	0.0128	0.326	0.0135	0.343
30	0.0114	0.290	0.0120	0.305

Minimum Thickness Allowance for Coatings

Sheet steel products are normally coated with a metallic coating (i.e. zinc or 55% aluminum-zinc alloy), and also may be painted. The thicknesses of typical hot-dipped metallic coatings are given in Table 2. These metallic coating thicknesses must be added to the base sheet thickness when determining the delivered sheet thickness. Metallic coatings are also subject to manufacturing tolerances the same as the base steel. Therefore, the actual thickness of the metallic coating may be greater than the values listed in Table 2. This factor needs to be considered when attempting to verify the base steel thickness of a coated product.

Table 2: Minimum Metallic Coating Thicknesses				
Coating Designation (Imperial)	**Coating Designation (Metric)**	**Coating Mass[1] (g/m^2)**	**Coating Thickness[3] (in)**	**Coating Thickness[3] (mm)**
A01	ZF001	No minimum[2]	No minimum[2]	No minimum[2]
A25	ZF75	75	0.0004	0.011
G01	Z001	No minimum[2]	No minimum[2]	No minimum[2]
G40	Z120	120	0.0007	0.017
G60	Z180	180	0.0010	0.025
G90	Z275	275	0.0015	0.039
AZ50	AZM150	150	0.0016	0.040
AZ55	AZM165	165	0.0017	0.044
AZ60	AZM180	180	0.0019	0.048

(1) Coating mass is based on the minimum average coating weight total both sides based on the triple spot test as specified in ASTM A653/A653M and A792/A792M.
(2) "No minimum" means that there are no established minimum requirements for this coating designation based on the triple spot test.
(3) The coating thickness is calculated from the minimum coating mass based on the following conversion factors:

Zinc (ASTM A653/A653M)	1 micron = 7.14 g/m^2
55% AL-ZN (ASTM A792/A792M)	1 micron = 3.75 g/m^2

A significant amount of sheet steel is also prefinished with a paint system on top of the metallic coating. The thickness of these paint/primer layers must also be included when measuring the thickness of the sheet. The thicknesses of typical paint coatings vary from 0.0003 to 0.001 in. (0.008 to 0.025 mm) per side. Some thick film paint systems (e.g. Barrier Series) have thicknesses of 0.004 to 0.012 in. (0.100 to 0.300 mm). Listed in Table 3 are the thicknesses of common prefinished paint systems used in Canada.

Table 3: Thicknesses of Prefinished Paint Systems		
Paint System	**Nominal Thickness[1]**	
	inches	**mm**
Perspectra Series, WeatherX	0.001	0.025
10000 Series	0.001	0.025
Elite and Metallic Series	0.002	0.051
Barrier Series – 4 mil	0.004	0.100
Barrier Series – 8 mil	0.008	0.200
Barrier Series – 12 mil	0.012	0.300
Washcoat	0.0003	0.008

(1) The paint thicknesses listed are per coated side.

Minimum Thickness for Common Prefinished Material

Table 4 shows the minimum thickness for a galvanized sheet with a common paint system.

Table 4: Minimum Thickness for Prefinished[1] Sheet				
Gauge Number	Minimum Base Steel Thickness (95% of Design Thickness)		Minimum Coated Steel Thickness[2]	
	inches	mm	inches	mm
20	0.0341	0.866	0.0369	0.938
22	0.0284	0.721	0.0312	0.793
24	0.0227	0.577	0.0255	0.649
26	0.0170	0.432	0.0198	0.504
28	0.0142	0.359	0.0170	0.431
29	0.0128	0.326	0.0156	0.398
30	0.0114	0.290	0.0142	0.362

(1) The sheet has a G90 (Z275) zinc coating (0.0015 in./0.039 mm), a Perspectra Series paint coating on the finish side (0.001 in./0.025 mm) and a wash coat on the reverse side (0.0003 in./0.008 mm).
(2) Nominal paint thicknesses were used to calculate the overall minimum coated steel thicknesses.

Additional Gauge Equivalents for Steel Studs

The steel stud industry in Canada has harmonized with the United States manufacturers and adopted gauge number equivalents that are different than shown in Table 1. These gauges are unique to the light steel framing industry and are shown in Table 5. The CSA-S136 maximum under-tolerance also applies to these gauges as does the metallic coating allowances listed in Table 2.

Table 5: Standard Thicknesses for Lightweight Steel Framing Components					
Designation Thickness	Minimum Base Steel Thickness[1]		Design Thickness		Steel Framing Gauge No. (for reference only)
(mils)[2]	(in)	(mm)	(in)	(mm)	
18	0.0179	0.455	0.0188	0.478	25
33	0.0329	0.836	0.0346	0.879	20
43	0.0428	1.087	0.0451	1.146	18
54	0.0538	1.367	0.0566	1.438	16
68	0.0677	1.720	0.0713	1.811	14
97	0.0966	2.454	0.1017	2.583	12

(1) Minimum thickness represents 95% of the design thickness, and is the minimum allowable thickness of the base steel delivered to the jobsite.
(2) A "mil" is 1/1000 of an inch (e.g. 30 mils is 0.030 inches).

Conclusion

An important thing to remember about gauge numbers is that they do not refer to only one thickness but instead represent a range of thicknesses within the allowable tolerances, or to different thicknesses for different products. Gauge numbers are not regulated and are generally used for convenience in sales literature. Decimal thickness is required for structural design and material ordering. The steel industry encourages everyone to use decimal thicknesses in specifying sheet steel products and avoid the potential problems inherent with gauges.

For More Information

For more information on sheet steel building products, or to order any CSSBI publications, contact the CSSBI at the address shown below or visit the web site at www.cssbi.ca.