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1 Sizes of Wire Gauges from Sizes.com

Source: Sizes.com's web site with additions.

The way wire is made leads to a "natural" series of sizes. A rod (made in a rolling mill) is pulled through a hole whose diameter is slightly smaller than the rod's. This process is repeated through ever-smaller holes until the wire is as fine as desired.

To reduce the number of steps for economy's sake, the manufacturer would like the change in size at each drawing to be as large as possible. On the other hand if the change in size is too great the wire will break while being drawn. Older wire gauges like the Birmingham, Washburn & Moen, and Lancashire came from calling the wire from the first drawing number 1, from the second drawing #2, and so on. Note that the higher the number, the finer the wire.

For a description of how wire is made see subsection 1.15, page 77 for an explination from Hugh P. Tiemann.

> It is impossible to draw a wire to an exact size. Ordinary practice is to draw a No. 10 B. & S. wire between 101 and 103 mils. The resulting wire may average 102 or 101.9 mils, or something different from either. A table calculated on the exact size is, therefore, as nearly right as though ordinary shop sizes were used. The weight and resistance of an actual wire will very seldom correspond with any table.
>
> Wire in Electrical Construction. Trenton, NJ:
> John A. Roebling's Sons Company, 1916, Page 75.

The web site Sizes.com *has information about many things. One of them is the sizes of wire. I copied their information and reformatted it and have it here. Their information is quite interesting and I reccomend their site as having large amount of useful data.*

On their web page there is a button to select "materials index" which is reccomended.

1.1 Wire gauges

On their Wire Gauges page the following different wire gauges are listed:

- Table Comparing Common Gauges Sizes subsection A.8, page 97
- American Steel and Wire Gauge section 1.3, page 7
- American Wire Gauge (AWG) subsubsection 1.4.2, page 9
- Birmingham, Stubs' Iron Wire Gauge subsection 1.5, page 13
- British Standard Wire Gage subsection 1.10, page 65
- Brown & Sharpe Wire Gauge (AWG) subsection 1.4, page 8
- Cocker's Wire Gauge section 1.3, page 7
- French Wire gauges subsection 1.8, page 45
  - Jauge carcasse section 1.8.5, page 53
  - Jauge de Limoges subsubsection 1.8.4, page 50

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  - Jauge de Paris subsubsection 1.8.2, page 46
  - Jauge Japy subsubsection 1.8.3, page 48
- Imperial Standard Wire Gage subsection 1.10, page 65
- Lancashire Gauge subsection 1.6, page 21
- London Gage section 1.3, page 7
- Market Wire Gauge section 1.3, page 7
- Miscelaneious Gauges subsection 1.3, page 7
  - Edison Standard Wire Gauge section 1.3, page 7
  - Morse Twist Drill Gauge section 1.3, page 7
  - Old English Wire Gage section 1.3, page 7
  - Roebling Wire Gauge section 1.3, page 7
  - Steel Wire Gauge section 1.3, page 7
  - Whitworth's Wire Gauge section 1.3, page 7
- Music Wire Gauges subsection 1.7, page 23
  - Allhof & Muller Gauge subsubsection 1.7.2, page 27
  - Am. Screw & Wire Co. Gauge subsubsection 1.7.3, page 29
  - Am. Steel & Wire Co. Gauge subsubsection 1.7.4, page 31
  - English Music Wire Gauge subsubsection 1.7.5, page 33
  - Felten & Guilleanume Gauge subsubsection 1.7.6, page 35
  - Poehlmann Music Wire Gauge subsubsection 1.7.7, page 37
  - Roebling, and Trenton Iron Co. Gauge subsubsection 1.7.8, page 39
  - W.N. Brunton Music Wire Gauge subsubsection 1.7.9, page 41
  - Wright Wire Co. Gauge subsubsection 1.7.10, page 43
- Needle Wire Gauge subsection 1.9, page 55
- United States Standard Gauge subsection A.8, page 97
- Washburn & Moen Wire Gauge section 1.3, page 7

1.2 Conversions between wire gauges

On their Wire Gauges page the following different wire gauge conversions are listed:.

- American Wire Gauge to ISO metric sizes
- ISO metric sizes to American Wire Gauge Table 33, page 76
- British Standard Wire Gauge to ISO metric sizes subsubsection 1.14.1, page 74 Table 32, page 75
- ISO metric sizes to British Standard Wire Gauge subsubsection 1.14.1, page 74

1.3 Misc Gauges

Edison Standard wire gauge A standard used in the 19th century by the Edison Electrical Light Company for wires made to carry electric current. The gauge number is the number of thousands of circular mils in the wire's cross section. Cross-sectional area is much more reasonable than diameter as a basis for sizing electric conductors.

Morse Twist Drill gauge It is a copy of the Lancashire gauge, subsection 1.6, page 21, the sizes being taken from wire and rod imported from Britain.

Old English wire gage Also known as the London gage. 19th century. Used for brass and copper wire, especially brass wire for weaving.

Roebling wire gauge Use began about 1830. Originally named for the Washburn and Moen Manufacturing Company, which was later merged into the American Steel and Wire Co.

This is the same as the Washburn and Moen Gauge, or the American Steel and Wire Gauge, except the diameters in most cases are given to the nearest mil.

This gauge is so generally used for steel wire that it is sometimes called the Steel Wire Gauge or the Market Wire Gauge.

A plot of this gauge is shown at Table 34, page 90.

> Wire in Electrical Construction.
> Trenton, NJ:
> A. Roebling's Sons Company, 1916, Page 51.

Stub's Steel Wire gauge Used for drill rod and tool steel wire. It is the basis of, though not identical to, the numbered sizes of American Standard twist drills. Note that there is also a Stub's Iron Wire Gauge.

A plot of this gauge is shown at Table 34, page 88.

Whitworth's wire gauge Also known as Cocker's Wire Gauge. The gauge number is simply the diameter of the wire in thousandths of an inch. For example, #1 has a diameter of 0.001 inch.

A plot of this gauge is shown at Table 34, page 94.

1.4 American or Brown & Sharp Wire Gauge from Sizes.com

Source: Sizes.com's web site.

The first effort toward uniformity was made by the wire manufacturers around Birmingham, England, who adopted a set of gauge numbers called the "Old English Wire-gauge," which was subsequently changed to the Birmingham Wire-gauge. This Birmingham wire-gauge formed the basis for most of the gauge numbers adopted by the American wire manufacturers with certain minor changes introduced by individual manufacturers, and up to the year 1857 this system continued with its consequent confusion and variations of size. During that year the Association of Brass Wire and Sheet Manufacturers requested the firm of Brown & Sharpe to make a number of "V" gauges numbered according to the Birmingham system, which they intended to adopt as their standard. In constructing this gauge it was at once seen by the Brown & Sharpe Company that there was a great lack of uniformity in the variations between the different sizes and numbers used in this system, and consequently Brown & Sharpe recommended to the association that they adopt a gauge the numbers of which would correspond to areas varying in geometrical progression. The advantage of such a system was at once seen by the brass manufacturers, and the gauge then proposed was adopted by them. Since that time the wisdom of the change has been proved throughout its continued use, especially for the users of electrical conductors, in which service the carrying capacity of the wire varying as the area is the most important point to be determined.

Source:

Author: Frederick A. C. Perrine.
Title: Conductors for Electrical Distribution. Their Materials and Manufacture.
Publisher: New York: D. Van Nostrand Co., 1903
Page: 76-77.

1.4.1 Wire Size Problems

With the exception of No. 0000, which is 460 mils in diameter, and No. 36 which is 5 mils, the diameters of the sizes B. & S. G. are indeterminate. The ratio of the diameter of any one size to that of the next lower size in .890 525 718 5. Using this ratio and deriving the size of each number from the next greater finally gives us 5.000 000 02 mils as the diameter of a No. 36 instead of an even 5 mils. The ratio is, therefore, slightly too large.

Title: Wire in Electrical Construction.
Publication: Trenton, NJ
Author: John A. Roebling's Sons Company, 1916
Page: 51.

Source: WWW.Sizes.com/materlsSaw Size

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1.4.2 American Wire Gauge

Also called the American Wire Gauge (AWG). Used in the United States since at least the 1880s for wires in all metals except iron and steel. There are two defined sizes: number 0000 wire is 0.4600 inch in diameter and number 36 is 0.0050 inch. The diameters of intermediate numbers are found by subdividing the interval between those sizes into 39 geometrical steps, with a constant ratio between adjacent sizes of:

To calculate the diameter of an American Wire Wire using the gauge number:

$$d = 0.005 \times 92^{\frac{36-Gauge}{39}}$$

The relationship between AWG wire sizes is: `the 39th root of the fraction 0.4600 over 0.0050 equals 1.1229322`

The diameter of each succeeding smaller size is the reciprocal, 0.890525 times the diameter of the previous, larger, size.

Reference: ASTM Standard B 258-02, Standard specification for standard nominal diameters and cross-sectional areas of AWG sizes of solid round wires used as electrical conductors.

1.4.3 Inch version of American or Brown & Sharp Wire Gauge from `Sizes.com`

Gauge (AWG)	Diameter mils	Area circular mils	Resistance in ohms, 20°C per 1000 feet	Weight 1000 feet, in lbs.
0 000	460.0	211,600	.0490	640.5
000	409.6	167,806	.0618	507.9
00	364.8	133,077	.0779	402.8
0	324.9	105,535	.0983	319.5
1	289.3	83,692.7	.1239	253.3
2	257.6	66,371.3	.1563	200.9
3	229.4	52,634.3	.1970	159.3
4	204.3	41,741.3	.2485	126.4
5	181.9	33,102.4	.3133	100.2
6	162.0	26,251.4	.3951	79.46
7	144.3	20,818.3	.4982	63.02
8	128.5	16,509.7	.6282	49.97
9	114.4	13,092.8	.7921	39.63
10	101.9	10,383.0	.9989	31.43
11	90.74	8,234.11	1.260	24.92
12	80.81	6,529.95	1.588	19.77
13	71.96	5,178.48	2.003	15.68
14	64.08	4,106.72	2.525	12.43
15	57.07	3,256.78	3.184	9.858
16	50.82	2,582.74	4.016	7.818
17	45.26	2,048.21	5.064	6.200
18	40.30	1,624.30	6.385	4.917
19	35.89	1,288.13	8.051	3.899
20	31.96	1,021.53	10.15	3.092

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Gauge (AWG)	Diameter mils	Area circular mils	Resistance in ohms, 20°C per 1000 feet	Weight 1000 feet, in lbs.
21	28.46	810.114	12.80	2.452
22	25.35	642.450	16.14	1.945
23	22.57	509.486	20.36	1.542
24	20.10	404.041	25.67	1.223
25	17.90	320.419	32.37	.9699
26	15.94	254.104	40.81	.7692
27	14.20	201.513	51.47	.6100
28	12.64	159.807	64.90	.4837
29	11.26	126.733	81.84	.3836
30	10.03	100.504	103.2	.3042
31	8.928	79.7031	130.1	.2413
32	7.950	63.2075	164.1	.1913
33	7.080	50.1258	206.9	.1517
34	6.305	39.7516	260.9	.1203
35	5.615	31.5244	329.0	.0954
36	5.000	25.0000	414.8	.0757
37	4.453	19.8259	523.1	.0600
38	3.965	15.7227	659.6	.0476
39	3.531	12.4686	834.8	.0377
40	3.145	9.88807	1049.0	.0299

Table 1: Inch version of American or Brown & Sharp Wire Gauge

A plot of this gauge is shown at Table 34, page 84.

1.4.4 Metric version of American or Brown & Sharp Wire Gauge from `Sizes.com`

Gauge (AWG)	Diameter mils	Area circular mils	Resistance in ohms, 20°C per 1000 feet	Weight 1000 feet, in lbs.
0 000	11.68	107.2	.1608	953.2
000	10.40	85.03	.2028	755.9
00	9.266	67.43	.2557	599.5
0	8.252	53.48	.3224	475.4
1	7.348	42.41	.4066	377.0
2	6.544	33.63	.5127	299.0
3	5.827	26.67	.6465	237.1
4	5.189	21.15	.8152	188.0
5	4.621	16.77	1.028	149.1
6	4.115	13.30	1.296	118.3
7	3.665	10.55	1.634	93.78
8	3.264	8.366	2.061	74.37
9	2.906	6.634	2.599	58.98
10	2.588	5.261	3.277	46.77
11	2.305	4.172	4.132	37.09
12	2.053	3.309	5.211	29.42
13	1.828	2.624	6.571	23.33
14	1.628	2.081	8.285	18.50
15	1.450	1.650	10.45	14.67
16	1.291	1.309	13.17	11.63
17	1.150	1.038	16.61	9.226
18	1.024	.8231	20.95	7.317
19	.9116	.6527	26.42	5.803
20	.8118	.5176	33.31	4.602
21	.7230	.4105	42.00	3.649
22	.6438	.3255	52.96	2.894
23	.5733	.2582	66.79	2.295
24	.5106	.2047	84.21	1.820
25	.4547	.1624	106.2	1.443
26	.4049	.1288	133.9	1.145
27	.3606	.1021	168.9	.9077
28	.3211	.08098	212.9	.7199
29	.2589	.06422	268.5	.5709
30	.2546	.05093	338.6	.4527
31	.2268	.04093	426.9	.3590
32	.2019	.03203	538.3	.2847
33	.1798	.02540	678.8	.2258
34	.1601	.02014	856.0	.1791
35	.1426	.01597	1079.4	.1420

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Gauge (AWG)	Diameter mils	Area circular mils	Resistance in ohms, 20°C per 1000 feet	Weight 1000 feet, in lbs.
36	.1270	.01267	1361.0	.1126
37	.1131	.01005	1716.2	.0893
38	.1007	.00797	2164.1	.0708
39	.0897	.00632	2728.9	.0562
40	.0799	.00501	3441.1	.0445

Table 2: Metric version of American or Brown & Sharp Wire Gauge

1.5 Birmingham Wire Gauge

Source: `Sizes.com`'s web site.

The steps are irregular. Departmental sanction by the United States government ended in 1914.

Gauge	Diameter in inches				Gauge	Diameter in inches			
	1	2	3	4		1	2	3	4
0 000		0.454			17		0.058	0.058	0.057
000		0.425			18		0.049	0.049	0.050
00		0.380		0.363	19		0.042	0.042	0.045
0		0.340		0.331	20		0.035		0.040
1		0.300	0.300	0.300	21		0.032		0.035
2		0.284	0.280	0.280	22		0.028		0.030
3		0.259	0.260	0.260	23		0.025		
4		0.238	0.240	0.240	24		0.022		
5		0.220	0.220	0.220	25		0.020		
6		0.203	0.200	0.200	26		0.018		
7		0.180	0.185	0.185	27		0.016		
8		0.165	0.170	0.170	28		0.014		
9		0.148	0.155	0.155	29		0.013		
10		0.134	0.140	0.140	30		0.012		
11		0.120	0.125	0.125	31		0.010		
12		0.109	0.110	0.110	32		0.009		
13		0.095	0.095	0.095	33		0.008		
14		0.083	0.085	0.085	34		0.007		
15		0.072	0.075	0.075	35		0.005		
16		0.065	0.065	0.065	36		0.004		

Table 4: Birmingham or Stubs' Wire Gauge

A plot of this gauge is shown at Table 34, page 86.

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1.5.1 C. Holtzapffe's gauge values

Gauge	Diameter in inches	Gauge	Diameter in inches
0 000	0.454	17	0.058
000	0.425	18	0.049
00	0.380	19	0.042
0	0.340	20	0.035
1	0.300	21	0.032
2	0.284	22	0.028
3	0.259	23	0.025
4	0.238	24	0.022
5	0.220	25	0.020
6	0.203	26	0.018
7	0.180	27	0.016
8	0.165	28	0.014
9	0.148	29	0.013
10	0.134	30	0.012
11	0.120	31	0.010
12	0.109	32	0.009
13	0.095	33	0.008
14	0.083	34	0.007
15	0.072	35	0.005
16	0.065	36	0.004

Table 5: Birmingham or Stubs' Wire Gauge from C. Holtzapffel

1.5.2 Latimer Clark's gauge values

Gauge	Diameter in inches	Gauge	Diameter in inches
1	0.300	11	0.125
2	0.280	12	0.110
3	0.260	13	0.095
4	0.240	14	0.085
5	0.220	15	0.075
6	0.200	16	0.065
7	0.185	17	0.058
8	0.170	18	0.049
9	0.155	19	0.042
10	0.140		

Table 6: Birmingham or Stubs' Wire Gauge from Latimer Clark

1.5.3 R. S. Culley's gauge values

Gauge	Diameter in inches	Gauge	Diameter in inches
00	0.363	11	0.125
0	0.331	12	0.110
1	0.300	13	0.095
2	0.280	14	0.085
3	0.260	15	0.075
4	0.240	16	0.065
5	0.220	17	0.057
6	0.200	18	0.050
7	0.185	19	0.045
8	0.170	20	0.040
9	0.155	21	0.035
10	0.140	22	0.030

Table 7: Birmingham or Stubs' Wire Gauge from R. S. Culley

The three values from Birmingham or Stubs' Wire Gauge above differ slightly. Here all three are plotted together.

Plot of Steel Wire Gauge, Waterbury Co., 1917 Gauge

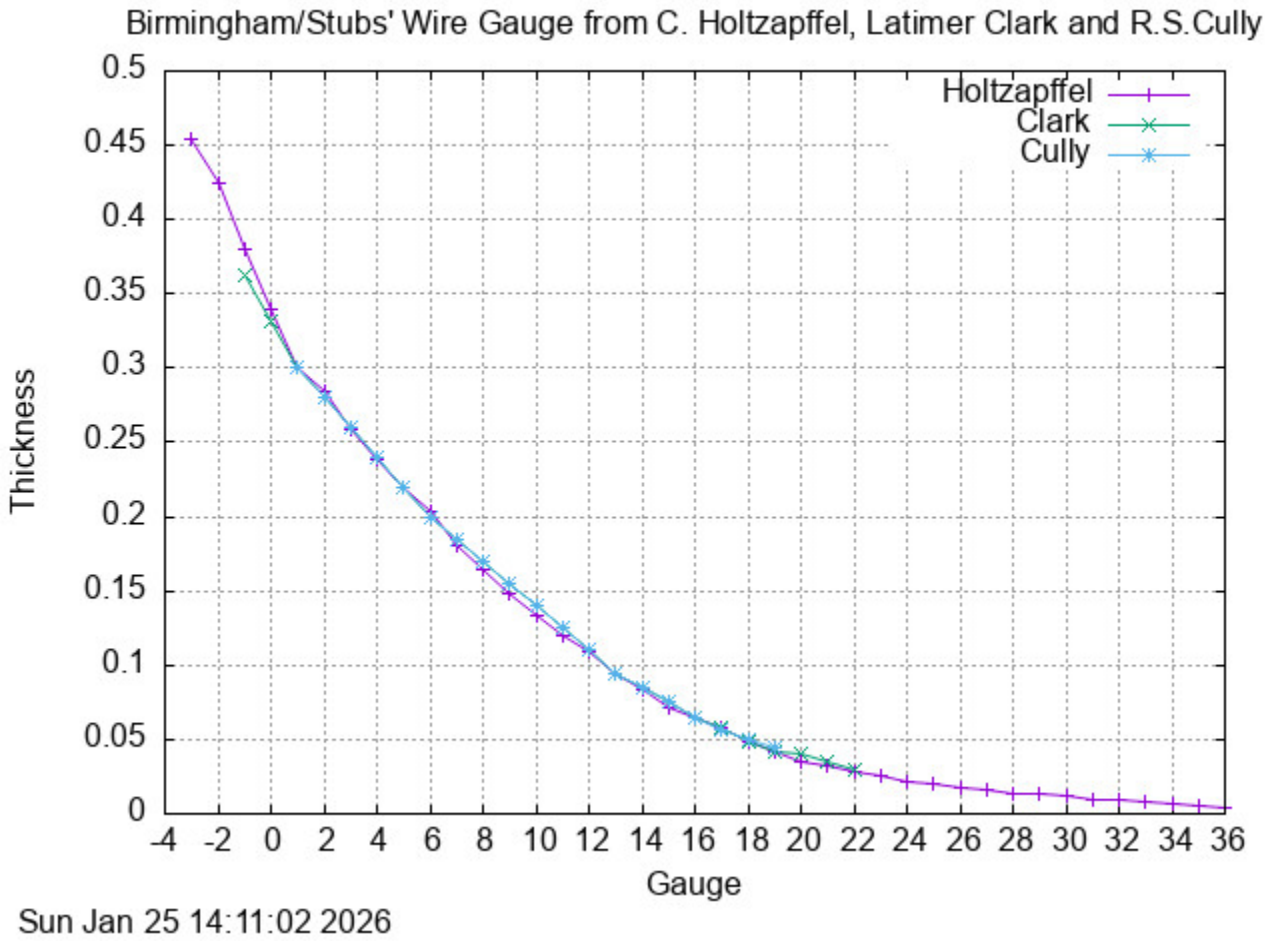

Figure 1: Birmingham or Stubs' Wire Gauge from C. Holtzapffel, Latimer Clark and R.S.Cully `BWG.inc`

1.5.4 Notes for the Birmingham Wire Gauge Table

1. This column is reserved for a yet-to-be-discovered 18th century list of BWG values.

2. C. Holtzapffel.

   On the Gauges at present used, for measuring the thickness of sheet metals and wires, and proposals for a new system of Gauges, founded on the decimal subdivision of the Standard Inch.

   > Journal of the Franklin Institute: , vol 15, August, 1847.
   > Reprinted from the: Glasgow Practical Mechanic and Engineers' Magazine:, circa 1843.
   > Holtzapffel's decimal figures are reprinted, with acknowledgement in, for example,
   > Joshua Rose: Modern Machine-Shop Practice, vol 1, 2nd ed.,
   > New York: Charles Scribner's Sons, 1892. page 384.
   > and, without acknowledgement, in, for example,
   > (U.S.) Dept. of Commerce and Labor.: Circular of the Bureau of Standards. No. 31. Copper Wire Tables.
   > Washington: Government Printing Office, 1912, Page 35, in a column headed "Birmigham Wire Gauge (Stubs')", Roebling (source 6 below) also identifies the B.W.G. with Stubs' Iron Wire Gauge, but whatever the situation in the early 1900s, at an earlier date the Birmingham Wire Gauges were not identical with Stubs'. The values given in Roebling's book (page 52) are those of Holtzapffel.

3. Latimer Clark

4. R. S. Culley.: A Handbook of Practical Telegraphy. 3rd ed. rev and enlarged.
   London: Longmans, Green, Reader and Dyer, 1868, Page 296.

   An authoritative source that went through many editions and was adopted by, for example, the Department of Telegraphs for India. But see source note 1, below.

1.5.5 Sources

1. Birmingham Wire Gauge — The diameters of the several gauges must be considered approximate only. There is no authorised standard, and the sizes of different makers vary considerably.

   > A Handbook of Practical Telegraphy. 3rd ed. rev and enlarged.
   > London: Longmans, Green, Reader and Dyer, 1868, Page 296

2. STANDARD GOVERNMENT WIRE
   1st.— The wire supplied under this tender must be of the gauge known as No. 6, Birmingham Wire Gauge (diameter .170 of an inch.)

   > Advertisement by Charles T. Chester,
   > Telegraph Wire.
   > The Telegrapher, vol 8, no, 21, Jan 13, 1871,. Page 166.

   The advertisement ran every week, identically worded, so a typographcal error is unlikely. The advertiser, Charles T. Chester, was regarded as one of the two best manufacturers of iron telegraph wire in the United States. Note that in Holtzapffel's list, No. 6 is 0.203 of an inch, not 0.170. Chester appears to be quoting a U.S. government specification.

3. In purchasing iron wire it has hitherto been the invariable custom to specify its size according to the Birmingham Gauge. This wire gauge varies with every manufacturer, and there is not only no standard from which he can correct his own, but no one is aware on what basis the gauge was originally made, so that it is impossible to reproduce it in any correct shape. Mr. Culley, in a note to table (No. 9) in his hand-book, says, "Birmingham Wire Gauge. — The diameters of the several gauges must be considered approximate only. There is no authorized standard, and the sizes of different makers vary considerably."

   Mr. Latimer Clark's paper, read before the British Association in September, 1867, so well describes the variations of different makers that it is useless to bring forth any further proof of its inconsistency and its self-evident inconvenience. It is evident that, in establishing any gauge, it should have been coherent through out; it should have been based on a regular increasing series, and should have started from some recognized and well known unit. Mr. Latimer Clark has pointed out the probability that the present Birmingham Wire Gauge originated from No. 16 Bell Wire as unit, that wire being 1/16th of an inch in diameter; but this is a mere arbitrary size to select, and although it may be understood that before telegraphs were in existence bell-hangers would start from a size most convenient to them, that size bears no relation to any telegraphic purpose, and it bears no relation whatever to the remainder of the series.

   H. Mallock and W. H. Preece.
   On a New Telegraph Wire Gauge.
   Telegrapher, vol 8, no 61, 19 October 1871. Page 481.

4. This gauge (hereinafter referred to as the B. W. G.) is represented by a series of numbered slots or cuts on the edges of a small rectangular steel plate. It is the practice to distinguish the diameters of wires and the thickness of plates of metal by the number of the slot or cut which the wire or plate may fit.

   There is no standard of such gauge or common agreement amongst those interested as to what are the dimensions in parts of an inch of the several slots or sizes of the true B. W. G. Its sizes are not geometrically or arithmetically progressive, and, consequently, bear no definite relation to each other. Its origin is obscure, and it would appear that the several slots or sizes arose from time to time as a new wire or new plate was introduced, and as the exigencies of a particular trade demanded. Considerable annoyance to engineers and pecuniary loss to contractors is stated to occur from a want of accuracy in the copies of this gauge, and the necessity of establishing a standard has lately been discussed, both in this country and in the United States.

   Board of Trade.
   12th Annual Report to Parliament on Standard Weights and Measures, for 1877-78.

5. When Britain adopted the Imperial Wire Gauge in 1884, the manufacturers of sheet metal rebelled. Though formerly they and the wire makers had used a common gauge, the new gauge suited the needs of wire makers, but not of sheet metal workers. In December the iron manufacturers met and resolved to adopt the Birmingham wire gauge as the standard gauge for sheet metal.

   There has been a great deal of discussion among the iron men, and two days ago a very influential meeting was held at the Birmingham Exchange, at which nearly every large sheet-metal works in the district was represented.

   It was there stated that the decision arrived at at the meeting in December had not been satisfactory, because manufacturers had not after long aud serious discussion been able to agree since then as to what the Birmingham wire-gauge really has been and is.

The result is a serious dilemma. The new imperial wire-gauge is only adapted for the use of wire-makers, and the old Birmingham gauge is a doubtful, some even said mythical, standard. One party declared it was really Partridge's gauge and another that it was Stubbs's gauge, and the result has been confusion, the meeting unanimously resolved:

That this meeting adopts the gauge known as the Birmingham gauge, aud further resolves that such Birmingham gauge shall be the proposed standard gauge for sheetiron and hoop-iron already printed and issued by the South Staffordshire Ironmasters' Association to the manufactured-iron trade, and by them approved, and also deposited with the Board of Trade, and that such gauge shall in future be used under the initial letters "B. G." This new gauge, to be known hereafter as "B. G.," is described as being a symmetrical adjustment of the Birmingham wire-gauge known as "B. w. g.," formulated by Mr. Hatton at the request of the Iron Masters' Association.

Wilson King,
Second Wire Gauge Report.
United States Consular Reports, No. 39 — March 1884.
Washington: Department of State., Page 316.

6. There are several other gauges in use, such as Wynn's, Cocker's, Ryland's, Watkins', Robinson's, and Brown and Sharpe's American gauge, while a great number are also employed under the name of "the old Birmingham wire gauge," and other titles.

   Get the following refrenced table A table attached to Mr. L. Clark's paper gives the diameter of each number of Birmingham wire gauge in decimals of an inch, according to thirteen published lists by different authorities, all of which differ.

   There can be little doubt that reform in this matter is very greatly required. For a long time it has been the custom in specifying the size of the wires for submarine cables to state, besides the number of the Birmingham wire gauge, the decimals of an inch that shall be understood by that number. This has been found necessary on account of the vagueness of the meaning of the words "Birmingham wire gauge," owing to the number of different interpretations of these words which have grown up through different manufacturers of gauges making them on some arbitrary principle of their own; the principle on which the original B.W.G. was constructed, if it ever had any, having been lost in obscurity possibly by bad workmanship in some of the early gauges.

   Review of Report of the Committee of the Society of Telegraph Engineers on the Birmingham Wire Gauge
   Engineering, vol 29, Feb 20 1890. Page 141.

7. This is abbreviated B. W. G. It is the same as Stubs' Iron Wire Gauge, but entirely different from Stubs' Steel Wire Gauge. Galvanized Telegraph and Telephone Wire, both bare and insulated, and Galvanized Armor Wire are usually designated by this gauge. Its use is not very extensive and is becoming less.

   Wire in Electrical Construction.
   Trenton, NJ: John A. Roebling's Sons Company,1916, Page 51.

1.5.6 For further reading

- Thomas Hughes
  The English Wire Gauge, with Descriptive Tables and Drawings
  London: Spon & Co., October, 1879

- Committee:
  Report to the Council of the Society of Telegraph Engineers on the Birmingham Wire Gauge.
  Journal of the Society of Telegraph Engineers, vol 8, pages 476-504, 1879

  A full discussion of the situation. In at least some copies, bound at the end of the volume is a second copy of the report, followed by "On the Unit of the Birmingham Wire Gauge", by C.V. Walker, a discussion of that paper, and finally Latimer Clark's, 1867 paper, "On the Birmingham Wire Gauge".

1.6 Lancashire Gauge

Source: The Whitworth Measuring Machine" page 80, 1877

Gauge	Size	Gauge	Size
X	.400	49	.070
V	.375	51	.065
S	.350	52	.060
P	.325	54	.055
N	.300	55	.050
K	.280	56	.045
G	.260	59	.940
C	.240	61	.038
2	.220	62	.036
5	.200	64	.034
13	.180	66	.032
19	.165	68	.030
23	.150	70	.028
29	.135	71	.026
31	.120	72	.024
34	.110	74	.022
38	.100	75	.019
41	.095	76	.018
42	.090	77	.016
43	.085	78	.015
45	.080	79	.014
47	.075	80	.013

Table 8: Lancashire Gauge

[0]LG.inc 2 February 2026 15:04

1.6.1 Plot of Lancashire Gauge

The Lancashire Gauge is a very strange gauge in that many of its "Gauge" numbers are letters and there are large "skips" between the numeric values. To plot the data out I had to use negative values starting at the lowest numeric value and decrementiing from `-1` to `-8`. I normally plot out the gauge values of a gauge to determine if I had made an "obvious" error in entering the data from an old document. In this gauge the plot does not "look" smooth in any imaginable way. I use gnuplot to do the actual plotting and it does not understand letters as numeric values for use on the X Axis, now does it understand 00 and othe "aught" values. To help gnuplot try and make a resonable plot I use negative numbers for any gauge less than `0` or that is a letter.

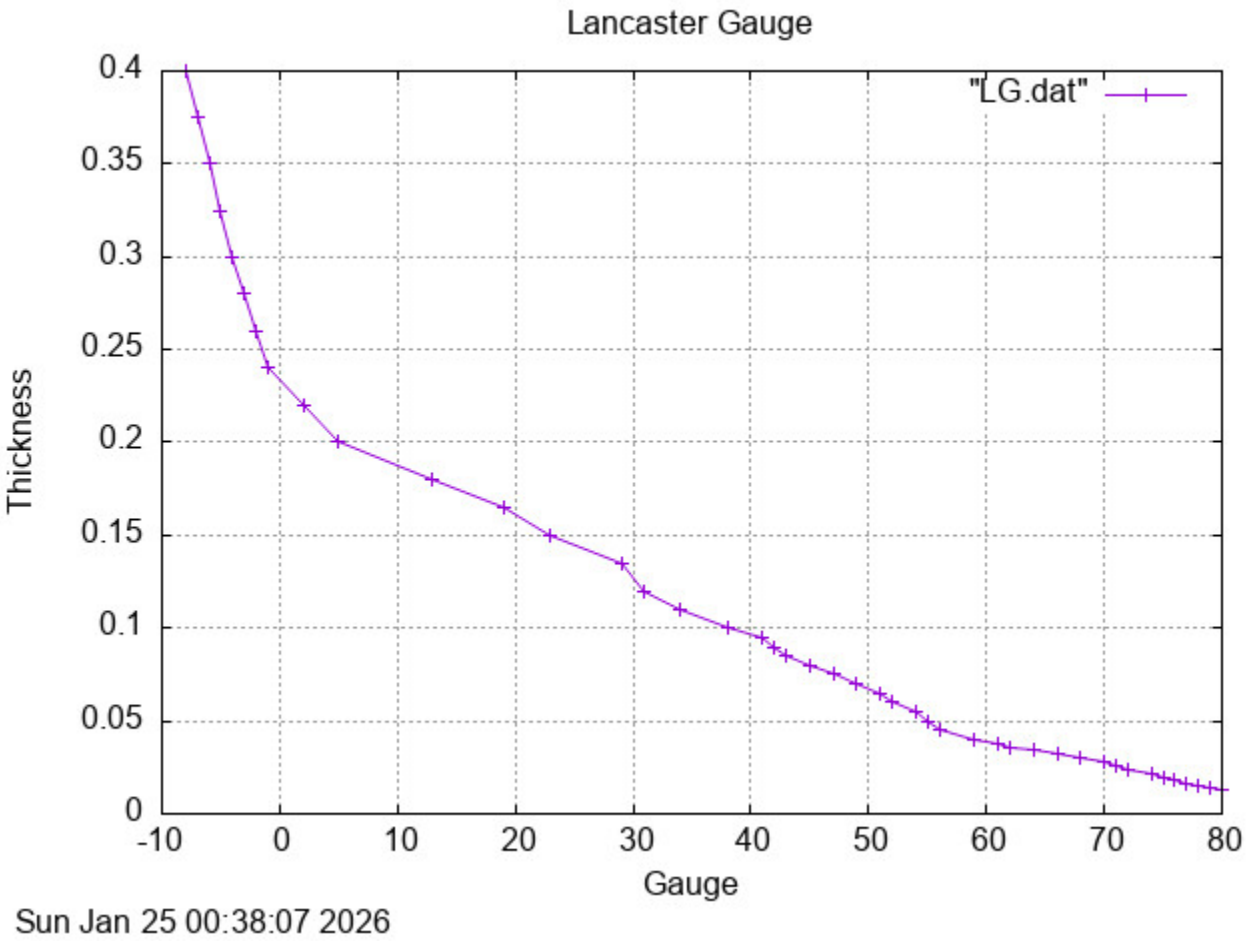

Figure 2: Lancashire Gauge `LG.inc`

1.7 Music Wire Gauges

Source: Machinery's Handbook, 6^{th} edition, 1924, Page 429.

Gage	Am. Steel & Wire Co.	Am. Screw & Wire Co.	Roebling, and Trenton Iron Co	Wright Wire Co.	Poehl-mann Music Wire	Felten & Guil-leanume	Allhof & Muller	W.N. Brun-ton Music Wire	English Music Wire
6/0	0.004	0.0095							
5/0	0.005	0.010							
4/0	0.006	0.011	0.007		0.006	0.0068			
3/0	0.007	0.012	0.0075		0.007	0.0075			
2/0	0.008	0.0133	0.0085	0.0085	0.008	0.0087	0.008	0.0085	
0	0.009	0.0144	0.009	0.009	0.009	0.0093	0.009	0.009	
1	0.010	0.0156	0.010	0.010	0.010	0.0098	0.010	0.010	
2	0.011	0.0166	0.011	0.011	0.011	0.0106	0.011	0.011	0.0105
3	0.012	0.0178	0.012	0.012	0.012	0.0114	0.012	0.012	0.0115
4	0.013	0.0188	0.013	0.013	0.013	0.0122	0.013	0.013	0.0125
5	0.014	0.0202	0.014	0.014	0.014	0.0138	0.014	0.014	0.0145
6	0.016	0.0215	0.016	0.016	0.016	0.0157	0.016	0.016	0.015
7	0.018	0.023	0.018	0.018	0.018	0.0177	0.018	0.017	0.0175
8	0.020	0.0243	0.020	0.020	0.020	0.0197	0.020	0.019	0.019
9	0.022	0.0256	0.022	0.022	0.022	0.0216	0.022	0.022	0.022
10	0.024	0.027	0.024	0.024	0.024	0.0236	0.024	0.024	0.0245
11	0.026	0.0284	0.026	0.026	0.026	0.0260	0.026	0.027	0.027
12	0.029	0.0296	0.028	0.028	0.029	0.0283	0.028	0.029	0.0285
13	0.031	0.0314	0.030	0.0305	0.031	0.0303	0.030	0.031	0.0305
14	0.033	0.0326	0.032	0.0325	0.033	0.0325	0.032	0.032	0.032
15	0.035	0.0345	0.034	0.034	0.035	0.0342	0.034	0.034	0.035
16	0.037	0.036	0.036	0.036	0.037	0.0362	0.036	0.036	0.036
17	0.039	0.0377	0.038	0.038	0.039	0.0382	0.038	0.038	0.039
18	0.041	0.0395	0.040	0.0405	0.041	0.0400	0.040	0.040	0.040
19	0.043	0.0414	0.042	0.042	0.043	0.0420	0.042	0.042	0.042
20	0.045	0.0433	0.044	0.044	0.045	0.0440	0.044	0.044	0.043
21	0.047	0.046	0.046	0.046	0.047	0.0460	0.046	0.046	0.0445
22	0.049	0.0483	0.048	0.0485	0.049	0.0480	0.048	0.048	0.047
23	0.051	0.051	0.051	0.0505	0.051	0.0510	0.051	0.050	0.049
24	0.055	0.055	0.055	0.0545	0.055	0.0550	0.055	0.054	0.053

Continued on the next page.

[0]MWG.inc 2 February 2026 15:04

Continued from the previous page.

Gage	Am. Steel & Wire Co.	Am. Screw & Wire Co.	Roebling, and Trenton Iron Co	Wright Wire Co.	Poehl-mann Music Wire	Felten & Guil-leanume	Allhof & Muller	W.N. Brun-ton Music Wire	English Music Wire
25	0.059	0.0586	0.059	0.0585	0.059	0.0590	0.059	0.058	0.056
26	0.063	0.0626	0.063	0.063	0.063	0.0630	0.063	0.062	0.0605
27	0.067	0.0675	0.067	0.067	0.067	0.0670	0.067	0.066	0.064
28	0.071	0.072	0.071	0.071	0.071	0.0710	0.071	0.069	0.0685
29	0.075	0.076	0.074	0.0745	0.075	0.0740	0.074	0.072	0.0715
30	0.080	0.080	0.078	0.078	0.080	0.0780	0.078	0.076	0.075
31	0.085	0.085	0.082	0.082		0.0820	0.082	0.080	
32	0.090	0.092	0.086	0.086		0.0860	0.086	0.086	
33	0.095		0.090	0.090			0.090	0.092	
34	0.100		0.095	0.096			0.094	0.098	
35	0.106		0.100				0.098	0.104	
36	0.112		0.105				0.102	0.110	
37	0.118		0.110					0.117	
38	0.124		0.115					0.121	
39	0.130		0.120					0.130	
40	0.138		0.125					0.140	
41	0.146		0.130						
42	0.154								
43	0.162								
44	0.170								
45	0.180								

Table 9: Music Wire Gauge

1.7.1 Properties of Steel Wire

Source: Machinery's Handbook, 1924, Page 424, 426.

Wire Gages A great number of different wire gages know by numbers have been in use. In order to avoid confusion, it would be well if, in general, gage numbers could be avoided and the size of the wire required given in decimals of an inch. However, when this cannot be done, care should be taken to adhere to the gage numbers which have become practiically standard for certian classes of wire. Upon the recommendation of the Bureau of Standards at Washington, a number of principal wire manufacturers and consumers have agreed that it would well to designate the American Steel & Wire Co.'s gage which is the same as the Washburn & Moen gage, as the "Steel Wire Gage". In cases where it becomes necessary to distinguish this from the British Imerial standard wire gage, it may be called the "U.S. Steel Wire Gage". This gage applies to all steel wire.

For copper wires and wires of other metals, the gage universally recognized in the United States is the "American Wire gage", which is also known as the Brown & Sharpe gage. No confusion should arise betweemn the steel wire gage and the American wire gage, because the fields covered by the two gageds are distinct and different.

The piano wire gage, designatged as the "American Steel & Wire Co.'s Music Wire Gage" is adopted as standard for piano wire upon the recommendation of the United States Bureau of Standards.

The trend of practice in the gaging of materials is increasing toward the direct spedification of dimensins inm decimal fractions of an inch without the use of gage numbers. The United States Navty Department in 1911 ordered that all diameters and thicknesses of material be specified directly in decimal fractions, omitting all refernce to gage numbers, and the War Deparment issued a similar order for wires. This is similar to the prectice in Europe shere sizes of wire are speified directly by the diameter in millimeters.

The tariff act of 1913 provides for the use of decimal dimentions in measuring wires and rods, but the measurement of steel strips is by gage. As the particular gage was not designated in tariff act, the Teasury Department in 1914 authorized the use of the American (B&S) wire gage. Prior to this the Birmingham wire gage had been employed. The Treasury Department also directed that the measurement of sheets and plates be in decimal parts of an inch instead ofuse the standard gage.

Strength of Piano and Plow-steel Wire The strength of wire is increaed considerably be drawing. So-called piano wire has an ultimate tensile strength of from 300,000 to 340,000 pounds per square inch. The composition of this wire is a follows: Carbon, 0.57 per cent; silicon, 0.09 per cent; sulpher, 0.011 per cent; phosphours, 0.018 per cent; maganese, 0.425 per cent. This wire is made in sizes raning from 0.029 to 0.052 inch (music wire gage No. 12 to 22 inclusive). So-called "plow-steel" wire has an ultimate tensile strength of 345,000 pounds per inch for wire 0.093 inch in diameter, and 200,000 pounds for wire 0.191 inc in diameter. The elongation is only about 1 per cent. The composition is about as follows: Carbon, 0.83 per cent; Manganese, 0.59 per cent; silicon, 0.14 per cent; sulphur, 0.01 per cent; phosphorus, nil; copper, 0.03 per cent.

Wire Drawing Iron and steel wire from No. 3 to No. 18 Brown & Sharpe wire gage (from 0.229 to 0.040 inch indiameter) is drawn from wire about 1/4 inch in diameter through holes in draw plages mad of a high-grade tungsten steel. The wire is reduced at each drawing or pass by one number or step in the Brown & Sharp wire gage scale, and at each drawing operation, the wire passes throug but one hole in the die. In the wire gage scale compiled in Messrs.

indexitBrown and Sharpe, the diameters of the wires of successive numbers incrase according to geometrical ratio. The Diameter of each succeeding number can be found by multiplying the diameter of the preceding number by 1.123, this being the ratio of the geometrical progression. The basic size is No. 36 wire, which is 0.005 inch in diameter.

Fine sizes of iron, steel or alloy-steel wire (between 0.040 and 0.002 inch in diameter are drawn through diamond dies, which consist of a body made from brass in which the damond is inserted. The diamond is of he variety known as bort. In the case of these small sizes, the wire is passed through a succession of dies (up to ten or twelve) in a single drawing operation. The size of diamond for wire 0.040 inch in idameter is about 3 ro 3 1/2 carats, while one-half-catat stones will suffice for dies for drawing wire 0.010 inch in diameter. The life of the diamond die used for drawing steel wire averages only about three days, while for the copper wire it may last for six months or a year. The speed at which the wire is drawn appears to have little efect on the life of the die, but the life depends solely on the length of wire passed through it. About 200 pounds of steel wire an be drawn through a No 32 B&S diamond die, before it size is too enlarged for further use. Fifteen pounds of wire only can be drawn through holes from 0.003 to 0.005 inch in diameter. Less than one pound can be drawn through holes smaller than 0.002 inch. When the diamond dies are worn too much, they are re-drilkled for a larger gage number. In drilling the diamonds, the average time for enlarging a hole 0.001 inch in diameter is about 1 1/2 hour. For hard music wire, diamonds of comparatively large size are required; thus for holes as small as 0.005 inch in diameter4, 2 to 2 1/2 carat diamonds are used.

Copper wire is drawn through dies of chiled cast iron; the reduction for each pass is equal to one number or step on the B&S, wire gage scale, but the wire passes through a number of successive dies at one operation,

as many as ten dies often being mounted in the same wire-drawing machine.

1.7.2 Allhof & Muller

Source: Machinery's Handbook, 6^{th} edition, 1924, Page 429.

Gage	Size	Gage	Size
00	0.008	18	0.040
0	0.009	19	0.042
1	0.010	20	0.044
2	0.011	21	0.046
3	0.012	22	0.048
4	0.013	23	0.051
5	0.014	24	0.055
6	0.016	25	0.059
7	0.018	26	0.063
8	0.020	27	0.067
9	0.022	28	0.071
10	0.024	29	0.074
11	0.026	30	0.078
12	0.028	31	0.082
13	0.030	32	0.086
14	0.032	33	0.090
15	0.034	34	0.094
16	0.036	35	0.098
17	0.038	36	0.102

Table 10: Allhof & Muller

[0]AM.inc 2 February 2026 15:04

Plot of Allhof & Muller

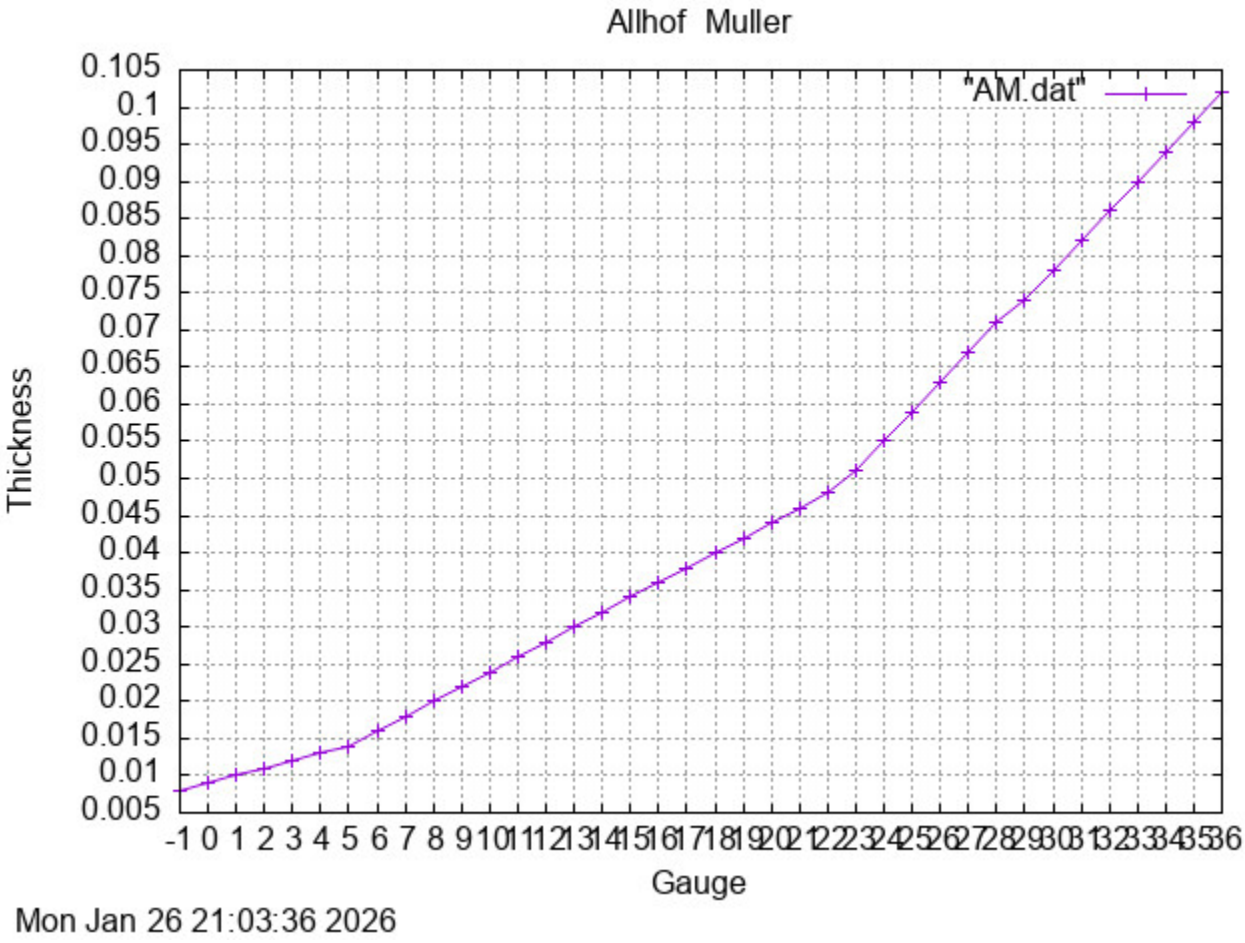

Figure 3: Allhof & Muller `AM.inc`

1.7.3 Am. Screw & Wire Co.

Source: Machinery's Handbook, 6^{th} edition, 1924, Page 429.

Gage	Size	Gage	Size
000 000	0.0095	14	0.0326
00 000	0.010	15	0.0345
0 000	0.011	16	0.036
000	0.012	17	0.0377
00	0.0133	18	0.0395
0	0.0144	19	0.0414
1	0.0156	20	0.0433
2	0.0166	21	0.046
3	0.0178	22	0.0483
4	0.0188	23	0.051
5	0.0202	24	0.055
6	0.0215	25	0.0586
7	0.023	26	0.0626
8	0.0243	27	0.0675
9	0.0256	28	0.072
10	0.027	29	0.076
11	0.0284	30	0.080
12	0.0296	31	0.085
13	0.0314	32	0.092

Table 11: Am. Screw & Wire Co.

[0]AScWC.inc 2 February 2026 15:04

Plot of Am. Screw & Wire Co.

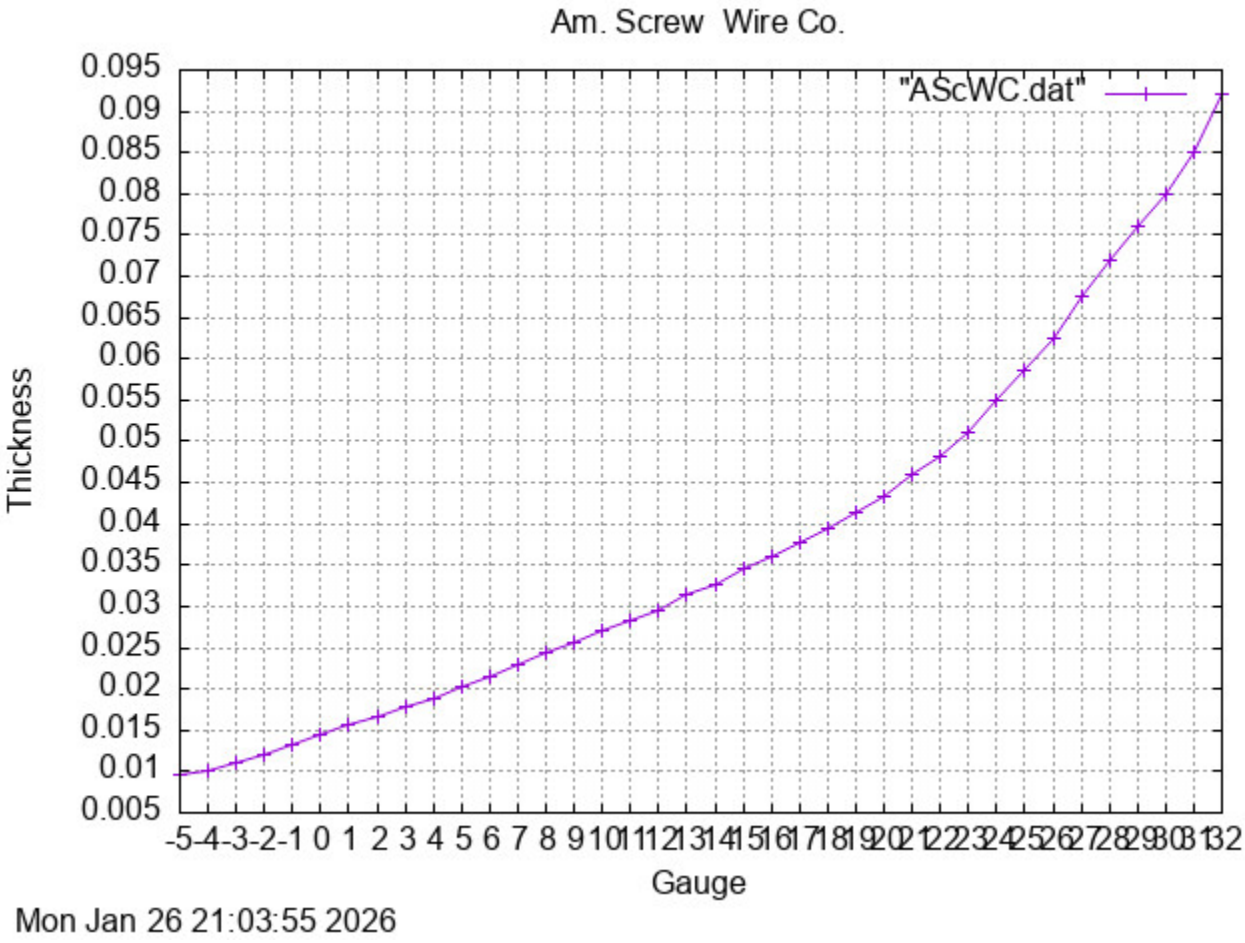

Figure 4: Am. Screw & Wire Co. `AScWC.inc`

1.7.4 Am. Steel & Wire Co.

Source: Machinery's Handbook, 6^{th} edition, 1924, Page 429.

Gage	Size	Gage	Size
000 000	0.004	21	0.047
00 000	0.005	22	0.049
0 000	0.006	23	0.051
000	0.007	24	0.055
00	0.008	25	0.059
0	0.009	26	0.063
1	0.010	27	0.067
2	0.011	28	0.071
3	0.012	29	0.075
4	0.013	30	0.080
5	0.014	31	0.085
6	0.016	32	0.090
7	0.018	33	0.095
8	0.020	34	0.100
9	0.022	35	0.106
10	0.024	36	0.112
11	0.026	37	0.118
12	0.029	38	0.124
13	0.031	39	0.130
14	0.033	40	0.138
15	0.035	41	0.146
16	0.037	42	0.154
17	0.039	43	0.162
18	0.041	44	0.170
19	0.043	45	0.180
20	0.045		

Table 12: Am. Steel & Wire Co.

[0]AStWC.inc 2 February 2026 15:04

Plot of Am. Steel & Wire Co.

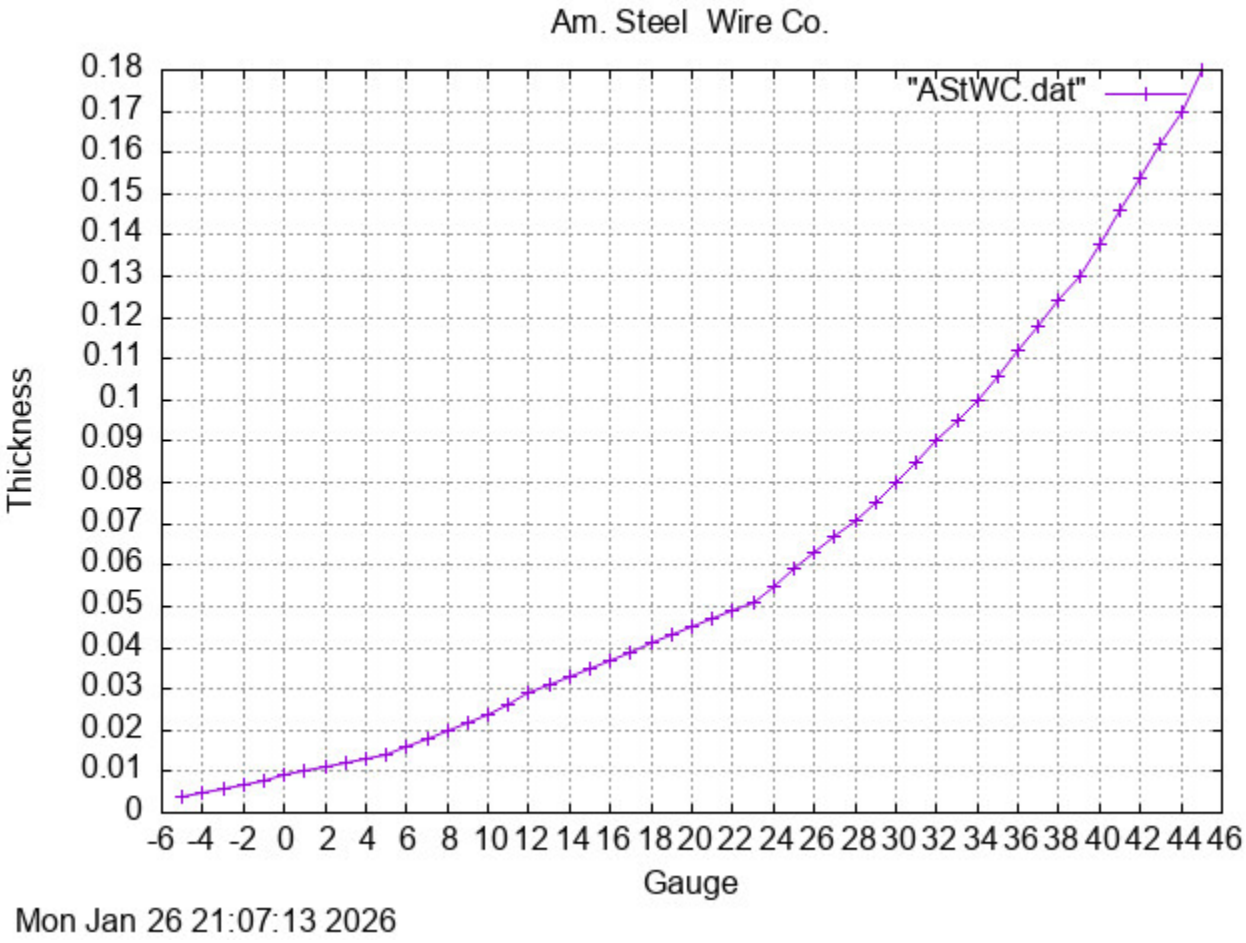

Figure 5: Am. Steel & Wire Co. `AStWC.inc`

1.7.5 English Music Wire

Source: Machinery's Handbook, 6^{th} edition, 1924, Page 429.

Gage	Size	Gage	Size
2	0.0105	17	0.039
3	0.0115	18	0.040
4	0.0125	19	0.042
5	0.0145	20	0.043
6	0.015	21	0.0445
7	0.0175	22	0.047
8	0.019	23	0.049
9	0.022	24	0.053
10	0.0245	25	0.056
11	0.027	26	0.0605
12	0.0285	27	0.064
13	0.0305	28	0.0685
14	0.032	29	0.0715
15	0.035	30	0.075
16	0.036		

Table 13: English Music Wire

[0]EMW.inc 2 February 2026 15:04

Plot of English Music Wire

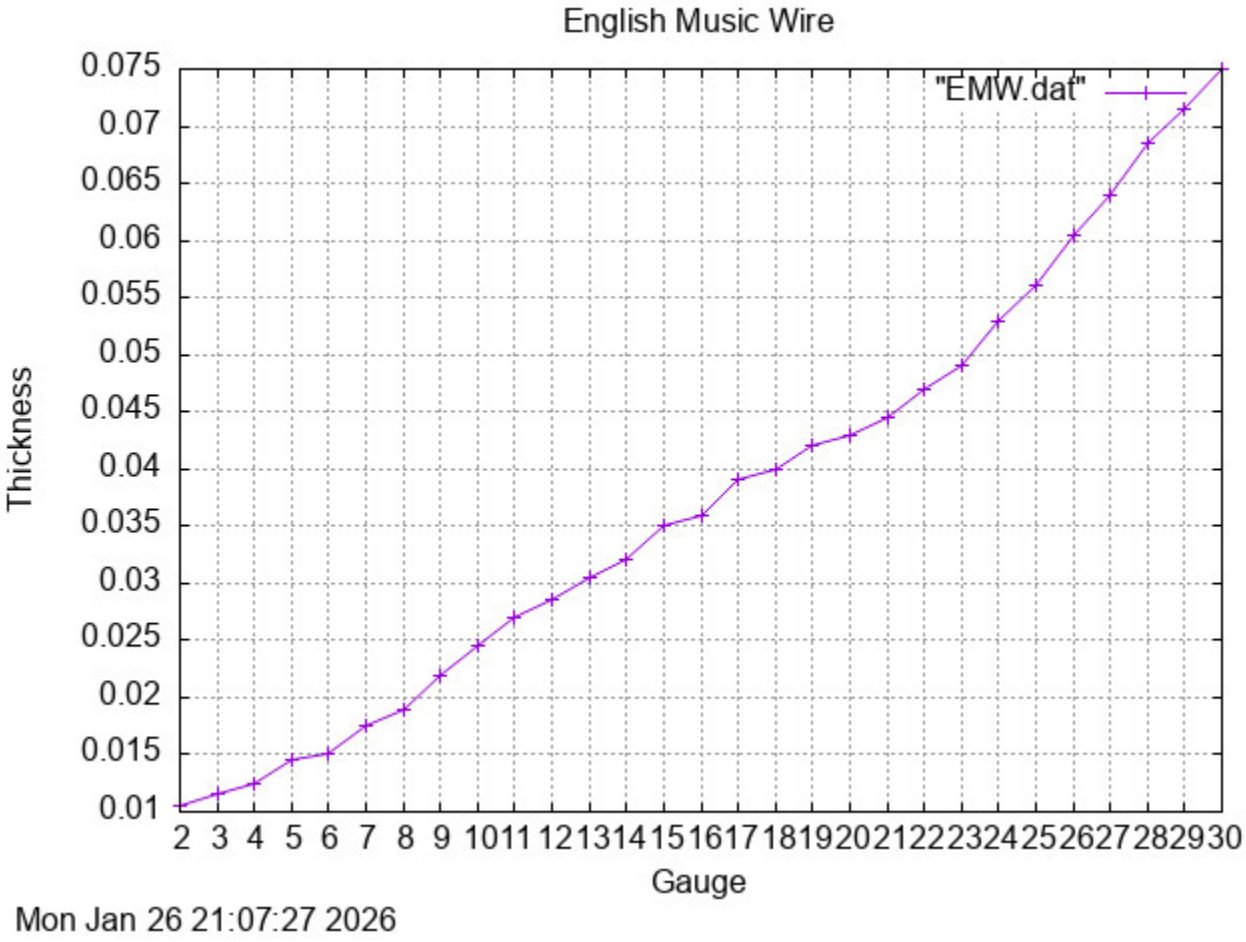

Figure 6: English Music Wire `EMW.inc`

1.7.6 Felten & Guilleanume

Source: Machinery's Handbook, 6^{th} edition, 1924, Page 429.

Gage	Size	Gage	Size
0 000	0.0068	15	0.0342
000	0.0075	16	0.0362
00	0.0087	17	0.0382
0	0.0093	18	0.0400
1	0.0098	19	0.0420
2	0.0106	20	0.0440
3	0.0114	21	0.0460
4	0.0122	22	0.0480
5	0.0138	23	0.0510
6	0.0157	24	0.0550
7	0.0177	25	0.0590
8	0.0197	26	0.0630
9	0.0216	27	0.0670
10	0.0236	28	0.0710
11	0.0260	29	0.0740
12	0.0283	30	0.0780
13	0.0303	31	0.0820
14	0.0325	32	0.0860

Table 14: Felten & Guilleanume

[0]FG.inc 2 February 2026 15:04

Plot of Felten & Guilleanume

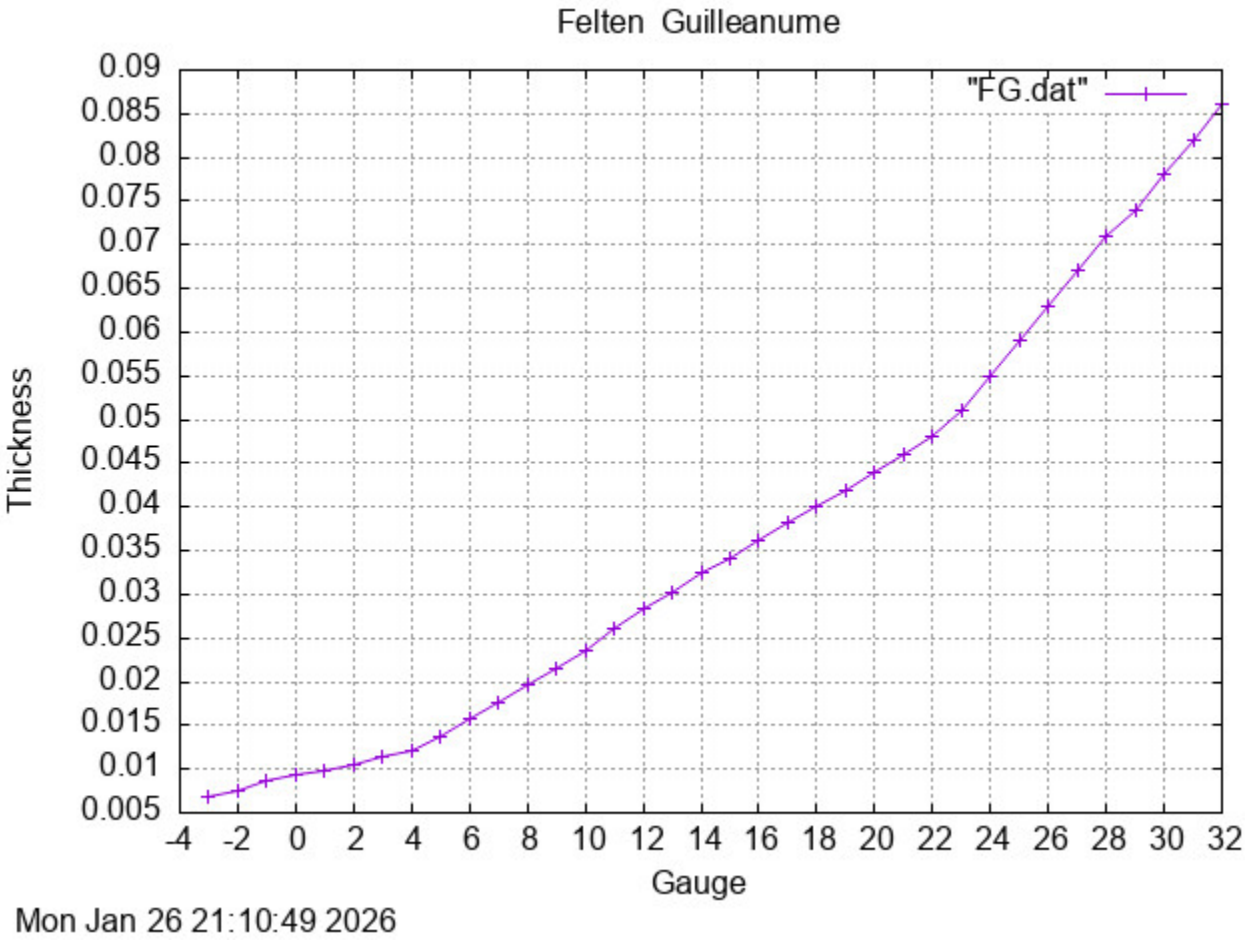

Figure 7: Felten & Guilleanume `FG.inc`

1.7.7 Poehlmann Music Wire

Source: Machinery's Handbook, 6^{th} edition, 1924, Page 429.

Gage	Size	Gage	Size
0 000	0.006	14	0.033
000	0.007	15	0.035
00	0.008	16	0.037
0	0.009	17	0.039
1	0.010	18	0.041
2	0.011	19	0.043
3	0.012	20	0.045
4	0.013	21	0.047
5	0.014	22	0.049
6	0.016	23	0.051
7	0.018	24	0.055
8	0.020	25	0.059
9	0.022	26	0.063
10	0.024	27	0.067
11	0.026	28	0.071
12	0.029	29	0.075
13	0.031	30	0.080

Table 15: Poehlmann Music Wire

[0]PMW.inc 2 February 2026 15:04

Plot of Poehlmann Music Wire

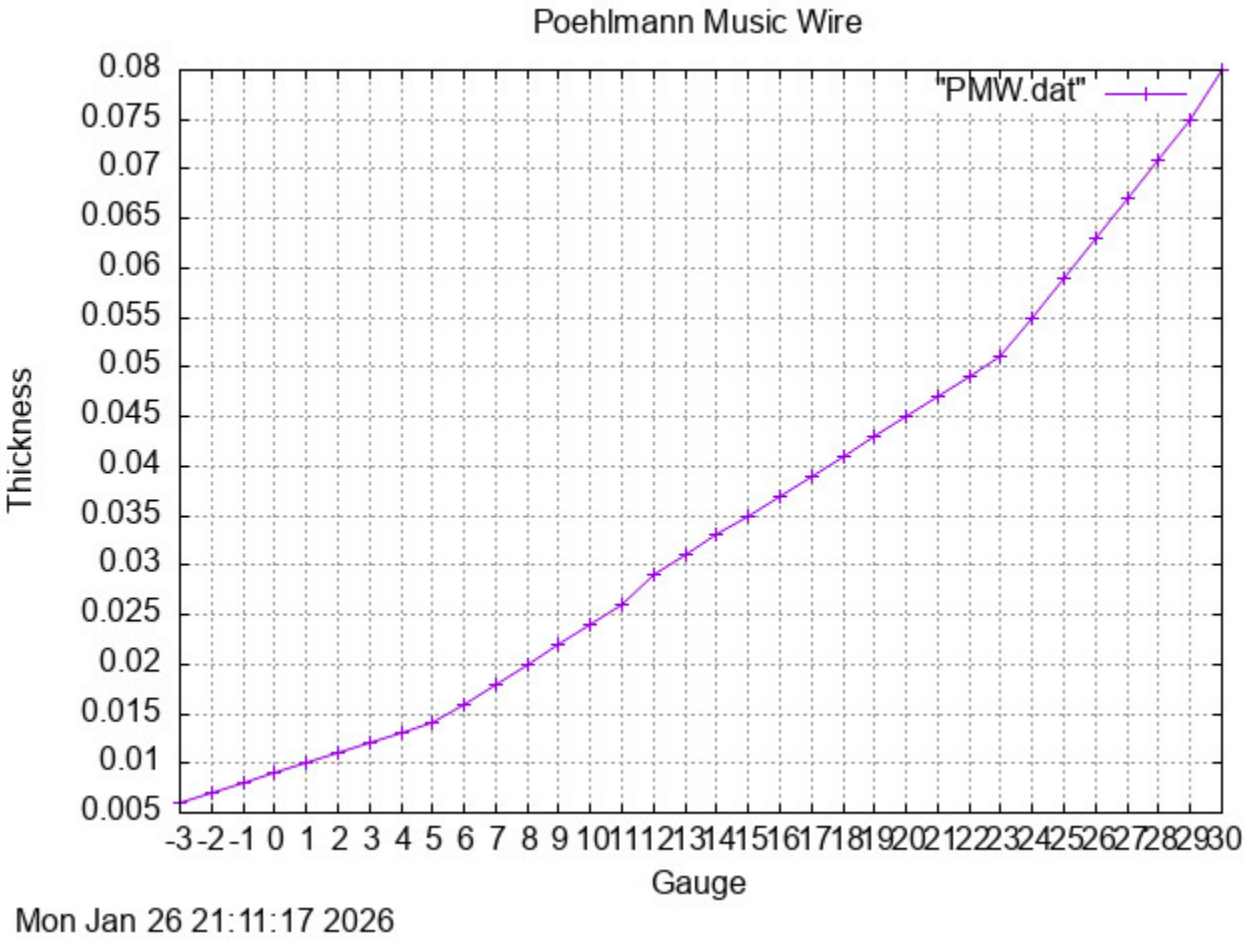

Figure 8: Poehlmann Music Wire `PMW.inc`

1.7.8 Roebling, and Trenton Iron Co.

Source: Machinery's Handbook, 6^{th} edition, 1924, Page 429.

Gage	Size	Gage	Size
0 000	0.007	20	0.044
000	0.0075	21	0.046
00	0.0085	22	0.048
0	0.009	23	0.051
1	0.010	24	0.055
2	0.011	25	0.059
3	0.012	26	0.063
4	0.013	27	0.067
5	0.014	28	0.071
6	0.016	29	0.074
7	0.018	30	0.078
8	0.020	31	0.082
9	0.022	32	0.086
10	0.024	33	0.090
11	0.026	34	0.095
12	0.028	35	0.100
13	0.030	36	0.105
14	0.032	37	0.110
15	0.034	38	0.115
16	0.036	39	0.120
17	0.038	40	0.125
18	0.040	41	0.130
19	0.042		

Table 16: Roebling, and Trenton Iron Co.

[0]RTIC.inc 2 February 2026 15:04

Plot of Roebling, and Trenton Iron Co.

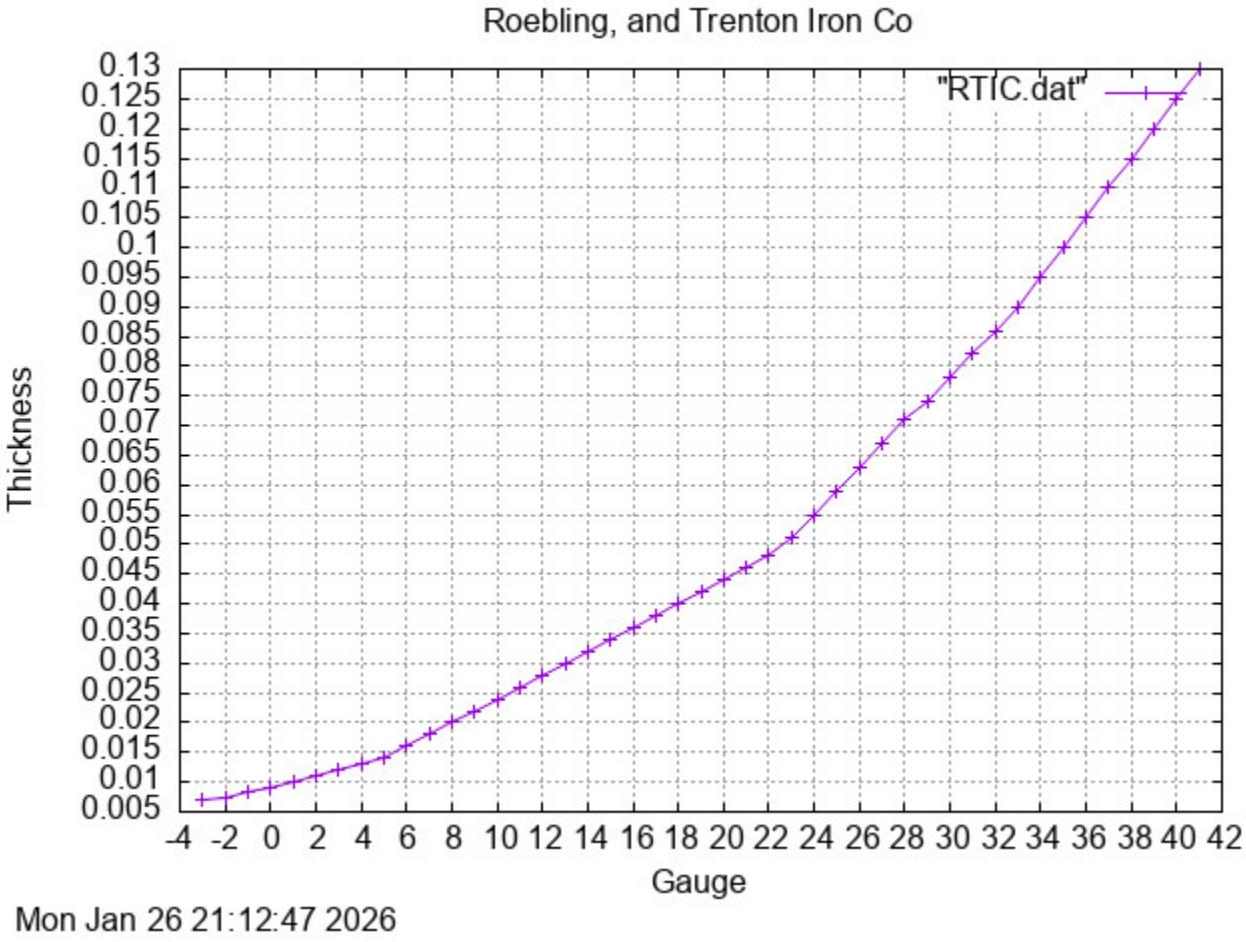

Figure 9: Roebling, and Trenton Iron Co. `RTIC.inc`

1.7.9 W.N. Brunton Music Wire

Source: Machinery's Handbook, 6^{th} edition, 1924, Page 429.

Gage	Size	Gage	Size
00	0.0085	20	0.044
0	0.009	21	0.046
1	0.010	22	0.048
2	0.011	23	0.050
3	0.012	24	0.054
4	0.013	25	0.058
5	0.014	26	0.062
6	0.016	27	0.066
7	0.017	28	0.069
8	0.019	29	0.072
9	0.022	30	0.076
10	0.024	31	0.080
11	0.027	32	0.086
12	0.029	33	0.092
13	0.031	34	0.098
14	0.032	35	0.104
15	0.034	36	0.110
16	0.036	37	0.117
17	0.038	38	0.121
18	0.040	39	0.130
19	0.042	40	0.140

Table 17: W.N. Brunton Music Wire

[0]WNBMW.inc 2 February 2026 15:04

Plot of W.N. Brunton Music Wire

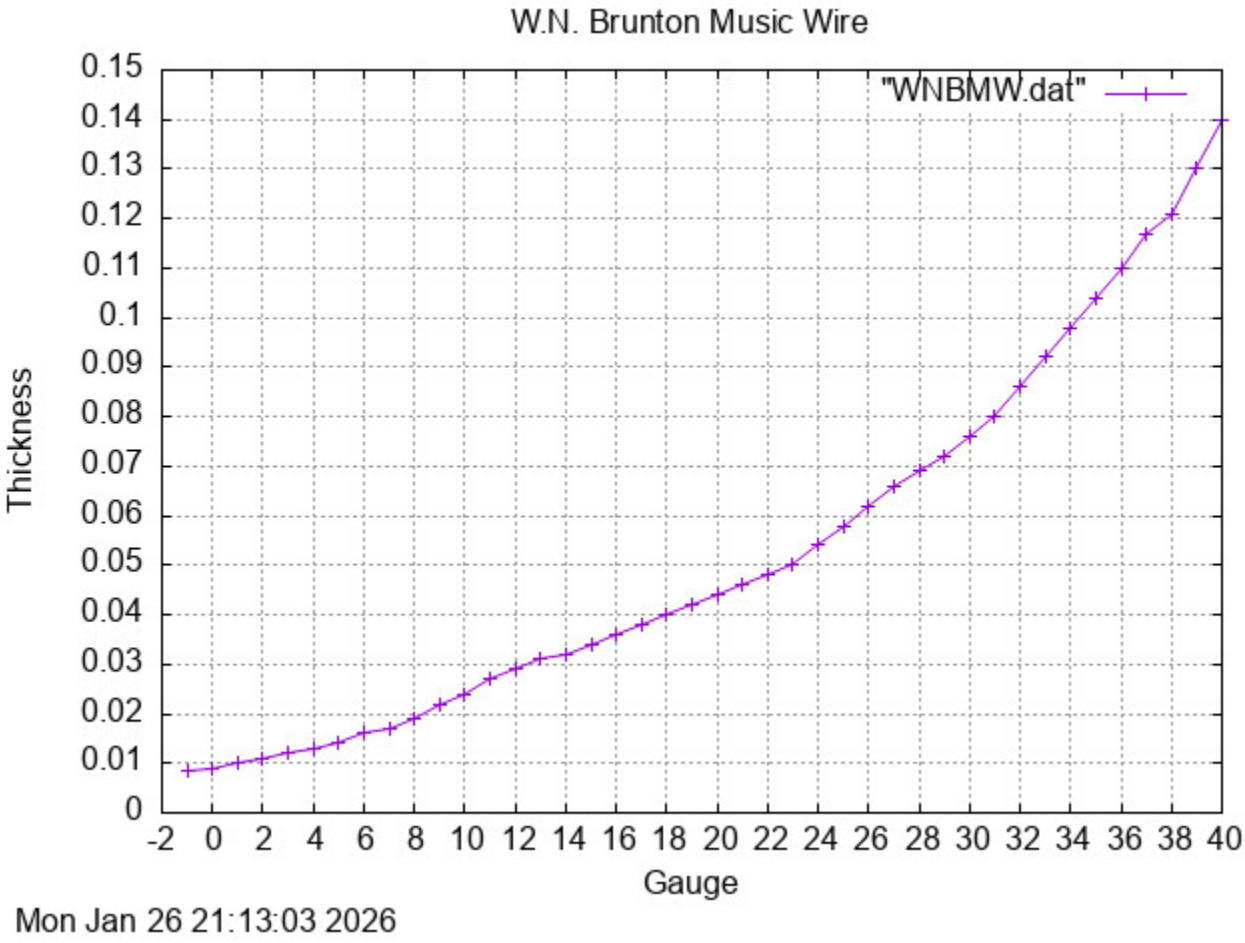

Figure 10: W.N. Brunton Music Wire `WNBMW.inc`

1.7.10 Wright Wire Co.

Source: Machinery's Handbook, 6^{th} edition, 1924, Page 429.

Gage	Size	Gage	Size
00	0.0085	17	0.038
0	0.009	18	0.0405
1	0.010	19	0.042
2	0.011	20	0.044
3	0.012	21	0.046
4	0.013	22	0.0485
5	0.014	23	0.0505
6	0.016	24	0.0545
7	0.018	25	0.0585
8	0.020	26	0.063
9	0.022	27	0.067
10	0.024	28	0.071
11	0.026	29	0.0745
12	0.028	30	0.078
13	0.0305	31	0.082
14	0.0325	32	0.086
15	0.034	33	0.090
16	0.036	34	0.096

Table 18: Wright Wire Co.

[0]WWC.inc 2 February 2026 15:04

Plot of Wright Wire Co.

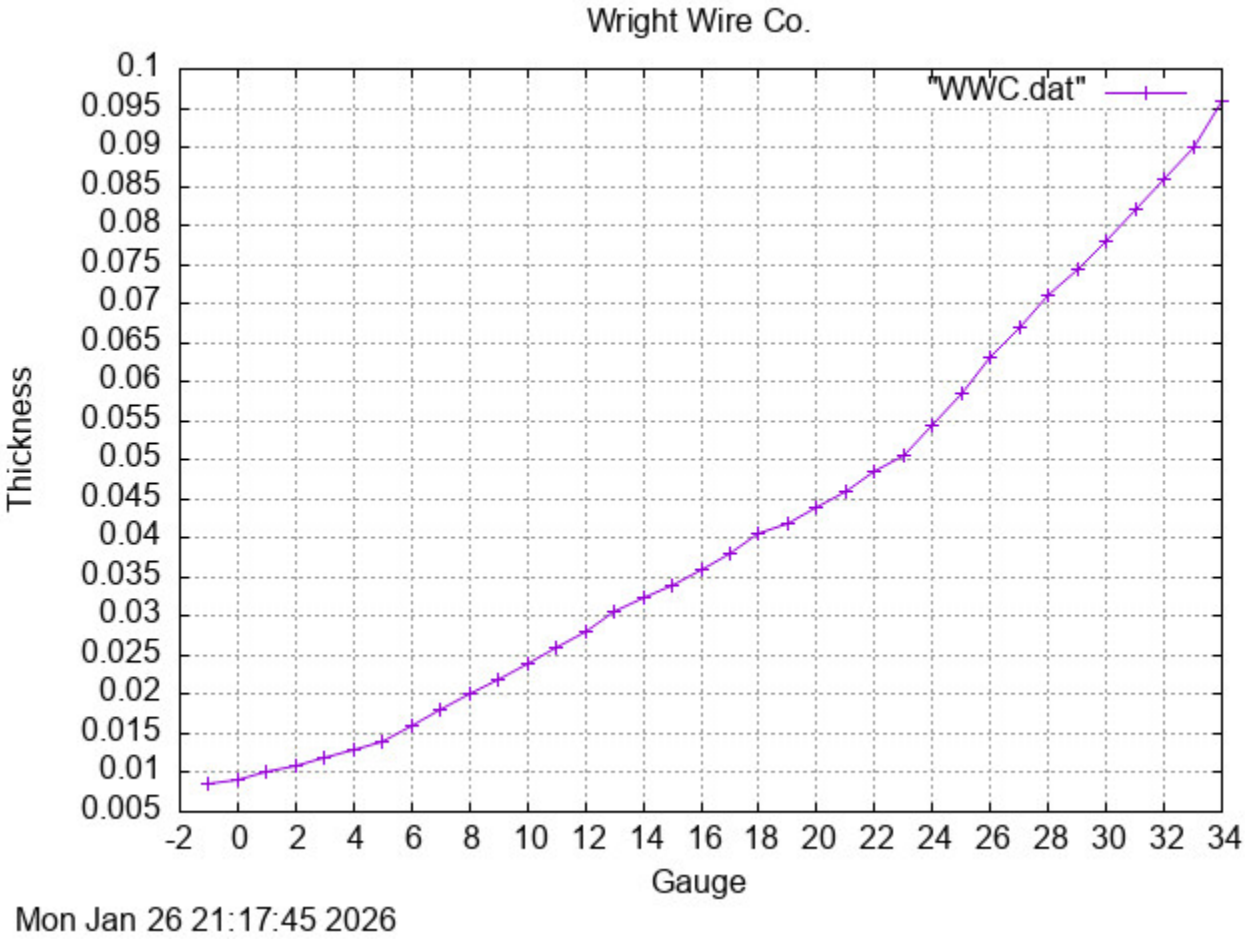

Figure 11: Wright Wire Co. `WWC.inc`

1.8 French wire gauges

Source: `Sizes.com`'s web site.

In addition to France, these gauges were used in Spain, Italy, Switzerland, Greece, Asia Minor, South America, and even to an extent in Germany, usually in competition with other gauges. They were used for wire and wire nails in the 19th and early 20th centuries.

1.8.1 Sources for French wire gauges

There is no doubt but that English wire gauges have been largely used on the continent of Europe in former times, and especially the so-called Birmingham wire-gauge. At present this wire gauge is still used in Belgium, Russia, Sweden, Norway, and Denmark. The new standard gauge is only being introduced by degrees. In Germany, the Birmingham wire gauge was used up to the year 1878, although the ancient Westphalian wire gauge and also the French gauge (or jauge de Paris) were used besides, to a small extent. In 1872, the German wire drawers adopted the so-called millimetre wire gauge, which is at present used throughout Germany and Austria, other wire gauges only being used occasionally. The millimetre gauge indicates the size of wire by tenths of a millimetre, so that for instance the No. 42 wire would be 4.2 mm. thick, and No. 4 wire would be 0.4 mm. thick. Certain standard sizes are, however, adopted by preference, coming up very nearly to the old Birmingham wire gauge, say:

As regards the system of measurement employed in Germany, wire gauges, i.e., plates of steel with notches representing the various sizes of wire, are still much used in the works, but in addition the micrometer or screw gauge is much employed, allowing the measurement of the size of wire to the smallest fraction of a millimetre.

In France, Spain, Italy, Switzerland, Greece, and Asia Minor, the French gauge, and principally the so-called jauge de Paris of 1857, is used. This gauge indicates the size of wire by numbers having certain equivalents in millimetres; and, contrary to the Birmingham wire gauge, where the smallest number indicates the largest size, in the French gauge the smallest number indicates the smallest size.

The jauge "japy", similar to the jauge de Paris, but with slightly smaller sizes for the different numbers, is also used to some extent in France and Switzerland; for the finer wires, card wire, copper wire, etc., the so-called jauge "carcasse" is in use.

With regard to Great Britain and the British colonies, they all now use the new standard wire gauge. In the United States of America, hitherto the Stubbs' Birmingham wire gauge has, we believe, been mostly used, besides Washburn & Moen's, and Brown and Sharpe's wire gauges.

If we are not mistaken there is a tendency in the United States to the adoption of the millimetre gauge. If this gauge should really be adopted in the states, the Americans will show that they are readier to take up an improvement than their English cousins, the millimetre gauge having been frequently proposed in England, but always declined on account of the conservative opposition it encountered. In South America both the Birmingham wire gauge or the new standard gauge and the jauge de Paris are used according to whether buyers have been accustomed to purchase in England or in France, the French imports of wire having of late been replaced by imports from Germany.

We are used to sell in the export market to whatever gauge may be desired.

In concluding, we beg to give you our opinion that the best system of measuring is the millimetre gauge, and that this gauge will be used to greater extent in the future; this will, however, greatly depend upon whether England will do away with her ancient system of measures, weights and money, and replace it by the far simpler metric system. This, we believe, is only a question of time.

A letter from Felten & Guilleaume, of Müllheim, near Cologne, "the largest makers in the world of iron and steel telegraph wire" replying to an inquiry from a M. Welles, who submitted it to The Electrical World.

[0]FWS.inc 2 February 2026 15:04

It subsequently appeared in The Electrician and Electrical Engineer, vol. 5, page 476 (Dec. 1885). Welles commented that "the statements made as to usage in different countries refer to line wire, and not to sheet metal, fine copper wires, etc."

1.8.2 Jauge de Paris 1857

Gauge	Diameter in Millimeters	Gauge	Diameter in Millimeters
P15	0.15	8	1.30
P14	0.16	9	1.40
P13	0.17	10	1.5
P12	0.18	11	1.6
P11	0.20	12	1.8
P10	0.22	13	2.0
P9	0.23	14	2.2
P8	0.25	15	2.4
P7	0.27	16	2.7
P6	0.28	17	3.0
P5	0.30 (Some say 0.3100)	18	3.4
P4	0.34	19	3.9
P3	0.37 (Some say 0.3810)	20	4.4
P2 or PP	0.42	21	4.9
P1	0.46	22	5.4
P0 or P	0.50	23	5.9
1	0.60	24	6.4
2	0.70	25	7.0
3	0.80	26	7.6
4	0.90	27	8.2
5	1.00	28	8.8
6	1.10	29	9.4
7	1.20	30	10.0

Table 19: Jauge de Paris 1857

Source

Cl. de Laharpe.
Notes & Formules de L'Ingènieur et du Constructeur-Mècanicien.
7th ed.
Paris: E. Bernard & Cie. 1889
Page 610.

Plot of Jauge de Paris 1857

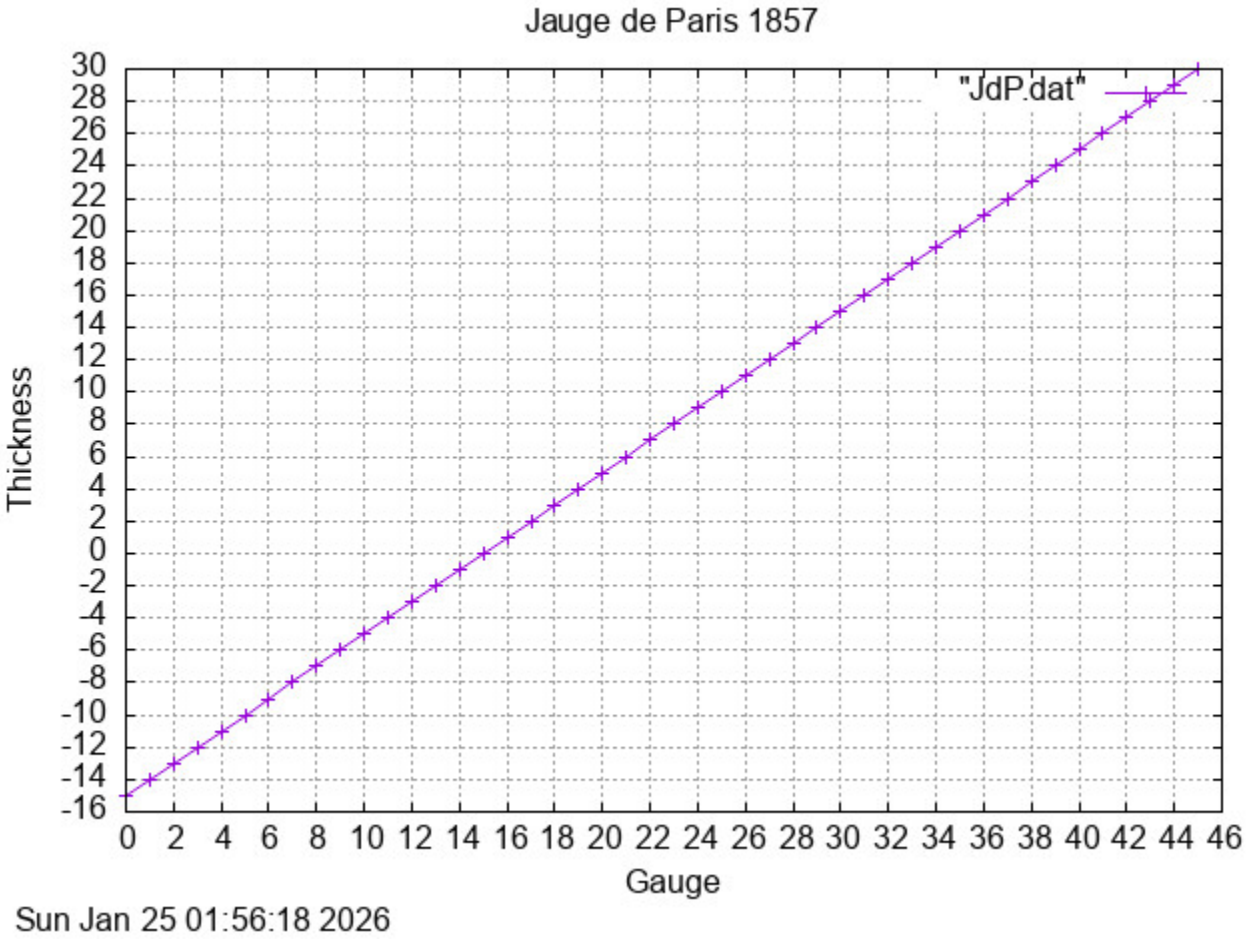

Figure 12: Jauge de Paris 1857 `FWS.inc`

1.8.3 Jauge Japy

Gauge	Diameter in Millimeters	Gauge	Diameter in Millimeters
10	1.45	28	9.4
11	1.60	29	10.0
12	1.75	30	10.5
13	1.90	31	11.0
14	2.05	32	11.5
15	2.2	33	12.5
16	2.4	34	13.5
17	2.7	35	14.5
18	3.0	36	15.5
19	3.5	37	16.5
20	4.0	38	17.5
21	4.6	39	18.5
22	5.2	40	19.5
23	5.9	41	20.5
24	6.6	42	21.5
25	7.3	43	22.5
26	8.0	44	23.5
27	8.7		

Table 20: Jauge Japy

Source

Hardware Tables, Formulae and Recipes... 6th edition.
London: The Ironmonger, 1924. Pages 3 and 63, which differ.

Plot of Jauge Japy

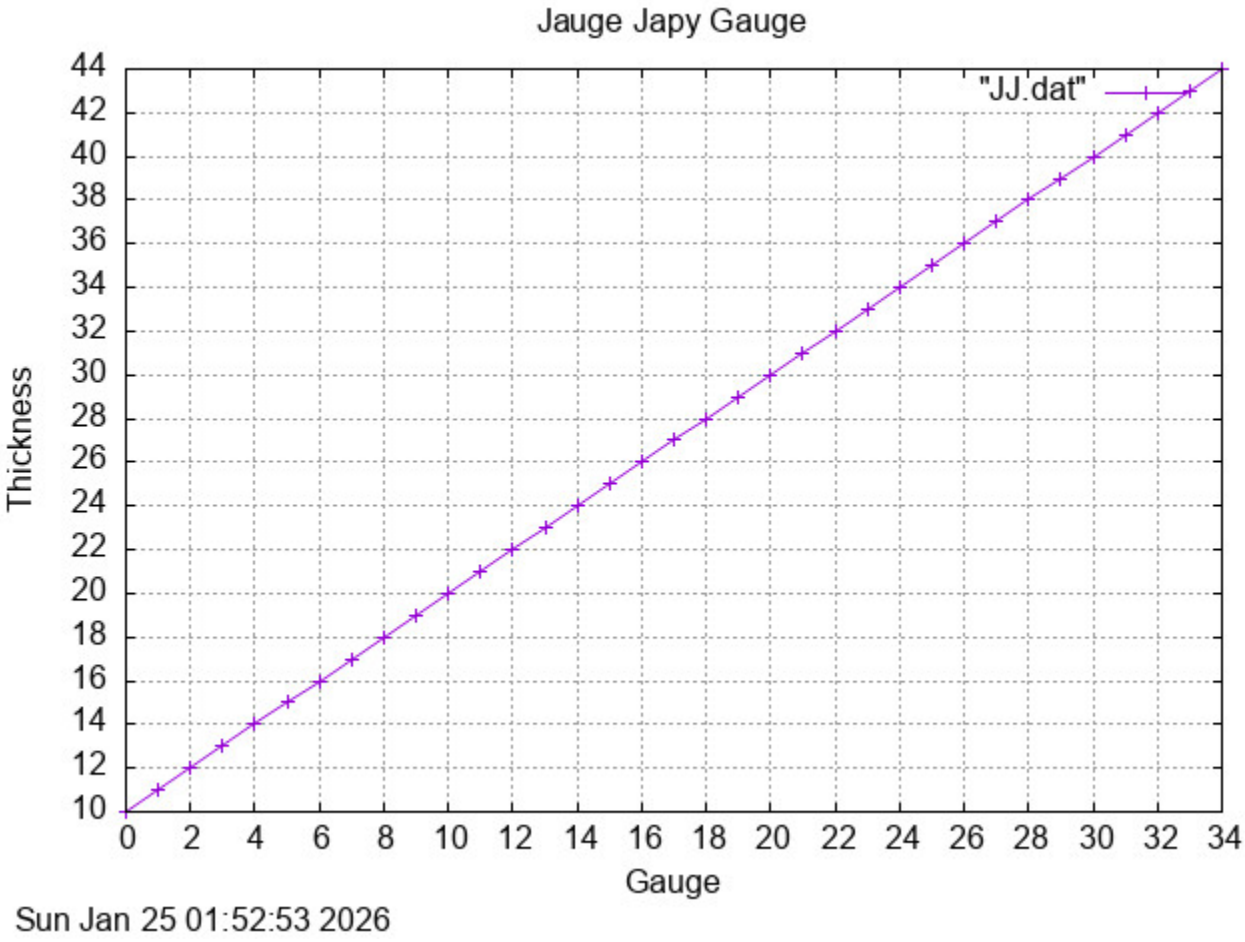

Figure 13: Jauge Japy `FWS.inc`

1.8.4 Jauge de Limoges

Gauge	Diameter in Millimeters	Gauge	Diameter in Millimeters
0	0.39	13	1.91
1	0.45	14	2.02
2	0.56	15	2.14
3	0.67	16	2.25
4	0.79	17	2.84
5	0.90	18	3.40
6	1.01	19	3.95
7	1.12	20	4.50
8	1.24	21	5.10
9	1.35	22	5.65
10	1.46	23	6.20
11	1.68	24	6.80
12	1.80		

Table 21: Jauge de Limoges

Source

Cl. de Laharpe.
Notes & Formules de L'Ingénieur et du Constructeur-Mécanicien.
7th ed.
Paris: E. Bernard & Cie. 1889
Page 610.

Plot of Jauge de Limoges

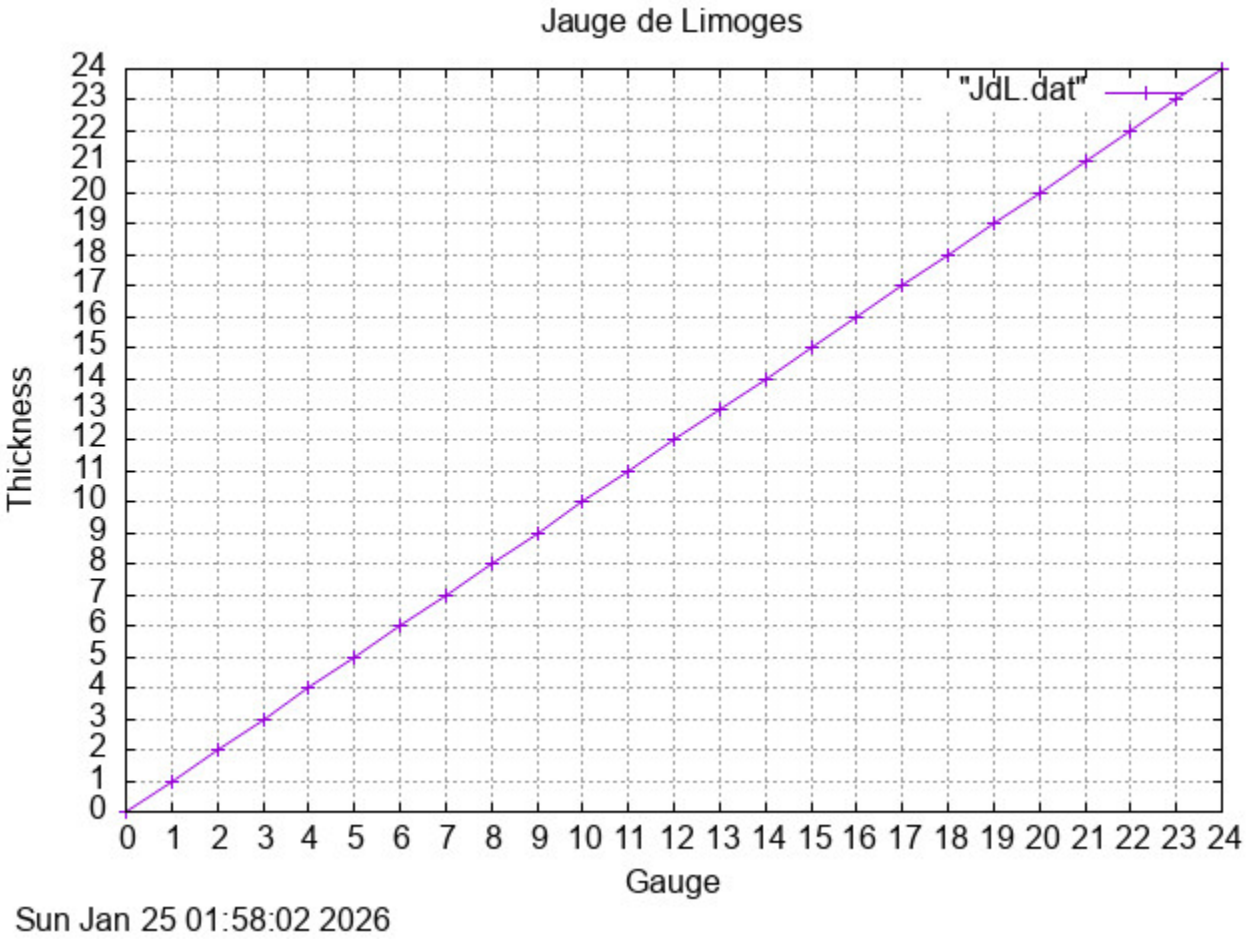

Figure 14: Jauge de Limoges `FWS.inc`

1.8.5 Jauge carcasse or du Commerce

Gauge	Diameter in Millimeters	Gauge	Diameter in Millimeters
P	0.50	32	0.17
12	0.47	34	0.14
14	0.44	36	0.12
16	0.40	38	0.11
18	0.37	40	0.10
20	0.34	42	0.09
22	0.32	44	0.08
24	0.29	46	0.07
26	0.26	48	0.06
28	0.22	50	0.05
30	0.20		

Table 22: Jauge de Limoges

Source

Cl. de Laharpe.
Notes & Formules de L'Ingénieur et du Constructeur-Mécanicien.
7th ed.
Paris: E. Bernard & Cie. 1889
Page 610.

Plot of Jauge carcasse or du Commerce

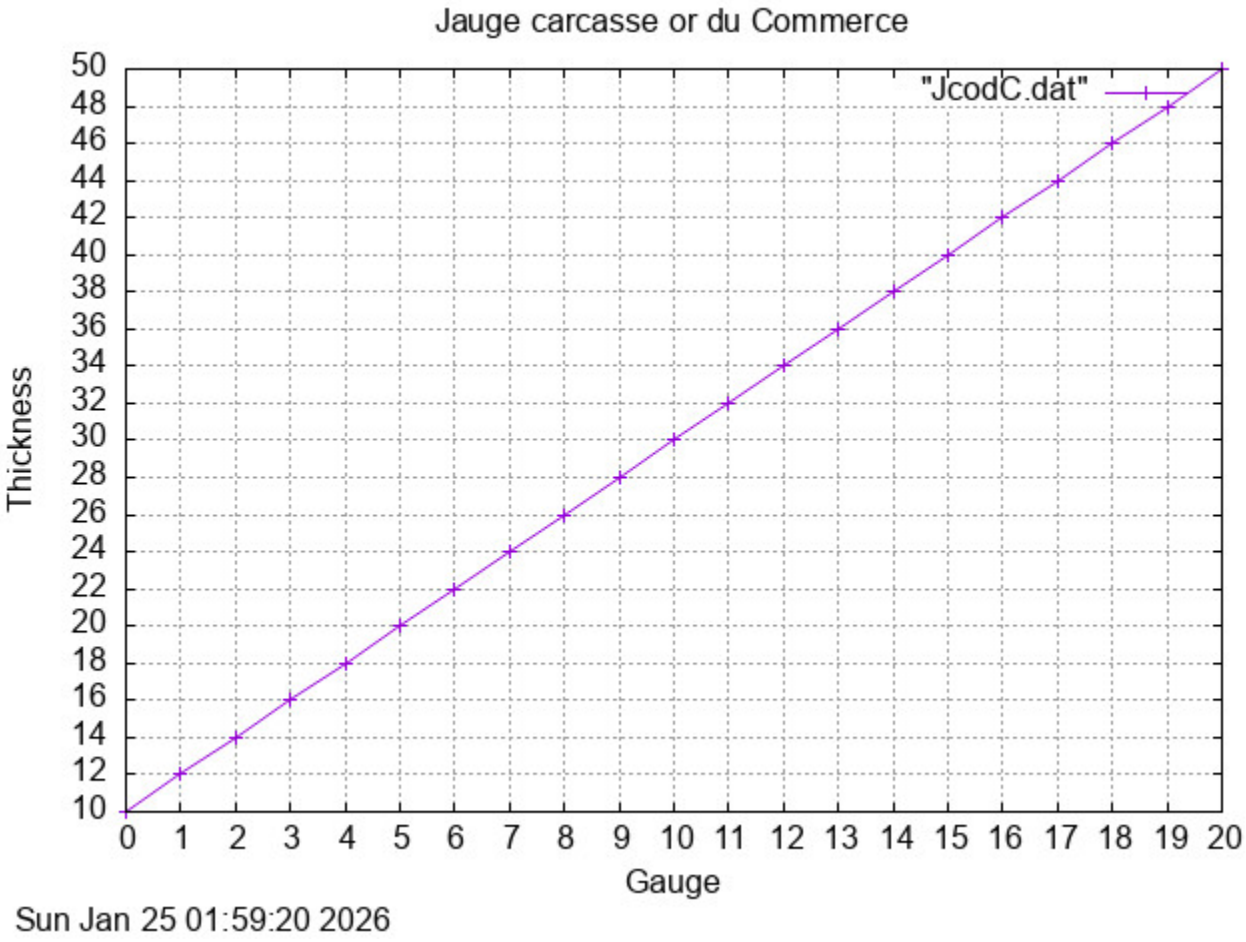

Figure 15: Jauge carcasse or du Commerce `FWS.inc`

1.8.6 Sources for French wire gauges

There is no doubt but that English wire gauges have been largely used on the continent of Europe in former times, and especially the so-called Birmingham wire-gauge. At present this wire gauge is still used in Belgium, Russia, Sweden, Norway, and Denmark. The new standard gauge is only being introduced by degrees. In Germany, the Birmingham wire gauge was used up to the year 1878, although the ancient Westphalian wire gauge and also the French gauge (or jauge de Paris) were used besides, to a small extent. In 1872, the German wire drawers adopted the so-called millimetre wire gauge, which is at present used throughout Germany and Austria, other wire gauges only being used occasionally. The millimetre gauge indicates the size of wire by tenths of a millimetre, so that for instance the No. 42 wire would be 4.2 mm. thick, and No. 4 wire would be 0.4 mm. thick. Certain standard sizes are, however, adopted by preference, coming up very nearly to the old Birmingham wire gauge, say:

As regards the system of measurement employed in Germany, wire gauges, i.e., plates of steel with notches representing the various sizes of wire, are still much used in the works, but in addition the micrometer or screw gauge is much employed, allowing the measurement of the size of wire to the smallest fraction of a millimetre.

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A letter from Felten & Guilleaume, of Müllheim, near Cologne, "the largest makers in the world of iron and steel telegraph wire" replying to an inquiry from a M. Welles, who submitted it to The Electrical World. It subsequently appeared in The Electrician and Electrical Engineer, vol. 5, page 476 (Dec. 1885). Welles commented that "the statements made as to usage in different countries refer to line wire, and not to sheet metal, fine copper wires, etc."

1.9 Hyprodermic Needle Dimensions

Source: Machinery's Handbook, 31^{st} Edition, 2020, page 2704. This is a very similar gauge to Stub's Iron Wire Gauge.

1.9.1 Hyprodermic Needle Dimensions Inside and Outside Dimentions

Gauge	Outside Diameter		Inside Diameter	
	mm	in	mm	in
6	5.156	0.2030	4.394	0.1730
7	4.572	0.1800	3.810	0.1500
8	4.191	0.1650	3.429	0.1350
9	3.759	0.1480	2.997	0.1180
10	3.404	0.1340	2.692	0.1060
11	3.048	0.1200	2.388	0.0940
12	2.769	0.1090	2.159	0.0850
13	2.413	0.0950	1.803	0.0710
14	2.108	0.0830	1.600	0.0630
15	1.829	0.0720	1.372	0.0540
16	1.651	0.0630	1.194	0.0470
17	1.473	0.0580	1.067	0.0420
18	1.270	0.0500	0.818	0.0330
19	1.067	0.0420	0.686	0.0270
20	0.902	0.0355	0.584	0.0230
21	0.813	0.0320	0.495	0.0195
22	0.711	0.0280	0.394	0.0155
22s	0.711	0.0280	0.140	0.0055
23	0.635	0.0250	0.318	0.0125
24	0.559	0.0220	0.292	0.0115
25	0.508	0.0200	0.241	0.0095
25s	0.508	0.0200	0.140	0.0055
26	0.457	0.0180	0.241	0.0095
26s	0.467	0.0184	0.114	0.0045
27	0.406	0.0160	0.191	0.0075
28	0.356	0.0140	0.165	0.0065
29	0.330	0.0130	0.165	0.0065
30	0.305	0.0120	0.140	0.0055
31	0.254	0.0100	0.114	0.0045
32	0.229	0.0090	0.089	0.0035
33	0.203	0.0080	0.089	0.0035

Table 23: Hyprodermic Needle Dimensions

[0]HND.inc 2 February 2026 15:04

Glitches in plots: In these gauges there are three "special" gauge values, 22s, 25s and 26s. When they are plotted I dropped the "s" and ploted these values along with the rest of the data. At the "s" points there is an otherwise unexpected, but explainable "glitch".

Needle Nominal Outside Diameter		Needle Nominal Inside Diameter
Gauge	Tolerance (in)	Tolerance (in)
7 8 9	±0.0010	±0.0030
10 12 14		±0.0020
16 17 19	±0.0005	±0.0015
25s 26 26s 27	+0.0005 −0.0000	+0.0015 −0.0000

Table 24: Hypodermic Needle Dimentions, Tolerances

Note most gauge IDs are omitted where nothing changes.

Plot of Inside vs Outside mm diameterse

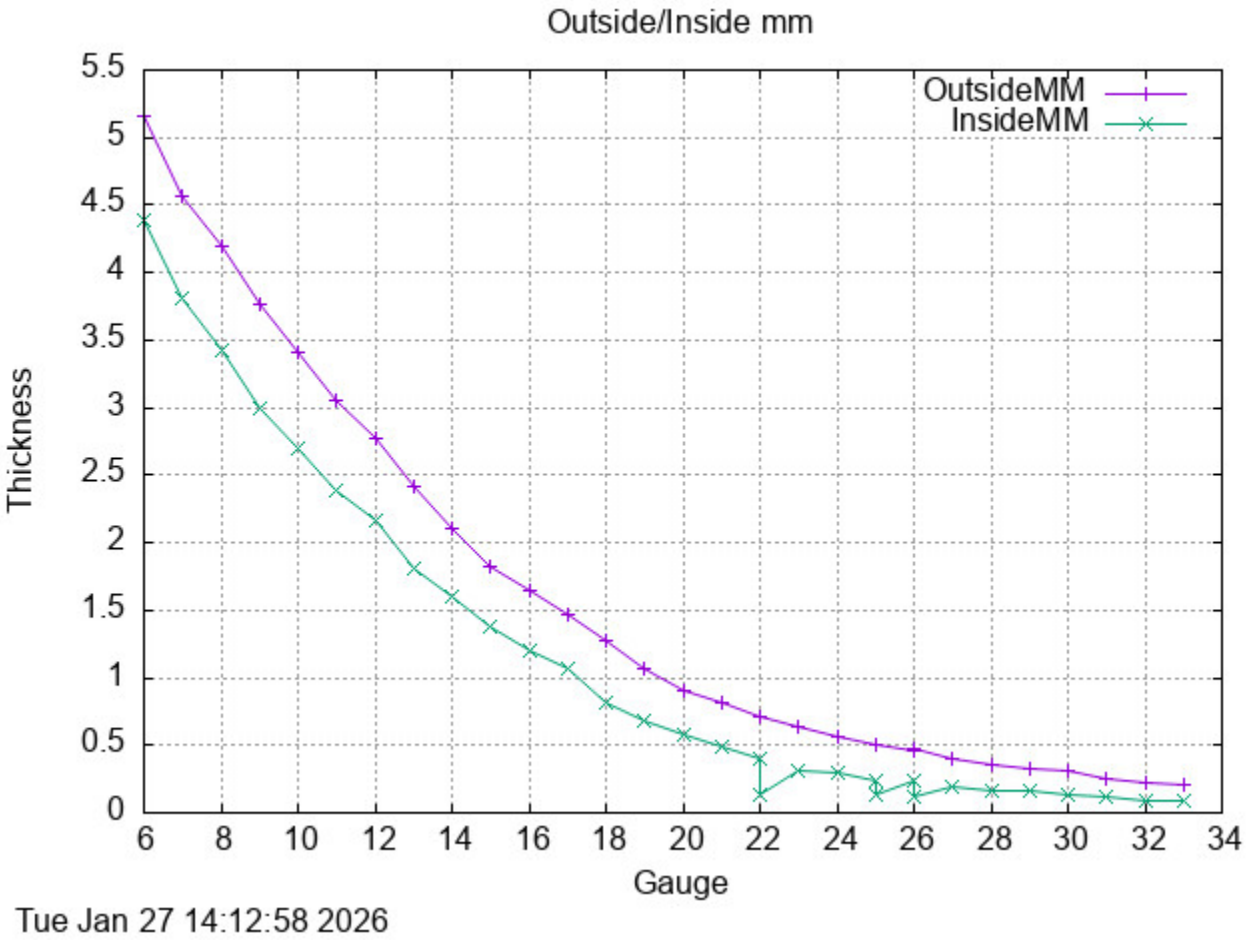

Figure 16: Inside vs Outside Hyprodermic Needle mm diameters `HND.inc`

Plot of Inside vs Outside inch diameters

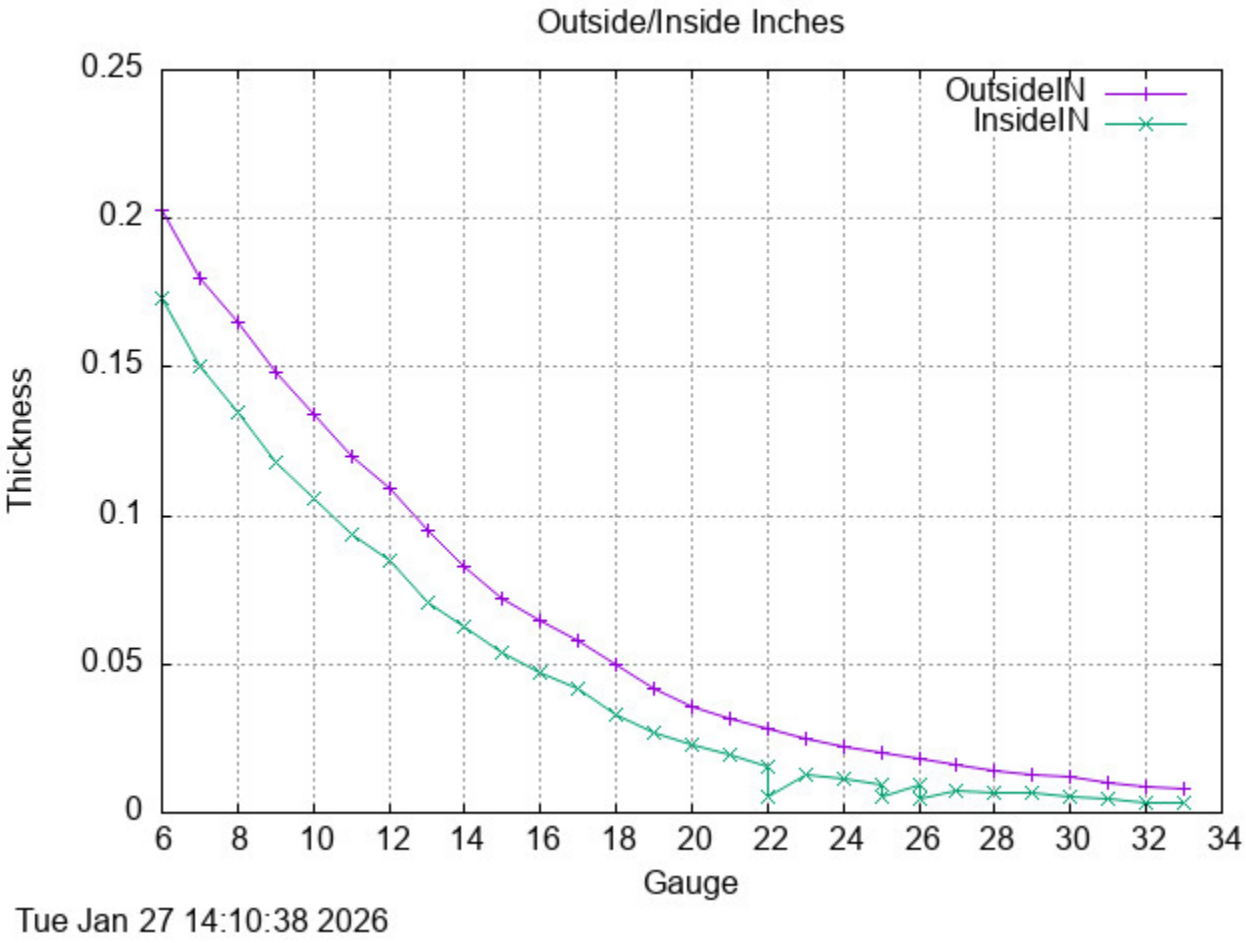

Figure 17: Inside vs Outside Hyprodermic Needle inch diameters `HND.inc`

1.9.2 Hyprodermic Needle Dimensions Outside Dimentions

Gauge	Outside Diameter	
	mm	in
6	5.156	0.2030
7	4.572	0.1800
8	4.191	0.1650
9	3.759	0.1480
10	3.404	0.1340
11	3.048	0.1200
12	2.769	0.1090
13	2.413	0.0950
14	2.108	0.0830
15	1.829	0.0720
16	1.651	0.0630
17	1.473	0.0580
18	1.270	0.0500
19	1.067	0.0420
20	0.902	0.0355
21	0.813	0.0320
22	0.711	0.0280
22s	0.711	0.0280
23	0.635	0.0250
24	0.559	0.0220
25	0.508	0.0200
25s	0.508	0.0200
26	0.457	0.0180
26s	0.467	0.0184
27	0.406	0.0160
28	0.356	0.0140
29	0.330	0.0130
30	0.305	0.0120
31	0.254	0.0100
32	0.229	0.0090
33	0.203	0.0080

Table 25: Hyprodermic Needle Outside Dimensions

Plot of Outside mm diameterse

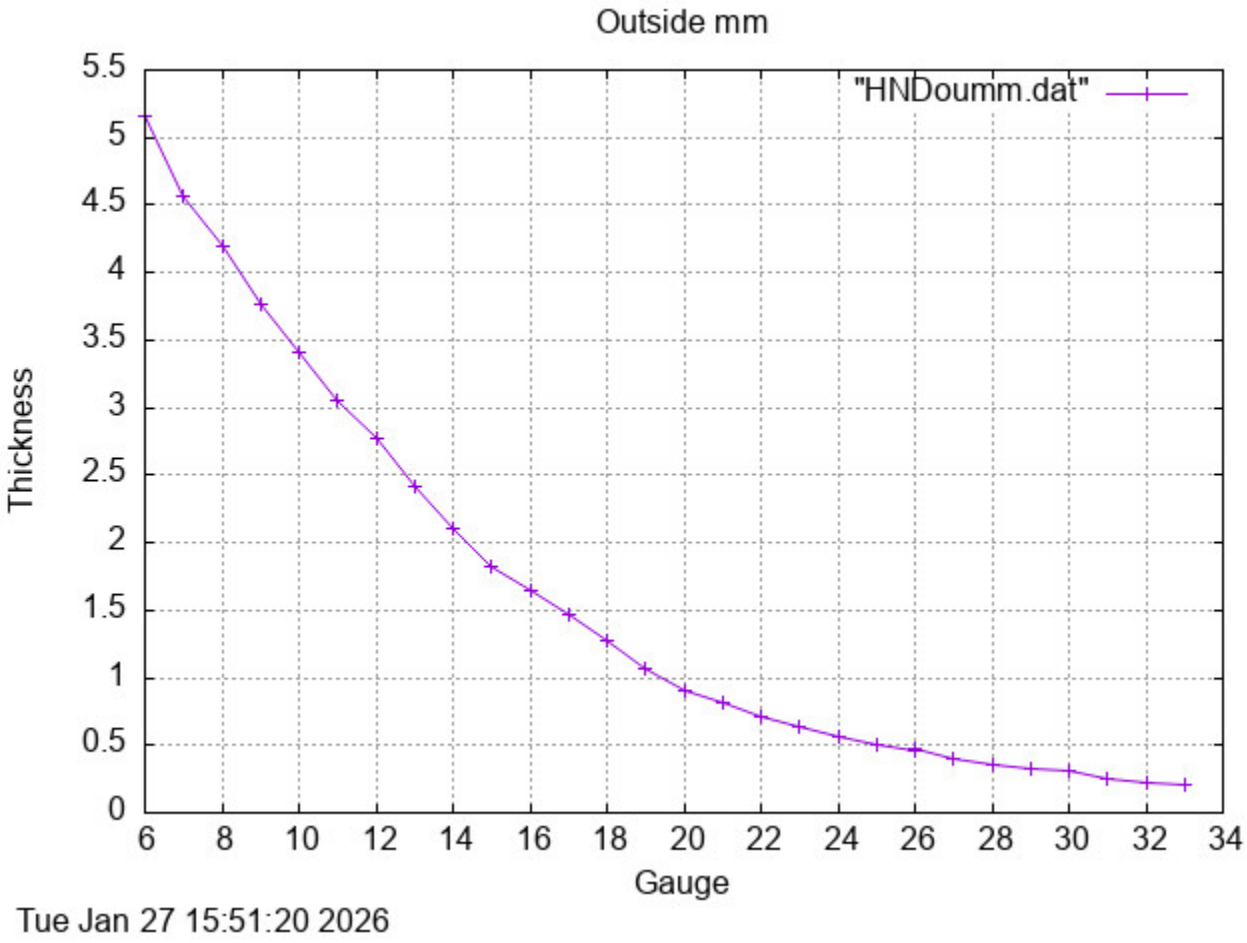

Figure 18: Outside Hyprodermic Needle mm diameters `HND.inc`

Plot of Outside inch diameters

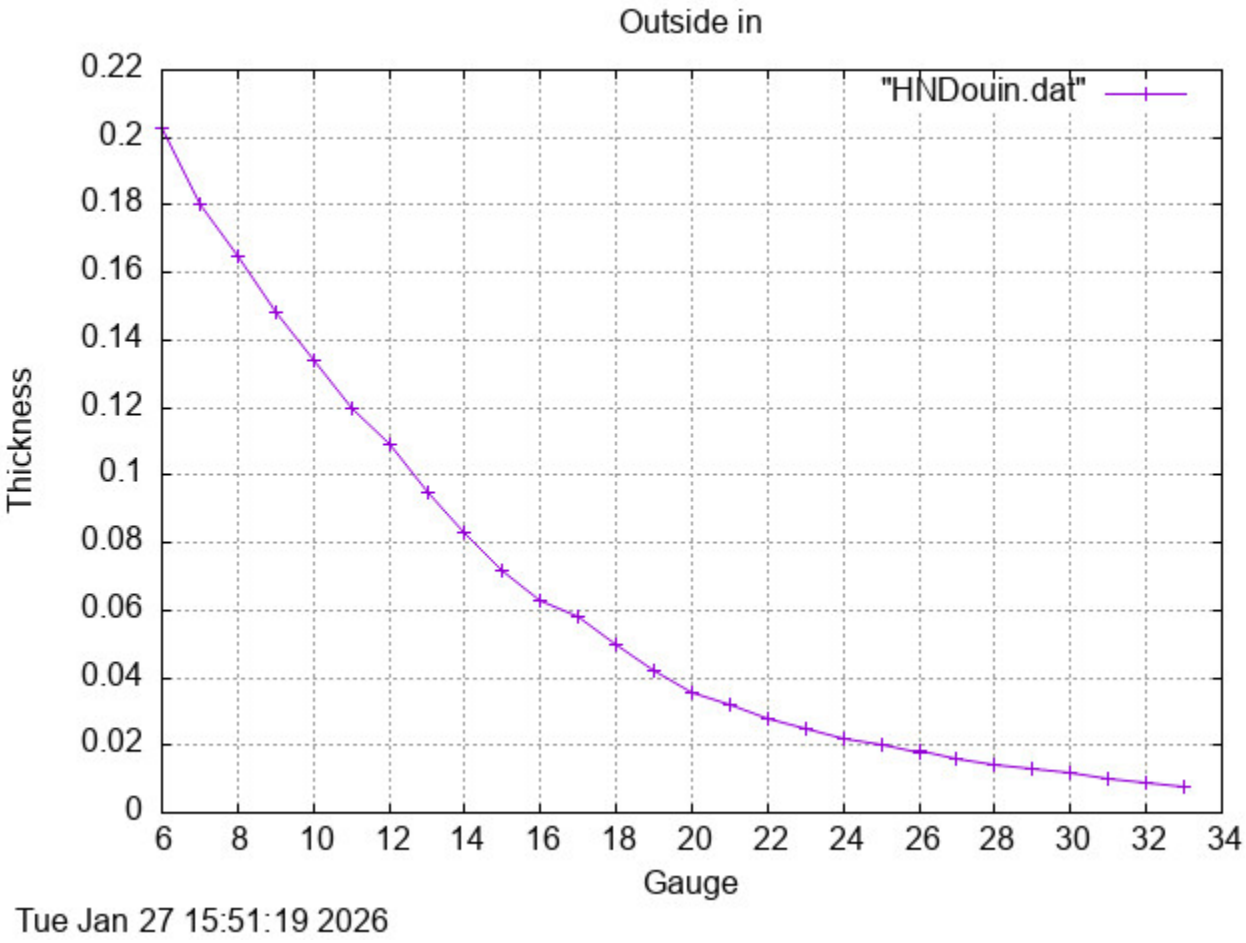

Figure 19: Outside Hyprodermic Needle inch diameters `HND.inc`

1.9.3 Hyprodermic Needle Dimensions Inside Dimensions

Gauge	Inside Diameter	
	mm	in
6	4.394	0.1730
7	3.810	0.1500
8	3.429	0.1350
9	2.997	0.1180
10	2.692	0.1060
11	2.388	0.0940
12	2.159	0.0850
13	1.803	0.0710
14	1.600	0.0630
15	1.372	0.0540
16	1.194	0.0470
17	1.067	0.0420
18	0.818	0.0330
19	0.686	0.0270
20	0.584	0.0230
21	0.495	0.0195
22	0.394	0.0155
22s	0.140	0.0055
23	0.318	0.0125
24	0.292	0.0115
25	0.241	0.0095
25s	0.140	0.0055
26	0.241	0.0095
26s	0.114	0.0045
27	0.191	0.0075
28	0.165	0.0065
29	0.165	0.0065
30	0.140	0.0055
31	0.114	0.0045
32	0.089	0.0035
33	0.089	0.0035

Table 26: Hyprodermic Needle Inside Dimensions

Plot of Inside mm diameterse

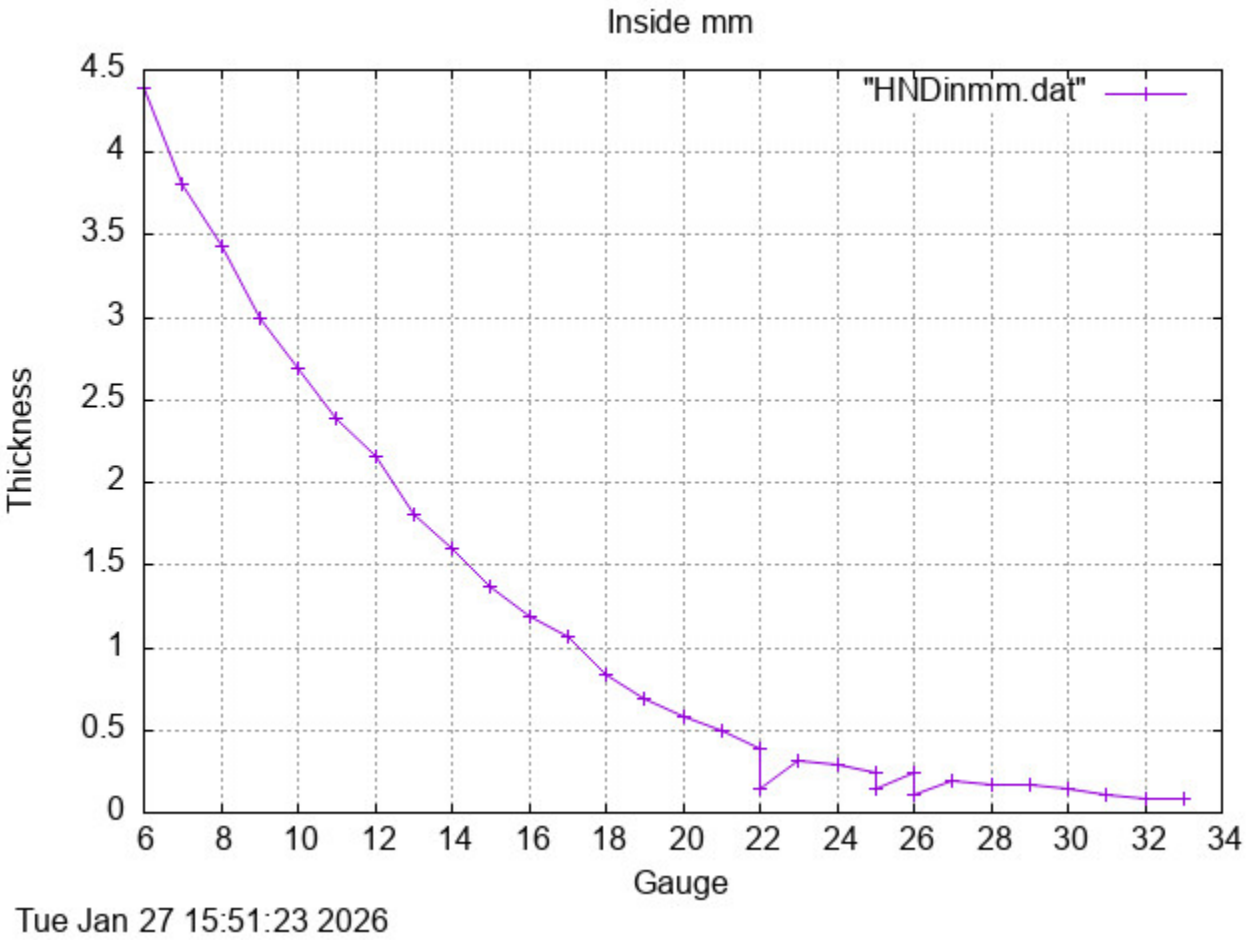

Figure 20: Inside Hyprodermic Needle mm diameters `HND.inc`

Plot of Inside inch diameters

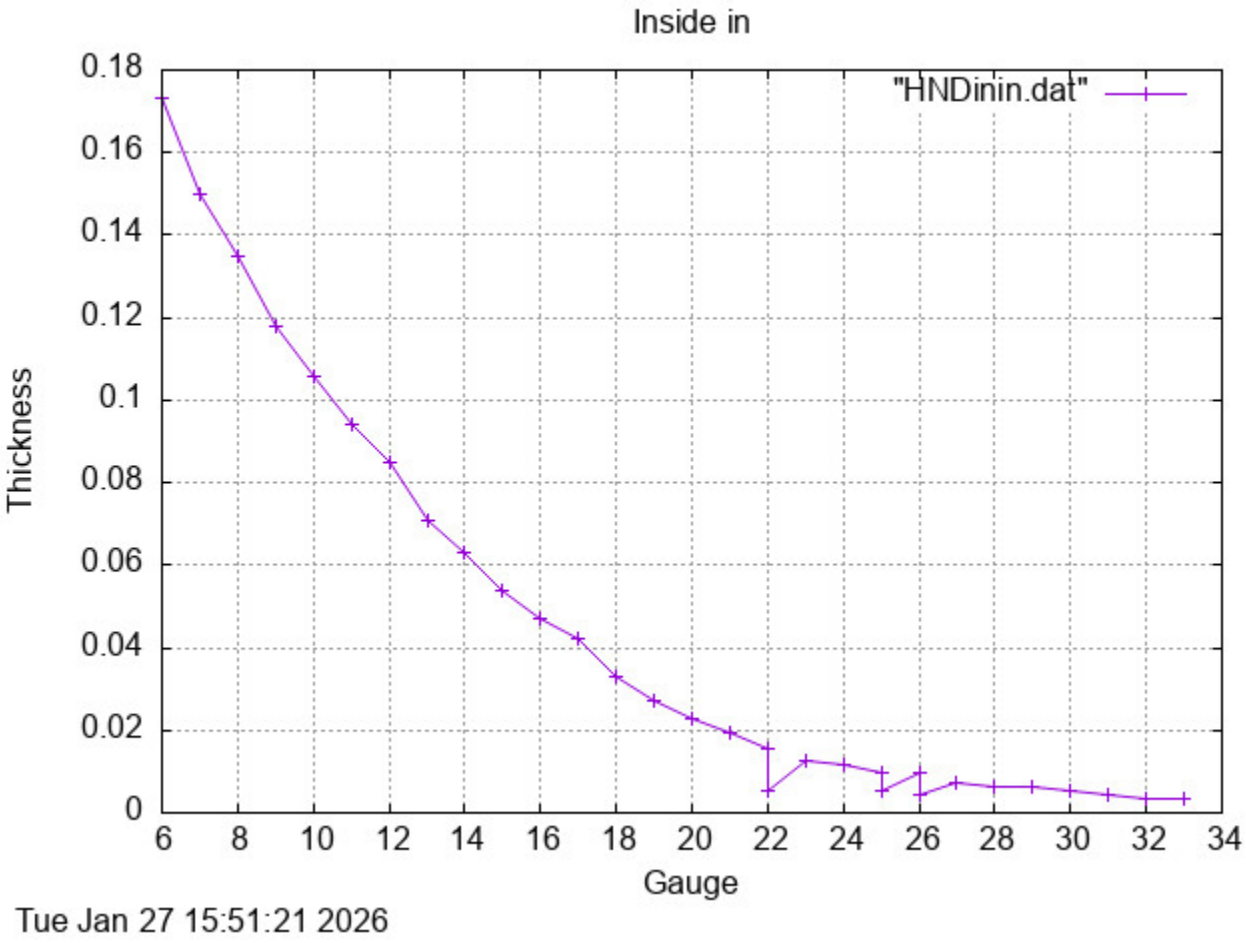

Figure 21: Inside Hyprodermic Needle inch diameters `HND.inc`

1.10 Imperial wire gauge

Source: `Sizes.com`'s web site.

Also called the New Standard Wire Gauge, Legalized Standard Wire Gauge, Imperial Standard Wire Gauge, or in other countries, simply British Standard. Abbreviated S.W.G. or I.S.W.G. Fixed by order of council August 23, 1883. It was constructed by improving the Birmingham wire gage. Made legal standard March 1, 1884.

For a table comparing diameters of this gauge with other wire gauges, see Appendix A, page 79.

Gauge	Diameter		Area of cross-section, square centimeters	Reqsistance, copper, ohms per meter	Weight, copper, grams per meter
	inches	centimeters			
7/0	0.5000	1.270	1.267	0.000137	1134
6/0	0.4640	1.179	1.091	0.000159	976.3
5/0	0.4320	1.097	0.946	0.000184	846.3
0 000	0.4000	1.016	0.811	0.000215	725.6
000	0.3720	0.945	0.701	0.000248	627.6
00	0.3480	0.884	0.614	0.000283	549.6
0	0.3240	0.825	0.532	0.000327	476.1
1	0.3000	0.762	0.456	0.000381	408.1
2	0.2760	0.701	0.386	0.000451	345.4
3	0.2520	0.640	0.322	0.000541	288.0
4	0.2320	0.589	0.273	0.000638	244.1
5	0.2120	0.538	0.228	0.000764	203.8
6	0.1920	0.488	0.187	0.000931	166.8
7	0.1760	0.447	0.157	0.00111	140.5
8	0.1600	0.406	0.130	0.00134	116.1
9	0.1440	0.366	0.105	0.00166	94.0
10	0.1280	0.325	0.0830	0.00210	74.3
11	0.1160	0.295	0.0682	0.00255	61.0
12	0.1040	0.264	0.0548	0.00317	49.0
13	0.0920	0.234	0.0429	0.00406	38.4
14	0.0800	0.203	0.0324	0.00536	29.0
15	0.0720	0.183	0.0263	0.00662	23.5
16	0.0640	0.163	0.0208	0.00838	18.6
17	0.0560	0.142	0.0159	0.0109	14.2
18	0.0480	0.122	0.0117	0.0149	10.4
19	0.0400	0.102	0.00811	0.0215	7.26
20	0.0360	0.0914	0.00657	0.0265	5.88
21	0.0320	0.0813	0.00519	0.0335	4.64
22	0.0280	0.0711	0.00397	0.0438	3.56
23	0.0240	0.0610	0.00292	0.0596	2.61

Continued on the next page.

[0]IWG.inc 2 February 2026 15:04

Continued from the previous page.

Gauge	Diameter		Area of cross-section, square centimeters	Reqsistance, copper, ohms per meter	Weight, copper, grams per meter
	inches	centimeters			
24	0.0220	0.0559	0.00245	0.0709	2.19
25	0.0200	0.0508	0.00203	0.0858	1.80
26	0.0180	0.0457	0.00164	0.106	1.47
27	0.0164	0.0417	0.00136	0.128	1.22
28	0.0149	0.0376	0.00111	0.157	0.893
29	0.0136	0.0345	0.000937	0.185	0.839
30	0.0124	0.0315	0.000779	0.223	0.697
31	0.0116	0.0295	0.000682	0.255	0.610
32	0.0108	0.0274	0.000591	0.294	0.529
33	0.0100	0.0254	0.000507	0.343	0.453
34	0.0092	0.0234	0.000429	0.406	0.384
35	0.0084	0.0213	0.000358	0.486	0.320
36	0.0076	0.0193	0.000293	0.594	0.262
37	0.0068	0.0173	0.000234	0.742	0.210
38	0.0060	0.0152	0.000182	0.954	0.163
39	0.0052	0.0132	0.000137	1.27	0.123
40	0.0048	0.0122	0.000117	1.49	0.104
41	0.0044	0.0112	0.0000981	1.77	0.0878
42	0.0040	0.0102	0.0000811	2.15	0.0726
43	0.0036	0.00914	0.0000657	2.65	0.0588
44	0.0032	0.00813	0.0000519	3.35	0.0464
45	0.0028	0.00711	0.0000397	4.38	0.0356
46	0.0024	0.00610	0.0000292	5.96	0.0261
47	0.0020	0.00508	0.0000203	8.58	0.0181
48	0.0016	0.00406	0.0000130	13.4	0.0116
49	0.0012	0.00305	0.00000730	23.8	0.00653
50	0.0010	0.00254	0.00000507	34.3	0.00453

Table 27: Imperial Wire Gauge

A plot of this gauge is shown at Table 34, page 92.

1.10.1 The Imperial Wire Gage is not a geometric or exponential series

Most modern gauges for materials like wire, sheet metal, nails and so forth are geometric or exponential series. In such a series, the values defined by any two adjacent gauge numbers are related by the same, constant ratio. For example, to find the next smaller size in the kitchen series "cup, half-cup, quarter-cup, 1/8 cup", just multiply by 0.5. Having a geometrically increasing (or decreasing) series of sizes is often convenient for engineering purposes.

This British system is not geometric, possibly because its 19th century devisers were trying to retain some resemblance to the Birmingham wire gages. Instead of specifying a constant ratio, they specified for each gauge the number of mils to subtract from its diameter to give the diameter of the next smaller size. Moreover, they changed the amount to be subtracted at irregular intervals.

for each of these gauges

find the diameter of the next smaller gauge by subtracting this number of mils (thousandths of an inch)

for each of these gauges	find the diameter of the next smaller gauge by subtracting this number of mils (thousandths of an inch)
7/0	36
6/0, 5/0	32
4/0	28
3/0, 00, 0, 1, 2	24
3 - 5	20
6 - 9	16
10 - 13	12
14 - 18	8
19 - 22	4
23 - 25	2
26 - 27	1.6
28 - 29	1.2
30 - 38	0.8
39 - 48	0.4
49	0.2

Table 28: Imperial Wire Gauge step corrections

Sources New British Standard Gauge. This is abbreviated N. B. S. G. The following names are also used: English Legal Standard Wire Gauge. Imperial Wire Gauge. This gauge is the legal standard for Great Britain and is used for all kinds of wire. Its use in this country (the United States is very limited).

Wire in Electrical Construction.
Trenton, NJ:
John A. Roebling's Sons Company, 1916
Page 51.

1.11 Trenton Iron Gauge

Source: catalog for 1911, Page 259 and Machinery's Handbook 6^{th} edition, for 1924 on page 425.

Gauge	Size	Gauge	Size
00 000	.45	19	.04
0 000	.4	20	.035
000	.36	21	.031
00	.33	22	.028
0	.305	23	.025
1	.285	24	.0225
2	.265	25	.02
3	.245	26	.018
4	.225	27	.017
5	.205	28	.016
6	.19	29	.015
7	.175	30	.014
8	.16	31	.013
9	.145	32	.012
10	.13	33	.011
11	.1175	34	.01
12	.105	35	.0093
13	.0925	36	.009
14	.08	37	.0085
15	.07	38	.008
16	.061	39	.0075
17	.0525	40	.007
18	.045		

Table 29: Trenton Iron

[0]TI.inc 2 February 2026 15:04

Plot of Trenton Iron Co. Gauge

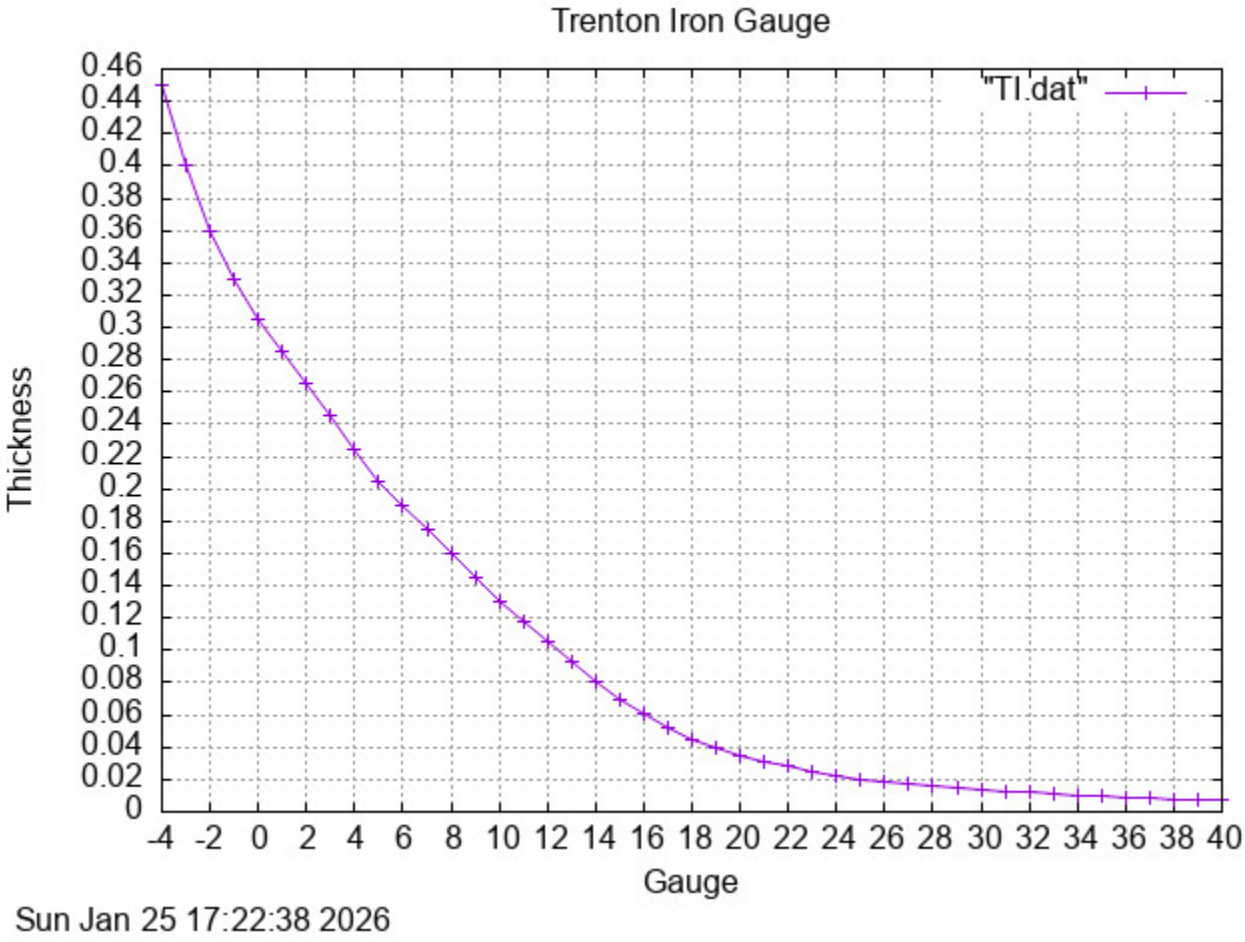

Figure 22: Trenton Iron Co. `TI.inc`

1.12 Birmingham Wire Gauge

Spurce:

The Whitworth Measuring Machine, 1877 Page 80

Gauge	Diameter in inches	Gauge	Diameter in inches
0 000	.450	18	.050
000	.425	19	.040
00	.375	20	.036
1	.300	21	.032
2	.280	22	.028
3	.260	23	.024
4	.240	24	.022
5	.220	25	.020
6	.200	26	.018
7	.180	27	.016
8	.165	28	.014
9	.150	29	.013
10	.135	30	.012
11	.120	31	.010
12	.110	32	.009
13	.095	33	.008
14	.085	34	.007
15	.070	35	.005
16	.065	36	.004
17	.060		

Table 30: Birmingham Wire Gauge from The Whitworth Measuring Machine

[0]WMBWG.inc 2 February 2026 15:04

From The Whitworth Measuring Machine, Birmingham Wire Gauge

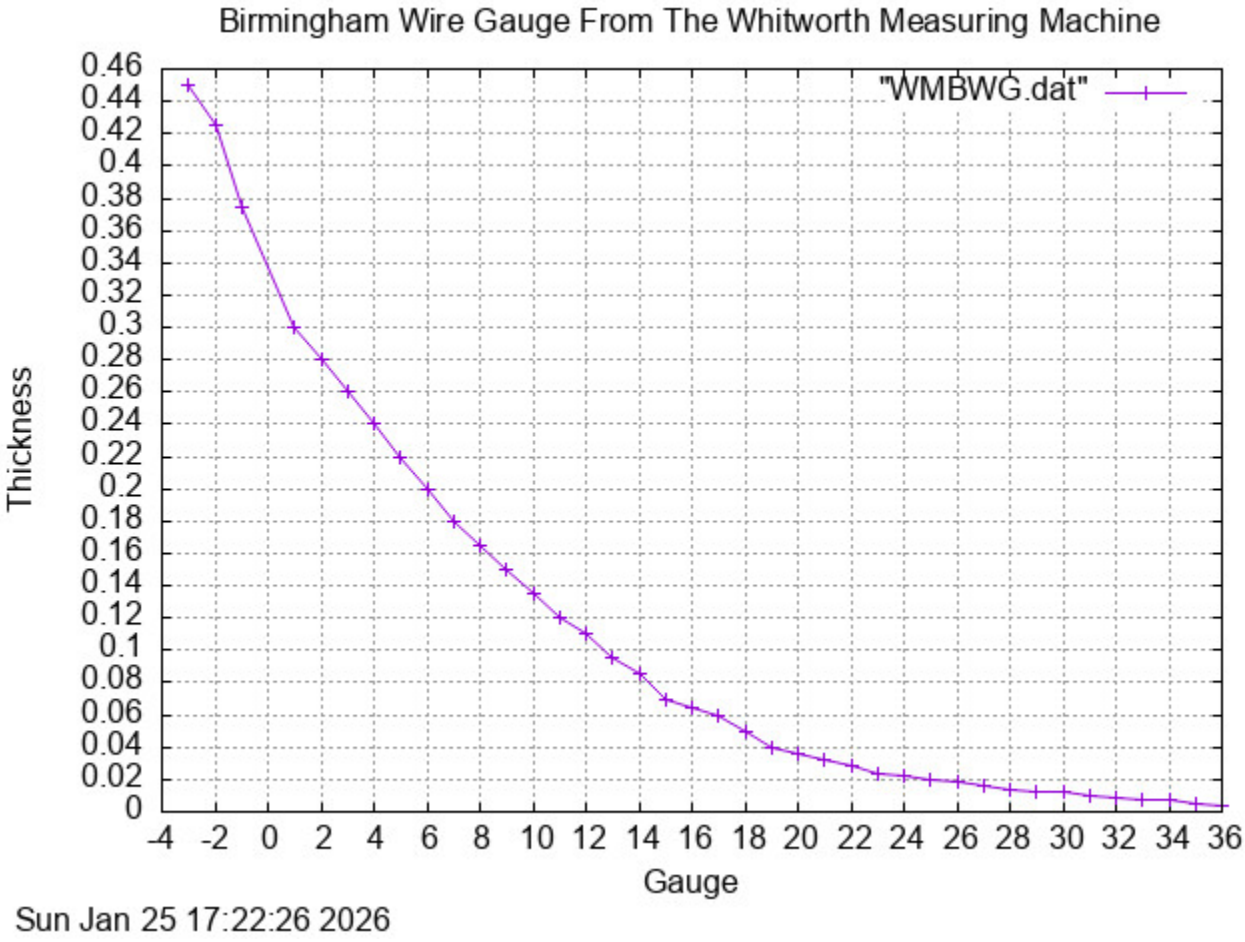

Figure 23: Birmingham Wire Gauge from The Whitworth Measuring Machine `WMBWG.inc`

1.13 Birmingham Plate Gauge

Spurce:

The Whitworth Measuring Machine, 1877 Page 80

Gauge	Diameter in inches	Gauge	Diameter in inches
1	.004	16	.050
2	.005	17	.055
3	.008	18	.060
4	.010	19	.065
5	.012	21	.070
6	.013	22	.075
7	.015	24	.080
8	.016	25	.095
9	.019	26	.010
10	.024	27	.110
11	.028	28	.120
12	.034	31	.135
13	.036	34	.150
14	.040	36	.165
15	.045		

Table 31: Birmingham Plate Gauge from The Whitworth Measuring Machine

[0]WMBPG.inc 2 February 2026 15:04

From The Whitworth Measuring Machine, Birmingham Plate Gauge

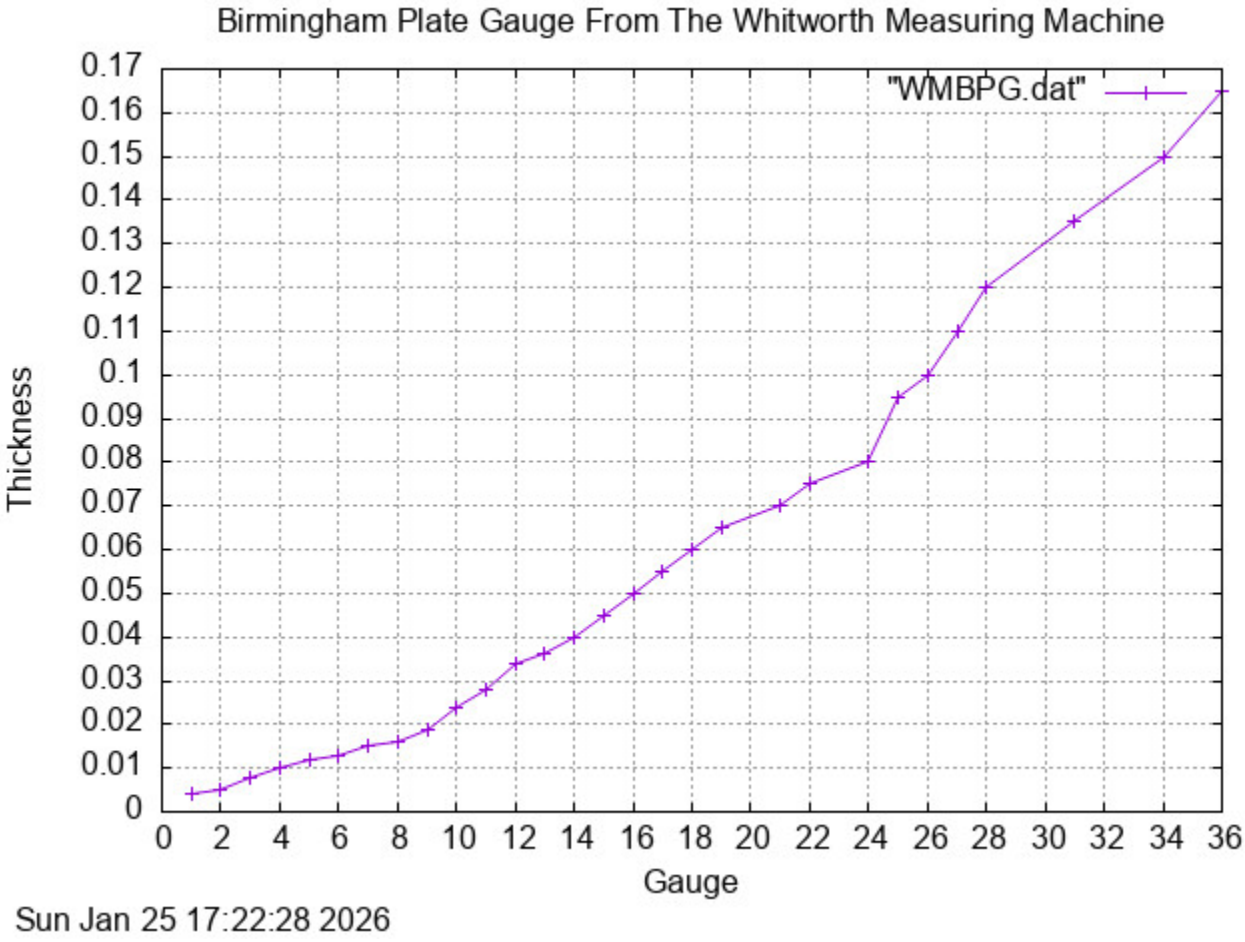

Figure 24: Birmingham Plate Gauge from The Whitworth Measuring Machine `WMBPG.inc`

1.14 Metric Wire Sizes

1.14.1 Metrically-sized equivalents for SWG-sized electrical cables

Source: `Sizes.com`'s web site.

The British Standard Wire Gauge (not to be confused with the Steel Wire Gauge, also with the symbol SWG) is based on the wire's diameter. The metric conductor sizes are based on the nominal area of the cross section of the conductor. The actual cross-sectional areas depend in part upon the stranding of the cable.

A cable with the metric value shown will have at least as much carrying capacity as the SWG cable for which it is being substituted. In other words, values have always been rounded up. For that reason, **Warning: do not use this table to find the SWG equivalent to a metric cable**.

The table assumes the metric-sized cable is substituted for an SWG-sized cable **Warning: ¿of the same type**. It cannot be used, for example, to find a metrically-sized aluminum cable to substitute for a copper SWG cable. If the types are dissimilar, consult the cable manufacturer's literature to determine capacity.

[0]SWG2M.inc 2 February 2026 15:04

For Standard Wire Gauge	Substitute Metric Nominal Cross-sectional Area square millimeters
7/0	150
6/0	120
5/0	95
4/0	95
3/0	95
2/0	70
0	70
1	50
2	50
3	35
4	35
5	25
6	25
7	16
8	16
9	16
10	10
11	10
12	6
13	6
14	4
15	4
16	2.5
17	2.5
18	1.5
19	1
20	0.75
21	0.75
22	0.5

Table 32: Metrically-sized equivalents for SWG

1.14.2 Metric-sized equivalents for AWG-sized electrical cables

Source: `Sizes.com`'s web site.

The American Wire Gauge is based on the wire's diameter; the metric conductor sizes are based on the nominal area of the cross section of the conductor. The actual cross-sectional areas depend in part upon the stranding of the cable.

A cable with the metric value shown will have at least as much carrying capacity as the AWG cable for which it is being substituted. In other words, values have always been rounded up. For that reason, **Wwarning: do not use this table to find the AWG equivalent to a metric cable**.

The table assumes the metric-sized cable will be substituted for an AWG-sized cable **Warning: of the same type**. It cannot be used, for example, to find a metric-sized aluminum cable to substitute for a copper AWG cable. If the types are dissimilar, consult the cable manufacturer's literature to determine capacity.

American Wire Gauge (AWG)	Substitute this Metric Nominal Cross-sectional Area, square millimeters
6/0	185
5/0	150
4/0	120
3/0	95
2/0	70
0	70
1	50
2	35
3	35
4	25
5	25
6	16
7	16
8	10
9	10
10	6
11	6
12	4
13	4
14	2.5
15	2.5
16	1.5
17	1.5
18	1
19	0.75
20	0.75
21	0.5

Table 33: Metric-sized equivalents for AWG

[0]M2AWG.inc 2 February 2026 15:04

1.15 Making Wire

Source: `Sizes.com`'s web site.

In 1910 Hugh Tiemann wrote the following concise description of the manufacture of steel wire. The **boldface emphases** are his.

Wire.— This is the name given to small metal filaments (usually round) produced in pieces of considerable length by **drawing**, *i.e.*, successively reducing (and thereby extending) the section by repeatedly pulling it cold (**cold drawing**) through tapered holes in a die or **draw plate** (**block**, **die plate**). Drawing is necessary as it is impracticable to roll such small sections commercially.

Billets are first reduced, in a rolling mill, to **wire rods** (rounds) about 0.2" to 0.3" in diameter, which are coiled up into **bundles**. These bundles are placed in a **pickling bath** of dilute sulphuric acid, heated by steam, to remove the scale, and are then transferred to the **rinsing bath** to remove the greater part of the acid, after which they are put on a revolving frame and sprayed with water to still further remove the acid; this causes a certain amount of rust to form on the surface, which acts later as a slight lubricant and is known as a **rust coating** or **water coating**. The last traces of acid are eliminated by treatment in the **lime bath** (**liming**), after which the bundles are dried (**baked**) at a low temperature in a furnace called the **baker**. If the wire is to be **bright finished** (*i.e.*, unannealed), it is transferred from the rinsing bath immediately to the lime bath.

The **draw plate** is a piece of hard (high carbon) steel (more rarely cast iron) containing a number of **holes** through which the wire is drawn. Usually all those in one plate are of the same size and the wire is passed through successive plates, each hole serving for one (sometimes two) bundles. After use the plates are annealed (as the metal around the holes has been hardened), the holes reduced by hammering and then opened up to the exact size by punching (**pricking**). The plates used for the first few reductions are sometimes referred to as the **roughing blocks**, **nipping blocks**, or **nippers**; those for the last, as **finishing blocks**.

Drawing is performed on the **draw bench**, which comprises the draw plate and a power reel for pulling the wire through. To start the wire through the hole, it must be pointed either with a small hammer, or by a pair of small rollers with grooves of different sizes, given a rocking movement (like an alligator shears) by an eccentric. The wire is then pulled through by a pair of tongs (**grippers** or **nippers**) attached to a crank shaft, giving a reciprocating (back and forth) movement, until there is a sufficient length to attach it to the power reel. The term **ratch** is used for the pull of the wire through the die at one operation where a straight pull and not a reel is used. The plate is sometimes tilted backward at a slight angle to **kill** the wire, *i.e.*, prevent the tendency to spring out into an unmanageably large coil on removal from the reel. To reduce the friction in drawing, the wire must be coated with some substance which acts as a lubricant. In **dry drawing**, grease is employed: it is piled against the back of the draw plate around the hole, and one application serves for a number of reductions. In **wet drawing**, the wire is given a **lees coating** by passing it through **lees liquor** composed of water and some kind of flour, sometimes fermented and sometimes mixed with milk of lime. A **copper coating** (**lacquer**) is obtained by treating the wire with a weak acidulated solution of copper sulphate, and then usually passing it through lees liquor before drawing. After this treatment it is known as **lacquered**, **straw-tinted**, or **coppered wire**; this method is sometimes called the **liquor-bright process**. If the finished wire is to be coppered, it must receive an additional treatment.

Multiple drawing is where the wire is drawn through a number of dies simultaneously, being reeled up only after passing through the last, instead of after each plate. In this case, to avoid breaking, it is necessary to provide a power reel between each pair of holes, around which the wire is given a couple of turns. Passing the wire through the various dies and around the reels is called **stringing up**. After about 8 to 10 **holes** (hole in this sense means pass or reduction) the wire is so much hardened that it must be reannealed, etc.,

[0]Making Wire.inc 2 February 2026 15:04

before drawing can be continued. This fine wire is sometimes **batted**, *i.e.*, beaten with wooden sticks while being washed after pickling.

Plain drawn wire (**bench hardened wire**) is wire in the condition in which it leaves the last hole, without any further treatment.; **Plain annealed wire** is where it is annealed in closed iron pots to render it soft and pliable. **Galvanized wire** is annealed and then coated with zinc (spelter). In galvanizing, the wire is passed (a) through a lead bath to anneal it; (b) through a weak pickling solution to remove the scale formed; (c) through a rinsing bath; and (d) through the molten spelter contained in the **galvanizing pan**. The excess of zinc is removed by drawing it through plugs of asbestos, called **wipers**. The wire is kept below the surface of the zinc by passing it under heavy toothed bars called **sinkers**. In modern practice a number of wires or strands are treated simultaneously, the whole series of operations being continuous, and one power reel serving to pull each strand through (**Bedson's continuous galvanizing process**). Attempts have been made to produce **bright annealed wire** by annealing in a reducing atmosphere so no oxide or scale will be formed. **Tinman's wire** is a soft bright-drawn wire used in the manufacture of various tin plate goods. **Improved steel wire** or **patented steel wire**, after finishing in the usual manner, is heated in a muffle, quenched in oil, and tempered in molten lead. **Plow steel wire** is made from a fine grade of high-carbon, crucible steel, and is so called because it was originally used for dragging steam plows. **Gun screw wire** is a name sometimes employed for wire made from a high grade of refined wrought iron. **B. B. wire**, **E. B. B. wire**, or **four-sided charcoal wire** were grades in England, used for telegraphic work, made of fagots composed of puddled billets in the center, and four flats outside, of (a) best, best puddled iron (b) or top and bottom of charcoal iron with sides of best, best puddled iron, or (c) charcoal iron all around, respectively. Instead of cleaning wire with acid, it is sometimes put into a **scouring barrel**, in which it is rotated with some cleaning material.

Hugh P. Tiemann
Iron and Steel. A Pocket Encyclopedia
New York: McGraw-Hill Book Company, 1910

A A table comparing diameters of some common gauges

Source: `Sizes.com`'s web site.

Note that 4/0 (pronounced "four aught") is an abbreviation for 0000, 2/0 for 00, and so on.

Common Wire Gauges, Based on Diameter in Inches							
Gauge	American or Brown & Sharpe Wire Gauge	Birmingham or Stubs' Iron Wire	Stubs' Steel Wire Gauge	Washburn & Moen, Roebling or American Steel and Wire Co.	Imperial Wire Gauge	Whitworth's	Steel Wire Gauge, Waterbury Co., 1917
9/0	—	—	—	—	—	—	0.005
8/0	—	—	—	—	—	—	0.0055
7/0	—	—	—	0.4900	0.5000	—	0.006
6/0	0.5800	—	—	0.4615	0.4640	—	0.0065
5/0	0.5165	0.500	—	0.4305	0.4320	—	0.007
4/0	0.4600	0.454	—	0.3938	0.4000	—	0.0075
3/0	0.4096	0.425	—	0.3625	0.3720	—	0.008
2/0	0.3648	0.380	—	0.3310	0.3480	—	0.0085
0	0.3249	0.340	—	0.3065	0.3240	—	0.009
1	0.2893	0.300	0.227	0.2830	0.3000	0.001	0.010
2	0.2576	0.284	0.219	0.2625	0.2760	0.002	0.011
3	0.2294	0.259	0.212	0.2437	0.2520	0.003	0.012
4	0.2043	0.238	0.207	0.2253	0.2320	0.004	0.013
5	0.1819	0.220	0.204	0.2070	0.2120	0.005	0.014
6	0.1620	0.203	0.201	0.1920	0.1920	0.006	0.016
7	0.1443	0.180	0.199	0.1770	0.1760	0.007	0.018
8	0.1285	0.165	0.197	0.1620	0.1600	0.008	0.020
9	0.1144	0.148	0.194	0.1483	0.1440	0.009	0.022
10	0.1019	0.134	0.191	0.1350	0.1280	0.010	0.024
11	0.0907	0.120	0.188	0.1205	0.1160	0.011	0.026
12	0.0808	0.109	0.185	0.1055	0.1040	0.012	0.028
13	0.0720	0.095	0.182	0.0915	0.0920	0.013	0.030
14	0.0641	0.083	0.180	0.0800	0.0800	0.014	0.032
15	0.0571	0.072	0.178	0.0720	0.0720	0.015	0.034
16	0.0508	0.065	0.175	0.0625	0.0640	0.016	0.036
17	0.0453	0.058	0.172	0.0540	0.0560	0.017	0.038
18	0.0403	0.049	0.168	0.0475	0.0480	0.018	0.040

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Common Wire Gauges, Based on Diameter in Inches

Gauge	American or Brown & Sharpe Wire Gauge	Birmingham or Stubs' Iron Wire	Stubs' Steel Wire Gauge	Washburn & Moen, Roebling or American Steel and Wire Co.	Imperial Wire Gauge	Whitworth's	Steel Wire Gauge, Waterbury Co., 1917
19	0.0359	0.042	0.164	0.0410	0.0400	0.019	0.042
20	0.0320	0.035	0.161	0.0348	0.0360	0.020	0.044
21	0.0285	0.032	0.157	0.03175	0.0320	0.021	0.046
22	0.0253	0.028	0.155	0.0286	0.0280	0.022	0.048
23	0.0226	0.025	0.153	0.0258	0.0240	0.023	0.051
24	0.0201	0.022	0.151	0.0230	0.0220	0.024	0.055
25	0.0179	0.020	0.148	0.0204	0.0200	0.025	0.059
26	0.0159	0.018	0.146	0.0181	0.0180	0.026	0.063
27	0.0142	0.016	0.143	0.0173	0.0164	0.027	0.067
28	0.0126	0.014	0.139	0.0162	0.0149	0.028	0.071
29	0.0113	0.013	0.134	0.0150	0.0136	0.029	0.074
30	0.0100	0.012	0.127	0.0140	0.0124	0.030	0.078
31	0.0089	0.010	0.120	0.0132	0.0116	0.031	0.082
32	0.0080	0.009	0.115	0.0128	0.0108	0.032	0.086
33	0.0071	0.008	0.112	0.0118	0.0100	0.033	0.090
34	0.0063	0.007	0.110	0.0104	0.0092	0.034	0.094
35	0.0056	0.005	0.108	0.0095	0.0084	0.035	0.098
36	0.0050	0.004	0.106	0.0090	0.0076	0.036	0.102
37	0.0045	—	0.103	—	0.0068	0.037	0.106
38	0.0040	—	0.101	—	0.0060	0.038	0.112
39	0.0035	—	0.099	—	0.0052	0.039	0.118
40	0.0031	—	0.097	—	0.0048	0.040	0.125
41	0.0028	—	0.095	—	0.0044	0.041	0.132
42	0.0025	—	0.092	—	0.0040	0.042	0.139
43	0.0022	—	0.088	—	0.0036	0.043	0.146
44	0.00198	—	0.085	—	0.0032	0.044	0.153
45	0.00176	—	0.081	—	0.0028	0.045	0.160
46	0.00157	—	0.079	—	0.0024	0.046	—
47	0.00140	—	0.077	—	0.0020	0.047	—
48	0.00124	—	0.075	—	0.0016	0.048	—

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Common Wire Gauges, Based on Diameter in Inches

Gauge	American or Brown & Sharpe Wire Gauge	Birmingham or Stubs' Iron Wire	Stubs' Steel Wire Gauge	Washburn & Moen, Roebling or American Steel and Wire Co.	Imperial Wire Gauge	Whitworth's	Steel Wire Gauge, Waterbury Co., 1917
49	0.001108	—	0.072	—	0.0012	0.049	—
50	0.00099	—	0.069	—	0.0010	0.050	—
51	—	—	0.066	—	—	0.051	—
52	—	—	0.063	—	—	0.052	—
53	—	—	0.058	—	—	0.053	—
54	—	—	0.055	—	—	0.054	—
55	—	—	0.050	—	—	0.055	—
56	—	—	0.045	—	—	0.056	—
57	—	—	0.042	—	—	0.057	—
58	—	—	0.041	—	—	0.058	—
59	—	—	0.040	—	—	0.059	—
60	—	—	0.039	—	—	0.060	—
61	—	—	0.038	—	—	0.061	—
62	—	—	0.037	—	—	0.062	—
63	—	—	0.036	—	—	0.063	—
64	—	—	0.035	—	—	0.064	—
65	—	—	0.033	—	—	0.065	—
66	—	—	0.032	—	—	0.066	—
67	—	—	0.031	—	—	0.067	—
68	—	—	0.030	—	—	0.068	—
69	—	—	0.029	—	—	0.069	—
70	—	—	0.027	—	—	0.070	—
71	—	—	0.026	—	—	0.071	—
72	—	—	0.024	—	—	0.072	—
73	—	—	0.023	—	—	0.073	—
74	—	—	0.022	—	—	0.074	—
75	—	—	0.020	—	—	0.075	—
76	—	—	0.018	—	—	0.076	—
77	—	—	0.016	—	—	0.077	—
78	—	—	0.015	—	—	0.078	—

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Common Wire Gauges, Based on Diameter in Inches

Gauge	American or Brown & Sharpe Wire Gauge	Birmingham or Stubs' Iron Wire	Stubs' Steel Wire Gauge	Washburn & Moen, Roebling or American Steel and Wire Co.	Imperial Wire Gauge	Whitworth's	Steel Wire Gauge, Waterbury Co., 1917
79	—	—	0.014	—	—	0.079	—
80	—	—	0.013	—	—	0.080	—

Table 34: Comparing Diameters of some Common Gauges

A.1 American or Brown & Sharpe Wire Gauge

Gauge	Size	Gauge	Size
000 000	0.5800	23	0.0226
00 000	0.5165	24	0.0201
0 000	0.4600	25	0.0179
000	0.4096	26	0.0159
00	0.3648	27	0.0142
0	0.3249	28	0.0126
1	0.2893	29	0.0113
2	0.2576	30	0.0100
3	0.2294	31	0.0089
4	0.2043	32	0.0080
5	0.1819	33	0.0071
6	0.1620	34	0.0063
7	0.1443	35	0.0056
8	0.1285	36	0.0050
9	0.1144	37	0.0045
10	0.1019	38	0.0040
11	0.0907	39	0.0035
12	0.0808	40	0.0031
13	0.0720	41	0.0028
14	0.0641	42	0.0025
15	0.0571	43	0.0022
16	0.0508	44	0.00198
17	0.0453	45	0.00176
18	0.0403	46	0.00157
19	0.0359	47	0.00140
20	0.0320	48	0.00124
21	0.0285	49	0.001108
22	0.0253	50	0.00099

Table 35: American or Brown & Sharpe Wire Gauge

[0]Common Gauges.inc 2 February 2026 15:04

Plot of American or Brown & Sharpe Wire Gauge

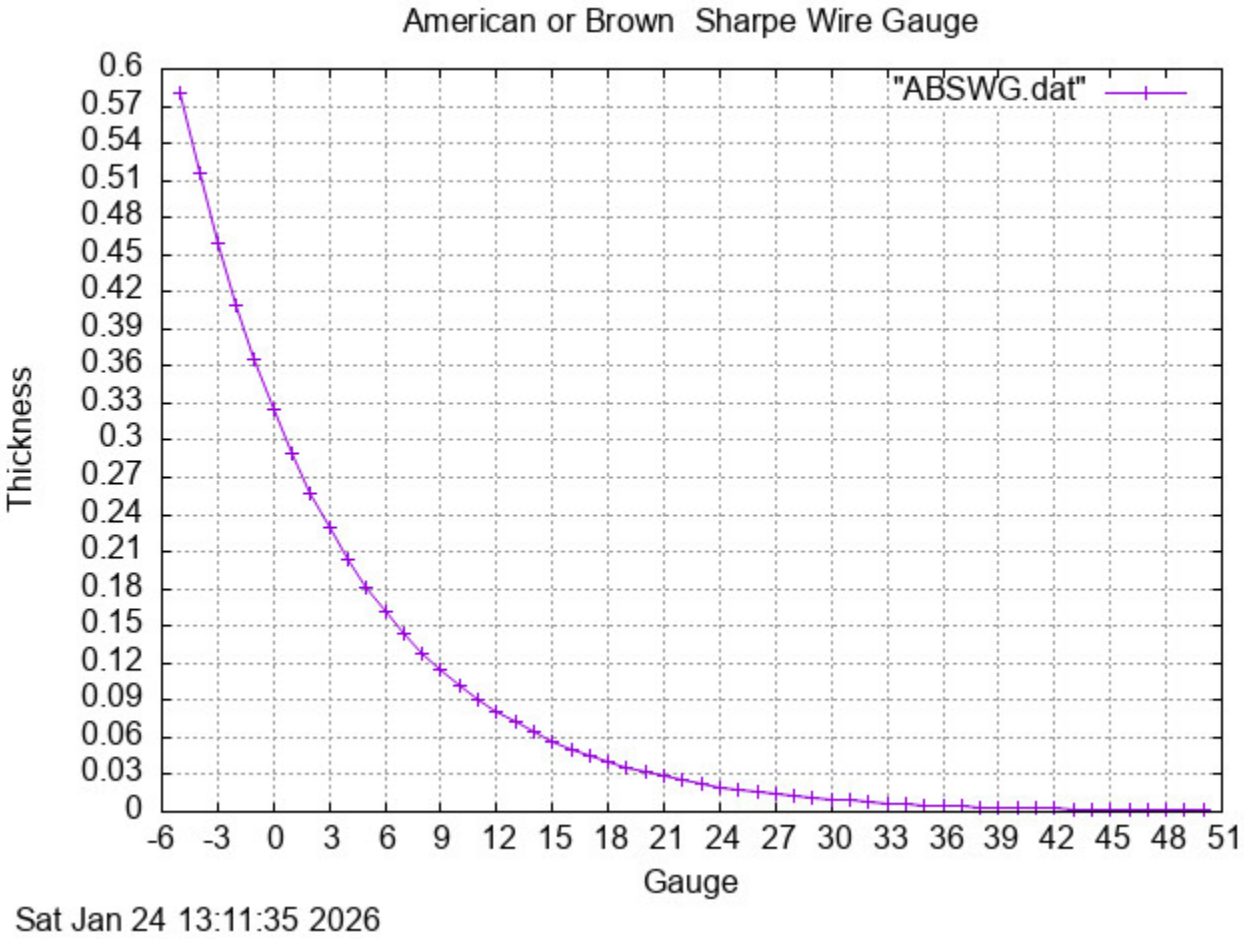

Figure 25: American or Brown & Sharpe Wire Gauge `Common Gauges.inc`

A.2 Birmingham or Stubs' Iron Wire

Gauge	Size	Gauge	Size
00 000	0.500	17	0.058
0 000	0.454	18	0.049
000	0.425	19	0.042
00	0.380	20	0.035
0	0.340	21	0.032
1	0.300	22	0.028
2	0.284	23	0.025
3	0.259	24	0.022
4	0.238	25	0.020
5	0.220	26	0.018
6	0.203	27	0.016
7	0.180	28	0.014
8	0.165	29	0.013
9	0.148	30	0.012
10	0.134	31	0.010
11	0.120	32	0.009
12	0.109	33	0.008
13	0.095	34	0.007
14	0.083	35	0.005
15	0.072	36	0.004
16	0.065		

Table 36: Birmingham or Stubs' Iron Wire Gauge

[0]Common Gauges.inc 2 February 2026 15:04

Plot of Birmingham or Stubs' Iron Wire Gauge

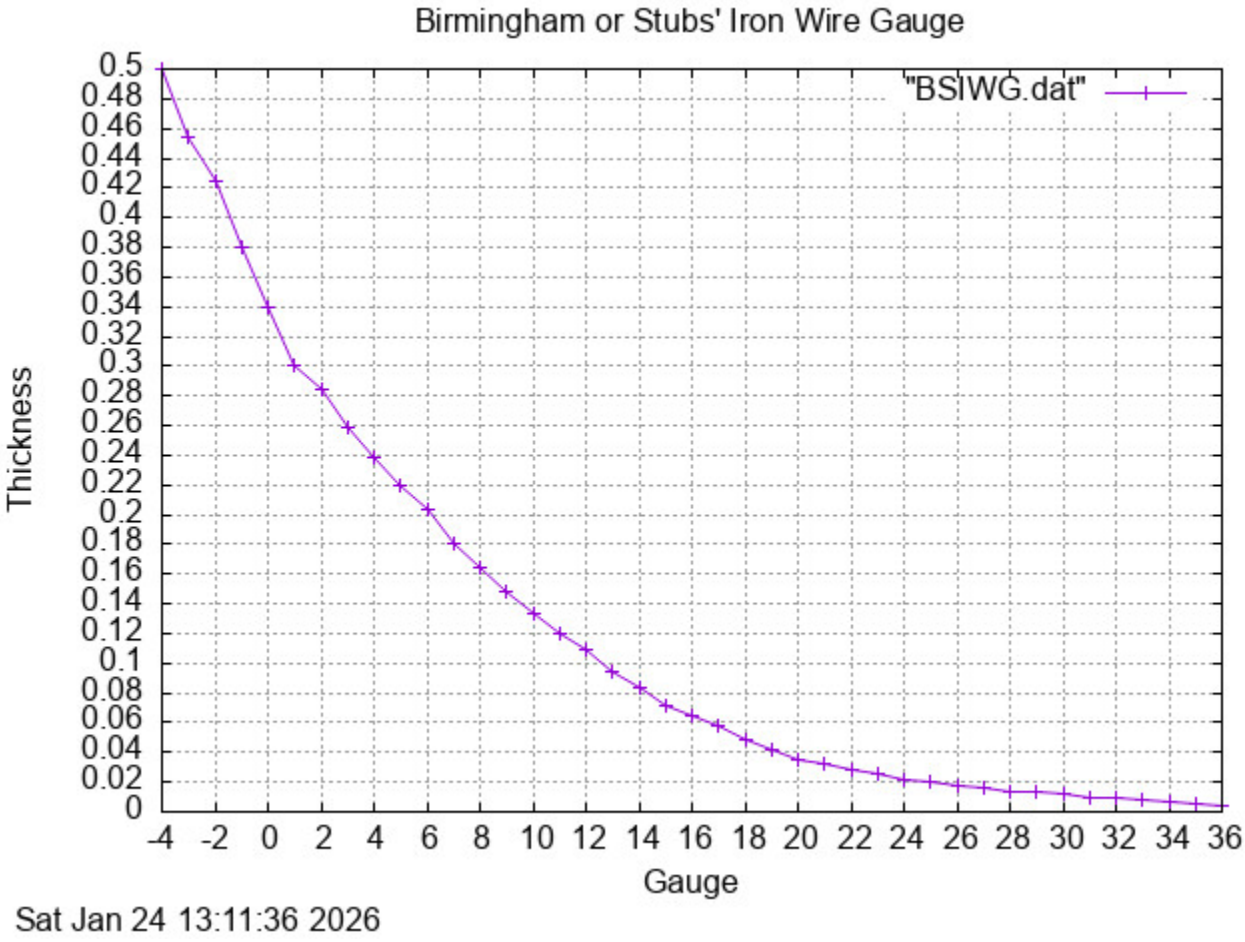

Figure 26: Birmingham or Stubs' Iron Wire Gauge `Common Gauges.inc`

A.3 Stubs' Steel Wire Gauge

Gauge	Size	Gauge	Size	Gauge	Size	Gauge	Size
1	0.227	21	0.157	41	0.095	61	0.038
2	0.219	22	0.155	42	0.092	62	0.037
3	0.212	23	0.153	43	0.088	63	0.036
4	0.207	24	0.151	44	0.085	64	0.035
5	0.204	25	0.148	45	0.081	65	0.033
6	0.201	26	0.146	46	0.079	66	0.032
7	0.199	27	0.143	47	0.077	67	0.031
8	0.197	28	0.139	48	0.075	68	0.030
9	0.194	29	0.134	49	0.072	69	0.029
10	0.191	30	0.127	50	0.069	70	0.027
11	0.188	31	0.120	51	0.066	71	0.026
12	0.185	32	0.115	52	0.063	72	0.024
13	0.182	33	0.112	53	0.058	73	0.023
14	0.180	34	0.110	54	0.055	74	0.022
15	0.178	35	0.108	55	0.050	75	0.020
16	0.175	36	0.106	56	0.045	76	0.018
17	0.172	37	0.103	57	0.042	77	0.016
18	0.168	38	0.101	58	0.041	78	0.015
19	0.164	39	0.099	59	0.040	79	0.014
20	0.161	40	0.097	60	0.039	80	0.013

Table 37: Stubs' Steel Wire Gauge

[0]Common Gauges.inc 2 February 2026 15:04

Plot of Stubs' Steel Wire Gauge

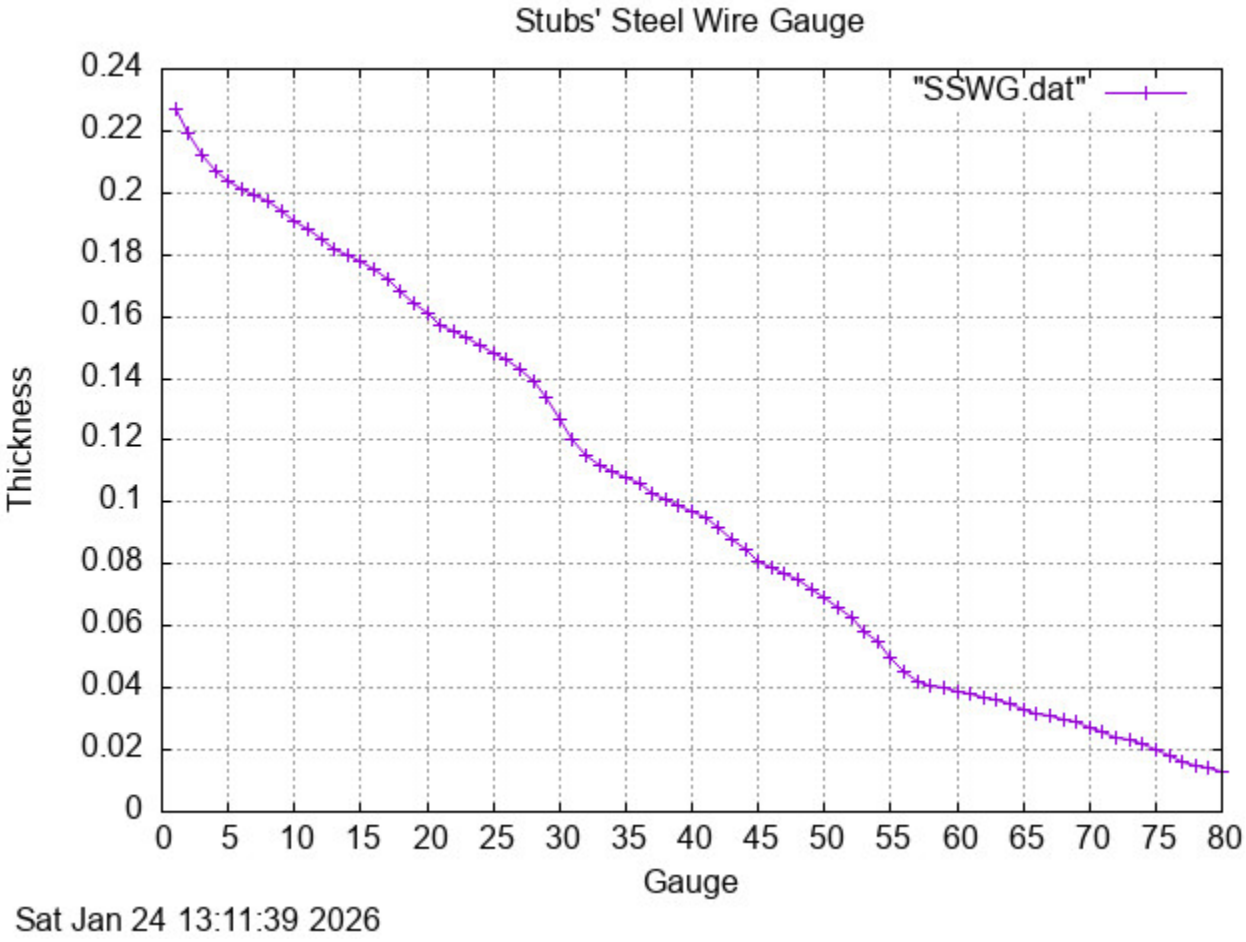

Figure 27: Stubs' Steel Wire Gauge `Common Gauges.inc`

A.4 Washburn & Moen, Roebling or American Steel and Wire Co.

Gauge	Size	Gauge	Size
0 000 000	0.4900	16	0.0625
000 000	0.4615	17	0.0540
00 000	0.4305	18	0.0475
0 000	0.3938	19	0.0410
000	0.3625	20	0.0348
00	0.3310	21	0.03175
0	0.3065	22	0.0286
1	0.2830	23	0.0258
2	0.2625	24	0.0230
3	0.2437	25	0.0204
4	0.2253	26	0.0181
5	0.2070	27	0.0173
6	0.1920	28	0.0162
7	0.1770	29	0.0150
8	0.1620	30	0.0140
9	0.1483	31	0.0132
10	0.1350	32	0.0128
11	0.1205	33	0.0118
12	0.1055	34	0.0104
13	0.0915	35	0.0095
14	0.0800	36	0.0090
15	0.0720		

Table 38: Washburn & Moen, Roebling or American Steel and Wire Co. Gauge

[0]Common Gauges.inc 2 February 2026 15:04

Plot of Washburn & Moen, Roebling or American Steel and Wire Co. Gauge

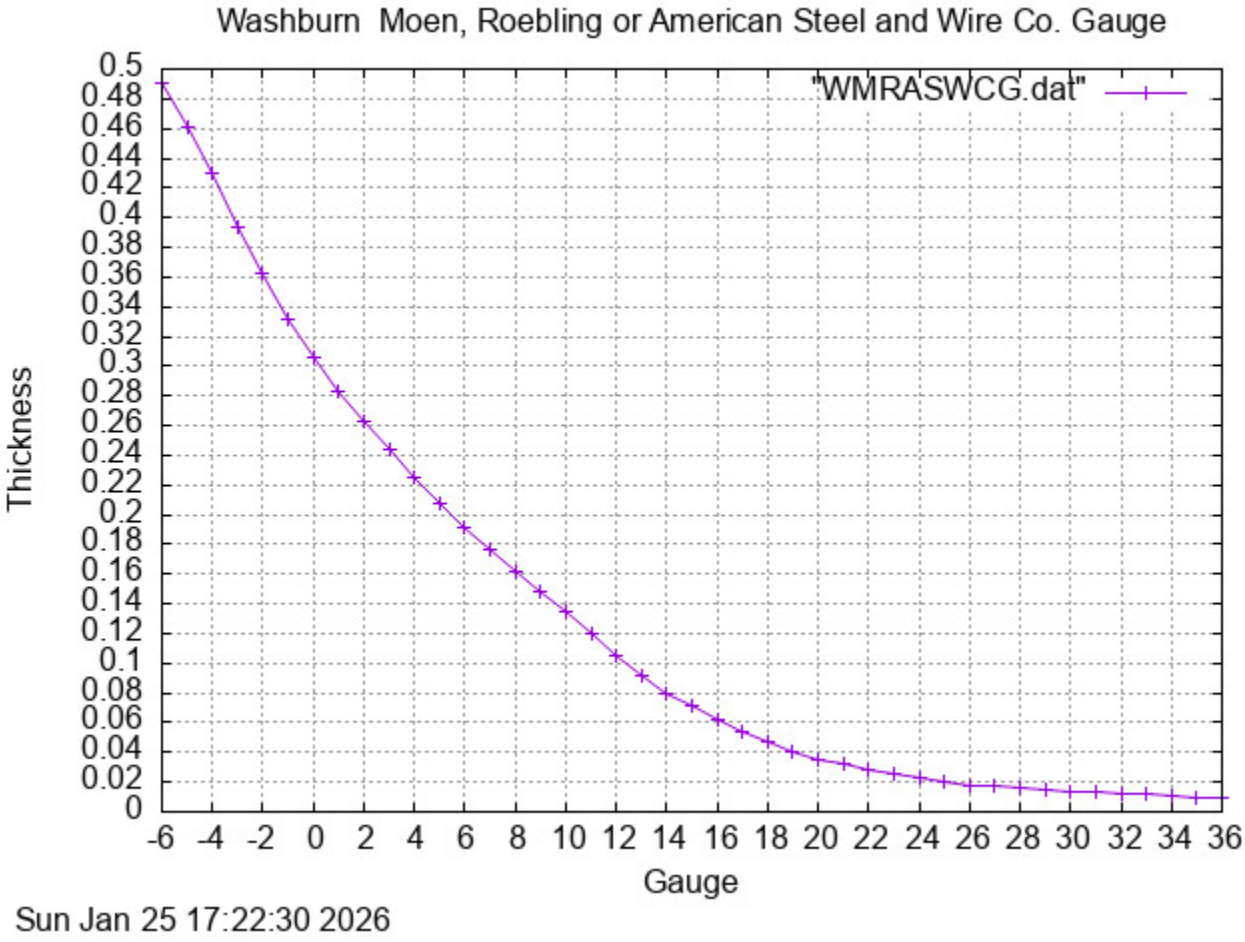

Figure 28: Washburn & Moen, Roebling or American Steel and Wire Co. Gauge `Common Gauges.inc`

A.5 Imperial Wire Gauge

Gauge	Size	Gauge	Size
0 000 000	0.5000	23	0.0240
000 000	0.4640	24	0.0220
00 000	0.4320	25	0.0200
0 000	0.4000	26	0.0180
000	0.3720	27	0.0164
00	0.3480	28	0.0149
0	0.3240	29	0.0136
1	0.3000	30	0.0124
2	0.2760	31	0.0116
3	0.2520	32	0.0108
4	0.2320	33	0.0100
5	0.2120	34	0.0092
6	0.1920	35	0.0084
7	0.1760	36	0.0076
8	0.1600	37	0.0068
9	0.1440	38	0.0060
10	0.1280	39	0.0052
11	0.1160	40	0.0048
12	0.1040	41	0.0044
13	0.0920	42	0.0040
14	0.0800	43	0.0036
15	0.0720	44	0.0032
16	0.0640	45	0.0028
17	0.0560	46	0.0024
18	0.0480	47	0.0020
19	0.0400	48	0.0016
20	0.0360	49	0.0012
21	0.0320	50	0.0010
22	0.0280		

Table 39: Imperial Wire Gauge

[0]Common Gauges.inc 2 February 2026 15:04

Plot of Imperial Wire Gauge

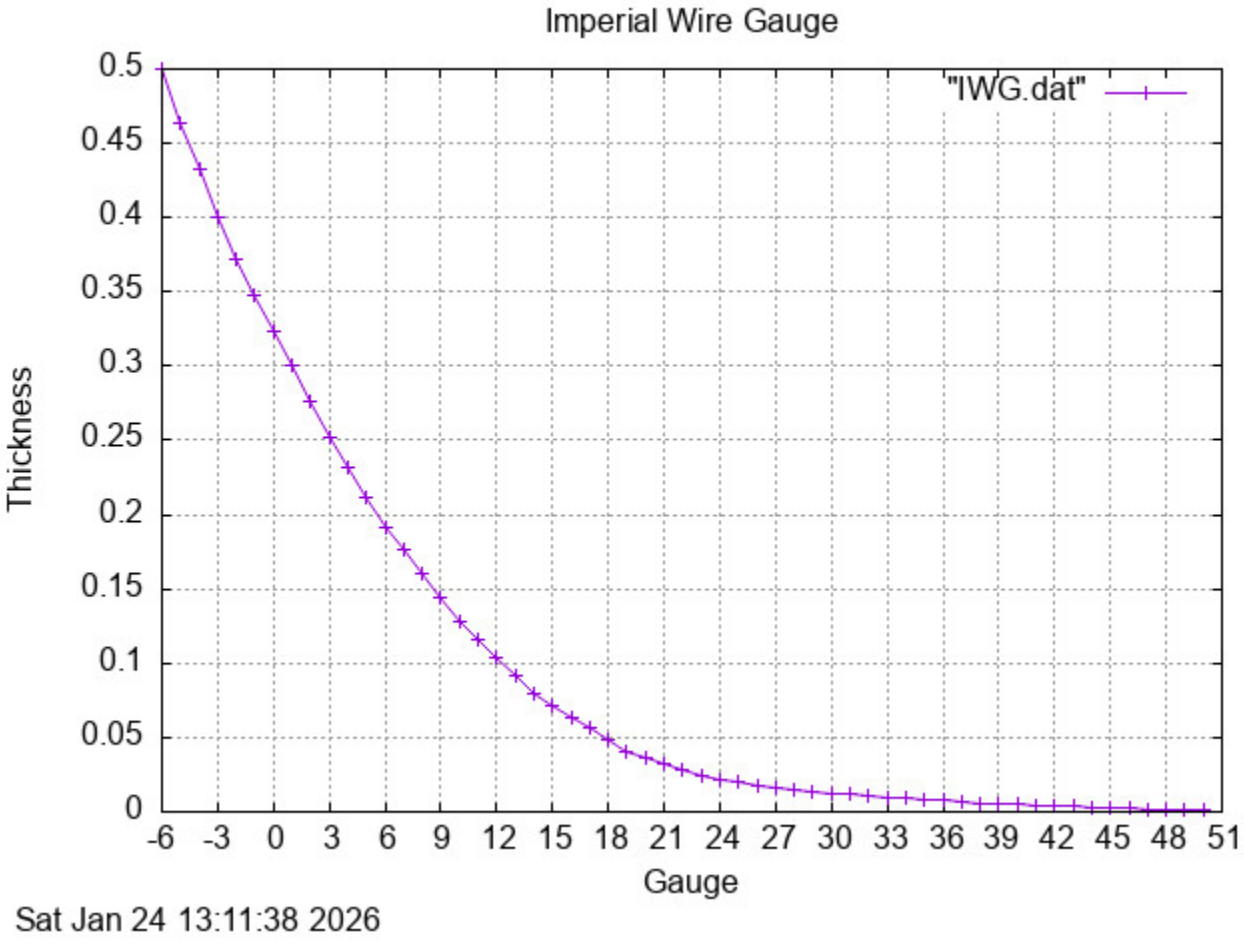

Figure 29: Imperial Wire Gauge `Common Gauges.inc`

A.6 Whitworth's

Gauge	Size	Gauge	Size	Gauge	Size	Gauge	Size
1	0.001	21	0.021	41	0.041	61	0.061
2	0.002	22	0.022	42	0.042	62	0.062
3	0.003	23	0.023	43	0.043	63	0.063
4	0.004	24	0.024	44	0.044	64	0.064
5	0.005	25	0.025	45	0.045	65	0.065
6	0.006	26	0.026	46	0.046	66	0.066
7	0.007	27	0.027	47	0.047	67	0.067
8	0.008	28	0.028	48	0.048	68	0.068
9	0.009	29	0.029	49	0.049	69	0.069
10	0.010	30	0.030	50	0.050	70	0.070
11	0.011	31	0.031	51	0.051	71	0.071
12	0.012	32	0.032	52	0.052	72	0.072
13	0.013	33	0.033	53	0.053	73	0.073
14	0.014	34	0.034	54	0.054	74	0.074
15	0.015	35	0.035	55	0.055	75	0.075
16	0.016	36	0.036	56	0.056	76	0.076
17	0.017	37	0.037	57	0.057	77	0.077
18	0.018	38	0.038	58	0.058	78	0.078
19	0.019	39	0.039	59	0.059	79	0.079
20	0.020	40	0.040	60	0.060	80	0.080

Table 40: Whitworth's Gauge

[0]Common Gauges.inc 2 February 2026 15:04

Plot of Whitworth's Gauge

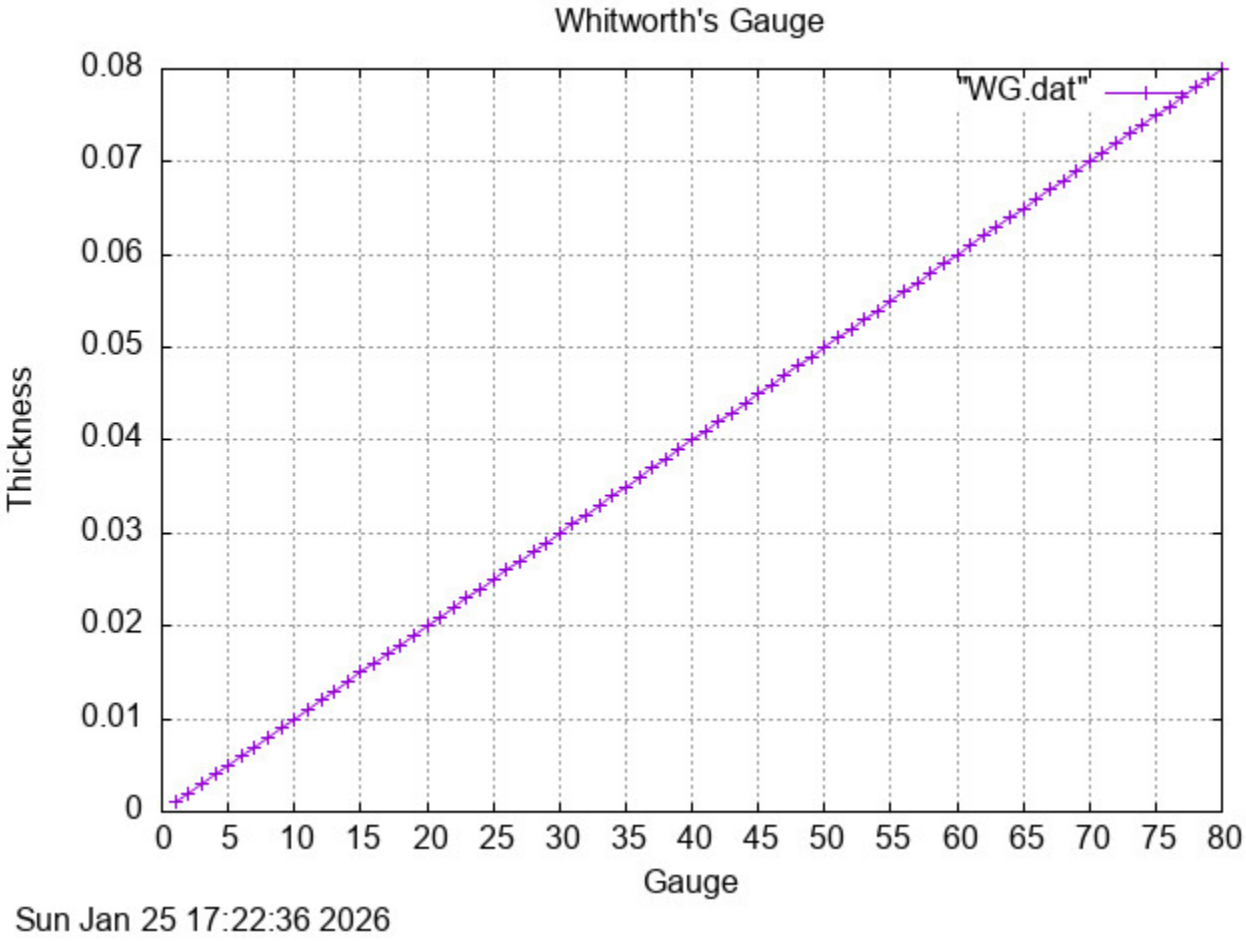

Figure 30: Whitworth's Gauge `Common Gauges.inc`

A.7 Steel Wire Gauge, Waterbury Co., 1917

Gauge	Size	Gauge	Size
000 000 000	0.005	19	0.042
00 000 000	0.0055	20	0.044
0 000 000	0.006	21	0.046
000 000	0.0065	22	0.048
00 000	0.007	23	0.051
0 000	0.0075	24	0.055
000	0.008	25	0.059
00	0.0085	26	0.063
0	0.009	27	0.067
1	0.010	28	0.071
2	0.011	29	0.074
3	0.012	30	0.078
4	0.013	31	0.082
5	0.014	32	0.086
6	0.016	33	0.090
7	0.018	34	0.094
8	0.020	35	0.098
9	0.022	36	0.102
10	0.024	37	0.106
11	0.026	38	0.112
12	0.028	39	0.118
13	0.030	40	0.125
14	0.032	41	0.132
15	0.034	42	0.139
16	0.036	43	0.146
17	0.038	44	0.153
18	0.040	45	0.160

Table 41: Steel Wire Gauge, Waterbury Co., 1917

[0]Common Gauges.inc 2 February 2026 15:04

Plot of Steel Wire Gauge, Waterbury Co., 1917 Gauge

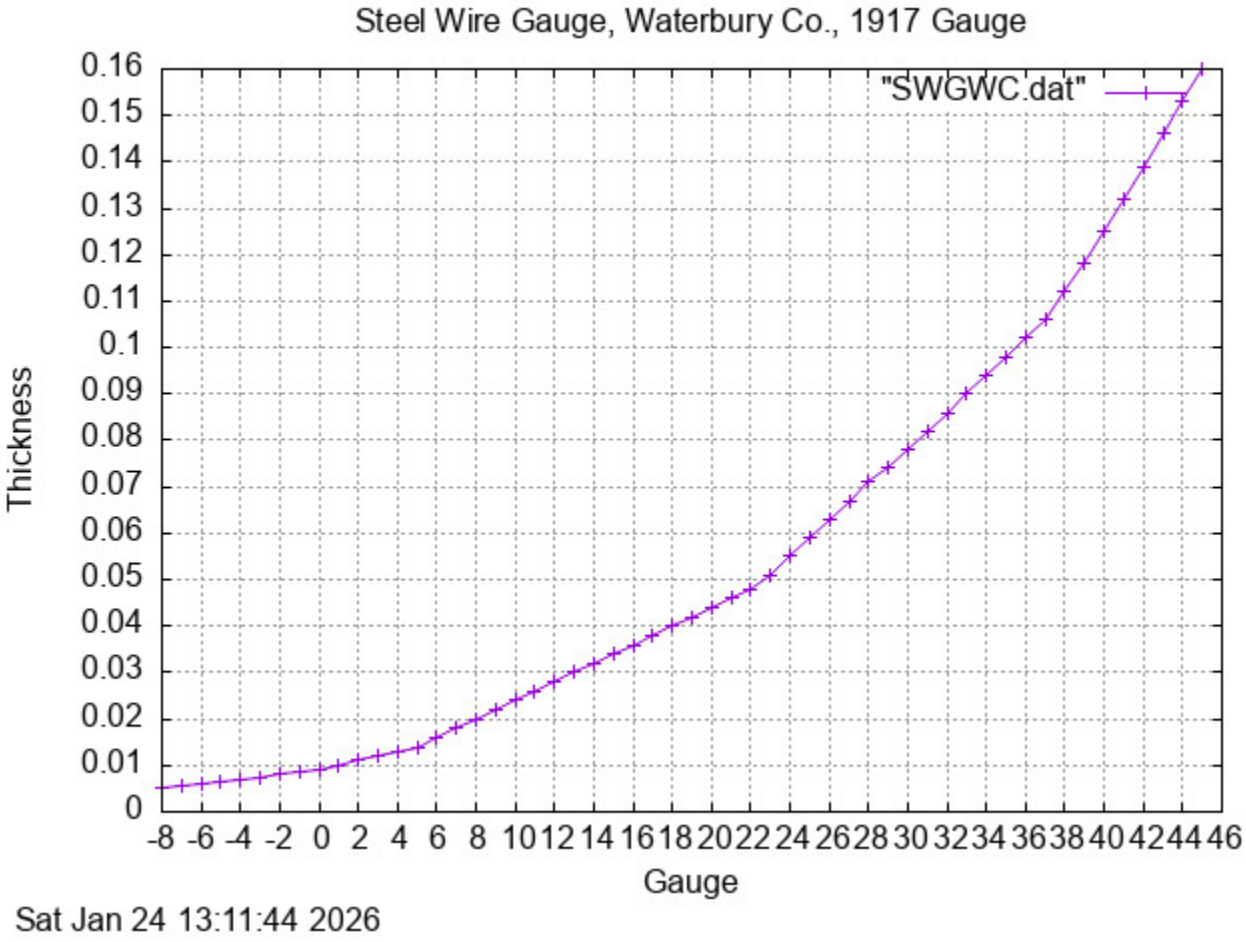

Figure 31: Steel Wire Gauge, Waterbury Co., 1917 Gauge `Common Gauges.inc`

A.8 Sizes of Numbers of the United States Standard Gauge

Source: Brown & Sharpe Catalog No. 29, 1924, pages 172 and 173. For gauges 39 through 44 the source was Lufkin Precision Tools, Catalog No. 7, page T138.

This is an slightly changed item from the Brown & Sharpe catalog about an act of Contress that established this set of values as the "Standard Gauge Sizs" for use in the United States.

Yes the title of this section came directly form the page in the Brown & Sharpe catalog. It is not a typing error from me.

For Sheet and Plate Iron and Steel

An Act

Establishing a Standard Gauge for Sheet and Plate Iron and Steel.

Be it enacted by the Senate and the House of Representatives of the Uniteed States of Americal in Congress assembled:

That for the purpose of securing uniformity the following is established as the only gauge for sheet and plate iron and steel in the United States of America nameley:

Gauge	Thickness in Fractions	Thickness in Decimal	Gauge	Thickness in Fractions	Thickness in Decimal	Gauge	Thickness in Fractions	Thickness in Decimal
0 000 000	1/2	.5	11	1/8	.125	28	1/64	.015625
000 000	15/32	.46875	12	7/64	.109375	29	9/640	.0140625
00 000	7/17	.4375	13	3/32	.09375	30	1/80	.0125
0 000	13/32	.40625	14	5/64	.078125	31	7/640	.0109375
000	3/8	.375	15	9/128	.0703125	32	13/1280	.01015625
00	11/32	.34375	16	1/16	.0625	33	3/320	.009375
0	5/16	.3125	17	9/160	.05625	34	11/1280	.00859375
1	9/32	.28125	18	1/20	.05	35	5/640	.0078125
2	17/64	.265625	19	7/160	.04375	36	9/1280	.00703125
3	1/4	.25	20	3/80	.0375	37	17/2560	.006640625
4	15/64	.235375	21	11/320	.034375	38	1/160	.00625
5	7/32	.21875	22	1/32	.03125	39	15/2560	.005859375
6	13/64	.203125	23	9/320	.028125	40	7/1280	.00546875
7	3/16	.1875	24	1/40	.025	41	27/5120	.0052734375
8	11/64	.171875	25	7/320	.021875	42	13/2560	.005078125
9	5/32	.15625	26	3/160	.01875	43	25/5120	.0048828125
10	9/64	.140625	27	11/640	.0171875	44	3/640	.0046875

Table 42: United States Standard Gage

[0]BandSamericanstandard.inc 2 February 2026 15:04

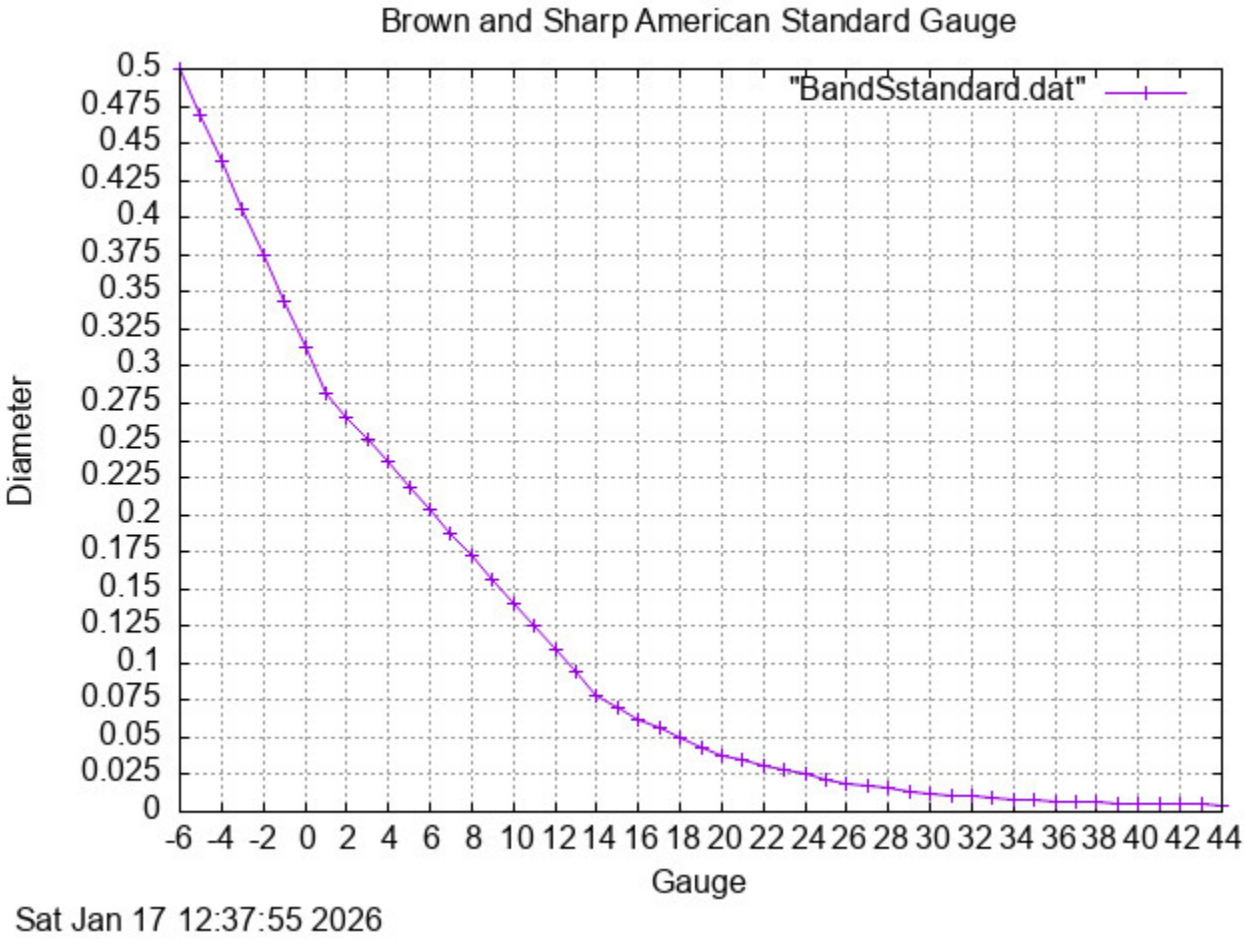

Figure 32: American Standard Gauge for Sheet and Plate Iron and Steel `BandSamericanstandard.inc`

B Mechanics' and Engineers' Pocket-Book Gauges

B.1 Mechanics' and Engineers' Pocket-Book American Gauge

Source: Mechanics' and Engineers' Pocket-Book, 1906, page 118, 120.

In the Mechanics' and Engineers' Pocket-Book on Page 118. The table is titled "Wrought Iron, Steel, Copper, and Brass Plates.". These are the entries for Ameican Gauge. On page 120 the same gauge vlues are ther, but there are three additonal fractonal values added for gauges 24, 39 and 36.

Gauge	Thickness		Gauge	Thickness	
0 000	.46	7/16 Full	19	.035 89	
000	.409 64		20	.031 961	
00	.364 8	3/8 Light	21	.028 462	
0	.324 86	1/8 Light	22	.025 347	
1	.289 3		23	.022 572	
2	.256 63	1/4 Full	24	.020 1	1/50 Full
3	.229 42		25	.017 9	
4	.204 31	1/5 Full	26	.015 94	
5	.181 94	3/16 Light	27	.014 195	
6	.162 02		28	.012 641	
7	.144 28		29	.011 257	
8	.128 49	1/8 Full	30	.010 025	1/100 Full
9	.114 43		31	.008 928	
10	.101 89	1/10 Full	32	,007 95	
11	.090 742		33	.007 08	
12	.080 808		33	.006 304	
13	.071 961		35	.005 614	
14	.064 084		36	.005	1/200
15	.057 068		37	.004 453	
16	.050 82	1/20 Full	38	.003 965	
17	.045 257		39	.003 531	
18	.040 303		40	.003 144	

Table 43: American Gauge

A special note about "strange" thicknesses:

B.1.1 Notes about saw steel thicknesses

As there are many gauges in use differing from each other, and even the thickness of a certain specified gauge, as the Birlmingham, are not assumed the same by all manfacturers, orders for sheets and wires should always state the weight per square foot, or the thickness in thousnadths of an inch.

[0]AG.inc 2 February 2026 15:04
[0]Memo.inc 2 February 2026 15:04

B.1.2 Notes about gauge sizes

The difficulities experience in using Wire Gauges of the usual forms are well set foth in the following Circular issued by "Messrs. Miller, Metcalf, & Parkin", Steel Manfacturers, Pittsburg, Pa.

Memorandum on Gauges

Relferring to the annexed tables, we would call attention to some of the absurdities and anomalies of the present system of gauges, denoted by numbers.

A perusal of these tables should satisfy us that we have a sufficient variety to choose from, and ample refinement, when we get down to one-millionth of an inch, which is the final figure in some cases.

In some cases the difference between two numbers falls as low as two one-thuslands of an inch, in others it is only one one-thousandth, &c.

It may be possiblel to make one gauge to any of these standards, which shall be so accurate as to defy the detection of an error, and with the same care it may be possiable to make a thousand such gauges, but every mechanium and every person accustomed to making accurate measurements of the best work, knows that it is simply impossible to obtain absolute accurcy in such pieces of work, when produced in large quanities.

It is impossible commercially, on account of the cost, and that settles the question.

Every one knows of the wonderful accuracy of the Whitworth gauges and also their enormous price, which makes them almost unsalable.

In regard to ordinary wire gauges, they are notoriously inaccurate, because they cannot be made accurate and be at all salable.

We have two new gauges in our possession, which were kept in our offices for purposes of comparison, and to prevent their wearing they were not allowed to go into the mills.

In a recent case, a sample under discussion, measured on one gauge, tight twenty-three, and on the other, light twenty-four, and our customer said it was neither, by his gauge, and did not suit him, anyhow.

One of our new gauges has its No. 23 so much larger than its No. 22, that the difference can be easily detected by the naked eye; yet No. 23 ought to be two to four thousands smaller than No. 22.

If we were to roll to No. 23 by that gauge, how would our customer get what he wanted, unless his gauge accidentally contained the same blunder? Yet our gauge is a new one, stamped with the maker's name, and cost about six dollars.

Another trouble is with the wearing of the gauges, for which there is no remedy; and we imagine that no man ever throws away gauge because it is worn out. On the contrary, it reprsents an outlay of six dolars; he is used to it; he measures everything by it; and he is mad when anything does not measure to suit it. A still more serious difficulty arises from a very common mode of ordering "tight," "full" or "scant," "heavy" or "easy"; or such a number and one-half, for instance $15\frac{1}{2}$.

This latter is terribly confusing to a roller; he almost always takes it to mean that it is to be thicher than the whole number, and is pretty certin to make $14\frac{1}{2}$ for $15\frac{1}{2}$ if he is not warned beforhand.

Then in reguard to the terms "light," "easy," &c., we have, for instance the differences between Nos. 27 and 28, in the three systems, as follows:—

`.00225` `.002` `.001554`

or two hundred and twenty-five one-hundred-thounsandths, two one-thounsandths, and fifteen hundred and fifty-four millionths.

How is it possible for a roller to know just how many milliontjhs of an inch another man, whom he never saw, means when No. 28 "full", or No. 27 "easy"? And how is he to guess how many thousandths of an inch the other man's gauge is wrong it its make, or how many hundreths it has worn in years of steady use?

This is no fancy sketch; the above are every-day difficulties in this age, when every man knows just what he wants and will have nothing else, and yet has no better way of telling wants, that to say I want such a gauge "tight" when probably his gauge differs from every other gauge that was ever made.

There is a very easy and simple way out of this whole snarl, and that is to abandon fixed gauges and numbers altogether.

The micrometer Sheet Metal Gauges made by the Brown & Sharpe Manfacturing Co of Providence, R. I., cost less than a common gauge, or no more. They measure thousandths of an inch very accurately, and even a quarter of a thousandth may be neatly measured.

They are very simple, so that any boy of ordinary intelligence can be taught to use one in a very few minutes. They have very easy arrangements for re-adjustment, when worn; and even when worn considerably, they can be used accurately, without adjustment, by making allowance for the error in reading at the zero line.

We find that mechanics like to work to them, and that there is very little trouble to get sheet rolling done to within a thousandth of an inch on fine sizes.

Our workers are fully supplied with these instruments, and we urge all parties in ordering to give us dimensions and not numbers.

We cannot now recall a single case of serous complaint having arisen where we have had dimentions exprssed in decimals to work to.

B.1.3 Notes about Stubs' Gauge

In using the gauges known as Stub's Gauges, there should be constantly born in mind the difference between the Stubs' Iron Wire Gauge and the Stubs' Steel Wire Gauge.

The Stubs' Iron Wire Gauge is the one commonly known as the English Standard Wire, or Birmingham Gauge, and designates the Stubs' *soft* wire sizes.

The Stubs' Steel Wire Gauge is the one that is used in measuring drawn steel wire or drill rods of Stubs' make, and is also used by many makers of American drill rods.

B.2 Mechanics' and Engineers' Pocket-Book Birmingham Gauge

Source: Mechanics' and Engineers' Pocket-Book, 1906, page 119, 121.

In the Mechanics' and Engineers' Pocket-Book on Page 119. The table is titled "Wrought Iron, Steel, Copper, and Brass Plates.". These are the entries for Birmingham Gauge.

Gauge	Thickness		Gauge	Thickness	
0 000	.454	7/16 Full	17	.058	
000	.424		18	.049	1/20 Light
00	.38	3/8 Full & 19	.042		
0	.34	1/3 Full	20	.035	
1	.3		21	.032	
2	.284		22	.028	
3	.259	1/4 Full	23	.025	1/40
4	.238		24	.022	
5	.22		25	.02	1/50
6	.203	1/5 Full	26	.018	
7	.18	3/16 Light	27	.016	
8	.165	1/6 Light	28	.014	
9	.148	1/7 Full	29	.013	
10	.134		30	.012	
11	.12	1/8 Light	31	.01	1/100
12	.109		32	.009	
13	.095	1/10 Light	33	.008	
14	.083		34	.007	
15	.072		35	.005	1/200
16	.065		36	.004	1/250

Table 44: Birmingham Gauge

A special note about "strange" thicknesses:

B.2.1 Notes about saw steel thicknesses

As there are many gauges in use differing from each other, and even the thickness of a certain specified gauge, as the Birlmingham, are not assumed the same by all manfacturers, orders for sheets and wires should always state the weight per square foot, or the thickness in thousnadths of an inch.

B.2.2 Notes about gauge sizes

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Memorandum on Gauges

[0]BG.inc 2 February 2026 15:04
[0]Memo.inc 2 February 2026 15:04

Relferring to the annexed tables, we would call attention to some of the absurdities and anomalies of the present system of gauges, denoted by numbers.

A perusal of these tables should satisfy us that we have a sufficient variety to choose from, and ample refinement, when we get down to one-millionth of an inch, which is the final figure in some cases.

In some cases the difference between two numbers falls as low as two one-thuslands of an inch, in others it is only one one-thousandth, &c.

It may be possiblel to make one gauge to any of these standards, which shall be so accurate as to defy the detection of an error, and with the same care it may be possiable to make a thousand such gauges, but every mechanium and every person accustomed to making accurate measurements of the best work, knows that it is simply impossible to obtain absolute accurcy in such pieces of work, when produced in large quanities.

It is impossible commercially, on account of the cost, and that settles the question.

Every one knows of the wonderful accuracy of the Whitworth gauges and also their enormous price, which makes them almost unsalable.

In regard to ordinary wire gauges, they are notoriously inaccurate, because they cannot be made accurate and be at all salable.

We have two new gauges in our possession, which were kept in our offices for purposes of comparison, and to prevent their wearing they were not allowed to go into the mills.

In a recent case, a sample under discussion, measured on one gauge, tight twenty-three, and on the other, light twenty-four, and our customer said it was neither, by his gauge, and did not suit him, anyhow.

One of our new gauges has its No. 23 so much larger than its No. 22, that the difference can be easily detected by the naked eye; yet No. 23 ought to be two to four thousands smaller than No. 22.

If we were to roll to No. 23 by that gauge, how would our customer get what he wanted, unless his gauge accidentally contained the same blunder? Yet our gauge is a new one, stamped with the maker's name, and cost about six dollars.

Another trouble is with the wearing of the gauges, for which there is no remedy; and we imagine that no man ever throws away gauge because it is worn out. On the contrary, it reprsents an outlay of six dolars; he is used to it; he measures everything by it; and he is mad when anything does not measure to suit it. A still more serious difficulty arises from a very common mode of ordering "tight," "full" or "scant," "heavy" or "easy"; or such a number and one-half, for instance $15\frac{1}{2}$.

This latter is terribly confusing to a roller; he almost always takes it to mean that it is to be thicher than the whole number, and is pretty certin to make $14\frac{1}{2}$ for $15\frac{1}{2}$ if he is not warned beforhand.

Then in reguard to the terms "light," "easy," &c., we have, for instance the differences between Nos. 27 and 28, in the three systems, as follows:—

.00225	.002	.001554

or two hundred and twenty-five one-hundred-thounsandths, two one-thounsandths, and fifteen hundred and fifty-four millionths.

How is it possible for a roller to know just how many milliontjhs of an inch another man, whom he never saw, means when No. 28 "full", or No. 27 "easy"? And how is he to guess how many thousandths of an inch the other man's gauge is wrong it its make, or how many hundreths it has worn in years of steady use? This is no fancy sketch; the above are every-day difficulties in this age, when every man knows just what he wants and will have nothing else, and yet has no better way of telling wants, that to say I want such a gauge "tight" when probably his gauge differs from every other gauge that was ever made.

There is a very easy and simple way out of this whole snarl, and that is to abandon fixed gauges and numbers altogether.

The micrometer Sheet Metal Gauges made by the Brown & Sharpe Manfacturing Co of Providence, R. I., cost less than a common gauge, or no more. They measure thousandths of an inch very accurately, and even a quarter of a thousandth may be neatly measured.

They are very simple, so that any boy of ordinary intelligence can be taught to use one in a very few minutes. They have very easy arrangements for re-adjustment, when worn; and even when worn considerably, they can be used accurately, without adjustment, by making allowance for the error in reading at the zero line.

We find that mechanics like to work to them, and that there is very little trouble to get sheet rolling done to within a thousandth of an inch on fine sizes.

Our workers are fully supplied with these instruments, and we urge all parties in ordering to give us dimensions and not numbers.

We cannot now recall a single case of serous complaint having arisen where we have had dimentions exprssed in decimals to work to.

B.2.3 Notes about Stubs' Gauge

In using the gauges known as Stub's Gauges, there should be constantly born in mind the difference between the Stubs' Iron Wire Gauge and the Stubs' Steel Wire Gauge.

The Stubs' Iron Wire Gauge is the one commonly known as the English Standard Wire, or Birmingham Gauge, and designates the Stubs' *soft* wire sizes.

The Stubs' Steel Wire Gauge is the one that is used in measuring drawn steel wire or drill rods of Stubs' make, and is also used by many makers of American drill rods.

B.3 Mechanics' and Engineers' Pocket-Book Birmingham Gauge? Thickness of Plates

Source: Mechanics' and Engineers' Pocket-Book, 1906, page 121.

In the Mechanics' and Engineers' Pocket-Book on Page 121. The table on the bottom of the page is titled "Thickness of Plates.". These might be the entries for Birmingham Gauge Thickness of Plates.

No.	Inch.	No.	Inch.
1	.312 5	17	.056 25
2	.281 25	18	.08
3	.25	19	.043 75
4	.234 375	20	.037 5
5	.218 75	21	.034 375
6	.203 125	22	.031 25
7	.187 5	23	.028 125
8	.171 875	24	.025
9	.156 25	25	.023 44
10	.140 625	26	.021 875
11	.125	27	.020 312
12	.112 5	28	.018 75
13	.1	29	.017 19
14	.087 5	30	.015 625
15	.075	31	.014 06
16	.062 5	32	.012 5

Table 45: Birmingham Gauge? Thickness of Plates

[0]BGP.inc 2 February 2026 15:04

B.4 Mechanics' and Engineers' Pocket-Book Birmingham Gauge Silver and Gold

Source: Mechanics' and Engineers' Pocket-Book, 1906, page 119.

In the Mechanics' and Engineers' Pocket-Book on Page 119. The table on the bottom of the page is titled "Thickness of Sheet Silver, Gold, etc.". These are the entries for Birmingham Gauge for Silver and Gold.

Note: In the original document that the values for gauges 5 and 6 are the same. It seems resonable that the gauge for 6 shoud be .014. But I didn't want to chage the value, preferring to remain as close to the original as I could.

No.	Inch.	No.	Inch.	No.	Inch.
1	.004	13	.036	25	.095
2	.005	14	.041	26	.103
3	.008	15	.047	27	.113
4	.01	16	.051	28	.12
5	.013	17	.057	29	.124
6	.013	18	.061	39	.126
7	.015	19	.064	31	.133
8	.016	20	.067	32	.143
9	.019	21	.072	33	.145
10	.024	22	.074	34	.148
17	.057	25	.077	35	.158
18	.061	24	.082	36	.167

Table 46: Birmingham Gauge for Silver and Gold

[0]BGSG.inc 2 February 2026 15:04

B.5 Mechanics' and Engineers' Pocket-Book French Gauges (*Jauges de Fils de Fer*)

Source: Mechanics' and Engineers' Pocket-Book, 1906, page 123.

In the Mechanics' and Engineers' Pocket-Book on Page 123. This is the start of the French wire gagugs in the Mechanics' and Engineers' Pocket-Book. In all there are three different gauges listed.

B.5.1 Wire-Gauge (*Jauge de Limoges*)

No.	mm	Inch.	No.	mm	Inch.	No.	mm	Inch.
0	.39	.0154	9	1.35	.0532	18	3.4	.134
1	.45	.0177	10	1.46	.0575	19	3.95	.156
2	.56	.0221	11	1.68	.0661	20	4.5	.177
3	.67	.0264	12	1.8	.0706	21	5.1	.201
4	.79	.0311	13	1.91	.0752	22	5.65	.222
5	.9	.0354	14	2.02	.0795	23	6.2	.244
6	1.01	.0398	15	2.14	.0843	24	6.8	.268
7	1.12	.0441	16	2.25	.0886			
8	1.24	.0488	17	2.84	.112			

Table 47: *Jauge de Limoges* Gauge

B.5.2 For Galvanized Iron Wire Gauge

No.	mm	Inch.	No.	mm	Inch.	No.	mm	Inch.
1	.6	.0236	9	1.4	.0551	17	3.	.118
2	.7	.0276	10	1.5	.0591	18	3.4	.134
3	.8	.0315	11	1.6	.063	19	3.9	.154
4	.9	.0354	12	1.8	.0709	20	4.4	.173
5	1.	.0394	13	2.	.0787	21	4.9	.193
6	1.1	.0433	14	2.2	.0866	22	5.4	.213
7	1.2	.0473	15	2.4	.0945	23	5.9	.232
8	1.3	.0512	16	2.7	.106			

Table 48: Galvanized Iron Wire

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B.5.3 For Wire and Bars Gauge

Mark	mm	Mark	mm	Mark	mm	Mark	mm	Mark	mm
P	5	7	12	13	20	19	39	25	70
1	6	8	13	14	22	20	44	26	76
2	7	9	14	15	24	21	49	27	82
3	8	10	15	16	27	22	54	28	88
4	9	11	16	17	30	23	59	29	94
5	10	12	18	18	34	24	64	30	100
6	11								

Table 49: Wire and Bars Gauge

B.6 Mechanics' and Engineers' Pocket-Book New Standard Wire Gauge of Great Britan

Source: Mechanics' and Engineers' Pocket-Book, 1906, page 122.

In the Mechanics' and Engineers' Pocket-Book on Page 118. The table is titled " New Standard Wire Gauge Great Britan, 1884" has the folloing wire gauges listed. The range is for 7/0 to 50.

No.	Inch.	No.	Inch	No.	Inch.
7/0	.5	13	.092	32	.0108
6/0	.464	14	.08	33	.01
5/0	.434	15	.072	34	.0092
4/0	.4	16	.064	35	.0084
3/0	.372	17	.056	36	.0076
2/0	.348	18	.048	37	.0068
0	.324	19	.04	38	.006
1	.3	20	.036	39	.0052
2	.276	21	.032	40	.0048
3	.252	22	.028	41	.0044
4	.232	23	.024	42	.004
5	.212	24	.022	43	.0036
6	.192	25	.02	44	.0032
7	.176	26	.018	45	.0028
8	.160	27	.0164	46	.0024
9	.144	28	.0148	47	.002
10	.128	29	.0136	48	.0016
11	.116	30	.0124	49	.0012
12	.104	31	.0116	50	.001

Table 50: New Standard Wire Gauge of Great Britan, 1884

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B.7 Mechanics' and Engineers' Pocket-Book Sir Joseph Whitworth & Co's Gauge

Source: Mechanics' and Engineers' Pocket-Book, 1906, page 122.

In the Mechanics' and Engineers' Pocket-Book on Page 122. At the top of the page a a table of English Wire Gauges.

Note: The diamete3r valye for gauge No. 95 may be incorrect and might be .095. However I left it as it is in the book to try and maintain acuracy to the original. Also note that many gauges are "skipped" over. Again this in the orignal.

Sir Joseph Whitworth, in 1857, introduced a Standard Wire-Gauge, ranging from half an inch to a thousandth, and comprising 62 measurments. It commences with least thichness, and incrases by thousandths of an inch up to half an inch. Smallest thickness, $\frac{1}{1000}$ of an inch, is No. 1; No. 2 is $\frac{2}{1000}$, and so on, increasing up to No. 20 by intervals of $\frac{1}{1000}$; from No. 20 to No. 40 by $\frac{2}{1000}$; and from No. 40 to No. 100 by $\frac{5}{1000}$. The thicknesses are designated or marked by their respective numbers in thousands of an inch.

This gauge is entering into general use in England.

No.	Inch.	No.	Inch.	No.	Inch.	No.	Inch.	No.	Inch.
1	.001	14	.014	34	.034	85	.085	240	.24
2	.002	15	.015	36	.036	90	.09	260	.26
3	.003	16	.016	38	.038	95	.09	280	.28
4	.004	17	.017	40	.04	100	.1	300	.3
5	.005	18	.018	45	.045	110	.11	325	.325
6	.006	19	.019	50	.05	120	.12	350	.35
7	.007	20	.02	55	.055	135	.135	375	.375
8	.008	22	.022	60	.06	150	.15	400	.4
9	.009	24	.024	65	.065	165	.165	425	.425
10	.01	26	.026	70	.07	180	.18	450	.45
11	.011	28	.028	75	.075	200	.2	475	.475
12	.012	30	.03	80	.08	220	.22	500	.5
13	.013	32	.032						

Table 51: Sir Joseph Whitworth & Co's Gauge

[0]SJW.inc 2 February 2026 15:04

B.8 Mechanics' and Engineers' Pocket-Book South Staffordshire Gauge

Source: Mechanics' and Engineers' Pocket-Book, 1906, page 129 " Weight of Sheet Iron (English)". As by Wire-gauge used in South Staffordshire, England.

Note that the reverse gauge order which was in the original.

No.	Inch	No.	Inch	No.	Inch
32	.0125	21	.0344	10	.1406
31	.0141	20	.0375	9	.1563
30	.0156	19	.0438	8	.1719
29	.0172	18	.05	7	.1875
28	.0188	17	.0563	6	.2031
27	.0203	16	.0625	5	.2188
26	.0219	15	.075	4	.2344
25	.0234	14	.0875	3	.25
24	1	13	.1	2	.2813
23	1.13	12	.1125	1	.3125
22	1.25	11	.125		

Table 52: South Staffordshire Gauge

[0]SSG.inc 2 February 2026 15:04

B.9 Mechanics' and Engineers' Pocket-Book Roebling?

Source: Mechanics' and Engineers' Pocket-Book, 1906, page 163

In the Mechanics' and Engineers' Pocket-Book on Page 163. The page heading is "Galvanized Charcoal Iron Wire Rope" With a sub heading of John A. Roebling's Sons Co. On the lower part of the page there is table for "Gauge, Weight, and Length of Iron Wire." I have assumed that the gauge numbers are from the Roebling" company.

Gauge	Diam	Gauge	Diam.
6/0	.46	16	.063
5/0	.43	17	.054
4/0	.393	18	.047
3/0	.362	19	.041
2/0	.331	20	.035
1/0	.307	21	.032
1	.283	22	.028
2	.263	23	.025
3	.244	24	.023
4	.225	25	.02
5	.207	26	.018
6	.192	27	.017
7	.177	28	.016
8	.162	29	.015
9	.148	30	.014
10	.135	31	.035
11	.12	32	.013
12	.105	33	.011
13	.092	34	.01
14	.08	35	.0095
15	.072	36	.009

Table 53: Roebling?

[0]RAS.inc 2 February 2026 15:04

B.10 Mechanics' and Engineers' Pocket-Book Vielle-Montagne

Source: Mechanics' and Engineers' Pocket-Book, 1906, page 151

In the Mechanics' and Engineers' Pocket-Book on Page 151 there is a listing of Dimensions and Weight of Sheet Zinc with the thickness of the zinc plade given a gauge number from 9 $\longrightarrow$ 26. I haven't seen this set of gauges elsewhare so I have included it here.

No.	Thickness	
	Millim.	Inch.
9	.41	.0161
10	.51	.0201
11	.6	.0236
12	.69	.0272
13	.78	.0307
14	.87	.0343
15	.96	.0378
16	1.1	.0433
17	1.23	.0485
18	1.36	.0536
19	1.48	.0583
20	1.66	.0654
21	1.85	.0729
22	2.02	.0795
23	2.19	.0862
24	2.37	.0933
25	2.52	.0992
26	2.66	.1047

Table 54: Vielle-Montagne

[0]VM.inc 2 February 2026 15:04

B.11 Mechanics' and Engineers' Pocket-Book Warrington, Rylands Brothers Gauge

Source: Mechanics' and Engineers' Pocket-Book, 1906, page 122.

In the Mechanics' and Engineers' Pocket-Book on Page 122. At the top of the page a a table of English Wire Gauges.

No.	Inch.	No.	Inch.	No.	Inch.
7/0	1/2	6	.191	17	.053
6/0	15/32	7	.174	18	.047
5/0	7/16	8	.159	19	.041
4/0	13/32	9	.146	20	.036
3/0	3/8	10	.133	21	.0315
2/0	11/32	10.5	.125	22	.028
0	.326	11	.117		
1	.3	12	.1		
2	.274	13	.09		
3	.25	14	.079		
4	.229	15	.69		
5	.209	16	.0625		

Table 55: Warrington, Rylands Brothers Gauge

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5. Crawling the Site is allowed if done in accordance with the provisions of our robots.txt file, but scraping the Site is prohibited.

6. This agreement shall be governed by and construed in accordance with the laws of the State of California applicable to agreements made and to be performed in California. You agree that any legal action or proceeding between you and Sizes, Inc. for any purpose concerning these Terms or the parties' obligations hereunder shall be brought exclusively in a state or federal court of competent jurisdiction sitting in California. If any provision of this agreement shall be unlawful, void, or for any reason unenforceable, then that provision shall be deemed severable from this agreement and shall not effect the validity and enforceability of any remaining provisions. This is the entire agreement between the parties relating to the subject matter herein and shall not be modified except in writing, signed by both parties.

7. This agreement is effective until terminated by either party. You may terminate this agreement at any time by destroying all materials obtained from this Site and all copies thereof, whether made under the terms of this agreement or otherwise. This agreement will terminate immediately without notice from Sizes, Inc. if in Sizes, Inc.'s sole discretion you fail to comply with any term or provision of this agreement. Upon termination, you must destroy all materials obtained from this Site and all copies thereof, whether made under the terms of this agreement or otherwise.

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