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1 Sizes of Wire Gauges from `Sizes.com`

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 1.14, page 42 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:

- American Steel and Wire Gauge section 1.3, page 5
- American Wire Gauge (AWG) subsubsection 1.4.2, page 6
- Birmingham Wire Gage subsection 1.5, page 11
- British Standard Wire Gage subsection 1.9, page 30
- Brown & Sharpe Wire Gauge (AWG) subsection 1.4, page 6
- Cocker's Wire Gauge section 1.3, page 5
- Edison Standard Wire Gauge section 1.3, page 4
- Imperial Wire Gauge subsection 1.9, page 30
- Jauge carcasse section 1.8.4, page 28
- Jauge de Limoges subsubsection 1.8.3, page 25

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- Jauge de Paris subsubsection 1.8.1, page 21
- Jauge Japy subsubsection 1.8.2, page 23
- Lancashire Gauge subsection 1.7, page 19
- London Gage section 1.3, page 5
- Market Wire Gauge section 1.3, page 5
- Morse Twist Drill Gauge section 1.3, page 4
- Needle Wire Gauge section 1.3, page 4
- Old English Wire Gage section 1.3, page 5
- Roebling Wire Gauge section 1.3, page 5
- Imperial Standard Wire Gage subsection 1.9, page 30
- Steel Wire Gauge section 1.3, page 5
- Birmingham, Stubs' Iron Wire Gauge subsection 1.5, page 11
- Stubs' Steel Wire Gauge section 1.3, page 5
- Washburn & Moen Wire Gauge section 1.3, page 5
- Whitworth's Wire Gauge section 1.3, page 5

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 19, page 41
- British Standard Wire Gauge to ISO metric sizes subsubsection 1.13.1, page 39 Table 18, page 40
- ISO metric sizes to British Standard Wire Gauge subsubsection 1.13.1, page 39

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 1.7, page 19, the sizes being taken from wire and rod imported from Britain.

Needle Wire Gauge Derived from the Birmingham Wire Gauge. #1 = $18\frac{1}{2}$ B.W.G.; #2 = 19 B.W.G., and so on to #14 = 31 B.W.G. See S. S. Wheeler, Electrical World, Nov. 12, 1887,

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 Figure 20, page 51.

> 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 Figure 20, page 50.

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 Figure 20, page 53.

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

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/materls`Saw Size

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:

Get Formulla

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

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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
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

Continued on the next page.

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Gauge (AWG)	Diameter mils	Area circular mils	Resistance in ohms, 20°C per 1000 feet	Weight 1000 feet, in lbs.
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 20, page 48.

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

Continued on the next page.

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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

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 Figure 20, page 49.

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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

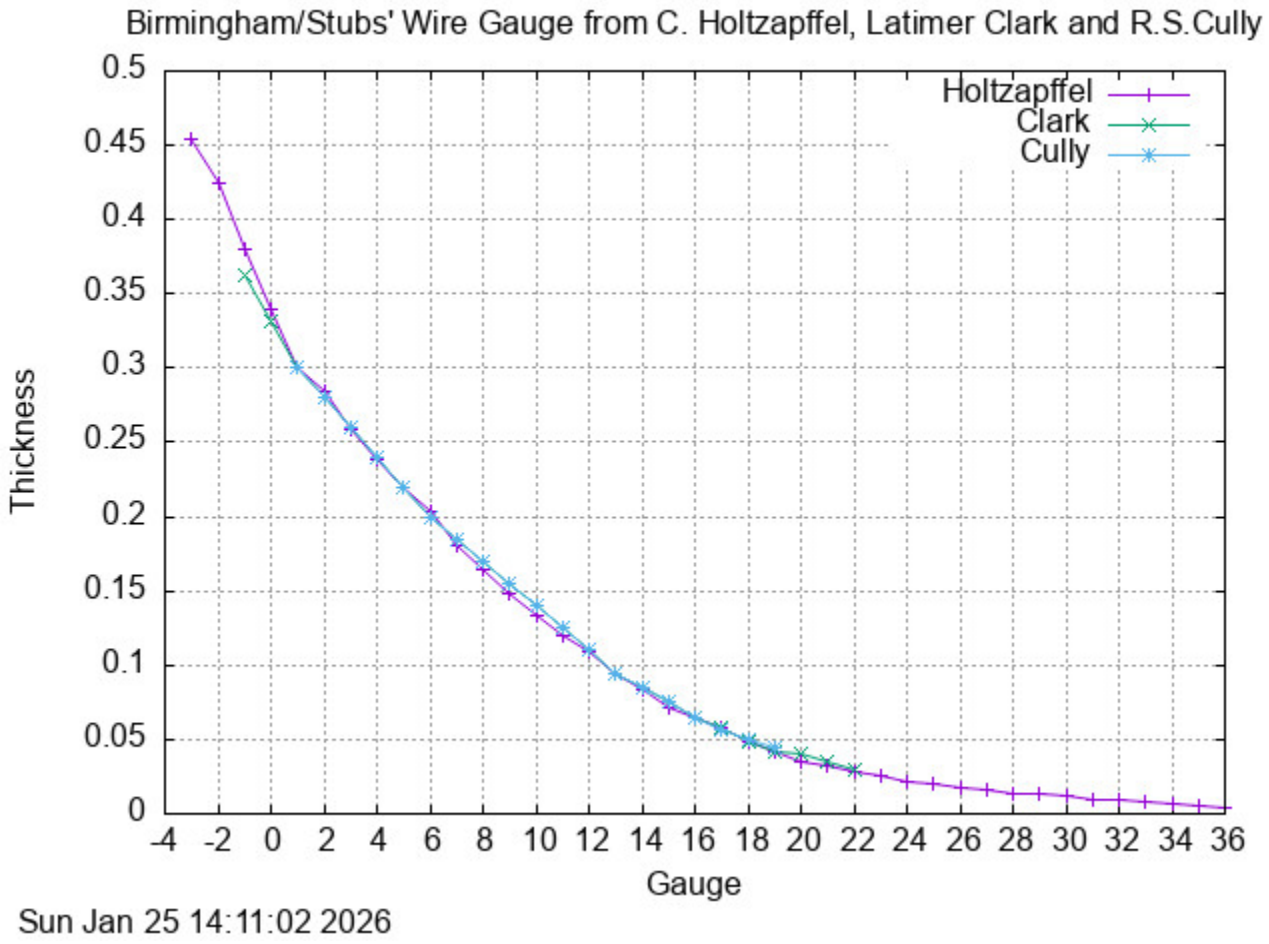

Figure 1: Birmingham or Stubs' Wire Gauge from C. Holtzapffel, Latimer Clark and R.S.Cully

1.6 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.

1.6.1 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.

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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.

1.6.2 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".

1.7 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

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1.7.1 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.

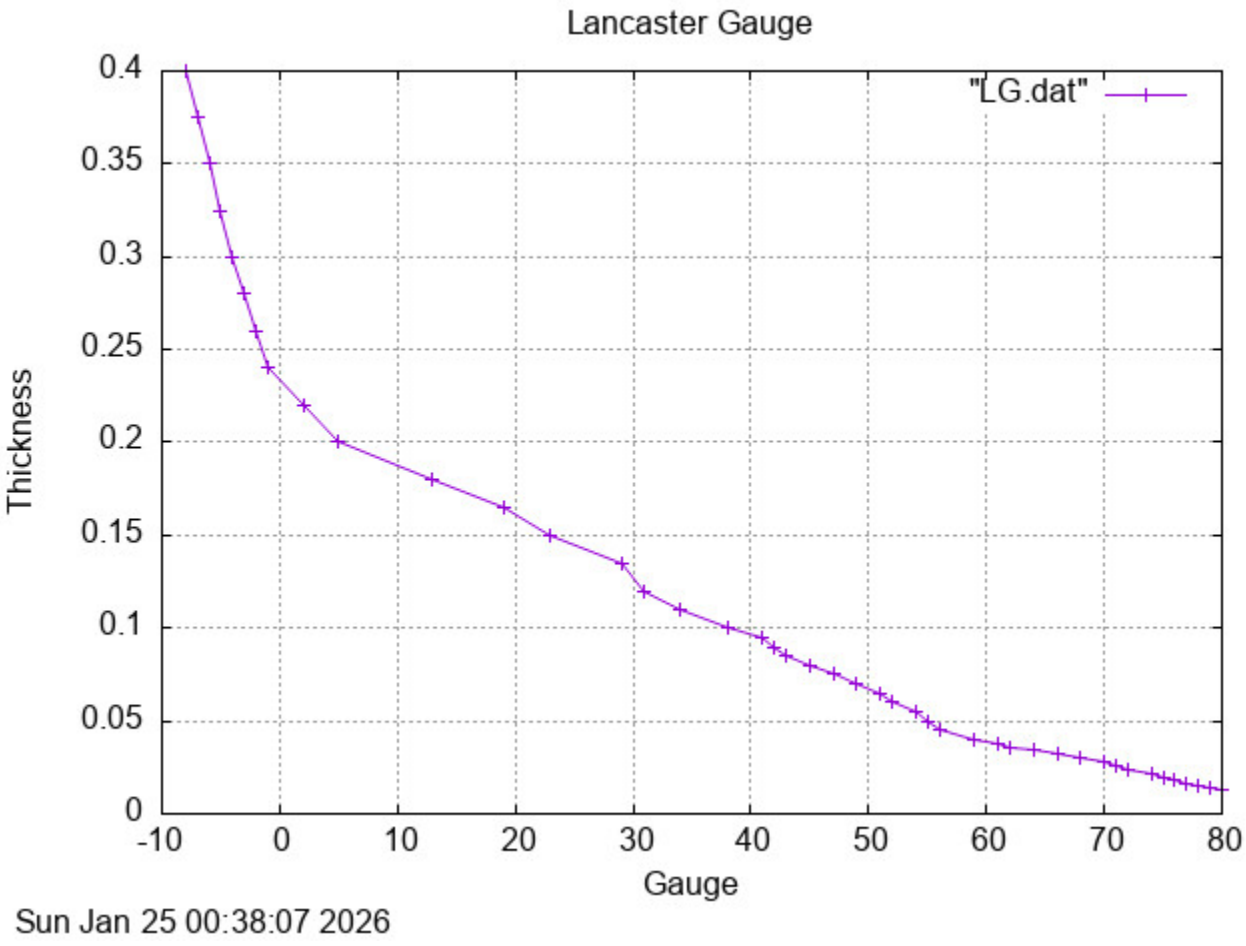

Figure 2: Lancashire Gauge

1.8 French wire gauges

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 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 9: 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.

[0]FWS.inc 25 January 2026 21:19

Plot of Jauge de Paris 1857

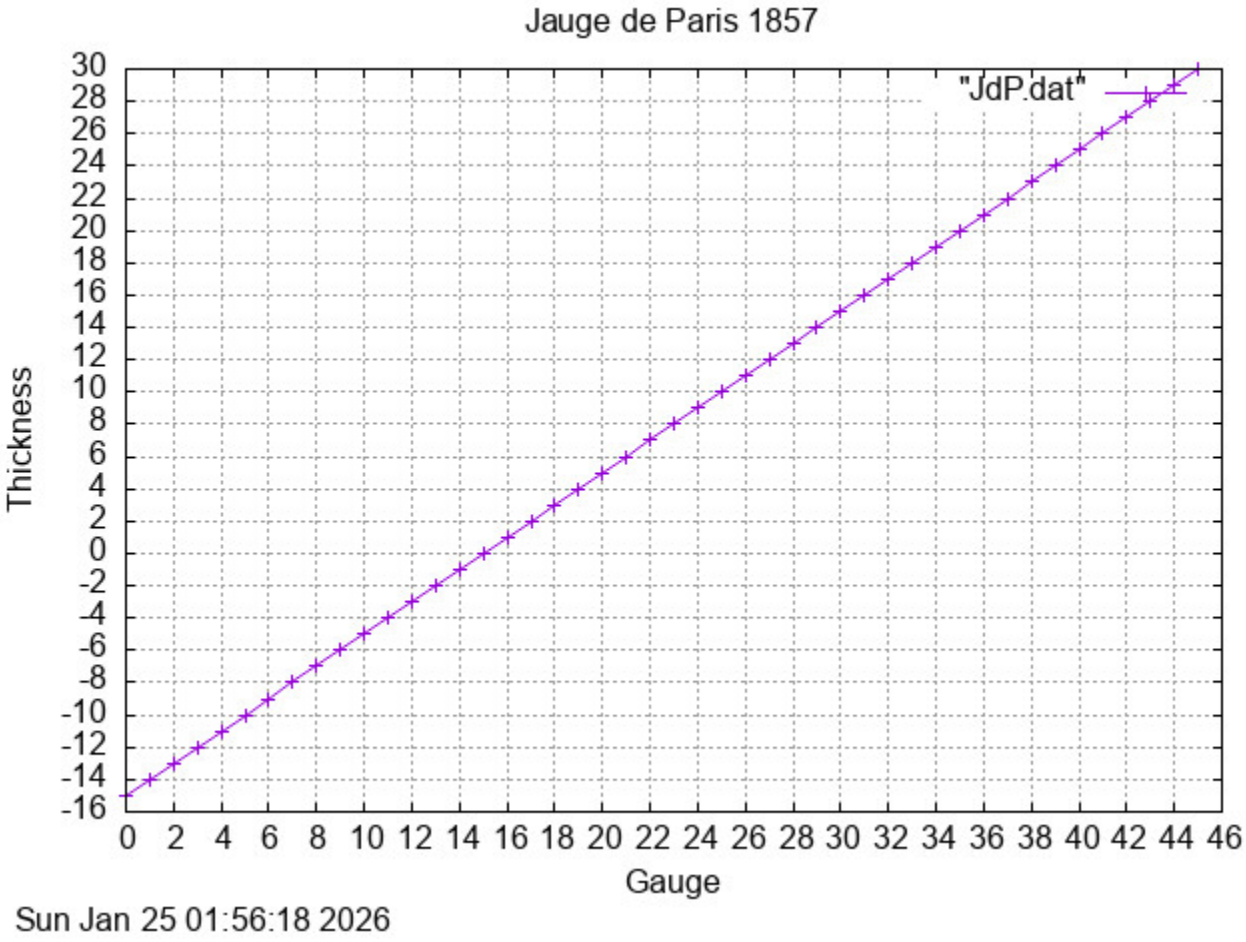

Figure 3: Jauge de Paris 1857

1.8.2 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 10: Jauge Japy

Source

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

Plot of Jauge Japy

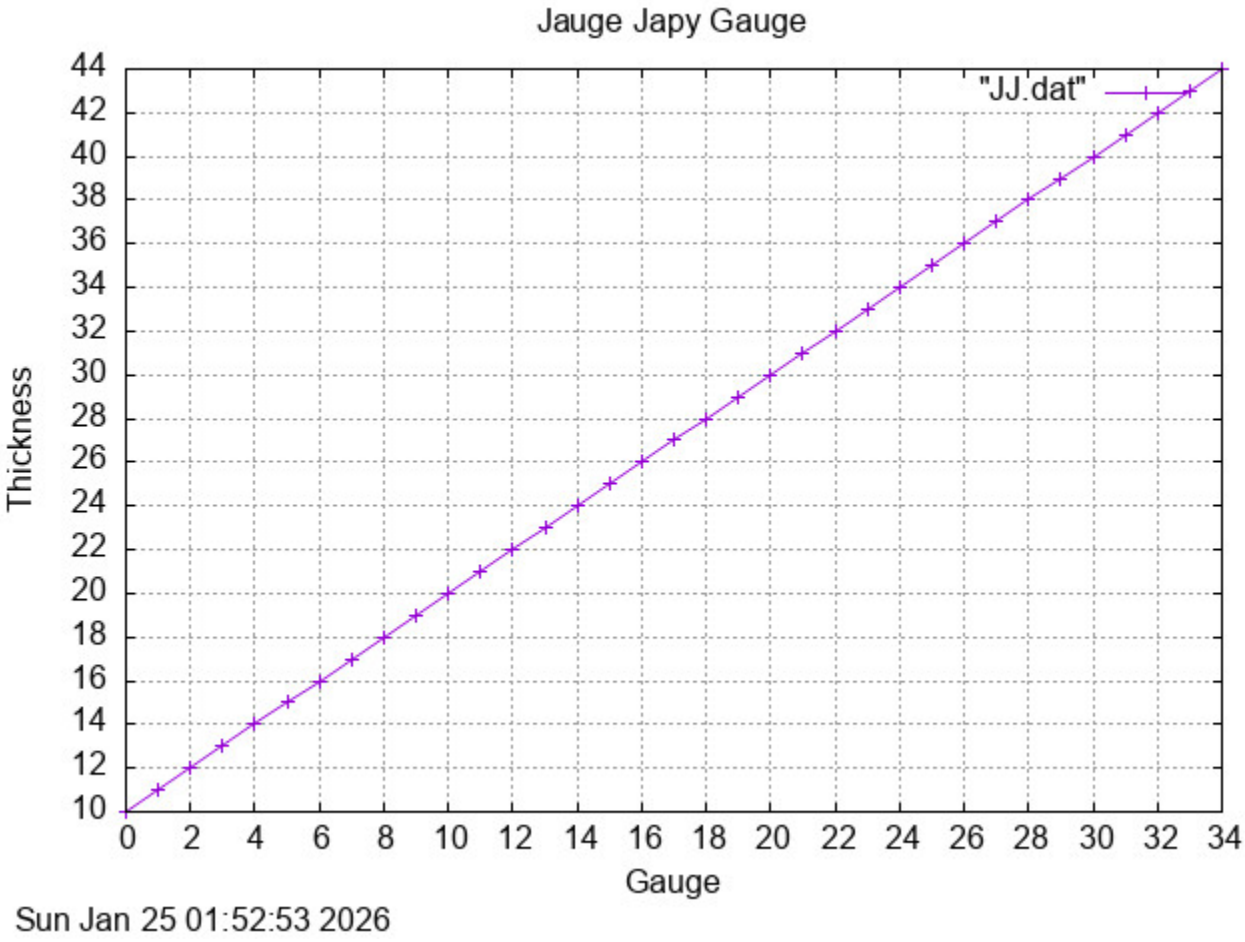

Figure 4: Jauge Japy

1.8.3 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 11: 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

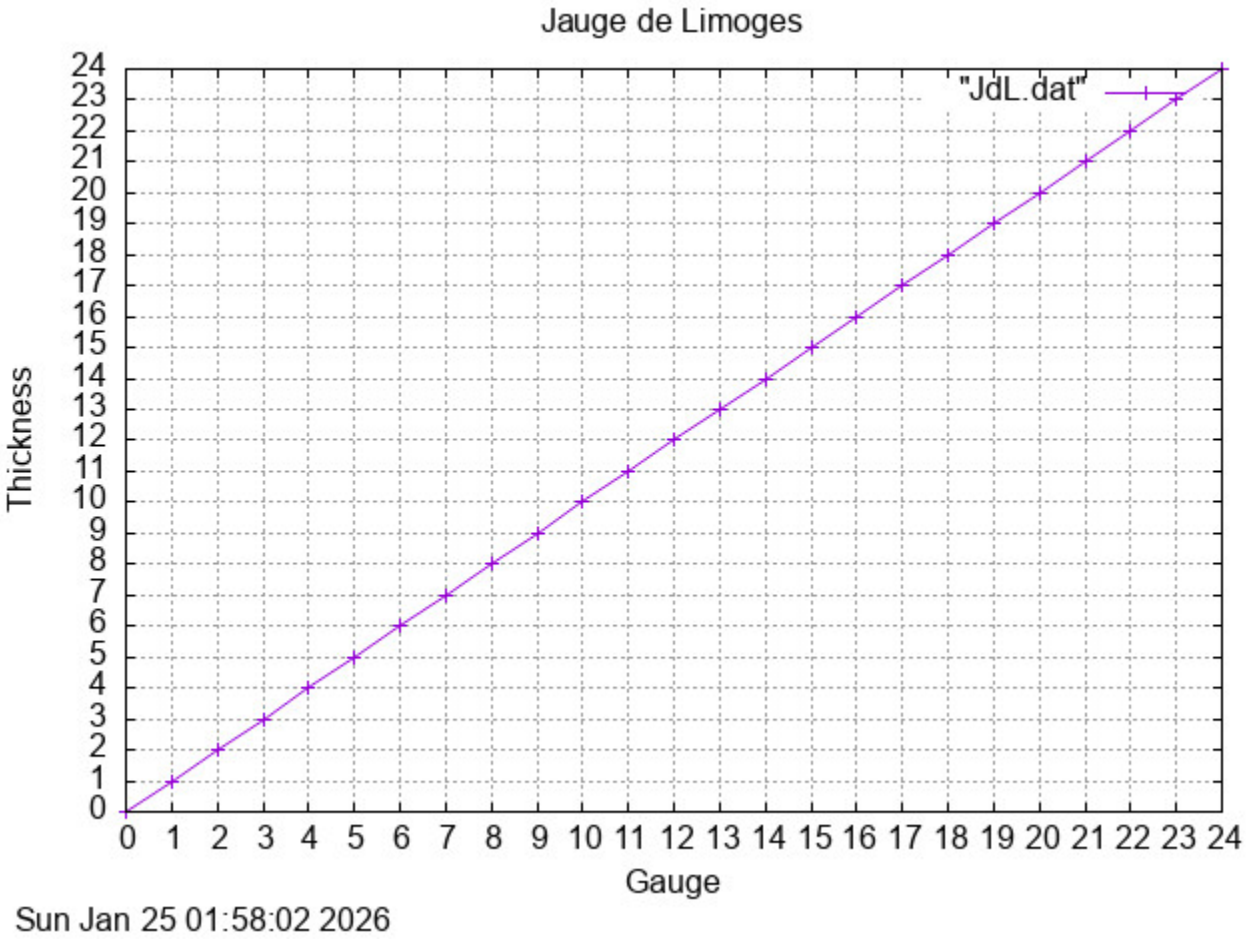

Figure 5: Jauge de Limoges

1.8.4 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 12: 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

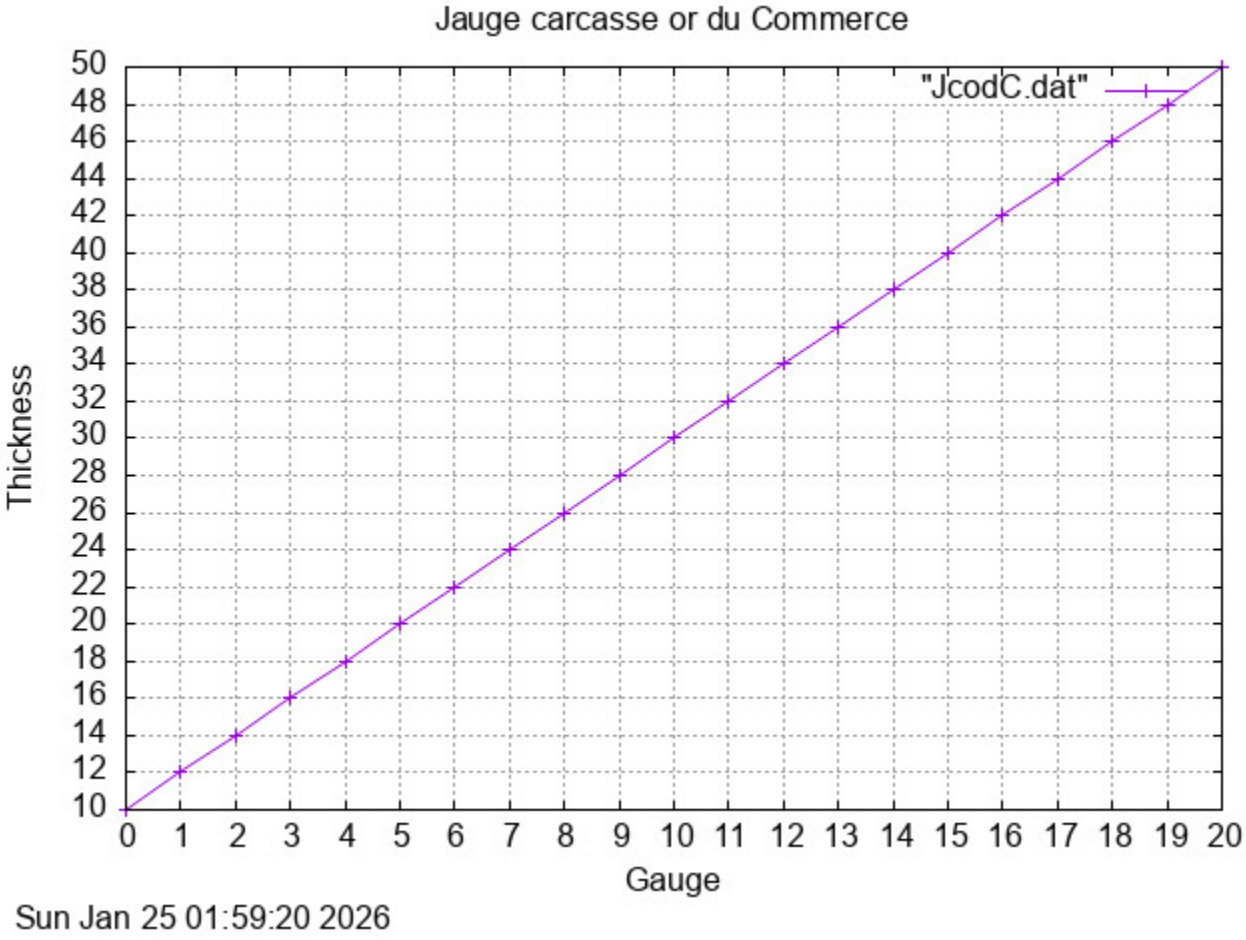

Figure 6: Jauge carcasse or du Commerce

1.8.5 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. 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 Imperial wire gauge

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 44.

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.

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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 13: Imperial Wire Gauge

A plot of this gauge is shown at Figure 20, page 52.

1.9.1 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 14: 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.

1.10 Trenton Iron Gauge

I "found" this gauge when I was looking through the Pratt & Whitney catalog for 1911. I haven't sen it any whareelse.

Source

Trenton Iron Co. Trenton N.J.
Pratt & Whitney Catalog 1911, Page 259

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 15: Trenton Iron

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Plot of Trenton Iron Co. Gauge

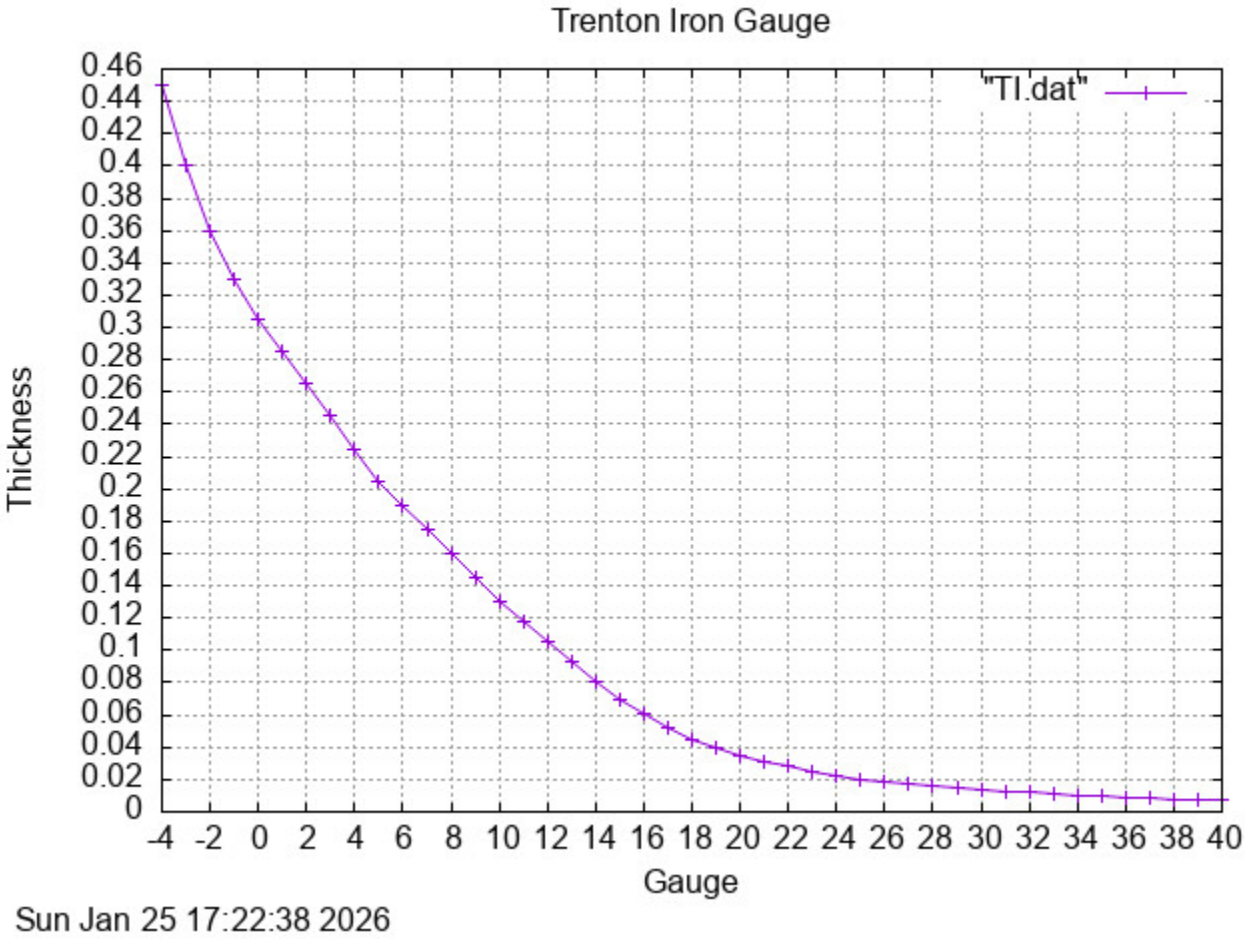

Figure 7: Trenton Iron Co.

1.11 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 16: Birmingham Wire Gauge from The Whitworth Measuring Machine

[0]WMBWG.inc 25 January 2026 21:19

From The Whitworth Measuring Machine, Birmingham Wire Gauge

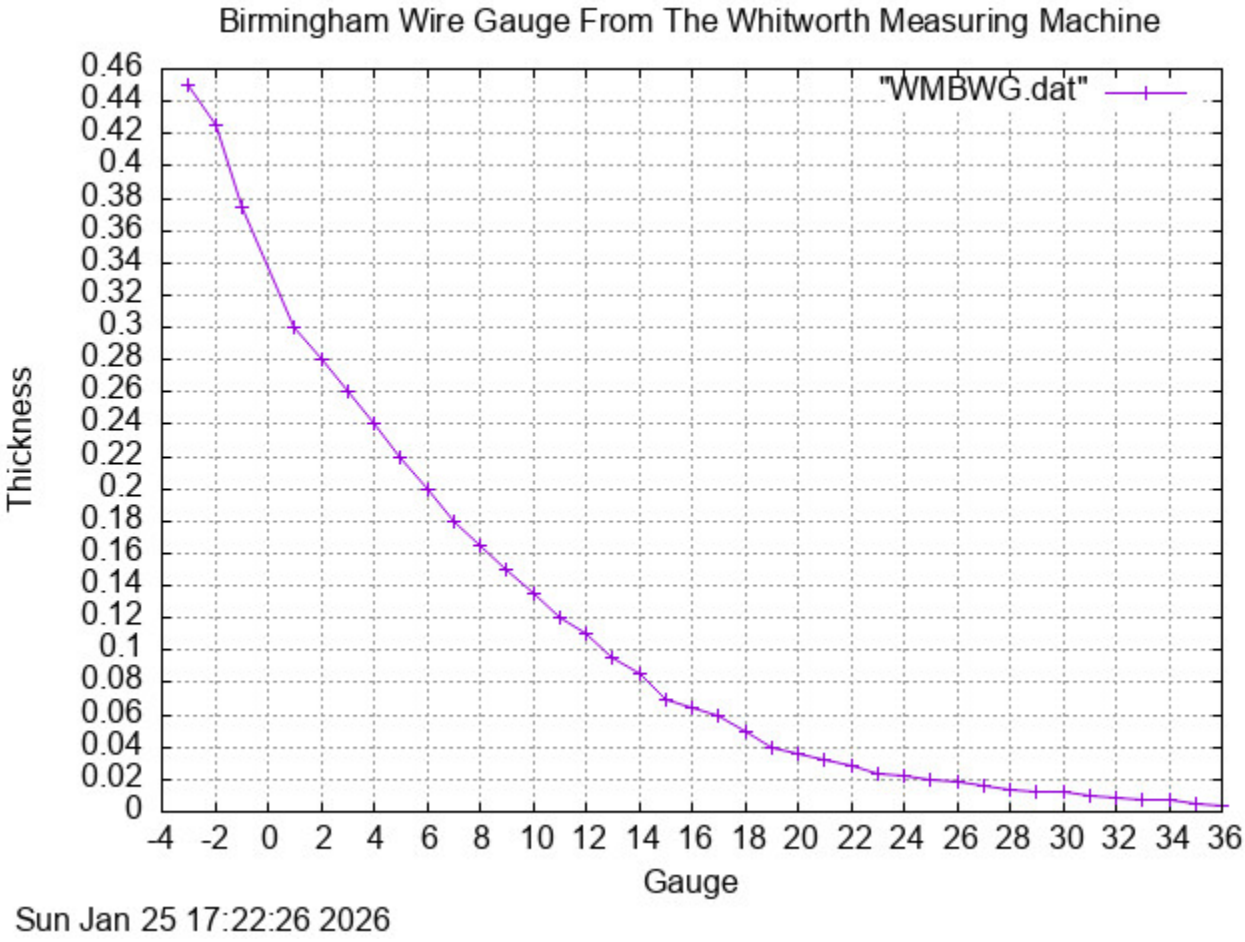

Figure 8: Birmingham Wire Gauge from The Whitworth Measuring Machine

1.12 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 17: Birmingham Plate Gauge from The Whitworth Measuring Machine

[0]WMBPG.inc 25 January 2026 21:19

From The Whitworth Measuring Machine, Birmingham Plate Gauge

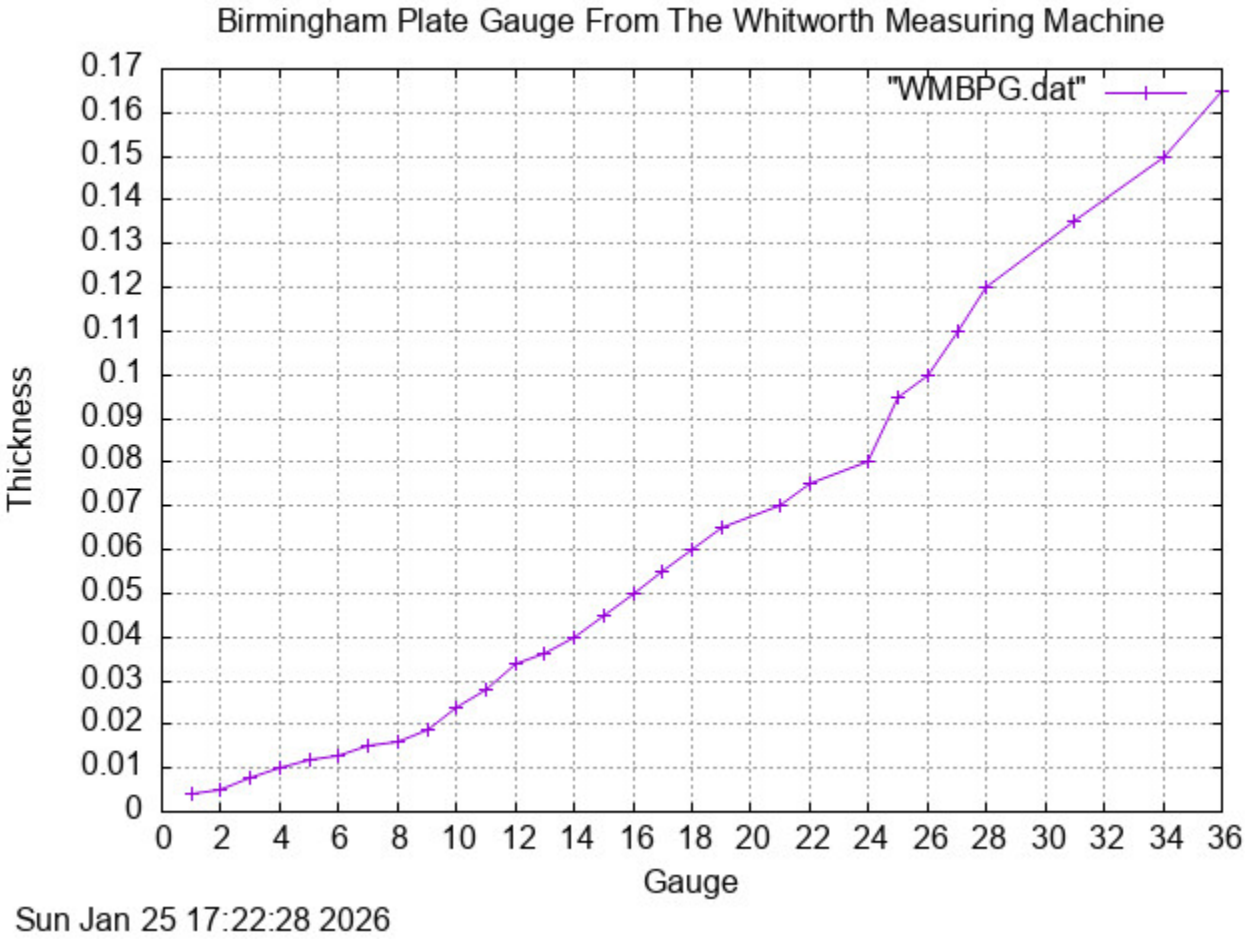

Figure 9: Birmingham Plate Gauge from The Whitworth Measuring Machine

1.13 Metric Wire Sizes

1.13.1 Metrically-sized equivalents for SWG-sized electrical cables

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 25 January 2026 21:19

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 18: Metrically-sized equivalents for SWG

1.13.2 Metric-sized equivalents for AWG-sized electrical cables

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 19: Metric-sized equivalents for AWG

[0]M2AWG.inc 25 January 2026 21:19

1.14 Making Wire

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.,

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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

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
19	0.0359	0.042	0.164	0.0410	0.0400	0.019	0.042

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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
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	—
49	0.001108	—	0.072	—	0.0012	0.049	—

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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
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	—
79	—	—	0.014	—	—	0.079	—

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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
80	—	—	0.013	—	—	0.080	—

Table 20: Comparing Diameters of some Common Gauges

Plot of American or Brown & Sharpe Wire Gauge

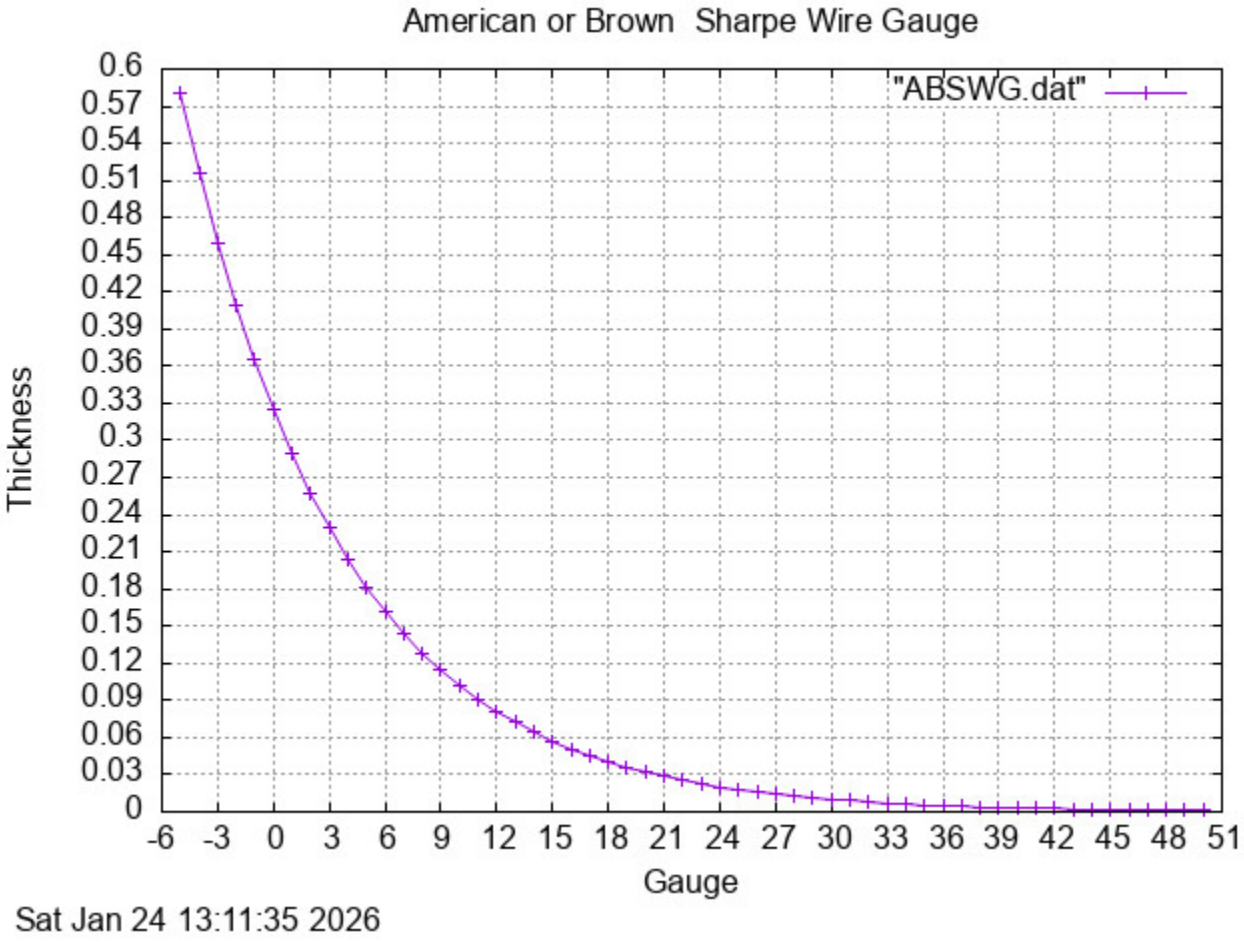

Figure 10: American or Brown & Sharpe Wire Gauge

Plot of Birmingham or Stubs' Iron Wire Gauge

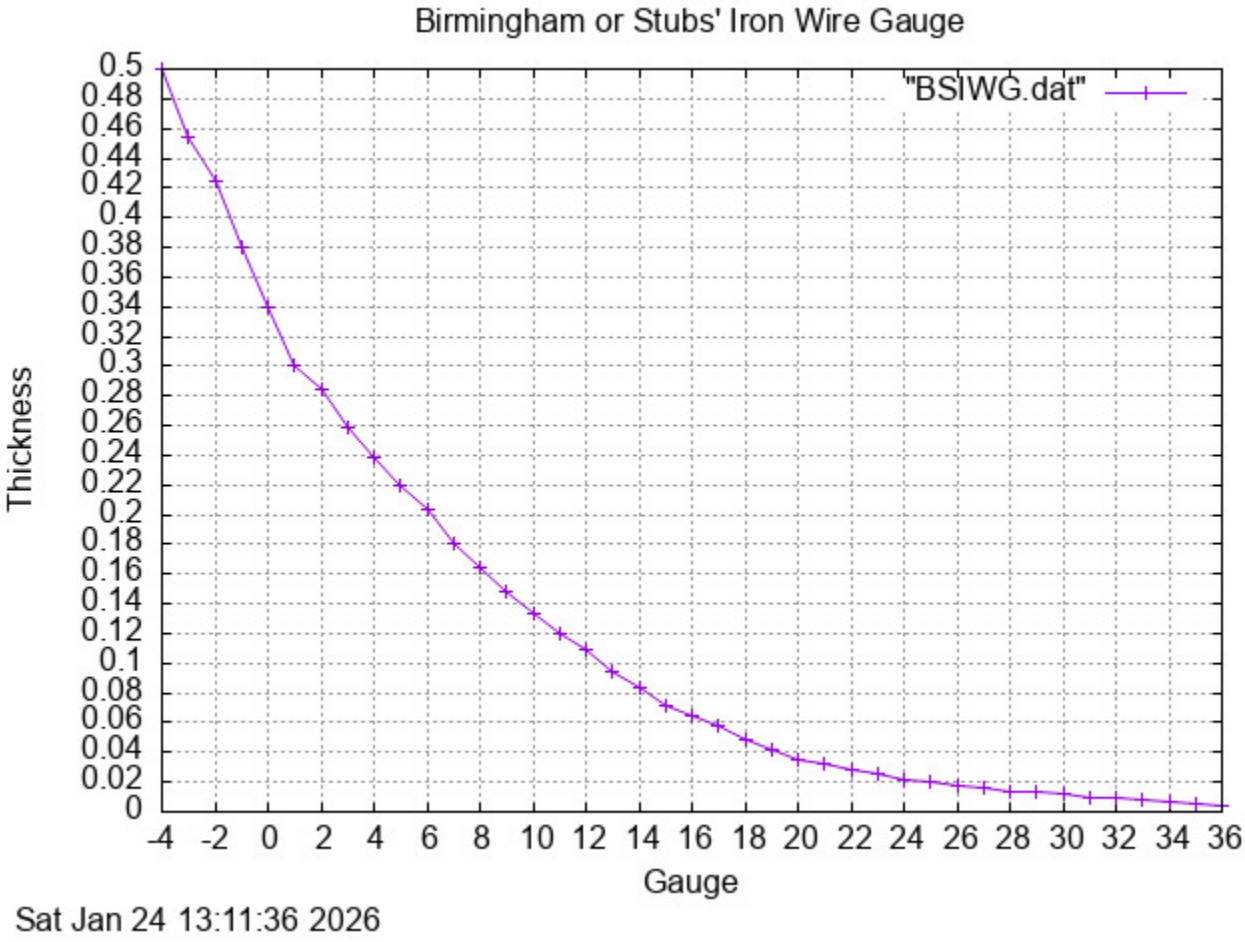

Figure 11: Birmingham or Stubs' Iron Wire Gauge

Plot of Stubs' Steel Wire Gauge

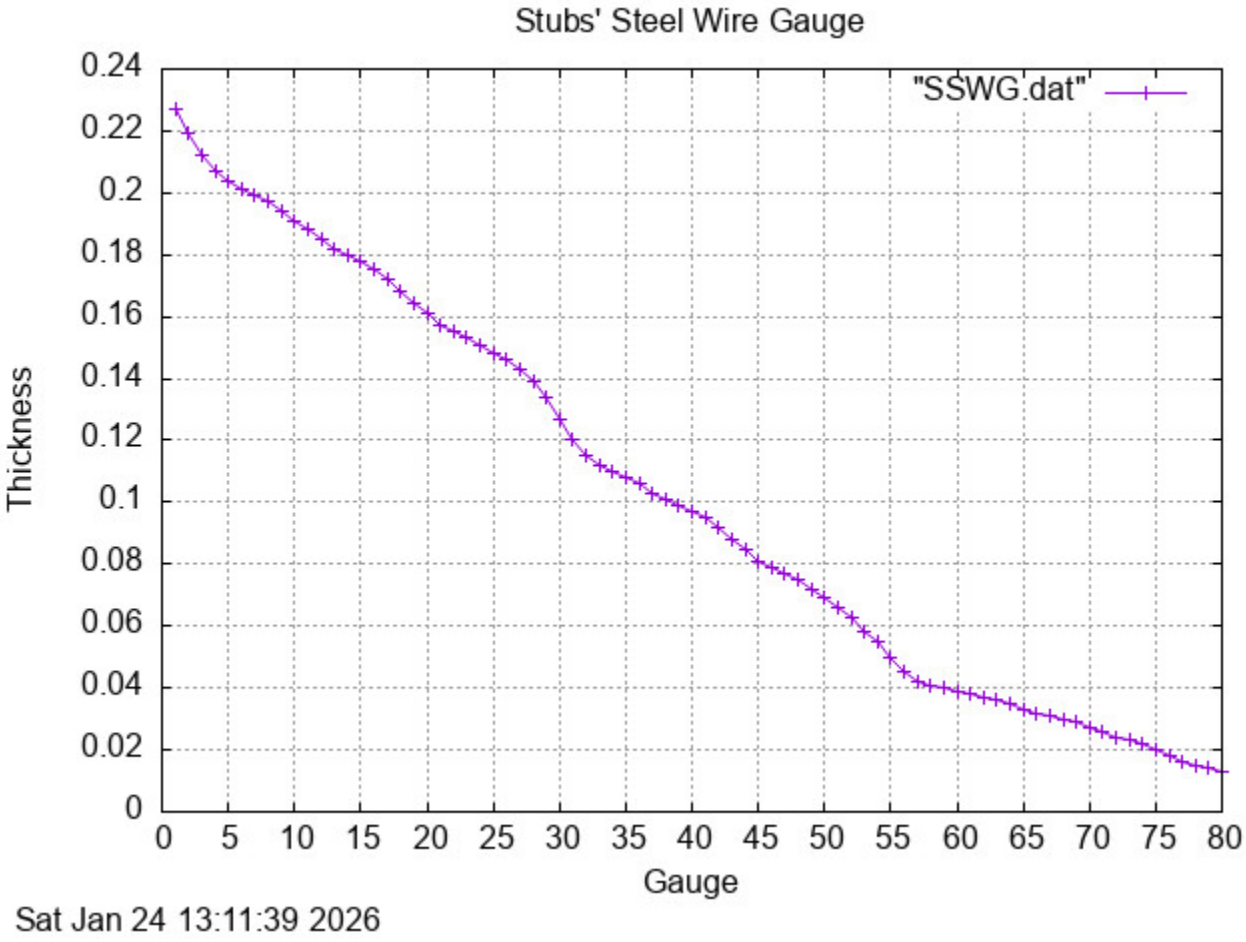

Figure 12: Stubs' Steel Wire Gauge

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

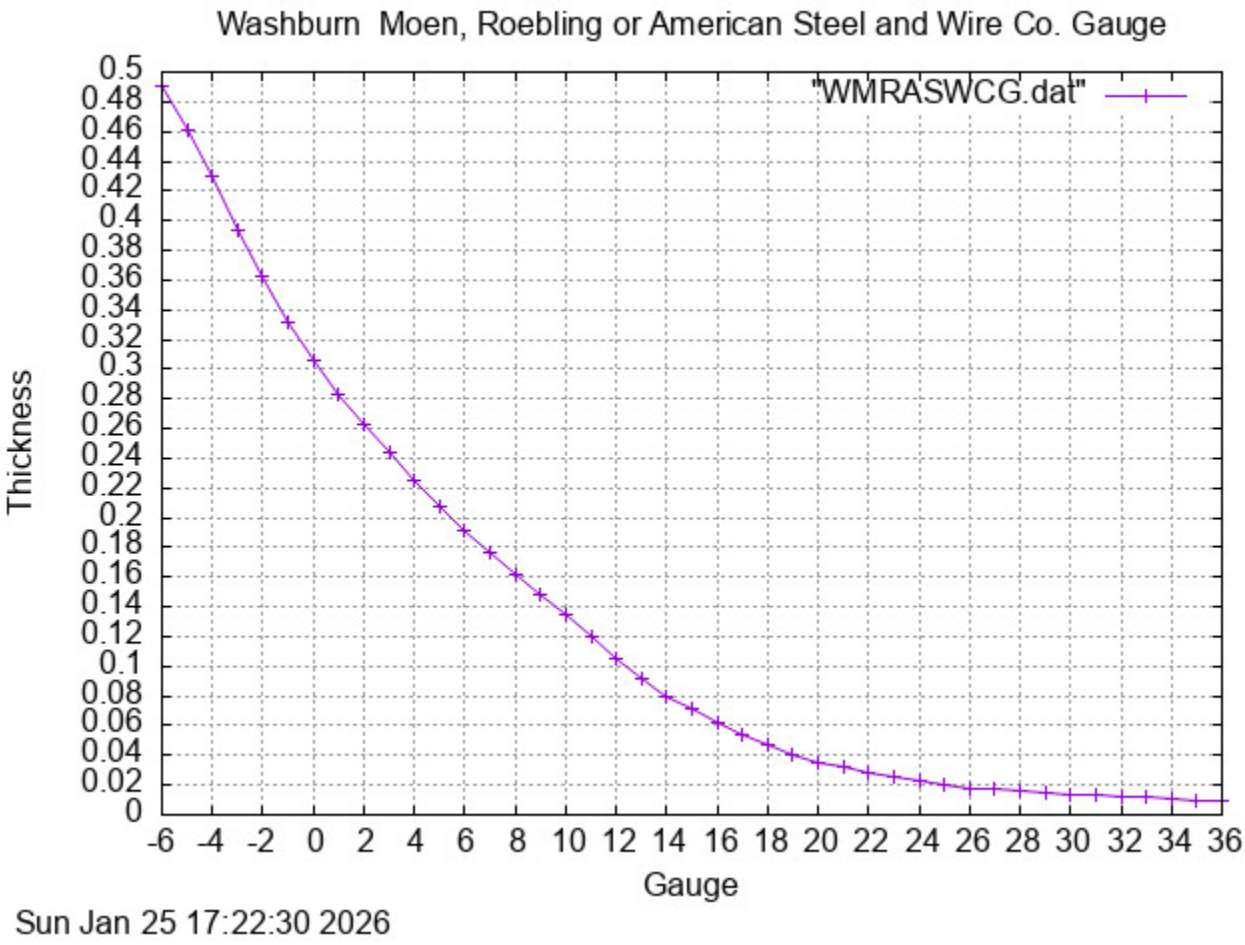

Figure 13: Washburn & Moen, Roebling or American Steel and Wire Co. Gauge

Plot of Imperial Wire Gauge

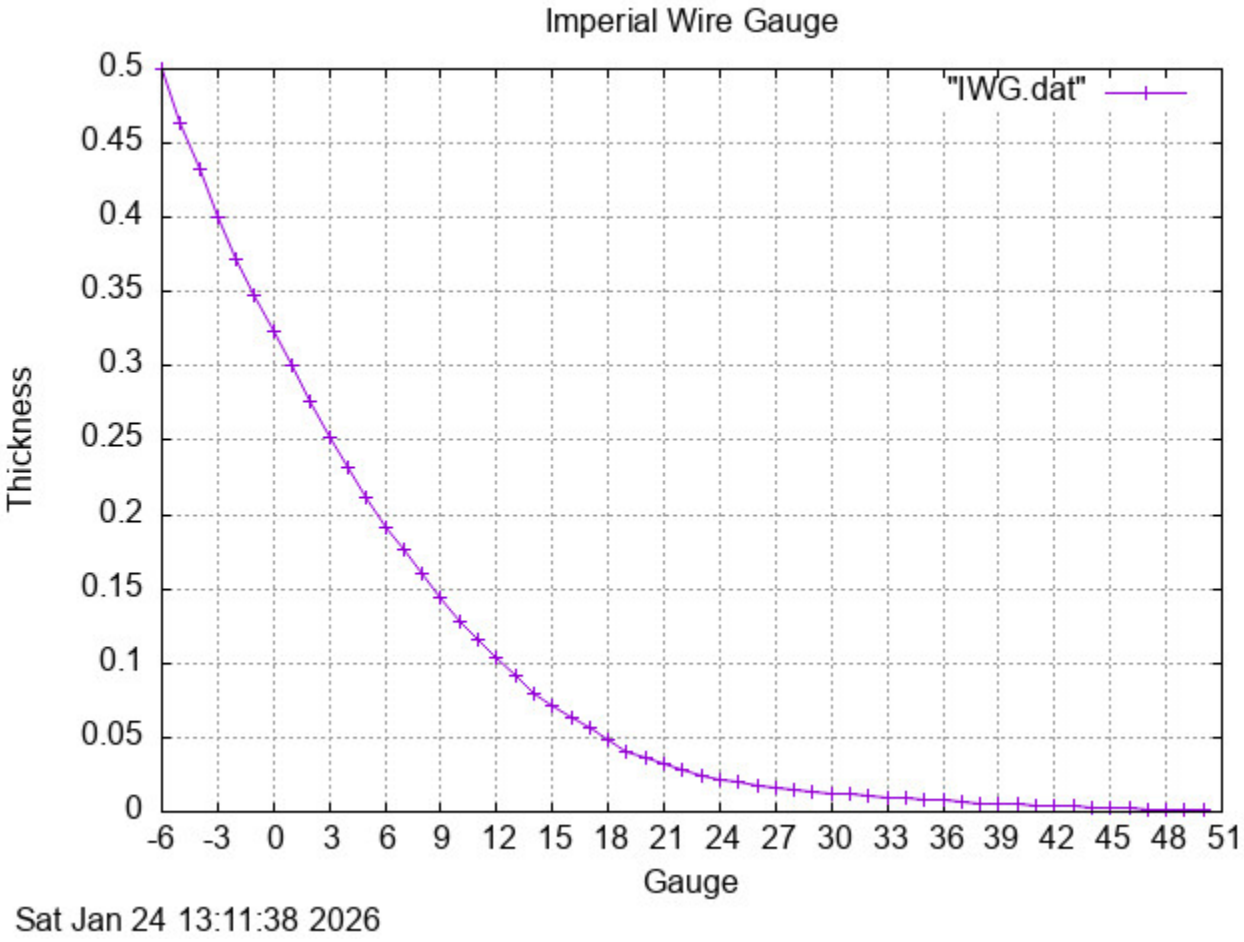

Figure 14: Imperial Wire Gauge

Plot of Whitworth's Gauge

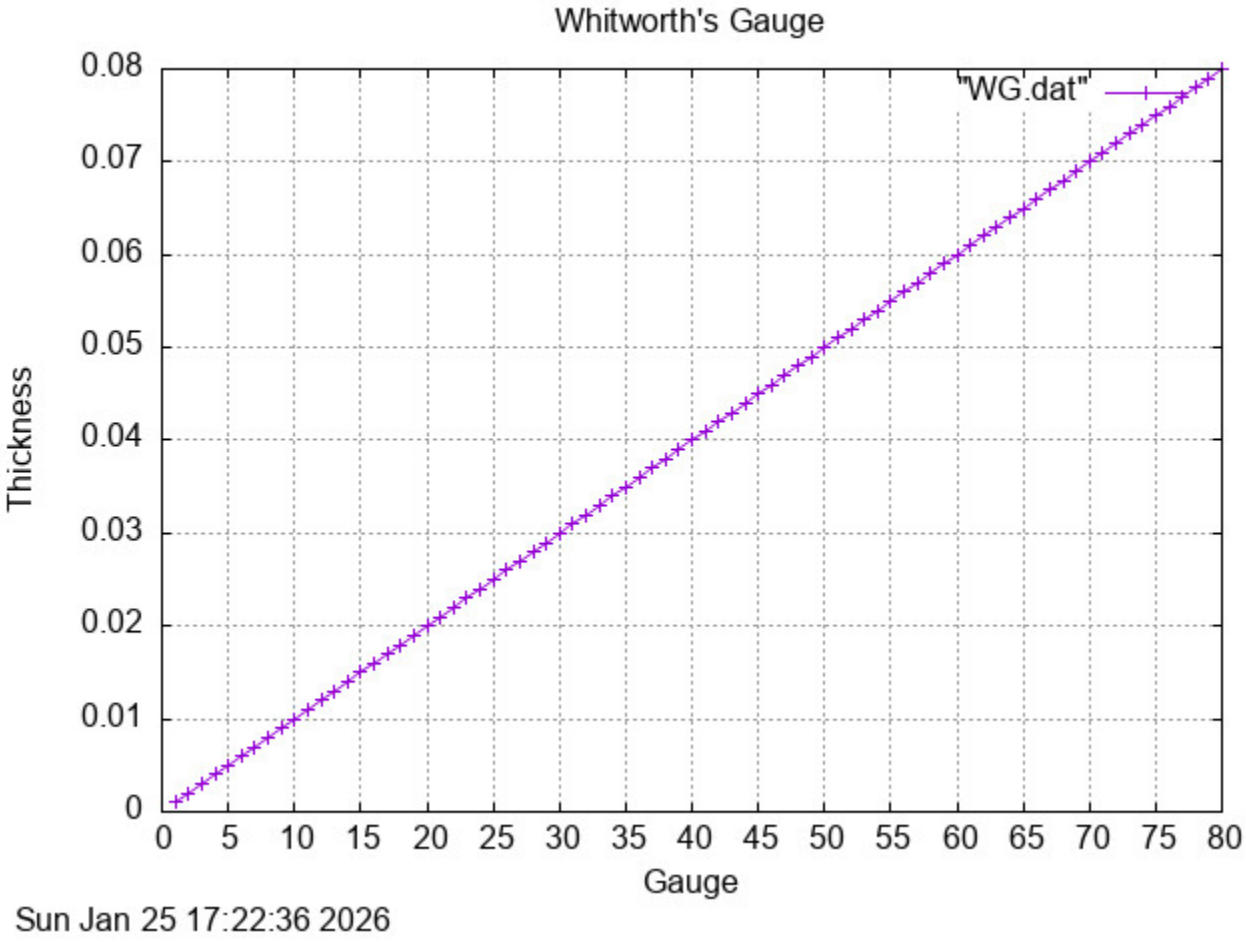

Figure 15: Whitworth's Gauge

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

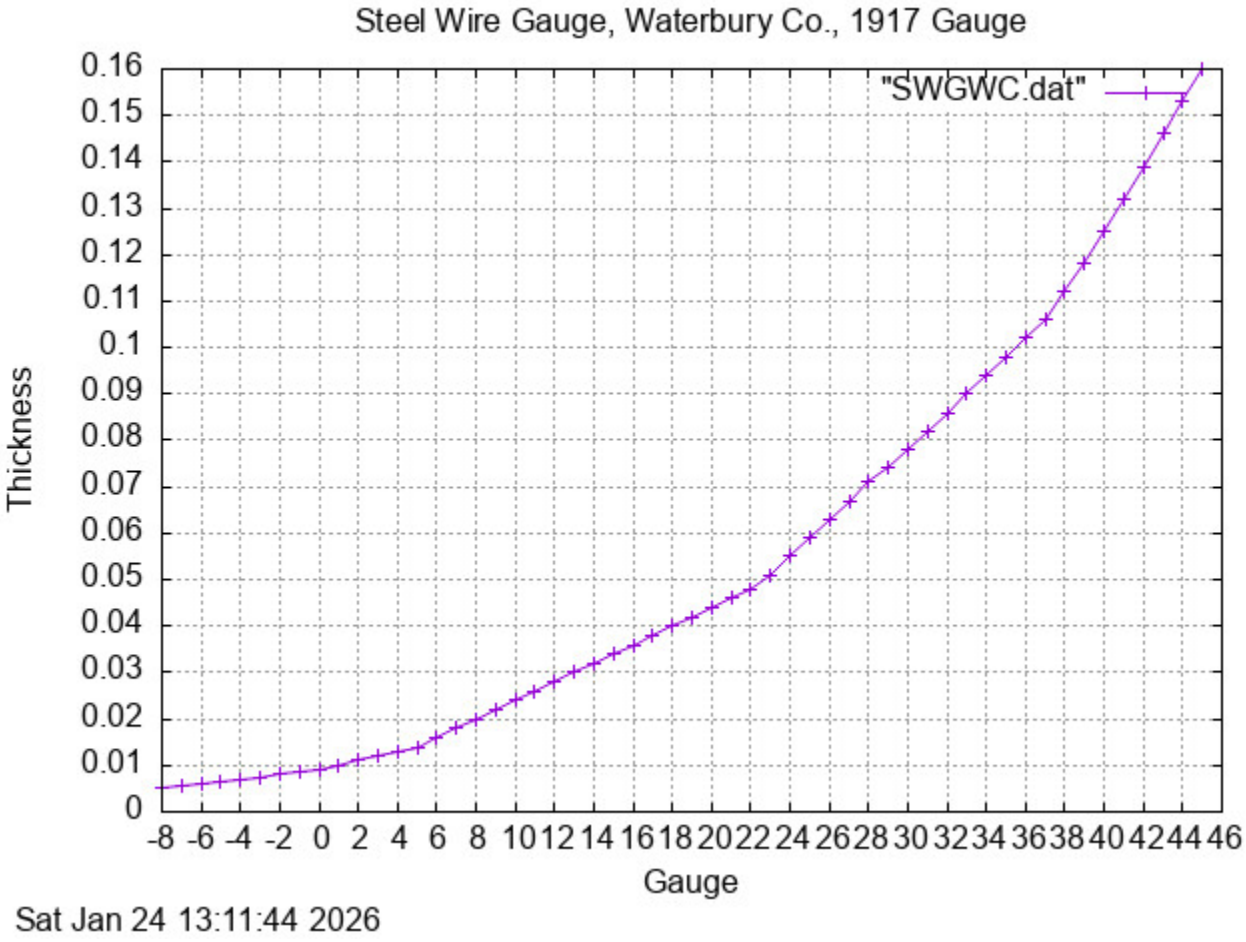

Figure 16: Steel Wire Gauge, Waterbury Co., 1917 Gauge

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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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