



## When A Job Calls Out Metric, Soft Convert WWR

*What do you do when a job specification calls out metric styles of reinforcement but welded wire reinforcement (WWR) is available only in U.S. customary (inch-pound) styles?*

### SOFT METRICATE

One of the legacies of the decades-old and as-yet unrealized attempt to convert the U.S. measuring system to the metric system is that a small percentage of jobs today specify metric styles of reinforcement. Yet, even though few if any WWR producers possess the necessary machinery to meet the metric specification, this does not preclude taking advantage of the performance and cost benefits of using WWR.

With its greater strength, generally higher ductility, and significantly lower placing costs, WWR is a highly practical and cost-efficient alternative to traditional rebar concrete reinforcement.

WWR may be used in virtually any structural application—buildings, bridges, highways, tunnels, pipelines and precast component systems, for instance—that typically would rely on rebar to fortify concrete. In fact, both ACI and AASHTO have considered WWR comparable to rebar for many years, and testing requirements—i.e., tensile, yield strength at various strain rates, and bend testing—are similar for both products. WWR, moreover, adheres to additional required tests, such as reduction of area (ROA) and wrap and weld shear testing (with 50% of the samples having the weld in the center of the gage length).

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**COMMON STYLES OF METRIC WELDED WIRE REINFORCEMENT (WWR) WITH EQUIVALENT US CUSTOMARY UNITS<sup>3</sup>**

	A <sup>1</sup> (mm <sup>2</sup> /m)	Metric Styles (MW = Plain wire) <sup>2</sup>	Wt. (kg/m <sup>2</sup> )	Equivalent US Customary Style	A <sup>1</sup> (in <sup>2</sup> /ft)	Wt (lbs/CSF)
A <sup>1</sup> & <sup>4</sup>	88.9	102x102 - MW9xMW9	1.51	4x4 - W1.4xW1.4	.042	31
	127.0	102x102 - MW13xMW13	2.15	4x4 - W2.0xW2.0	.060	44
	184.2	102x102 - MW19xMW19	3.03	4x4 - W2.9xW2.9	.087	62
	254.0	102x102 - MW26xMW26	4.30	4x4 - W4.0xW4.0	.120	88
	59.3	152x152 - MW9xMW9	1.03	6x6 - W1.4xW1.4	.028	21
	84.7	152x152 - MW13xMW13	1.46	6x6 - W2.0xW2.0	.040	30
	122.8	152x152 - MW19xMW19	2.05	6x6 - W2.9xW2.9	.058	42
	169.4	152x152 - MW26xMW26	2.83	6x6 - W4.0xW4.0	.080	58
B <sup>1</sup>	196.9	102x102 - MW20xMW20	3.17	4x4 - W3.1xW3.1	.093	65
	199.0	152x152 - MW30xMW30	3.32	6x6 - W4.7xW4.7	.094	68
	199.0	305x305 - MW61xMW61	3.47	12x12 - W9.4xW9.4	.094	71
	362.0	305x305 - MW110xMW110	6.25	12x12 - W17.1xW17.1	.171	128
C <sup>1</sup>	342.9	152x152 - MW52xMW52	5.66	6x6 - W8.1xW8.1	.162	116
	351.4	152x152 - MW54xMW54	5.81	6x6 - W8.3xW8.3	.166	119
	192.6	305x305 - MW59xMW59	8.25	12x12 - W9.1xW9.1	.091	69
	351.4	305x305 - MW107xMW107	9.72	12x12 - W16.6xW16.6	.166	125
D <sup>1</sup>	186.3	152x152 - MW28xMW28	3.22	6x6 - W4.4xW4.4	.088	63
	338.7	152x152 - MW52xMW52	5.61	6x6 - W8xW8	.160	115
	186.3	305x305 - MW57xMW57	3.22	12x12 - W8.8xW8.8	.088	66
	338.7	305x305 - MW103xMW103	5.61	12x12 - W16xW16	.160	120
E <sup>1</sup>	177.8	152x152 - MW27xMW27	3.08	6x6 - W4.2xW4.2	.084	60
	317.5	152x152 - MW48xMW48	5.52	6x6 - W7.5xW7.5	.150	108
	175.7	305x305 - MW54xMW54	3.08	12x12 - W8.3xW8.3	.083	63
	317.5	305x305 - MW97xMW97	5.52	12x12 - W15xW15	.150	113

<sup>1</sup> Group A - Compares areas of WWR at f<sub>y</sub> = 60,000 psi with other reinforcing at f<sub>y</sub> = 60,000 psi  
<sup>2</sup> Group B - Compares areas of WWR at f<sub>y</sub> = 70,000 psi with other reinforcing at f<sub>y</sub> = 60,000 psi  
<sup>3</sup> Group C - Compares areas of WWR at f<sub>y</sub> = 72,500 psi with other reinforcing at f<sub>y</sub> = 60,000 psi  
<sup>4</sup> Group D - Compares areas of WWR at f<sub>y</sub> = 75,000 psi with other reinforcing at f<sub>y</sub> = 60,000 psi  
<sup>5</sup> Group E - Compares areas of WWR at f<sub>y</sub> = 80,000 psi with other reinforcing at f<sub>y</sub> = 60,000 psi

<sup>6</sup> Wires may also be deformed, use prefix MD or D, except where only MW or W is required by building codes (usually less than a MW26 or W4). Also wire sizes can be specified in mm<sup>2</sup> (metric) or .001 in.<sup>2</sup> (US Customary) increments.  
<sup>7</sup> For other available styles or wire sizes, consult other WRI publications or discuss with WWR manufacturers.  
<sup>8</sup> Styles may be obtained in roll form. Note: It is recommended that rolls be straightened and cut to size before placement.

When specifying WWR in metric styles, convert the U.S. Equivalent Customary (in-pound) styles to Metric styles and round to whole numbers. The balance of this Tech Fact discusses this soft conversion technique and provides examples.

**STRUCTURAL WELDED WIRE REINFORCEMENT METRIC STYLES** (styles with wire areas from MW or MD26 to MW or MD290) will have both wire spacings and wire areas rounded to whole numbers.

**BUILDING FABRIC STYLES / METRIC STYLES** (styles with wire areas less than MW or MD26), as with the structural WWR styles, wire spacings and wire areas will be rounded to whole numbers. Pipe fabric styles and wire sizes will be published in another tech fact.

**EXAMPLES\***

1. A typical metric structural WWR style is: 305 x 305 - MD 71 x MD 71  
 The equivalent inch-pound structural WWR style is: 12 x 12 - D11 x D11
2. A typical metric building fabric style is: 152 x 152 - MW 19 x MW 19  
 The equivalent inch-pound building fabric style is: 6 x 6 - W2.9 x W2.9

Note: Wire spacings are in millimeters (mm) and wire areas are in square millimeters (mm<sup>2</sup>). The MD (metric) or D (inch-pound) prefixes designate deformed wire. The MW (metric) or W (inch-pound) prefixes designate plain wire.

To determine sheet sizing, soft convert width of sheets from inches to millimeters and lengths of sheets from feet to meters. An example is: 2438 mm x 6.1 m equals 96" x 20' Building fabric rolls are figured similarly, for example: 1524 mm x 45.7 m equals 60" x 150'

For mass (weight) calculations use: wire area in mm<sup>2</sup> x 0.00784 = mass (kg/meter). For the inch-pound unit equivalent use: wire area in 2 x 3.4 = weight (lbs./foot).

\*Conversion factors: 25.4 mm = 1 inch, 645 mm<sup>2</sup> = 1 inch<sup>2</sup>, 304.8 mm = 1 foot. A reminder, the inch-pound wire areas in the examples are in<sup>2</sup> multiplied by 100.

## Metric Wire Area, Diameter & Mass With Equivalent U.S. Customary Units<sup>☆</sup>

Metric Units <sup>*</sup>				U.S. Customary Units <sup>**</sup>				Gage Guide
Size <sup>☆</sup> (mw = Plain) (mm <sup>2</sup> )	Area (mm <sup>2</sup> )	Diameter (mm)	Mass (kg/m)	Size <sup>☆</sup> (w = Plain) (in <sup>2</sup> x100)	Area (in <sup>2</sup> )	Diameter (in)	Weight (lb/ft)	
MW290	290	19.2	2.28	W45	.450	.757	1.530	
MW200	200	16.0	1.57	W31	.310	.628	1.054	
MW130	130	12.9	1.02	W20.2	.202	.507	.687	7/0
MW120	120	12.4	.941	W18.6	.186	.487	.632	6/0
MW100	100	11.3	.784	W15.5	.155	.444	.527	5/0
MW90	90	10.7	.706	W14.0	.140	.422	.476	
MW80	80	10.1	.627	W12.4	.124	.397	.422	4/0
MW70	70	9.4	.549	W10.9	.109	.373	.371	3/0
MW65	65	9.1	.510	W10.1	.101	.359	.343	
MW60	60	8.7	.470	W9.3	.093	.344	.316	2/0
MW55	55	8.4	.431	W8.5	.085	.329	.289	
MW50	50	8.0	.392	W7.8	.078	.314	.263	1/0
MW45	45	7.6	.353	W7.0	.070	.298	.238	
MW40	40	7.1	.314	W6.2	.062	.283	.214	1
MW35	35	6.7	.274	W5.4	.054	.262	.184	2
MW30	30	6.2	.235	W4.7	.047	.245	.160	3
MW26	26	5.7	.204	W4.0	.040	.226	.136	4
MW25	25	5.6	.196	W3.9	.039	.223	.133	
MW20	20	5.0	.157	W3.1	.031	.199	.105	
MW19	19	4.9	.149	W2.9	.029	.192	.098	6
MW15	15	4.4	.118	W2.3	.023	.171	.078	
MW13	13	4.1	.102	W2.0	.020	.160	.068	8
MW10	10	3.6	.078	W1.6	.016	.143	.054	
MW9	9	3.4	.071	W1.4	.014	.135	.048	10

\* Metric wire sizes can be specified in 1mm<sup>2</sup> increments.

\*\*U.S. customary sizes can be specified in .001 in<sup>2</sup> increments.

Note ☆ – For other available wire sizes, consult other WRI Publications or discuss with WWR manufacturers.

Note ★ – Wires may be deformed, use prefix MD or D, except where only MW or W is required by building codes (usually less than MW26 or W4).

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## LOOKING TO THE FUTURE

It is important for design professionals, contractors, distributors and fabricators to know they can specify and order the exact area of steel required for their individual projects. Therefore, for some time in the future, most wire sizes will be available in 1 mm<sup>2</sup> (.001 in<sup>2</sup>) increments.

A table of 24 metric wire sizes and properties along with the equivalent inch-pound units and also a conversion table on WWR styles are reproduced in this tech fact sheet. The intent of the tables are to have design professionals begin specifying welded wire styles in 5 and 10 square millimeter increments above an MW or MD 26. Below that size WRI will list the typical standards (MW 9, MW 13, MW 19 and MW 26), as well as the 5mm<sup>2</sup> increments in between (MW 10, MW 15, MW 20).

In addition to this information WRI has soft converted tables in the current “Manual of Standard Practice for Structural WWR” (WWR 500), commonly referred to as the MSP.

## ADDITIONAL DATA INCLUDED IN THE MSP

Along with discussion on nomenclature, manufacturing and availability, specifications, handling and placing, there are these subjects as well:

*Design Aids—Tables on cross sectional areas of welded wire for (51 mm to 457 mm) 2 “ to 18 “ wire spacings are included.*

*Development and Splice Lengths—Tables for wire areas from MW or MD 26 to MW or MD 290 (W or D 4 to W or D 45).*

*Mass (Weight) Calculations—There are tables to determine metric units (kg per meter) or inch-pound units (lbs. per foot) for efficient calculations.*

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