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The Metric Materials Team... Same Players...Different Numbers!

In the previous issue of WINK'S WORDS we discussed the differences in dimensional or size designations between metric and standard fasteners. And from a dimensional standpoint the differences are real. Metric and standard fasteners are not interchangeable!

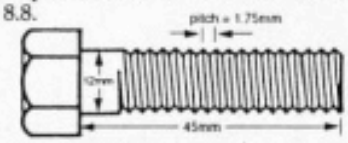
The material designation for metric fasteners is also different. But, they don't stock standard and metric materials at the metal supply house. Life in the fastener industry is confusing enough. The same materials are used for both, but in metric they call the materials by different names. Or, to be more precise, different numbers.

For example, you will find standard carbon steel fasteners designated Grade 2, Grade 5 or Grade 8. Metric fasteners made from the same materials would be labeled Class 5.8, Class 8.8 and Class 10.9, respectively. Seems crazy, doesn't it?

The metric people had a method to their madness. Their numbers actually mean something. The number before the decimal represents 1% of the tensile strength in the metric units, Megapascals (MPa), which can be converted to pounds per square inch (psi) by multiplying by 145.

The decimal number indicates the ratio of yield strength to tensile strength. With these numbers a design engineer has a pretty good idea of the strength properties of the bolt, screw or nut.

Let's take an example. We have the metric fastener from the previous issue — M12 x 45 hex head cap screw 8.8.



The 8.8 says that its tensile strength is 800 (the first number 8 x 100)MPa, or 800 x 145 = 116,000psi. The ratio of yield strength to tensile strength is .8, so the yield strength would be .8 x 116,000 or 92,800psi. Chart No. 1 shows comparable numbers for metric designations classes 5.8, 8.8 and 10.9.

Easy, isn't it. But before you get too comfortable with this formula, when they got to stainless steels they changed it.

Since most stainless steel fasteners are made from the 300 Series stainless steels we'll stick with that category. In metric designations they are divided into three groups: A1 for free cutting stainless, Type 303; A2 for more corrosion resistant grades 302, 304, 321; A4 for grades with molybdenum, such as type 316.

Material Designations

Metric Grade	Equivalent To
A1	303
A2	302, 304, 304L, 321, 347
A4	316, 316L, 317, 317L

A second number gives the strength class: 50, 70, or 80. For example A2-50. However, instead of these numbers (50, 70, 80) designating 1% of the tensile strength as in the carbon steel fasteners, they represent 10%, or 1/10th. A 50, then, would mean a tensile strength in the range of 72,500psi (50 x 10 = 500 MPa x 145 = 72,500psi).

Metric Strength Designation

Property Class (A1, A2, A4)	Tensile Str. MPa	Tensile Str. PSI MPa x 145
50	500	72,500
70	700	101,500
80	800	116,000

You'd think they'd leave the numbers at 5,7 and 8, which would be 1% like the steel system. No, that would make it too easy.

Chart No. 1: Property Designations for Metric Fasteners

Metric Class	Steel Equivalent To	Min. Yield Strength MPa = N/mm²	Min. Tensile Strength MPa = N/mm²	Conversion Factor	Min. Yield Strength PSI	Min. Tensile Strength PSI
5.8	ref. Gr. 2	420	520	145	60,900	75,400
8.8 up to above M16	ref. Gr. 5	640	800	145	92,800	116,000
10.9	ref. Gr. 8	940	1040	145	136,300	150,800