MEASURING NUTS AND BOLTS

Nuts and bolts come in a great variety of sizes. The size of the head of a bolt or nut is measured between the flat sides of the hexagon. In standard American nuts and bolts these sizes usually follow one another in 1/16" steps. Thus you have 1/2" (8/16") bolts and 9/16" bolts and 5/8" (10/16") bolts, but you don't find 2/3" bolts. Foreign cars use metric-sized nuts and bolts which are measured in the same way from flat side to flat side, but in millimeters instead of sixteenths of an inch. Some English cars use yet another way of measuring head sizes known as the "Whitworth system." Instead of measuring from flat to flat of the hexagon, Whitworth sizes measure from point to point. Fortunately most British manufacturers have switched over to metric sizes or standard American sizes.

Unfortunately, head size isn't all there is to measuring nuts and bolts. Bolts are also measured by diameter—that is, through the threads. Thus you could have a bolt with a 1/2" head and a diameter of 1/4" or one with a 1/2" head and a 3/16" diameter. Nuts are measured for diameter across the widest opening the threads make.

As if this weren't enough, nuts and bolts (and studs and screws as well) are also measured according to how coarse or fine their threads are. This measurement is made in "threads per inch." A bolt with 16 threads per inch is rather coarsely threaded. Twenty threads per inch is a fine thread.

Once in a while you will run into a nut or a bolt which has **left-hand thread.** This means it screws in counterclockwise and screws out clockwise. Often left-hand thread nuts and bolts have a little "L" marked on them. Sometimes they don't—then you just have to try turning the "wrong" way and see what happens.

WRENCH SIZES

The size of a wrench refers to the size of the nut or bolt it fits (see Appendix, p. 92, on measuring sizes of nuts and bolts). Most sets of American wrenches start at 3/8" and go up in steps of 1/16". The largest wrench in a set might be anywhere from 3/4" to 1-5/16". (What we call "American" wrenches are also known as SAE [Society of Automotive Engineers] wrenches.) Wrenches smaller than 3/8" are called "miniatures" or "ignition" wrenches. There are also metric wrenches, which you will need if you want to work on foreign cars.

Americans spend a good deal of time in school learning a chaotic system of weights and measures and forget most of it rapidly. Most of us remember that there are 12 inches in a foot and 3 feet in a yard and even that there are 5,280 feet in a mile. Hardly anyone knows how big an acre is or how many pints there are in a gallon or . . .

Most of our units of weight and measure had different origins at different times. An inch was three barleycorns laid end to end. A foot was the length of Charlemagne's foot (he had big feet). A yard was the distance from the tip of Henry I's nose to the tip of his outstretched arm. Roman legions used to count off paces as they marched—a thousand paces (*mille passuum*) was roughly 5,000 feet and the English changed the name to "mile."

As you can see, our system of measure has its roots in Roman imperialism, feudal class structure and an agricultural economy. Not very relevant to a technological industrial society.

Most countries had different and equally illogical systems of measure until the French Revolution came along. The French revolutionaries decided they needed a more orderly and convenient system and chose the meter (3.28 feet) as the standard unit of measure ("meter" comes from the Greek word for measure). They then derived all other units of measure from the meter in multiples of 10 or 1/10. A centimeter is 1/100 of a meter and a millimeter is 1/1000 of a meter. A kilometer is 1000 meters. A liter is 1000 cubic centimeters and a kilo ("key" for short) is the weight of a liter of water. Neat and easy.

Over the years other countries adopted the metric system or had it forced upon them by imperialist colonizers from one European state or another, until only the English-speaking countries were holding out. Now Great Britain and the Commonwealth are in the middle of a ten-year switchover, leaving the U.S. as the lone non-metric nation in the world. In every other country school children can learn their system of measure in a month. In the U.S. we spend years getting a partial grip on our system of measure.

What all this means to you as an auto mechanic is that you may need two sets of wrenches—one for American-built cars and another for foreign makes. Most English cars are using metric nuts and bolts by now (although a few still use the Whitworth system—see Appendix, p. 92).

Metric wrench sets start with 6 or 7 mm. (millimeters) and go up to 19 mm. in 1 mm. intervals. Sixteen and 18 mm. wrenches are not usually included in metric sets. Fortunately, 16 and 18 mm. nuts and bolts are not usually included on cars.

If you are going to do a lot of work on foreign cars you have to get yourself a set of metric combination wrenches and sockets. If it's just a question of tightening one nut on a Volkswagen, you may find that you can fake it with your American wrenches. Several sizes in the American and metric systems are close enough to be almost interchangeable. Unfortunately most of these switches work in one direction only: you can use a wrench which is slightly too big on a bolt, but you can't use one which is a little too small. The table shows you which fakes you can get away with. Try not to use it just because you're too lazy to fetch the right wrench out of your tool box!

MICKEY MOUSE'S METRIC CONVERSION CHART

	WRENCH SIZE	FITS	BOLT SIZE
American to metric	3/8		9 mm
	7/16		11 mm
	9/16		14 mm
	11/16		17 mm
	3/4		19 mm
Metric to American	10 mm		3/8
	11 mm		7/16*
	13 mm		1/2
	17 mm		5/8
	19 mm		3/4*
	21 mm		13/16

* *sometimes*