Converting This to That

Measurement in the Diecutting and Diemaking Industry

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Diagram 1

Without measurement, we would have confusion, mayhem and inconsistency.

Many of us more than likely purchase a service or product from an international source. If we are located in the United States, it is almost guaranteed the international vendor's system of weights and measure is different than yours. This multi-part article is an effort to conquer the fear and confusion of adapting to the world's standard metric system.

Measurement can be defined as the function of determining weight, distance, time, temperature, electric current, volume and luminous intensity. In order to do so, we relate the target object against an instrument that is divided into standard units or compare it with an object of calibrated size, weight, volume, etc. (see Diagram 1).

Without measurement, we would have confusion, mayhem and inconsistency. Early civilizations realized the value of this practice for the purposes of construction, agriculture and trade. Unit standardization was typically compared to parts of the human anatomy or agricultural bounty and was limited to a single community or small geographic region.

An ancient Egyptian civilization created the earliest verified standard unit of measure, the royal cubit rod (see Diagram 2). A cubit is defined as the distance from one's elbow to the tip of one's hand (see Diagram 3). As trade expanded geographically, various cultures discovered variation in the definition of their cubit as compared to others. Standardization was imminent.

Many arguments can be made when globalization actually began, but many agree the United Kingdom's and European acceptance of the gold standard in the mid- to late-1800s is a good benchmark for recognition. The world trade market was booming and mass migration for many had begun for those seeking a better life. Shortly before, the British Imperial System of measurement was established and widely accepted all over the globe.

Around the same time period, ideas for a rational, decimal-based system with measures derived from nature were being introduced. Expressed in multiples of 10, the metric system gained wide acceptance rapidly as a much simpler universal method.

Diagram 2

In 2020, there are 195 sovereign countries around the world. Of those, there are only three who officially still use the Imperial system of measurement. Many of us today can make an argument that the "second" wave of globalization and influence on their businesses began much more recently. Personally, I can cite four events in history that drastically changed world economics: Opening the Berlin Wall (1989), development of the World Wide Web (1991), the North American Free Trade Agreement (1993) and the formation of the Euro Currency (1999). This 10-year period significantly opened up international trade and, for those in the US, the odds are you will be exchanging with a company who is NOT using the imperial system. To avoid confusion, mayhem and inconsistency, I suggest we join the rest of the world and make an effort to better understand and integrate metric measurement systems into our operations.

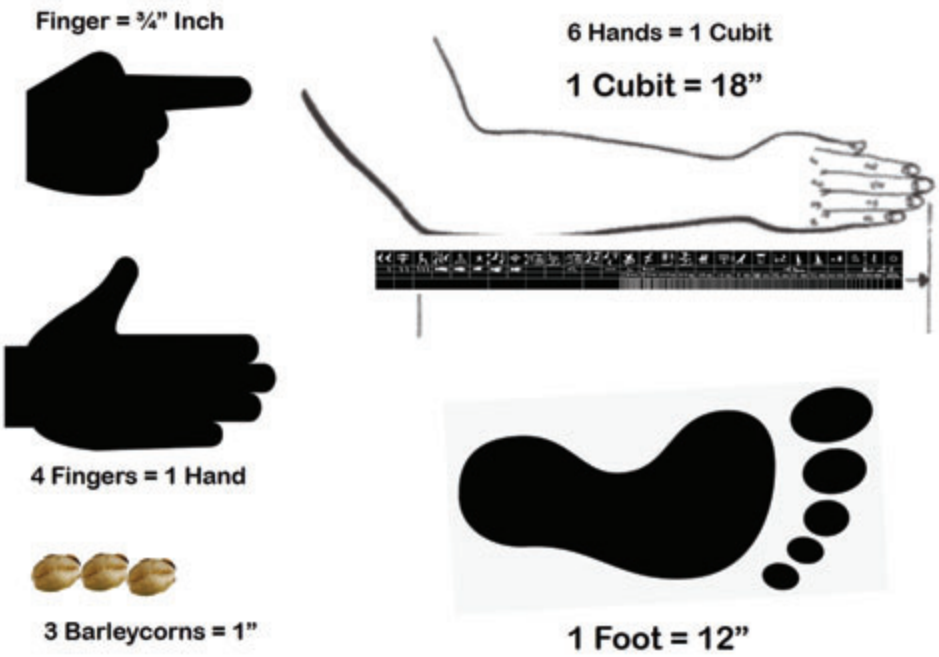

Diagram 3

Most of us in America have had some sort of classroom instruction on the metric system. However, it was very limited and just like our foreign language classes, we may not have been very motivated or interested in using these skills as a 12-year-old going about our daily activities. If we want to improve and incorporate these talents into our businesses, we must practice. I will attempt to pique your motivation better than my 6th grade math teacher by focusing on the functions we use most in tooling and converting, primarily distance, area and weight.

Did you know? The length of a meter was established by dividing the distance from the North Pole to the Equator by 10 million (see Diagram 4).

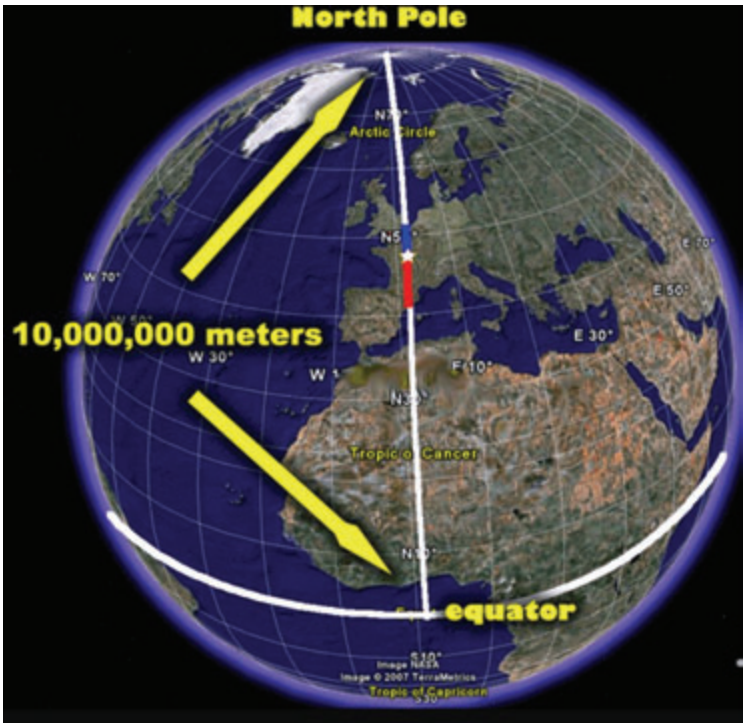

Diagram 4

Metric

The most common activity of the metric system we will use is distance, and the units of measure we need to understand are the

Diagram 5

micron (µm), millimeter (mm), centimeter (cm) and the meter (m). You can, with confidence, relate value to base-10 mathematics.

Determining the physical size of a sheet we are diecutting, the height or thickness of a cutting rule, the diameter of a punch or the linear quantity per box of an extruded product such as matrix are all examples of when we can apply this knowledge. Millimeter (mm) and meter (m) are the two you will want to master initially.

The next most common function to best understand is weight: gram (g) and kilogram (kg). Not used nearly as much as "distance determination," a common application is to reveal the contents within bottles, for example super glue is often displayed in grams. However, it's not uncommon to see wood glue and contact adhesive displayed in milliliters (ml). I don't know why this is, yet prefer to avoid mayhem and confusion and maintain the motivation to learn, therefore onward we go.

Imperial

I believe what confuses most metric users in understanding imperial measure is when we identify a distance (in inches) but sometimes use fractions and other times use decimals (multiples of 10) for a partial unit displayed as, 15.500" or 15 ½". It seems similar to what we have done to the Queen's English language.

The most common activities of imperial we will use for distance are the inch (") and the foot ('), while for weight, it will be ounce (oz) and pound (lb).

One foot is equal to 12 inches and one pound is equal to 16 ounces. I personally think multiples of 10 are much simpler to master.

Did you know? In early Arab civilization, to be consistent with agricultural trade transactions, they established 450 barley grains were equal to one ounce and 7200 grains were equivalent to one pound (see Diagram 5).

Fractions/Decimals

When an object of measure needs to be divided because it is less than one full unit, the imperial system can display that *portion* as a fraction (½) or a decimal (0.500). We will often see this on CAD drawings identifying the overall sheet size as 28 ½" x 40 ¼" or 28.500" x 40.250". The practice of comparing fractions to decimals is easily learned by understanding they are no different than the evenly spaced graduations on the ancient cubit rod (see Diagram 2 again). We will master this technique, and you will be well on your way to accepting the metric system.

Estimating

I cannot stress the importance of estimation when comparing the two methods. We need to know when we are at least in the "right postal or ZIP Code" during communications and not on the opposite ends of the country.

The simplest example is weather. When your colleague extends an invitation to visit and expresses the temperature will be 25°-30°, failure to recognize they did not mean Fahrenheit, may I suggest buying scissors at the airport and go Bill Belichick (US football coach known for cutting the sleeves off his hoodies) for the trip. I do think we all have that particular conversion within the ZIP Code. Others, perhaps not.

Ensuing issues of *The Cutting Edge* will provide methods to estimate quickly and with confidence.

If you are asked to diecut a job that is 800mm x 600mm, will it fit your press? If you are asked to use 32mm rule, can you even process it or is your tool block too short? Your customer has paper that is 300 microns thick; which crease do you use? The ensuing issues of *The Cutting Edge* will provide methods to estimate quickly with confidence.

Specific applications

Slang terminology is commonplace. Two that are very confusing to me are when work-

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MEASUREMENT

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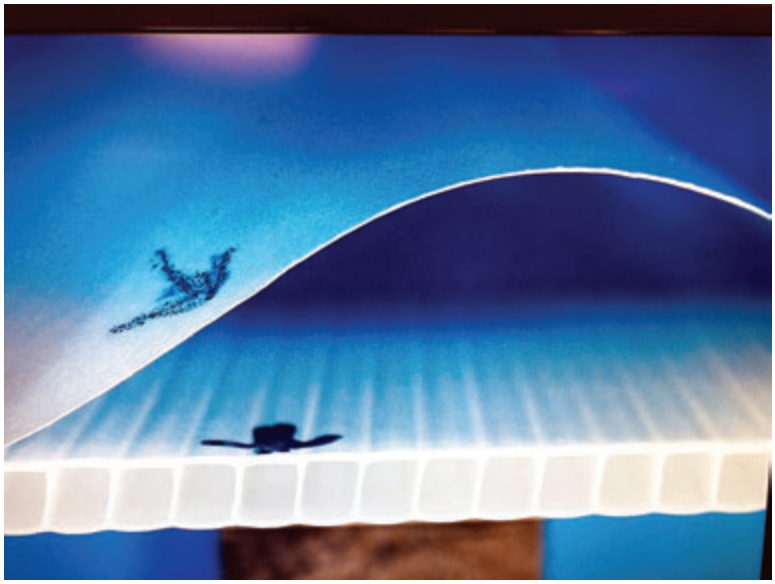

Diagram 6

ing with plastic extruded film rolls and sheet materials. Many refer to Mylar film as 3 or 4 "mil" thick. They are referring to 0.003" or 0.004" thick. I have had the same term (mil) used to describe the thickness of corrugated plastic sheets. "Hello, I'm cutting a 4 mil Corroplast. What crease should I use?" The reference here is slang for millimeter (mm) which is about 0.160" thick (see Diagram 6)!!

Another is the reference to point. When talking steel rule thickness or letter press, a single point is equal to 0.014" but when referring to paperboard thickness the same word refers to 0.001" caliper…just like Mylar. We will be sure to blow the fog off this one moving forward.

Geometry

Fortunately, radial dimension is simple in most diecutting and diemaking applications. Machine cylinders rotate and often have evenly positioned holes for fastening the tool. Gaskets have a bolt circle diameter that specifies a need to have eight evenly spaced

holes for fasteners. Circles have 360° regardless if they are dimensioned as 200mm diameter or 8". 360/8 = 45. This means each hole is on a 45° angle from the center axis.

As we dig deeper in the upcoming issue, we'll address the use of pi (π) in common calculations without needing the finite value; four decimal places are sufficient (not 3.14156...to infinity).

Conversions

When converting metric to imperial, I want quick methods to know if 22.8mm crease rule is nearly 0.900" high, or will I need a calculator to be sure?

So often we forget how to convert. Should I multiply by 25.4 or divide by 25.4?

We will learn that "1628" diecutter is 1.6m x 2.8m or about 66" x 113".

And 25 microns is 1/1000" (0.001"), therefore my 300-micron (300 / 25 = 12) sheet is 12 "point" (0.012"). For the letterpress readers, please let us know if we should cover picas, agate caliper and/or any other terms.

Tolerance and understanding scale of subject

The perspective of scale and tolerance on a specific project is important. The typical standard of using three place decimals (0.xxx) is not always possible for several reasons. I doubt early traders counted 7,200 grains per pound of barley when transactions were negotiated for the whole village. Somebody eventually created a vessel which was accepted as a calibrated method. That vessel was reduced in size when the transaction was proportionally smaller.

Realize what it is you are working on. If it is a CAD layout of your factory floor, please don't dimension the drawing as 2456.375". Perhaps annotating the length as 205' will make it easier for all to perceive the building size in comparison to a football field, without the need for that calculator.

If designing a small automotive or electronic gasket, that is when the three place decimal (0.xxx) applies. Avoid dimensioning these with a ridiculous fraction such as 3 1/128".

I believe it is time we join the party and try to adjust when it comes to measurement. In the coming issues, I will reflect back on each category and relate to our daily challenges with adaptation. Remember, practice makes perfect.

For the record, the other two countries joining the US in still using imperial are Myanmar, formerly Burma (SE Asia), and Liberia (West Africa).

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Have a suggestion for the next installment? This project has been a collaboratiive effort and we welcome your input. This first article is just the tip of the iceberg!

For possible future topics, we referenced the functions of determining weight, distance, time, temperature, electric current, volume and luminous intensity as potential topics. We also mentioned specifics like cover picas and agate caliper. Now, regarding our industry or just plain every day in and day out terms, what did we miss? What should we cover next? What passion, opinion or known scientific template do you have to share with our membership?

Readers are encouraged to add experiences and examples of how they were able to make what might be complicated re-expressed into more simple words and phrases. Please email your suggestions and feedback to staff@iadd.org. With your help, we can make this an IADD primer for all members to use.