HOW TO MEASURE AN AIR SHAFT

A normal activity of a Goldenrod representative is to measure an existing shaft for replacement. An experienced rep can measure a shaft in about ten minutes. The first question you should ask your customer before measuring the shaft is **<u>"Do you have a drawing of this shaft?"</u>** If so, get a copy and verify the accuracy of the drawing. Shafts can be altered and the drawing doesn't always match. If a drawing is not available, please continue.

Using a measuring tape and digital caliper while following a few basic instructions allow you to acquire measurements and create a sketch which will be adequate for our engineers to use as the basis for a CAD drawing. The measuring tools need to be accurate. Tape measures can be periodically checked with a caliper. Try, when possible, to avoid "bows" in the tape while measuring by laying the tape flat on the shaft. Beginning the measurement at the 1" tick helps avoid any inaccuracies that may have developed between the "lip" at the end of the tape. Sometimes the "lip" can be altered when the tape automatically snaps back into position after you've completed a task. Remember to subtract one inch when doing so.

Steps 1 – 7 requires a measuring tape.

Step 1: Measure the total length of the existing shaft. You may find that using a straight edge on the end of the shaft allows for a more accurate measurement. Do not include attachments such as gears, couplings, or other items which will not be provided with the shaft. This may require that you request that the bearing, gear or coupling be removed so that you can see the "naked" shaft. Make certain that the customer knows that we'll provide a quotation for the shaft only. If he would like pricing on ancillary items, we can provide a gear, coupling or bearing for an additional charge.

Step 2: Locate the position of the roll (web area) relative to shaft and load bearing centers (explained in Step 4).

Step 3: Determine maximum body length. This is achieved by measuring the distance between the machine frames, allowing for roll clearance including side adjustment, if any. **Note:** The body should be as long as practical without interfering with machine frames or bearings. **Note:** Also provide information as to how the shaft is placed in and taken out of the machine. If placed in the machine with lifting hooks for example, where do the hooks make contact with the shaft? Does the rewind shaft roll out onto a lifting table?

Step 4: Measure the distance (length) between the bearing centers. A bearing center (BC) can best be described as the center of the surface where the shaft rests in the machine. Also, as mentioned in Step 3, note the inside to inside frame dimension of the machine. **Note:** The BC dimension is the basis for all shaft stress and load calculations. It is required on all data sheets, sketches, or drawings.

Step 5: Show overall lengths of journals and the length of each individual step. Remember – the sum of all the components must equal the overall length (OAL) of the shaft. Always measure the overall length twice.

Step 6: Show position of drive/brake connector and dimensions. This could be a keyway, slot, flat area, square, pin at 90 degrees to the journal, or other mechanism.

Step 7: Show position of air valve(s). Please note if valve location shown is critical or if it is possible for Goldenrod engineering can choose placement of valve. Also indicate if the shaft has a large air valve (a little larger than a dime) or small/mini air valve.

Step 8 and 9 requires a digital caliper. (Many machines today will be assembled using metric measurements. Find a caliper that can display values in both metric and standard increments).

Step 8: Measure journal diameter at bearing area:

NOTE: Bearings need to be held in place or retained. There is typically a shoulder on one side of the bearing and a snap ring or lock nut on the other. If there are two bearings side by side, please indicate.

a. When bearings are mounted on journal and you're not able to remove: Measure O.D. X I.D. x width and name the bearing manufacturer and bearing number (even if customer is providing bearing). The journal diameter can then be determined from the bearing manufacturer's specifications book.

b. When the shaft runs on bearings or the bearing surface mounted on machine: Provide verbal description of load bearing area on machine and length or bearing area (wear area) on shaft journal. Allow for side-lay adjustment of shaft in machine.

c. With bearing assemblies: Provide sketch showing all dimensions of bearing housings and describe the item holding the bearing in place(nut and washer, or snap ring.) Please note any dimensions whichcan not be changed to ensure proper shaft operation. **Note:** If the customer has **safety chucks**, try to identify make and model number.

Step 9: Measure journal diameters.

Steps 10 and 11 require both a measuring tape and digital caliper.

Step 10: Measure journal options such as keyways, pinholes, tapers, etc. <u>Keyways</u> – Measure the length, depth and width of the keyway. Also – indicate position of keyway on journal. The keyway can be *open ended*, meaning they begin at some point on the journal and continue all the way to the end; or the can be *closed*, meaning that the entire keyway is located somewhere on the journal. <u>Pinholes</u> should be measure for diameter and placement in reference to some identifiable location on the shaft - i.e. "end of journal", etc. <u>Tapers</u> – measure the beginning of the taper, the end of the taper and the width of the taper. This will allow our engineering to determine the angle of the taper.

Step 11: Measure the width of the load bearing surfaces. Identify the material from which the bearing surface is made; i.e. roller bearings, bronze, plastic, or other. **Note**: If the shaft is supported by cam followers, the journals are heat treated or "hardened". Many times you can tell if the journal is heat treated by trying to scratch it with the hardened points of you caliper. If you cannot plainly see the scathes…it is hardened.

Some manufacturing plants have spare shafts available for you to measure at any time. Others have only one shaft which will be in use almost constantly. It is advisable to inquire when setting up your appointment as to when a shaft will be available to measure so that you waste little time to perform this task.

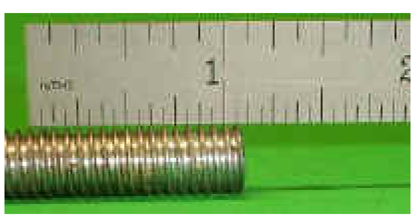
HELPFUL HINT! Keyways, pinholes, tapers, and slots wear with use and may be difficult to measure because their shapes are distorted. When this occurs, you will want to examine this part of the shaft thoroughly to find any original areas to measure, or measure its mating part (pin, chuck, key, etc.). A brief discussion with the department supervisor or maintenance man may provide clues, a replacement part, or a sketch or drawing they have made in order to make replacements.

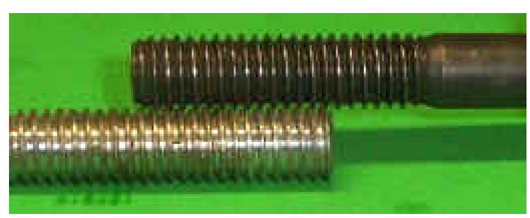
HINT: If you have a digital camera, ask the customer if you can bring it into the plant and if it would be alright if you take pictures of the application, shaft, and journals.

What about Measuring THREADS?

Threads on an air shaft have two descriptions. One is its diameter, measured to the height of the threads. The other is how many threads per inch. Or, in metric use, the pitch of the threads that is the measurement from one crest to the next.

To determine the number of threads per inch, a machine shop would use a thread pitch gauge. The gauge has multiple blades, each with a different thread pitch on it, and using it like a comb you use the blade that fits the thread. When you find the number of threads per inch, a fractional screw size would be written: diameter-threads per inch. Example: 1/2-20, 1/2 (inch) being the diameter and 20 threads per inch. Or for an air shaft – 1.5" diam x 20 threads per inch.





Most hobbyists don't have a thread pitch gauge, so you can use a scale. You can count how many thread crests are in an inch. If the fastener is short, measure how many in a quarter inch, then multiply by 4.

Another method of determining the thread pitch is to use a known thread on a screw or bolt, like you would use a gauge. An example is: if you had a 10-32 screw, you can use it to check any other 32-pitch thread, such as ¼-32 or ½-32, or any other 32 thread per inch screw.

Metric fasteners can be measured as above, but the metric description uses the distance between thread crest to thread crest. When using a scale the thread may be finer than the graduations on your scale. So count how many threads are in a centimeter and divide by 10. Or, if the screw is shorter than a centimeter, count the amount in half a centimeter and divide by 5. The screw size would be written diameter in millimeters x distance from crest to crest in millimeter. An example would be 8 x 1; so the bolt would be 8mm dia. and 1mm from thread crest to crest.

How to Measure Bolt Size for a **Shaftless Chuck**

There are six pieces of information that describe the measurement of a bolt. These are: diameter, thread pitch, shank length, grade, head and thread length. Bolt measurements can be calculated in millimeters or inches, but the manufacturer's specifications for bolts are international. This means that should you ask for a 1/2"x12x4" Grade 2 Hex Head Bolt with a 1" thread, the request is universally understood by bolt manufacturers.

How to Measure Bolt Size (Things You'll Need:Calibers /Tape measure)

Measure the diameter of the shank. The shank is the shaft-like part of the bolt. Use calibers to obtain an accurate measure of the shank's diameter. In the above example, 1/2 inch is the shank's diameter. It is the first measurement used to describe the bolt.

Determine the thread pitch by counting the threads along the shaft. Do this by measuring one inch of the shaft and counting how many threads (a rise and depth is one thread) are in that inch. In the example, there are 12 threads per inch, so the measure reads as 12.

Measure the length of the shank. The length of the shank is from the point where it meets the head to the opposite end. In the example, this is 4 inches.

Determine the grade of the bolt. The grade describes the grade of metal or the type of material used to manufacture the bolt. The grade of the bolt may be indicated by markings on the head. Manufacturers use a variety of ways to mark the grade on their bolts.
In the example, Grade 2 signifies a soft steel was used to make the bolt.

Look at the head of the bolt. The shape of the head indicates what type of bolt it is. If the head is square, it is a square head. A hex head will have a six-sided head. A carriage will have a dome-shaped head with a square support between it and the shaft.

There are hundreds of different types of bolts, though the most common ones are included in the above listings. In the example, the bolt is a hex head.

Measure the thread length. This is the amount of shaft that is actually threaded. In the example, the thread length is 1 inch.
A bolt size, then, consists of these six indicators. Were you to contact a bolt manufacturer and say, "I need 20 1/2 inch x 12 x 4 inch Grade 2 Hex Head bolts with a 1 inch thread length," the manufacturer would know exactly what you mean.

GOLDENROD
CORPORATION
PARTNERED WITH SVECOM P.E.