FORCING GAUGES

A reader, Mark Hirsch, kindly sent me an email regarding gauging problems that many companies face. I hope this column will provide answers if you are having similar problems.

The key problem deals with how much force should be used when applying fixed limit or Go/NoGo gauges to the work being inspected. When plain gauges are calibrated, minimal measuring force is used and that should be the case when they are used. However, since we receive many of these gauges for re-calibration, we get to understand how many of them are used or abused.

With respect to plain plug and ring gauges, there are no industry standards I am aware of that stipulate how much force should be applied. I have seen gauges with the ends of their handles badly deformed because someone was using a hammer or mallet to drive them into the work. This is obviously gross abuse and will give all kinds of wrong answers. No tools of any kind are needed to use these gauges effectively.

Plain Plug Gauges

Since the force used by one person compared to another can vary considerably, there is only one thing that is common in all situations - the gauge itself. If you apply a rule that says the weight of the gauge is the force to be applied it will be consistent. Hold the gauge over the hole to be checked and if its own weight will not allow it to enter, any additional force would mean you are attempting an interference-type fit when a free fit is required. This method also reduces problems when gauging thin walled bores or work in flexible materials.

Okay, I know the next question: What if the bore axis is not vertical? One way to deal with this is to hold the gauge as you would a pencil - with your fingertips. They should be on the flats of the main body of the handle and should not grip the handle with more force than you would a pencil. To keep the force down, do not allow operators to grip the gauge as they would a hammer by wrapping their fist around it. When large, heavy, gauges are involved, use one hand to support the gauge while the fingers of the other hand apply the entry force.

Plain Ring Gauges

Similar rules can be applied when using plain ring gauges and when they must be applied horizontally, they should be held by three finger-tips of one hand.

Larger gauges should be held between the thumb and forefinger of two hands, the fingers of which touch the outside diameter. The reason for this type of handling is to reduce the opportunity of applying too much force.

Plain Snap Gauges

Go/NoGo plain snap gauges have similar problems but the fix is easy. I recommend the weight of the gauge be the gauging force so the gauge is simply rested on the work. If it passes through the Go anvils and stops at the NoGo anvils, the part is good.

In a perfect world, you could monitor the force being applied with a Mark-10 force gauge and establish limits on what is acceptable to your company. However, management may not be too enamored of this approach due to cost.

Thread Plug Gauges

The ANSI standard B1.2 offers some guidance with respect to thread plug gauges. It notes that the NoGo member can enter the workpiece by up to three turns and the work can be considered satisfactory. Some companies have different rules from a maximum of two turns to full engagement as long as there is consistent drag felt when gauging the work. What constitutes “consistent drag” can lead to great discussions.

I happen to sit on the committee that is reviewing this standard and, in May, we were looking at this aspect but nothing was changed.

Thread plug gauges should be applied with the fingertips holding the gauge like a pencil to keep the torque within reasonable limits.

Thread Ring Gauges

I would suggest that thread ring gauges be handled and applied in a similar manner to plain ring gauges. The ANSI standard allows the NoGo gauge to engage the workpiece by up to three turns like the plug gauge.

Entry Problems

When close tolerance plain gauges are being used to check very narrow tolerances, it may be helpful to have a pilot ground on the gauge or a generous chamfer to help align it to the work.
Large, fine pitch thread plug gauges often present entry problems. These can be alleviated by having the gauge maker provide a pilot on specially made gauges. The pilot diameter would be about the same size as the minor diameter of the ring making it easier to align the gauge and engage the threads without damaging them. Obviously, if you’re gauging a blind hole, the “pilot” option will not work.

If these measures don't help reduce or eliminate arguing over the results of using fixed limit gauges, you may have to resort to measuring the features in question to reduce the human effect. Unfortunately, other human problems can come into play and you may not be any better off.

**Editor’s Note: Thanks, Mark, for suggesting the topic. Hill welcomes all questions and comments and attempts to answer all questions by phone, email or, as in this case, by an entire article.**

**AVOIDING CALIBRATION COST SURPRISES**

We regularly quote the costs of calibrating a group of gauges using a list customers have sent to us. All things being equal, this is easy to do but, sadly, all things are rarely equal. When the gauges arrive, what seemed to be a typical gauge from the description on the list often turns out to be more complex once our technicians take a look at it. This means that additional calibration costs may be encountered. Here are a few pointers to help you get a quotation and avoid such surprises:

- Visually inspect each gauge or instrument before you list it. This will often reveal situations that may lead to higher calibration cost. For example, with thread gauges, you may notice there are burrs on the thread form or that the starting thread is damaged. These are repairable situations in most cases, but they will increase the calibration cost. Similarly, gauges used on soft metals may have those metals bonded to the gauge like a coating. This has to be removed to ensure reliable calibration. When you’re dealing with instruments, check to see that they are functioning smoothly otherwise a repair may be needed before calibration can be done.
- Often only calibration reveals conditions that can trigger extra expense you hadn’t anticipated. Typical of this is when thread ring gauges are re-set. Many people calibrate thread rings and neglect to check the minor diameter after they have re-set the ring. We routinely do this check and regularly find that the minor diameter goes undersize after re-setting requiring it to be honed to bring it into tolerance - a service we provide at a nominal additional cost. But when it is done, you know all features of the ring will meet the standard.
- Often measuring instruments seem to be performing well but calibration reveals they are not repeating within reasonable parameters or their measuring contacts need to be replaced. Sometimes all the calibration process can tell you is that the instrument is too far gone and should be replaced.
- Accurate pricing requires an accurate description of the item to be calibrated. This would seem obvious but often a one or two digit or character change in a description can make a difference. Where thread ring gauges are concerned, a setting plug is used to re-set them and we keep a full range of all standard sizes and classes of fit masters on hand to do so. If you ask for a price to calibrate a 1/4-20 2A go ring, a quote will be given for a standard gauge. On receipt, we may find that the correct designation is 1/4-20 UNS 2A indicating a special pitch diameter for which there is no setting plug available from our extensive range of specials. If in doubt, please note the pitch diameters of the gauges and we'll check them for specials before quoting.
- Measuring instruments pose the greatest problem when it comes to describing them properly. Outside micrometers are a good example of what I mean. A “1-inch or 25mm micrometer” can mean different things. For example, instead of it being a regular instrument with flat, parallel anvils, it could be a thread measuring micrometer requiring additional calibration to ensure the form on the anvil and spindle are correct. It could also be a model with interchangeable rear anvils or one with an indicator linked to the moving rear anvil which requires different procedures. If a larger micrometer is involved, you should indicate if a setting master is included. When the instrument is marked with a model number, please indicate this and the brand name. If you’re uncertain about a description, find examples from your supplier's catalogues and indicate what you’ve done with a question mark. Example: Mitutoyo 145-185? or Starrett 790AFL-1? The question mark tells us what type of instrument it is and that it may or may not be the brand or model you have indicated.

The most accurate pricing is obtained by sending the instruments and gauges to us with a request that we "quote before proceeding"