

## Part 1: Setting Adjustable Thread Rings – “Why do I need the Set Plug”

Oftentimes we are sent special sized GO and NOT GO adjustable threaded ring gages for calibration, or we are asked to quote/manufacture new ones. In either case we must ask the customer if they own the set plug, and, in most cases, they do not. The most common response we get is, “Why do I need the set plug? The last company I sent these gages to didn’t require them.” Upon further investigation, it is found that the “other company” is using some form of direct measurement, either CMM or single point ball probes. The simple fact is that the “other company” is not following the consensus standards that govern this calibration, and in turn is misleading end users to believing their calibrations are valid and proper.

Several standards are quite clear on how adjustable thread rings are to be checked, set, adjusted, or calibrated:

- ASME B1.2 and ASME B1.16 state: Adjustable GO (and subsequently NOT GO) thread ring gages must be set to the applicable W tolerance setting plugs.
- MIL-STD-120 states: The pitch diameter of adjustable thread ring gages is adjusted by fitting the ring to a setting plug of known size.
- FED-STD-H28/6A states: The size of adjustable limit or indicating thread gages is controlled by utilizing the applicable W tolerance thread setting plug.
- IFI-301 states: The functional diameter of the working ring is set to the functional diameter size of the combined characteristics of the setting plug.



It is abundantly clear in all the standards that govern thread gaging that a set plug is required to set an adjustable ring gage.

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A few points that may help explain the reasoning and difference between setting a ring gage to a set plug versus directly measuring the pitch diameter are:

- Adjustable thread rings are not round. A set plug will engage the circular boundary, but a direct measure probe will simply measure (2) or more independent points in the thread groove, and chances are pretty good that the “best ball” size is not being used.
- Adjustable thread rings are intended to be used as a functional check of the product. Set plugs will confirm a functional fit, but direct measurement will only provide pitch diameter size at the specific thread groove that is probed. Direct measurement does not take factors such as flank angle, lead, root clearance, or helical offset into consideration. In other words, all the elements that make up functional fit are being ignored.
- Setting an adjustable thread ring gage to a setting plug may be subjective, because “firm fit” or “snug fit” as defined in the standards, may mean something different to different people. However, there is much more variation when taking more than one direct measurement of the same gage. In fact, there could be several “tenths” different in the actual setting between the two methods.

Calibration laboratories that are accredited to ISO 17025 either have to follow “standard methods” or they can develop their own as long as they are then validated. Validation of those alternative methods means that the result is repeatable to within measurement uncertainty using the standard method as the measuring stick. The direct measurement of pitch diameter on adjustable thread ring gages has been studied and proven to provide too large of a deviation. Therefore, direct measurement is not a valid alternative to setting adjustable thread ring gages with a setting plug.

Adjustable thread ring gages can be sensitive and it is highly recommended that end users have their own setting plug to periodically evaluate their proper setting. Settings can change if the ring is accidentally dropped or mishandled, and size can be affected by how abrasive or how much dirt and grit are on the product threads at the time of inspection.

Gage owners beware! Adjustable GO and NOT GO threaded ring gages certified without the use of the appropriate setting plugs are probably inaccurate. Unless adjustable thread ring gages are set to the appropriate threaded setting plugs as specified by ASME and other standards, gage certifications of those gages are invalid. The ASME standard governs their design and calibration, so adjustable thread ring gages that are calibrated by any other means other than a set plug are more than likely set to an inaccurate size. Furthermore, they may accept non-conforming threaded product or may erroneously reject conforming product.

So, to answer the question of “Why do I need the Set Plug”....because the standards say so!