



Part 1: Setting Adjustable Thread Rings-

“Why do I need the Set Plug?”

by Larry Borowski

第1部分：可调式螺纹环规设置- “我为什么需要塞块？”

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 it misleading the 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.

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

通常我们会将专用尺寸的GO和NOT GO可调式螺纹环规送去校正，或是购买/制造新的。不论是哪种情况，我们都必须询问顾客是否有塞块，但是大部分顾客都是没有的。最常见的顾客回复就是：“我为什么需要塞块？上次帮我校正这些环规的公司没有提出这样的要求。”在经过深入调查后，发现「其他公司」所使用的是CMM或是单点球头探针这类的直接测量法。也就是说，这个「其他公司」没有依照规范的共识标准来校正，因此误导末端用户相信他们的校正方法是有效与正确的。

有数个明确的标准可用来规范可调式螺纹环规的检查、设定、调整或校正，请参考下列说明：

- ASME B1.2与ASME B1.16的规定：可调式GO(和NOT GO)螺纹环规必须根据适用的W公差塞块来进行调整。
- MIL-STD-120的规定：可调式螺纹环规的节径，其调整方式是将螺纹环装到已知尺寸的塞块上。
- FED-STD-H28/6A的规定：可调限制的尺寸或是指示螺纹规是利用适用的W公差螺纹塞块来控制。
- IFI-301的规定：工作环的有效直径必须根据塞块综合特性的有效直径尺寸来调整。



- 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! ▣

所有规范螺纹规测的标准，都明确的规定在进行可调式环规调整时一定要使用塞块。

下面几点可帮助说明将环规安装到塞块与直接测量节径之间的推论与差异：

- 可调式螺纹环不是圆的。塞块会与环型周围接合，但若是使用探针直接测量，就只能测量螺纹槽或是螺纹槽里面的几个独立的点，这样就很可能达不到「最棒」尺寸。
- 可调式螺纹环是用来检查产品的功能性。塞块可以确认功能的适配性，但是使用直接测量法探测时只能获得特定螺纹槽的节径尺寸。直接测量法未将螺纹腹角、导程、螺根间隙或是螺旋偏距等因素列入考虑。换言之，所有构成功能适配性的要素都被忽视了。
- 将可调式螺纹环规装到塞块上牵涉到主观性的判断，因为不同的操作人员对于标准中的「牢牢贴和」或「紧密贴合」会有不同的认定。但是，使用相同量规进行多次直接测量会产生更多的变数。事实上，两种方法在实际安装时会有几成的差异。

根据ISO 17025认可的校正实验室，必须遵守「标准方法」或是自行开发经过验证的方法。那些替代方法的验证结果表示在使用像是测量棒标准法的量测不确定性环境下，结果具可重复性。经研究证明，直接测量可调式螺纹环规的节径，所得到的结果偏差过大。因此，直接测量法不是有效的替代法，不能用来取代使用塞块来装可调式螺纹环规。

可调式螺纹环规具敏感性，所以极力推荐末端用户要拥有自己的塞块，以便定期评估安装是否正确。如果螺纹环意外掉落或是错误操作都会让设定改变，而且尺寸也会因为摩擦方式或是检查时，在产品螺纹上的灰尘与碎屑量而受到影响。

拥有量规的使用者请注意！未使用适当塞块校正的可调式GO与NOT GO螺纹环规可能是不准确的。除非可调式螺纹环规是经过ASME及其他标准所规定的螺纹塞块正确的调整，否则那些量规的校正都是无效的。它们的设计与校正都受到ASME标准规范，所以使用其他方法校正的可调式螺纹环规的调整尺寸，可能就是不正确的。此外，它们可能因此接收了螺纹不符的产品，或是将合格产品乌龙的退回。

所以「我为什么需要塞块？」，因为标准就是这样规定的！ ▣