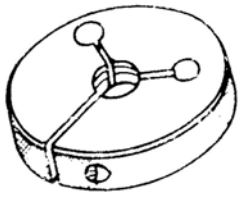
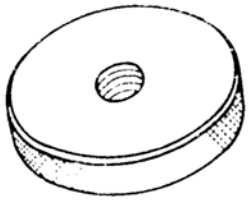
ASME B1.16 and ISO 1502 Thread Ring Gages Are Different Sizes



ASME B1.16
Split Ring Design



ISO 1502
Solid Ring Design

During recent years I have had several contacts from frustrated metric fastener suppliers and users who are having thread acceptability conflicts. The conflict is always the same. One party is absolutely confident that the screw threads are acceptable using their gages, but another party is just as confident that the same parts are not acceptable using their gages.

The Heart of the Problem

After asking a few questions I frequently learn that the parts are being manufactured on one continent and used on another. I then learn that one party is using thread gages produced in the United States to the American Society of Mechanical Engineers (ASME) Standard B1.16 and the other party is using thread gages made to the ISO Standard 1502. The conflict arises most frequently on the inspection of external threads where the parties are each using ring gages.

The prominent style of ring gage used in the USA is made to the ASME standards. This is a split style, adjustable ring gage. The predominant style of ring gage used in most of the rest of the world is the ISO solid, non-adjustable ring gage.

Parties to these issues become very confused about why they are having these disagreements. When they look at the two different thread standards, ASME B1.13 and ISO 965 they see that the pitch diameter specifications are identical. In both standards the pitch diameter size limits are 8.994 mm (GO) to 8.862 mm NOT GO. The assumption is, “Since the thread sizes are the same, the gage sizes must be the same.”

ASME and ISO Standards View Gage Tolerances Differently

In that assumption lays the fallacy. The ASME and ISO standards committees take completely different views of how gage tolerances should be applied relative to the product sizes and tolerances.

The ASME philosophy is that the maximum limits of thread gages should be exactly equal to the maximum product limits. When applying the tolerances to the gages the tolerance always comes into the product tolerance. Using the ASME gaging philosophy an ASME gage may fail an acceptable threaded product which is within the gages tolerance band, but AN ASME GAGE WILL NEVER ACCEPT A NON-COMFORMING PRODUCT THREAD!

The ISO philosophy is that thread gages should start below threaded product limits and be allowed to wear slightly beyond those product limits. USING THE ISO GAGING PHILOSOPHY NEW ISO GAGES MAY REJECT CONFORMING THREADED PRODUCTS AND USED ISO GAGES, AT THEIR EXTREME ALLOWABLE WEAR LIMTIS, MAY ACCEPT NON-CONFORMING THREADED PRODUCTS!

I have constructed the enclosed chart to try to show these gage size differences graphically to illustrate the reason why these metric thread gaging issues do occur and will continue to occur.

See Chart at end of article

The components of this chart are as follows:

1. The black bars at 8.994 and 8.862 represent the M10 X 1.5 6g threaded product limits that ASME B1.13 and ISO 965 agree on.
2. The yellow bar shows the ASME B1.16 gage limits that are located at the same extremes as the product limits.
3. The orange bar shows the ISO 1502 GO and NOT GO sizes for new solid ring gages.
4. The blue bar shows the ISO 1502 GO and NOT GO limits for the wear plugs that are used to determine when the ring gages must be replaced.
5. The purple bar shows the range within which all ASME and ISO will all accept M10 X 1.5 6g threaded products.

This chart shows that the total agreed upon tolerance for an M10 X 1.5 6 g threaded product pitch diameter is 0.132 mm. The ASME gage extreme limits are also 0.132 mm. The total possible gaging limits using a new NOT GO ring gage and a worn ISO GO ring gage is 0.148 mm. The total acceptability range within which you can be assured that both ASME and ISO ring gages, whether new or worn, will be accepted is 0.121 mm.

Recognizing this reality, which we cannot expect to ever be resolved between the ASME and ISO thread standards committees, what can international suppliers and users do to avoid these metric thread acceptability conflicts?

Practical Solutions

I offer the following suggestions to those who wish to adopt practical solutions for the avoidance of future occurrences of these inevitable metric thread gaging conflicts:

1. Parties can agree that if a properly certified set of ring gages, whether ASME or ISO, accepts the threaded products, all parties will agree the parts are acceptable.

   This is the most practical solution of all, but possibly the most difficult to get all parties to agree to. I contend that based on many years of history and experience, threaded parts that were made using ASME gages and used in USA applications have worked successfully. The exact same can be said of parts made using ISO gages and used in non-USA applications. It is my opinion that if metric threaded parts meet properly calibrated ISO or ASME ring gages the parts will assemble and they will pose no possible

strength threats.

2. In manufacturing, use ASME thread gages if the parts will be used within the United States and use ISO gages if the parts are intended for use in other parts of the world.

   The disadvantage to this approach is that manufacturers will have to maintain two different gage inventories. Another disadvantage of this approach is that many standard threaded parts are made at one location and shipped all over the world. Therefore the destination of the final use cannot be determined during manufacturing.

3. Metric threaded product manufacturers could adopt the use of SPECIAL ring gages made using the ASME split, adjustable ring design where the GO and NOT GO limits are restricted as illustrated by the purple bar to assure that products accepted by these gages will be accepted by all standard ISO or ASME gage any where in the world.

   The disadvantage of this approach to the manufacturer is the cost of these SPECIAL gages. These special ring gages will cost about double the cost of standard ASME ring gage. This still may be a very practical solution, because the added cost of ring gages as compared to the cost of resolving rejected screw and bolt disputes may be a small price to pay.

   I only worked out this non-conflict range for the M10 X 1.5 6g size for illustration in this article, but the same non-conflict size can be determined for all sizes and classes of metric threads.

4. These thread acceptability conflicts are based on the use of fixed-limit thread gages that are made to different sizes based on the different standards. A very practical solution to this problem is to use Tri-roll, variable thread gages as a final determiner of acceptability by all parties.

   This completely negates the problem because when using Tri-roll thread gages the inspector determines thread acceptability of the threaded products based on the gage reading as compared to the PRODUCT LIMITS. The gaging size limits are irrelevant.

   When measuring an M10 X 1.5 6g threaded product with a Tri-roll gage if the gage's indicator reading is between 8.994 and 8.862 the thread is acceptable. If the gage indicates the product thread is outside those limits, the product thread is non-conforming.

Tri-roll Gage indicating actual thread size of ¼-28 3A part.

This problem is real. It is not likely to go away. International suppliers and buyers can learn to live with the inevitable conflicts or they can consider adopting one of the suggested approaches listed above to eliminate these conflicts in the future.

For more information on this or other fastener related quality issues contact the author at sales@greensladeandcompany.com.

Chart Illustrating the Relationship of Product Thread Size to ASME and ISO Thread Gage Sizes

M10 X 1.5 6g					
			ISO 1502		
Gage	Size	ASME B1.16 Gage Limits	New Solid Gages	Wear Check Plugs	
Total Tolerance		0.132	0.148		
GO	9.001			9.001	
	9.000				
	8.999				
	8.998				
	8.997				
	8.996				
	8.995				
	8.994	6g Product High Limit (ASME B1.13 / ISO 965)			
	8.993				
	8.992				
	8.991				
	8.990				
	8.989				
	8.988				
	8.987				
	8.986		8.986		8.986
	8.985				
	8.984				
	8.983				
	8.982				
	8.981				
	8.980				
	8.979 - 8.871				
	8.870				
	8.869				
	8.868				
	8.867				
	8.866				
NOT GO	8.865			8.865	8.865
	8.864				
	8.863				
	8.862	6g Product Low Limit (ASME B1.13 / ISO 965)			
	8.861				
	8.860				
	8.859				
	8.858				
	8.857				
	8.856				
	8.855				
	8.854				
	8.853		8.853		