About the Author/JOE GREENSLADE

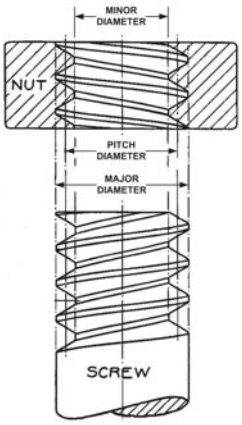
Joe Greenslade is President of Greenslade & Company, Inc. in Fort Worth, Texas, a supplier of fastener inspection products, inspection software, and ISO 17025 (A2LA) accredited calibration services. He also provides a variety of consulting services including serving as Expert Witness in fastener related litigations.

Joe has been in the fastener industry in a variety of capacities since 1970. He has written over 220 fastener technology related articles and has spoken to many fastener industry organizations throughout the United States. Joe has been awarded 12 U.S. Patents for fastener inspection devices.

Joe is an active member of the American Society of Mechanical Engineers (ASME), the American Society for Testing and Materials (ASTM), the National Fastener Distributor's Association (NFDA), and a member of the Board of Directors of the American Association for Laboratory Accreditation (A2LA). He is a former member of the Industrial Fasteners Institute (IFI). He was a member of the Fastener Quality Act Task Force representing the fastener industry. Joe also serves on the Screw Thread Improvement Task Force working with government and industry to improve aerospace related thread specifications, and thread gaging and calibration procedures.

Inspecting Threads With Thread Gages Is NOT Enough

There is a wide-spread, potentially dangerous misunderstanding by fastener suppliers that if a threaded fastener is acceptable using the appropriate size GO and NOGO thread gages that the thread is acceptable for ALL characteristics. The use of GO and NOGO thread gages to inspect threads is NOT adequate and they do not even inspect the most critical characteristics on the thread.



The GO and NOGO thread gages only determine if the **"pitch diameter"** of the inspected part is within acceptable size. When a part passes the GO and NOGO thread gage inspection that only indicates that the evaluated part will go together with a counterpart that has also passed its GO and NOGO thread gage inspection. These inspections do **NOT** indicate whether or not these threads will strip out of a mating part when they are placed into service. **The pitch diameter size alone does NOT predict thread strength.**

What inspection DOES evaluate potential thread strength?

The most critical thread characteristic on an external thread (screws and bolts) is the **"MAJOR DIAMETER."** The most critical characteristic on an internal thread (nuts) is the **"MINOR DIAMETER."**

It is the amount of overlap between the external thread's MAJOR DIAMETER and the internal thread's MINOR DIAMETER that determines whether or not the threads will strip out of one another when the applications stresses are applied to the product joint. Standard bolt and nut products are designed so that when the major diameter of a screw or bolt is within specified size and the minor diameter of the mating nut is within specified size the failure mode will always be the bolt breaking.

Thread Stripping

Thread stripping is by far a more dangerous type of fastener failure than is bolt breaking. Application stresses are determined based on the tensile strength of the screws or bolts used. When threads strip, the strength of the screw or bolt has not been completely utilized.

When a screw or bolt major diameter is undersized or when the nut minor diameter is oversized, the amount of thread overlap is decreased. This means there is less material mass between the external and internal threads to resist a shearing action between them when the stresses of tightening or the stresses of the application are exerted on the joint. The shearing away of either the internal thread or the external thread is what is referred to as "thread stripping."

GO/NOGO Thread Gages

Bolt entering GO ring gage.

Bolt not entering GO ring gage.

GO and NOGO thread ring gages do NOT inspect the major diameter of a screw or bolt. The major diameter in a ring gage is larger than the maximum product thread major diameter. Threaded ring gages cannot and will not detect an undersized product thread's major diameter.

GO and NOGO threaded plug gages do NOT inspect the minor diameter of nuts. The minor diameter of GO and NOGO

threaded plug gages are smaller than the smallest allowable minor diameter of the nut thread. The GO and NOGO thread plug gage will never detect an oversized nut minor diameter.

Inspecting bolt's major diameter.

What should fastener suppliers do?

In addition to inspecting screw and bolt threads with GO and NOGO ring gages or Tri-roll thread gages, they should also inspect the major diameters of screw and bolt threads using a micrometer, caliper, or a NOGO cylindrical ring gage made at the applicable limits of the major diameter.

In addition to inspecting nut threads with GO/NOGO threaded plug gages internal threads should be inspected using GO/NOGO cylindrical plug gages manufactured at the applicable internal thread minor diameter.

What constitutes the minimum acceptable thread inspection process?

The simplest acceptable thread inspection system, as defined by the American Society of Mechanical Engineers (ASME) in the thread acceptability standard ASME B1.3, is System 21. The requirements of a System 21 Inspection are the evaluation of the limits or size of the following thread characteristics:

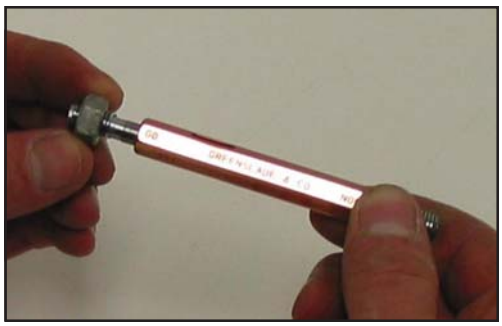
External Threads

- GO Maximum Material
  - GO Threaded Ring Gage
- NOGO Minimum Material
  - NOGO Threaded Ring Gage
- Major Diameter
  - Micrometer

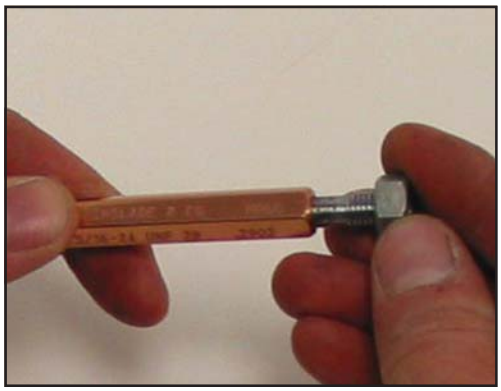
Internal Threads

- GO Maximum Material
  - GO Threaded Plug Gage
- NOGO Minimum Material
  - NOGO Threaded Plug Gage
- Minor Diameter
  - GO Cylindrical Plug Gage
  - NOGO Cylindrical Plug Gage

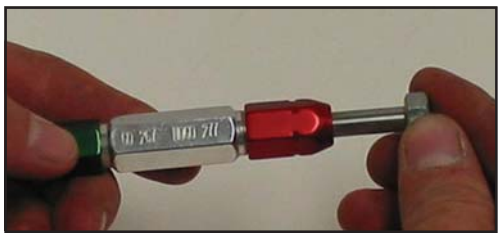
When inspecting screws, bolt, and nut threads, do not stop with the GO/NOGO thread gage evaluation. Passing a GO/NOGO threaded gage evaluation provides absolutely no assurance of thread strength. Always inspect the major diameter of external threads and the minor diameter of internal threads assurance of potential thread strength.



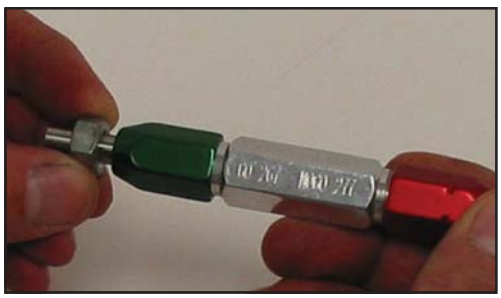
GO threaded plug gage enters nut.



NOGO threaded plug gage does not enter nut.



GO cylindrical plug gage enters nut minor diameter.



NOGO cylindrical plug gages does not enter nut minor diameter.

For more information on this or other quality assurance matters related to specifications, procedures, and/or equipment, contact the author at sales@greenslade andcompany.com.

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