A **Higher** Measure of **Value**

# TECHNICAL BOOKLET

Effective June 2012

GLASTONBURY SOUTHERN GSG GAGE

**www.gsgage.com**

AMIMA MEMBER AMERICAN MEASURING TOOL MANUFACTURERS ASSOCIATION

**Redline Service Available**

**Over 4,000 Thread Gages in Stock**

A2LA ACCREDITED Calibration CT Cert # 1553.01 TN Cert # 1553.02

# Product Index



**EFFECTIVE DATE OCTOBER 2012**

*Colchester, Connecticut*

*Erin, Tennessee*

**Glastonbury Southern Gage was formed in 1995 when two of the largest and oldest gage companies, Glastonbury Gage and Southern Gage, were united under one owner.**

**Glastonbury Gage** was founded in 1964 in Glastonbury, CT by individuals who had trained at Pratt Whitney Machine. From these beginnings, Glastonbury Gage has continually increased its product offering and services.

**Southern Gage** was founded in 1955 in Erin, TN as an outgrowth of the Woodworth Company. It grew to be a full service gage manufacturer with emphasis on thread gaging. During the 1980's Southern Gage became known for its educational and training programs on thread form and gaging. **In 1995, the owner of Glastonbury Gage purchased Southern Gage from ITW.**

In March 1999, the GSG Erin operations occupied its new 42,000 square foot state of the art manufacturing facility. It includes 5,000 square feet of laboratory space, temperature and humidity control for the entire plant, CNC thread grinding equipment and a streamlined process work flow.

In July 2001 GSG consolidated customer service and plain cylindrical production to improve deliveries and customer response. While this effort was successful, we at GSG continue to find ways of improving delivery and customer service. We intend to build on this platform to offer our customers quality products and services at competitive prices.

# TURN TO GSG FOR

## A **Higher** Measure of **Value**


**Glastonbury Southern Gage**
46 Industrial Park Road
Erin, TN 37061
P: 800-251-4243 (USA)
or 931-289-4243 (International)
F: 800-242-7142 (USA)
or 931– 289-4264 (International)

**Glastonbury Southern Gage**
87 Upton Road
Colchester, CT 06415
P: 860-537-7340
F: 860-537 4332

**Email Us**
sales@sg.gsgage.com

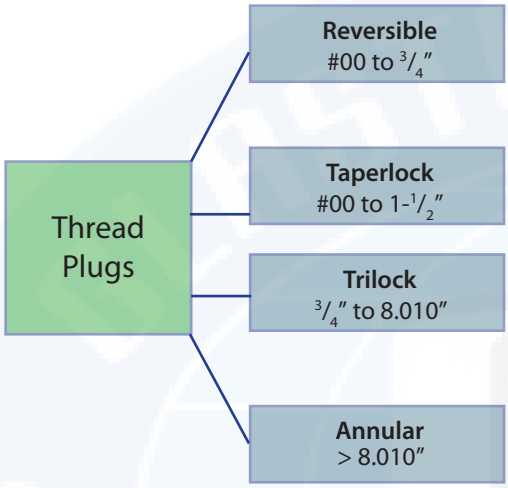
**Visit our website**
www.gsgage.com


ACCREDITED
Calibration
CT Cert # 1553.01
TN Cert # 1553.02

AMIMA MEMBER
AMERICAN MEASURING TOOL MANUFACTURERS ASSOCIATION

5B-0023
7-0422
11B-0058

# GSG CAPABILITIES *WELCOMING SPECIAL THREAD APPLICATIONS*




## *Thread Gaging*

**Diameters**
Minimum #00 (.047") (1.2mm) Maximum 14.250" (362mm)

**Length**
Maximum 30" (762mm) Depending On Tolerance

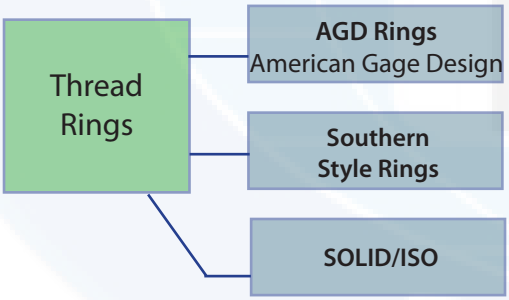
**Threads Per Inch**
1/4" ~120 (.21mm) Depending On Diameter

**Convolute**
32 TPI and coarser if larger than #6 (.138") (3.5mm)

**Chip/Dirt Groove**
Larger than #8 (.164") (4mm) 3 ~ 4 threads longer upon request

**Depth Steps**
Upon Request

**Limitations**
Flank Angles must be greater than 1 degrees




**Diameters**
Minimum #0 (.060") (1.5mm) Maximum AGD 12.250" (311mm)

**Southern Style**
14.250" (362mm)

**Length**
Maximum 6.5" (165mm) Depending On Tolerance

**Threads Per Inch**
1/2" ~102 (.25mm) Depending On Diameter

**Convolute**
20 TPI and coarser if larger than 3/8" (9.5mm)
Available for #10 (.190) (5mm) or Larger

**Limitations**
Flank Angles must be greater than 1 degrees

## *Special Thread Profiles*

- British Full Form & Truncated
- Buttress
- Whitworth
- Asymmetric
- JIS
- DIN
- ACME
- API
- Conical
- Multi-Start

## *Gage Certification*

- Long Form Certification
- A2LA Certification

## *Cylindrical Gaging*

- XXX, XX, X , Y, & Z
- Carbide Ring Gages
- Carbide Plug Gages
- Chrome Ring Gages
- Chrome Plug Gages
- Progressive Gages
- Master Discs
- Taper Gages
- Measuring Wires
- Segment Masters
- Titanium Plated Gages
- Taperlocks/Trilocks

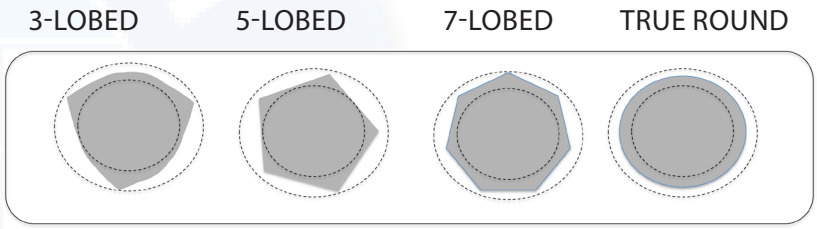
## *Special Gaging Capabilities*

- Wire EDM
- Rock Grinding
- Flat Lapping
- Grinding to .000050" (.0012mm)
- Jig Grinding
- Laser Marking
- ID and OD to 32 Inches
- Square and Hex Plug Gages
- Hole Location Gages
- Concentricity Gages
- Flush Pin Gages
- Template Gages
- Alignment Gages
- Rotor Masters
- Brake Drum Masters
- Crankshaft Masters
- Piston Masters
- Cam Shaft Masters
- Connecting Rod Masters

***Special material & plating options available (Chrome, Carbide & TiN Coating etc. )***

# WHY CHOOSE GSG?

- Highest quality Tool Steels
- Skilled craftsmen
- Black oxide of non gage surfaces available
- Quality systems and certification comply with ISO 17025
- Lapping
- Double stabilizing
- Thread grinding and lapping
- A2LA Accredited.
- Over 50 years of manufacturing experience
- Largest inventory of gages and gage blanks.
- Quick quote response.
- Documented procedures
- Knowledgeable sales staff.
- Engineering support.
- Membership in ANSI/ASME, AMTMA.
- Manufacture gages in most metals




**Why GSG on Cylindrical Plugs?**

The inherent problem of centerless grinding is the three, five or seven point lobing which occurs during the grinding process. Most gage manufacturers simply roll lap the gage for size and finish. The appearance is good but the lobing is still present. GSG ring laps gages which removes lobing and produces a truly round gage which typically far exceeds the roundness specification. Longer Life: When in use, contacting the part 360 degrees around the circumference of the gage rather than 3, 5 or 7 points gives the user longer gage life and confidence in your inspection process.

**Visit our website**
www.gsgage.com

The website contains technical information on thread gaging, cylindrical gaging, certification, ANSI specifications and much more.

## QUALITY + SERVICE = VALUE

- GSG offers the broadest range of products in the gage industry, offering expertise to solve a wide range of gage applications.
- GSG has a full engineering staff to help with special gage applications and can provide engineering consultation to solve your problems.
- GSG Staff holds key position within AMTMA and American Gage Standards Committees
- Quality control systems and procedures ensuring product quality.
- Double stabilizing for longer gage life.
- Continuous improvement of processes to improve delivery and quality performance.

# THREAD PLUG GAGES

A Thread Plug "GO" gage checks the minimum major diameter and the minimum pitch diameter size in a part, the "NOGO" checks for the hole not to exceed the maximum pitch diameter size in a part. All GSG Thread Plug Gages are manufactured to ASME/ANSI B1.2 or B1.16M. All gages are made of oil hardened Tool Steel.

## Reversible Thread Plugs

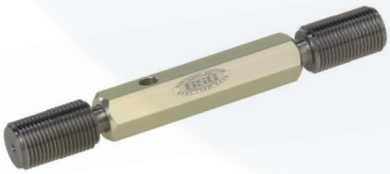
- Reversible style thread work plug gages are available up to and including ¾" (19.05mm).
- Gages can be reversed end for end in the handle resulting in double the wear life.
- Each end of the handle is color coded, green for Go and red for Nogo.
- Chip Grooves are provided on both ends of the Go work plug member #10/M4 & larger.

## Trilock Thread Plugs

- Trilock style Thread Work Plugs are available for ¾" (19.05mm) and larger.
- Gage can be reversed on the handle resulting in a longer wear life.
- Shown is a single end on a handle which reduces weight with large sizes.

## Taperlock Thread Plugs

- Taperlock style Thread Work Plug gages are available up to and including 1 ½" (38.1mm)
- Taperlocks are the most popular style in thread plug gaging.



## Taperlock Set Plugs

- Shown is a Go and Nogo Truncated (Master) Set Plug.
- Set Plugs are used to set thread rings for proper fit and feel and inspect ring for wear.
- Set Plugs have a common pitch diameter the full thread length of the Go or Nogo section. The crest of the thread is truncated for the first half of the set plug and "full form" the remaining length.

## Helical Coil Plug Gages (STI)

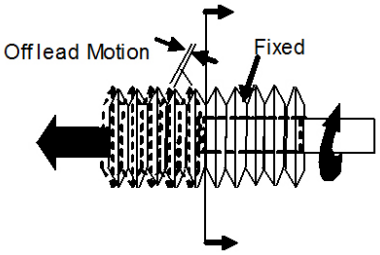
- Helical Coil plug gages are used to inspect the hole prior to inserting a screw thread insert when repairing a threaded hole.

## Hole Location Plugs

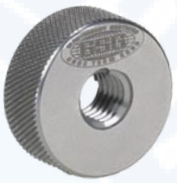
- GSG Manufactures hole location gages in two types. When checking the location of a small tapped hole the flex plug is used.
- When inspecting a larger hole (generally over 1.00") then the lead lock is used. Both gages locate on the flank angles of the threaded hole.
- Lead locks can be used in conjunction with the zero spindle and are a perfect way to inspect features for run-out to the pitch diameter of the thread.
- Special designs are available such as true position of threads to bore diameters with dial or digital indicators.

Flex Plug

Lead Lock



A Thread ring "GO" gage checks the maximum minor diameter and the maximum pitch diameter size in a part, the "NOGO" checks for the part not to exceed the minimum pitch diameter size on a part. All GSG Thread Ring Gages are manufactured to ASME/ANSI B1.2 or B1.16M. All gages are made of oil hardened Tool Steel.



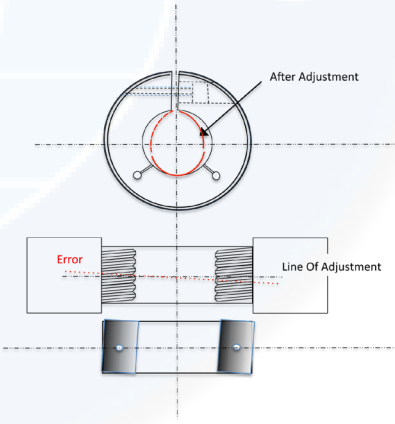
### Solid Thread Rings DIN Style

- The ISO standard requires Solid Thread Rings.
- Used to set the Zero Systems variable ITC units.

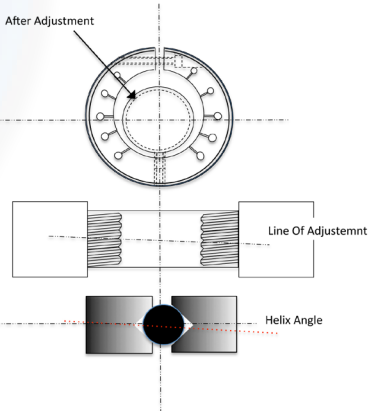
### AGD Thread Rings

- AGD thread rings comply with ASME/ANSI B47.1 gage blank standard.
- Sizes below $^1/_4$" (M6) are counterbored to hold specific length.

## AGD Style Rings




## Southern Style Rings

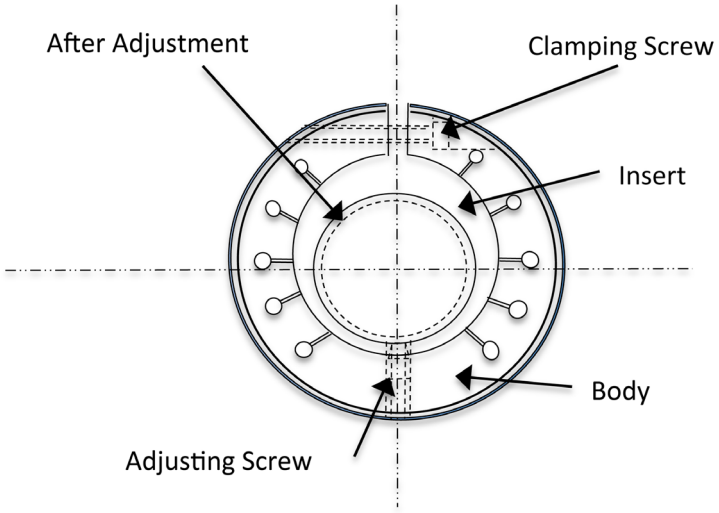



The "Southern style" sets round and stays round through all adjustments due to eccentric design and opposing pressures of the adjusting and locking mechanisms.

Features the unique "Automatic Helical Adjustment". The Helix Path of the thread along the line of adjustment remains true and in alignment throughout the life of the gage.

### Red NOGO Rings & Green GO Rings

- Color coded for easy identification of the Go and Nogo gage.
- The aluminum body makes large gage rings light weight and easier to use.




### Always loosen clamp screw before inserting set plug

**If too tight or if set plug will not enter:**

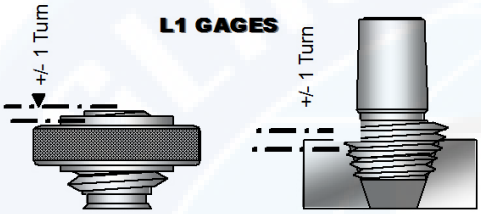
- Loosen clamp screw $^1/_4$" turn
- Advance adjusting screw $^1/_8$" turn
- Tighten clamp screw
- If still too tight repeat first three steps

**If too loose:**

- Loosen clamp screw $^1/_4$" turn
- Back out adjusting screw $^1/_8$" turn
- Tighten clamp screw
- If still too loose, repeat first three steps

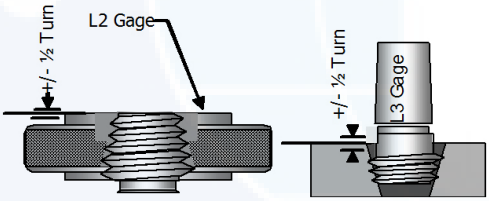
# TAPERED PIPE THREAD GAGES

GSG manufactures many types of pipe thread gages including, NPT, ANPT, NPTF, BSP and API working gages. Pipe thread gages are used to check the size and taper to ensure proper sealing of the manufactured components when assembled. Pipe gages come in different styles based on what they need to inspect, size or taper.



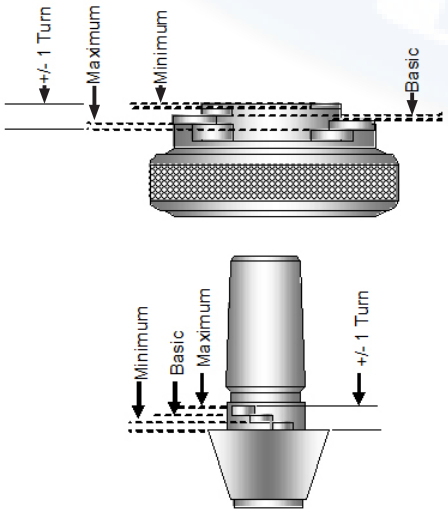

## L1 Gages

The L1 when screwed onto the pipe or plug into the hole "hand tight" should be flush with the end of the pipe or the hole, or gage plane, within 1 turn.




## L2 and L3 Gages

After using the L-1 gage the L2 ring or L3 plug is assembled with the part and must stop within $^1/_2$" turn plus or minus of where the L1 stopped. The L-2 ring and L-3 plug are designed to clear the threads of the part that the L-1 contacted with and contact with the threads further onto or into the part. This measures the taper of the thread on the part by comparing the front threads and the back threads. If the taper is too severe or too straight, the L-2 ring or L-3 plug will not stop within $^1/_2$" turn from the point where the L-1 stopped. *Remember the L2 and L3 are to check taper only not size.*




## Six Step Gages

The NPTF & ANPT system begins with the use of the L-1 gage having a 1 turn in or out limit (2 turns total) the same as the NPT system. The purpose of this gage is to measure the diameter size of the part. It is necessary to refine the standoff (distance from the step to the part) to a more accurate measurement because the 2-turn total tolerance limit must be divided into 3 equal zones. These three zones are known as the minimum, basic, and maximum zones, and the part is referred to as a minimum part, basic part, or maximum part.

The basic zone is the linear area within $^1/_3$" turn from the face of the part, in or out. If the plug gage is standing out from the face (or datum point) of the internal part more than $^1/_3$" of a turn you have a minimum part because the step on the gage stops within the minimum zone. Likewise, if the plug stands in more than $^1/_3$" of a turn you have a maximum part. The inverse applies to external threads. Knowing the type of part, you can pick the two appropriate steps of the six step gage. B/Bt for Basic, Mn/Mnt for Minimum, Mx/Mxt for Maximum. The face of the part should be between the two steps.

# API GAGES *AMERICAN PETROLIUM INSTITUTE*

SPEC 5B

SPEC 7

SPEC 11B

| Specification/ Application | Nominal Size From | Nominal Size To | TPI | TPF |
|---|---|---|---|---|
| **Spec 5B (Plug/Ring)** | | | | |
| Casing - Round | 4 1/2" | 13 3/8" | 8 | 3/4" |
| Line Pipe | 1/8" | 13 3/8" | 8-27 | 3/4" |
| Tubing - Non Upset | 1.05 | 3 1/2" | 10 | 3/4" |
| | 4 | 4 1/2" | 8 | 3/4" |
| Tubing - External Upset | 1.05 | 1.9 | 10 | 3/4" |
| | 2 3/8" | 4 1/2" | 8 | 3/4" |
| Tubing - Integral Joint | 2 3/8" | 4 1/2" | 8 | 3/4" |
| Extreme Line Casing | 5 | 7 5/8" | 6 | 1 1/2" |
| | 8 5/8" | 10 3/4" | 5 | 1 1/4" |
| **Spec 7 (Plug/Ring)** | | | | |
| NC Connections | NC 10 | NC 16 | 6 | 1 1/2" |
| | NC 23 | NC 50 | 4 | 2 |
| | NC 56 | NC 77 | 4 | 3 |
| Regular | 1 | 8 5/8" | 4-6 | 1 1/2" - 3 |
| Full Hole | 3 1/2" | 6 5/8" | 4-5 | 2, 3 |
| Internal Flush | 2 3/8" | 5 1/2" | 4 | 2 |
| **Other Oil Field Related Connections (Plug/Ring)** | | | | |
| H-90 | 2 3/8" | 8 5/8" | 3 - 3 1/2" | 1 1/4" - 3 |
| Slim Hole | 2 3/8" | | 4 | 2 |
| Extra Hole | 2 7/8" | 5 | 4 | 2 |
| Wide Open | 2 3/8" | | 4 | 2 |
| AOH | 2 3/8" | 4 1/2" | 4 | 1 1/2" |
| PAC | 2 3/8" | 3 1/2" | 4 | 1 1/2" |
| XHole | 2 7/8" | 3 1/2" | 4 | 2 |
| **Spec 11B** | | | | |
| Sucker Rods B1 to B6 | 1/2" | 1 1/8" | 10 | |
| Sucker Rods P1 to P8 | 1/2" | 1 1/8" | 10 | |

**Specials**
Mining: BECO, DI-22, DI-42
American National Special Threads
Tapered Thread Gages - AWWA

## *Services Offered*

### *Manufacturing*

- To API Spec Q1, Spec 5B, 7 &11B.
- CNC Grinding Equipment
- Special requests Welcome

### *Calibration*

- "State of the art "Lab
- Lab Equipment Modified for API Gages

### *Engineering*

- Industry "Experts"
- Design and Build

## *Products*

*Casing*
*Line Pipe*
*Rotary Connections*
*Sucker Rods*
*Drill Case*
*Tapered Gages*
*Tubing*
*Thread Profile*
*Special Orders*
*Oil Field Special Design*

5B-0023
7-0422
11B-0058

# CYLINDRICAL RING GAGES

- All cylindrical Rings are manufactured to ASME/ANSI B47.1 AGD standard and ASME/ANSI B89.1.6.
- Rings made from Tool Steel heat treated to Rc 58-62.
- When Min and Max master rings (.005"/.125mm max spread) are ordered for setting variable gages, the quantity two price may be used.
- All rings regardless of size are lapped to size and polished.
- Non gaging surfaces are black oxide and ring faces are surface ground.
- Roundness and taper not to exceed 50% of the applicable gagemaker's size tolerance and are non-accumulative.
- Sizes available up to 28"

## *Small Ring* .010" to 1.510"

- The designs for cylindrical ring gages are described in ASME standard B47.1.
- Rings below 1.510" are manufactured without a flanged outer diameter.
- Available in Steel, Carbide or Chrome.

## *Large Flanged Ring Gages* >1.510"

- Above 1.510" cylindrical rings are manufactured with a flanged diameter as pictured to the left.
- The removal of excess material from the outside diameter reduces weight for easier use by the operator.
- Available in steel or chrome.

## *Jacketed Carbide Ring Gages*

- The insert is solid Carbide with the outside jacketed with Steel.
- A solid Carbide ring would be heavy and subject to damage on the outside due to the carbide being hard and brittle. Available up to 4".

***Extra long rings and special materials available upon request***

## *Segmented Gages*

- Segmented gages are an alternative to standard Ring and Disc masters. They are used in setting swing and bore gages. Segmented gages are lighter and use less storage room than standard ring and disc masters. They are made to check one or multiple diameters.
- Segmented ID and OD gages are ground square to faces within .0002". Tolerances depending on size are +/- .0005" with either class X or XX geometry. Measurement uncertainty is within .00006" up to 21.000". The exact size can be engraved on the gage making it easier for set up.
- Segmented gages are made out of Tool Steel and heat-treated to Rc 58-62.
- Chrome is available upon request.

# CYLINDRICAL PLUG GAGES

All cylindrical plugs and discs are manufactured to ASME/ANSI B47.1 AGD standard and ASME/ANSI B89.1.5.

## Reversible Plug Gages

- The Reversible plug gage has the advantage that it can be reversed and used at the opposite end when one end becomes worn and goes out of tolerance.
- The gaging members are simple pins that can be removed from the handle by loosening the collet nuts at the ends.
- Each end of the handle is color coded, green for Go and red for Nogo.
- Depth steps are available upon request.
- Available in Steel, Carbide and Chrome.
- Extra long members available.
- Gaging surfaces are hardened to Rc 58-62.

## Taperlock Plug Gages

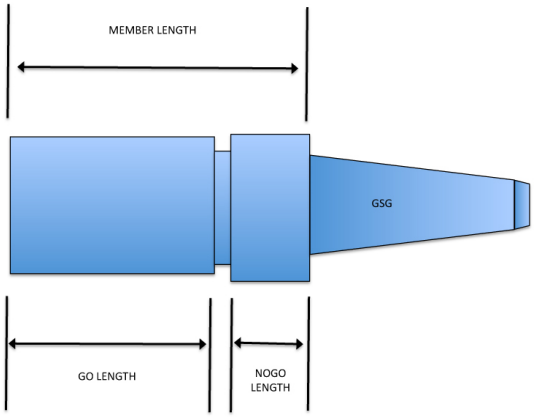
- The Taperlock gage is named because of the tapered shank, which locks into the tapered hole in the end of the handle.
- Used for gages up to 1 ½ inches
- As a further aid in identification, the Go and Nogo members have a different length of gaging surface. It is permissible to make the Nogo gage shorter because it is not supposed to enter the part.
- Depth steps are available upon request.
- Available in Steel, Carbide and Chrome.
- Gaging surfaces are hardened to Rc 58-62.
- Extra long members available.

## Trilock Plug Gages

- The Trilock design has been found best suited for gages between 1 ½ and 8 inches in diameter.
- The Trilock feature is the source for the name of this design. The handle has three prongs on the ends, which fit into three grooves equally spaced around the central hole of the gage members.
- A bolt holds the member to the handle and the Trilock grooves and prongs stabilize the member.
- Like the pin (reversible) type, Trilocks are reversible, since either face can be locked to the handle.
- Available in Steel, Carbide and Chrome. Gaging surfaces are hardened to Rc 58-62.

## Progressive Plug Gages

- In some special cases, a little gaging time can be saved by putting the Go and Nogo diameters on a single gage member.
- A progressive plug, for example, is suitable for checking a short hole, which is open at both ends.
- Obviously, the hole must be deeper than the Go section of the plug.




## Master Setting Discs

- Master Setting Discs are used for setting comparators, snap gages and other precision gages.
- They are furnished with insulated grips to prevent heat distortion.
- Also available are holders for bench top working.
- Discs above 2.510"/63.75mm are black oxide on all non gaging surfaces.
- Discs above 2.510"/63.75mm are Trilock design.
- Available in steel, carbide and chrome.

**STYLE 1**

**STYLE 2**

**STYLE 3**

# CYLINDRICAL TAPER GAGES

Glastonbury Southern Gage has specialized in cylindrical taper gages for many years with specially modified equipment for grinding and more importantly measuring a taper. The ANSI standard on Machine Tapers is confusing to the average user. These standards are written for the machine tool builder and tool holder manufacturer not the gage manufacturer or the customer trying to measure machine tapers. If you order a taper ring and plug gage to the ANSI standard they will not blue to each other. The machine taper ID is made with a decreasing taper, while the tool holder's OD is made with an increasing taper. The proper ordering procedure is to order a PLUG to the standard and a "check ring" to check the plug for wear, and visa versa for the RING to the plug.

**Company Name** _____ **Contact Name** _____

**Address** _____ **City** _____ **State** _____ **Zip** _____

**Phone** _____ **Email** _____

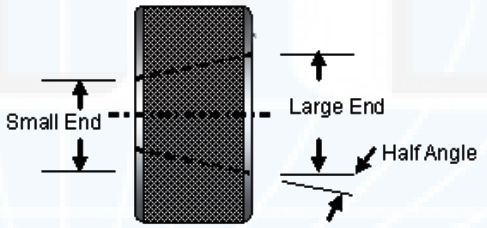
## Tapers available

- National Machine Tapers
- Morse Tapers
- Jarno Tapers
- Brown & Sharp Tapers
- Cat V Flange Tapers
- Medical Luer Tapers
- Steep Machine Tapers
- Reverse Engineer Special Tapers without blueprints or specifications

### *Ring Gage*

Mark Size _____
Tool # _____
Taper/FT _____
Taper/In _____
Included Angle _____
1/2 Angle _____
Taper Tol _____ *Inch/inch*

Diameter @ small end _____
Diameter @ large end _____
Overall length of taper _____
Steps @ large or small end (optional) _____

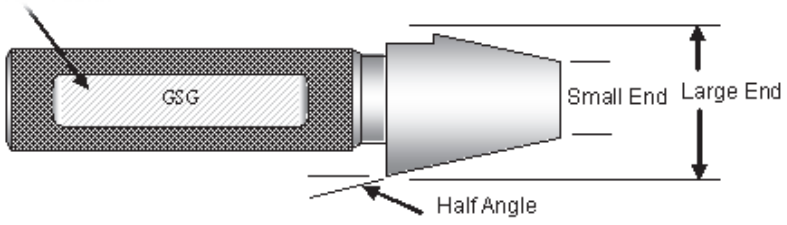



### *Ring Gage*

Mark Size _____
Tool # _____
Taper/FT _____
Taper/In _____
Included Angle _____
1/2 Angle _____
Taper Tol _____ *Inch/inch*

Diameter @ small end _____
Diameter @ large end _____

Overall length of taper _____
Steps @ large or small end (optional) _____

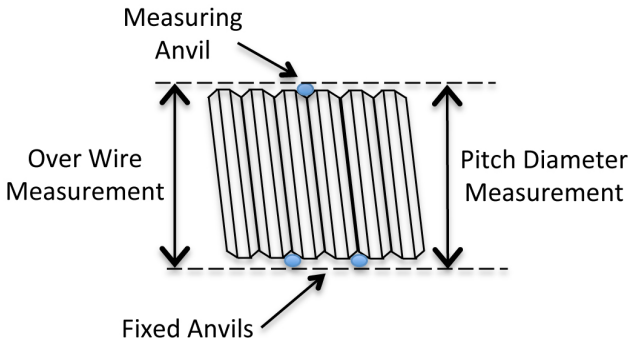



Complete form & **fax to (860) 537-4332**

Recognized as the standard method of obtaining the pitch diameter of thread plug or setting plug gages. Wire sizes are nominal. Calibrated size will show on the label with matching constant. In all cases the calibrated wire diameter will be within .000020", all three wires in each set having the same size within .000010"

| INCH WIRES | | |
|---|---|---|
| (N) Threads per Inch | (G) Nominal Best Wire Diameter | (C) Nominal Constant |
| 64 | 0.00902 | 0.01353 |
| 56 | 0.01031 | 0.01546 |
| 50 | 0.01155 | 0.01732 |
| 48 | 0.01203 | 0.01804 |
| 44 | 0.01312 | 0.01968 |
| 40 | 0.01443 | 0.02165 |
| 36 | 0.01604 | 0.02406 |
| 32 | 0.01804 | 0.02706 |
| 30 | 0.01925 | 0.02887 |
| 28 | 0.02062 | 0.03093 |
| 27 | 0.02138 | 0.03208 |
| 26 | 0.02221 | 0.03331 |
| 24 | 0.02406 | 0.03608 |
| 22 | 0.02624 | 0.03936 |
| 20 | 0.02887 | 0.04330 |
| 18 | 0.03208 | 0.04811 |
| 16 | 0.03608 | 0.05413 |
| 14 | 0.04142 | 0.06186 |
| 13 | 0.04441 | 0.06662 |
| 12 | 0.04811 | 0.07217 |
| 11 1/2" | 0.05020 | 0.07531 |
| 11 | 0.05249 | 0.07873 |
| 10 | 0.05774 | 0.08660 |
| 9 | 0.06415 | 0.09623 |
| 8 | 0.07217 | 0.10825 |
| 7 1/2" | 0.07698 | 0.11547 |
| 7 | 0.08248 | 0.12372 |
| 6 | 0.09623 | 0.14434 |
| 5 1/2" | 0.10497 | 0.15746 |
| 5 | 0.11547 | 0.17321 |
| 4 1/2" | 0.12830 | 0.19245 |
| 4 | 0.14434 | 0.21651 |
| 3 1/2" | 0.16496 | 0.24744 |
| 3 1/4" | 0.17765 | 0.26647 |
| 3 | 0.19245 | 0.28868 |
| 2 3/4" | 0.20995 | 0.31492 |
| 2 1/2" | 0.23094 | 0.34641 |
| 2 | 0.28868 | 0.43301 |

| METRIC WIRES | | |
|---|---|---|
| Pitch MM | (G) Nominal Best Wire Diameter | (C) Nominal Constant MM |
| 0.4 | 0.2309 | 0.3464 |
| 0.45 | 0.2598 | 0.3897 |
| 0.5 | 0.2887 | 0.4330 |
| 0.6 | 0.3464 | 0.5196 |
| 0.7 | 0.4041 | 0.6062 |
| 0.75 | 0.4330 | 0.6495 |
| 0.8 | 0.4619 | 0.6928 |
| 0.9 | 0.5196 | 0.7794 |
| 1 | 0.5774 | 0.8660 |
| 1.25 | 0.7217 | 1.0825 |
| 1.5 | 0.8660 | 1.2990 |
| 1.75 | 1.0104 | 1.5155 |
| 2 | 1.1547 | 1.7321 |
| 2.5 | 1.4434 | 2.1651 |
| 3 | 1.7321 | 2.5981 |
| 3.5 | 2.0207 | 3.0311 |
| 4 | 2.3094 | 3.4641 |
| 4.5 | 2.5981 | 3.8971 |
| 5 | 2.8868 | 4.3301 |
| 5.5 | 3.1754 | 4.7631 |
| 6 | 3.4641 | 5.1962 |
| 7 | 4.0415 | 6.0622 |
| 8 | 4.6188 | 6.9282 |
| 9 | 5.1962 | 7.7942 |
| 10 | 5.7735 | 8.6603 |

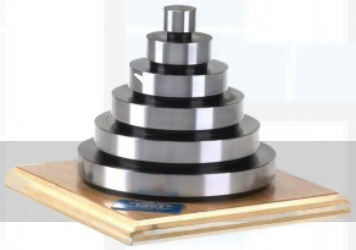


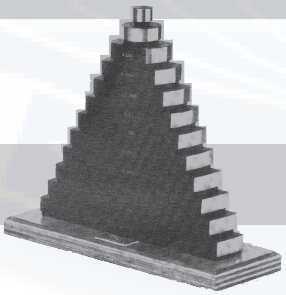

***Thread Measuring Wires***

# SURVEILLANCE MASTERS

## *Micrometer Masters*

GSG Micrometer masters are used to calibrate and set micrometers. The master is superior to gage block calibration because they do not require block stacks and therefore it is much faster to inspect the linear range of the tool. In addition they indicate wear on the micrometer anvil because it replicates how the micrometer is used.





### *Model # 01-1E (English)*
### *Model # 01-1M (Metric)*

- 01-1 diameter is Stainless Steel to reduce wear and prevent rust.
- Hardened, stabilized, ground and lapped to ±.0001".
- Comes complete with storage case.
- The master has two odd steps, one at .512" and another at .762". These steps allow checking of parallelism of the micrometer anvils.

### *Model # 16-1E (English)*
### *Model # 16-1M (Metric)*

- 1.00"-6.00" diameter in 1.00" increments
- 25-150mm diameter in 25.0mm increments
- Case hardened, stabilized, ground and lapped to ±.0001" or ±.0025mm

### *Model # 16-1/2E (English)*
### *Model # 16-1/2M (Metric)*

- 1/2"-6.00" diameter in 1/2" increments
- 12.5-150mm diameter in 12.5mm increments
- Case hardened, stabilized, ground and lapped to ±.0001" or ±.0025mm

### *Model # 112E (English)*
### *Model # 112M (Metric)*

- 1.00"-12.00" diameter in 1.00" increments
- 25-300mm diameter in 25.0mm increments
- Case hardened, stabilized, ground and lapped to ±.0001" or ±.0025mm

## *Vernier Caliper Masters*

GSG Vernier masters are used to calibrate and set Vernier calipers. The master is superior to gage block calibration because they do not require block stacks and therefore it is much faster to inspect linear range of the tool. In addition they indicate wear on the caliper anvils because both the ID and OD jaws are inspected without additional setup.

### *Model # VC-1E (English)*
### *Model # VC-1M (Metric)*

1.00"-6.00" diameter in 1.00" increments for outside jaws, $^{1}/_{2}$" to 4 $^{1}/_{2}$" inside jaws. ±.0002"
25-150mm diameter in 25.0mm increments for outside jaws, 12.5 to 112mm for inside jaws ±.005mm
Case hardened, stabilized, ground and lapped to ±.0002"

Larger sizes available upon request.

## Depth Micrometer Masters

GSG Depth Micrometer masters are used to calibrate and set Depth Micrometers. The master is superior to gage block calibration because they do not require block stacks and therefore it is much faster to inspect the linear range of the tool. The new ADM model offers a more rigid and stable tool than the traditional "step" master.

### Model # ADM-E (English)

- .5"-5.50" in 1.00" steps ±.0001"
- 6.5"-11.50" in 1.00" steps ±.0002"

### Model # ADM-M (Metric)

- 12.5-137mm in 25.0mm steps ±.0025mm
- 162.5-287mm in 25.0mm steps ±.005mm
- Case hardened, stabilized, ground and lapped

## Geometric Chek Master

The GSG Geo Metric Chek master is used to calibrate and set circular geometry systems. The master checks for perpendicularity (squareness), parallelism, roundness and concentricity.

### Model # GC-1

Master is supplied with complete certification for roundness, parallelism, perpendicularity and concentricity. Supplied with storage box.

## Z Axis Chek Master

GSG Z Axis Chek masters are used to calibrate and set the z axis on optical measuring machines. The master is superior to gage block calibration because they do not require block stacks and therefore it is much faster to inspect linear range of the machine.

### Model # LX-1 (lapped)
### Model # GX-1 (ground)

- LX-1 Lapped with Mirror Finish.
- GX-1 Ground finish for less reflection.
- Supplied with Certification and storage box.

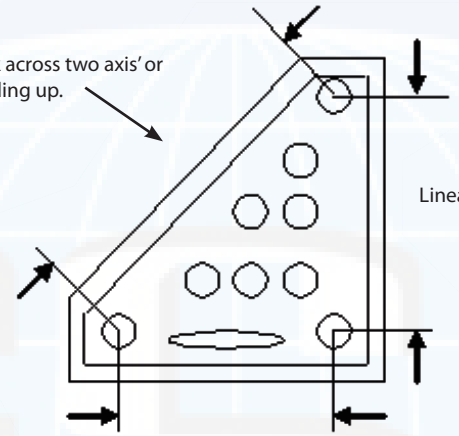
## QuikChek

GSG QUIKCHEK is used to calibrate Coordinate Measuring Machines (CMM). The QUIKCHEK provides an easy periodic check on the CMM to ensure it is within calibration and providing you with accurate readings. In addition it provides a more volumetric inspection of a CMM than the traditional ball bar.

### Model 8 Inch
### Model 16 Inch

- The QUIKCHEK is your mechanical assurance of CMM accuracy.
- The QUIKCHEK is 440c stainless steel hardened to Rc 60-62, stress relieved and triple stabilized . Supplied with certification and case.
- Special sizes available—contact factory.

# QUICKCHEK


## *Patent Number 5,313,410*

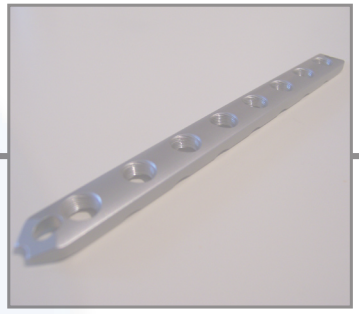
- The QUIKCHEK is a highly calibrated artifact using multiple hole patterns calibrated outside of the Coordinate Measuring Machine by conventional methods traceable to N. I. S. T. and is a tangible product that simulates actual parts being inspected with hole locations, true positions, and bolt circle callouts.
- The QUIKCHEK comes with certification, application procedure and lockable storage case.

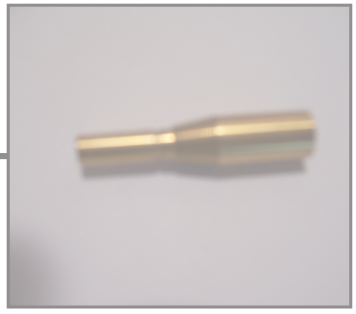
***The Glastonbury Southern Gage "QUICKCHEK" finally provides the assurance your CMM is working properly.***

| Specifications | 8 Inch Model | 16 Inch Model |
|---|---|---|
| Hole Diameter | 1.0000" | 2.0000" |
| Centerline to Centerline of Holes 2 sides | 8.0000" | 16.0000" |
| Centerline to Centerline of Hypotenuse | 11.3137" | 22.6274" |

| Calibrated Accuracies | 8 Inch Model | 16 Inch Model |
|---|---|---|
| Diameter roundness Within | .000010" | .000020" |
| Length Measurement Uncertainty | .000020" | .000040" |
| 90 Degree Angle | ≤1 second | ≤1 second |
| Flat & Parallel Within | .000050" | .0002" |

GSG is a leader in the design and manufacturing of variable and fixed limit gages in the medical industry. and has provided a number of gage solutions to the medical and orthopedic manufacturing industry.



## *Typical Gages*

- Taper Thread Gages
- Cylindrical Taper Gages
- Variable Thread Gages
- Cylindrical OD and ID Gages
- Fixed Limit Thread Gages
- Tin Coated Gages

## *Typical Applications*

- Bone Support Plates
- Bone Screws
- Thread & Cylindrical Luer Tapers
- Fittings
- Multi Start Threads
- Conical Threads
- Small Thread Gages (2mm)

## *Variable Thread Gage Features & Benefits*

- Inspect Stand Off Related to Conical Thread P.D.
- Inspect Conical Thread P.D. Related to Stand Off
- Variable Data For Machine Tool
- Machine Tool Capability
- Data Collection Available
- Reduced Gage Inventory
- Reduced Rejects

## *Part Masters*

- Part Type Masters are used extensively in the automotive industry. Typically used on shop floor inspection equipment as artifacts that reference the equipment, typical applications are: rotor, drum, connecting rod, cam shaft, piston and crank shafts.
- Almost every variable gage in use has a part master associated with it .
- All masters are made out of Tool Steel, hardened to 58-62 RC and double stabilized. Chrome plate is available (not used in areas where carbide probes touch the master). In cases where the gage might be used in a corrosive environment, 440-C Stainless Steel may be used. Certain tight manufacturing tolerance applications may need min., mean and max. condition masters for greater accuracy when setting the gage fixture.
- Our Engineering department will be pleased to review your part master needs.

## *When you call us, please be ready with the following information*

### Generic Information
- Bill to Address PO #
- Ship to Address PO #
- Ship via. (ups, acct #'s)
- Contact Name,
- Phone #, Fax #
- Quote # if previously quoted
- Certification required
- Special Instructions
- Marking Instructions

### Pipe Plug
- L1, L3 or 6 step
- NPT, NPTF, BSPT, ANPT etc.
- Handle
- EDP # if supplied by end user
- Certification required (A2LA, Standard Long Form)

### Pipe Ring
- L1, L2 or 6 step
- EDP # if supplied by end user
- Certification required (A2LA, Standard Long Form)

### Cylindrical Plug & Ring Gages
- Exact Size
- Taperlock, Reversible, Trilock, Setting Disc
- Go, No-go, Master, Min, Max
- Class XXX, XX, X, Y, Z
- Steel, Chrome, Carbide
- Handles/holders
- Certification required (A2LA, Standard Long Form)

### Thread Ring
- AGD or Southern Style (AGD will be supplied if not noted SS)
- Class of fit (2A, 3A or 6g if metric)
- Pitch Diameter if supplied by end user Go or No-go
- EDP # if supplied by end user
- Set & Sealed
- Certification required (A2LA, Standard Long Form)

### Flex Plug
- Size or EDP#

### Thread Plug
- Working or Setting Plug
- Taperlock, Reversible, Trilock, Other
- Class of fit (2B, 3B or 6H work), (2A, 3A or 6g set)
- Pitch Diameter if supplied by end user
- Go or No-go
- EDP # if supplied by end user
- Handle (Single End or Double End)
- Certification required (A2LA, Standard Long Form)

### Snap Gage
- Size (Go /No-go)
- Frame #
- Set and Sealed
- Certification required (A2LA, Standard Long Form)

### Tri-Roll / ITC / Zero Spindle
- EDP #
- Other than Stock Contact Factory

## *Where to buy*

GSG sells through a qualified distribution network, your zip code will identify a distributor for you.
Visit the www.gsgage.com to contact your distributor.
Should one not exist please contact us at GSG
1-800-251-4243

***We Accept Most Major Types of Credit Cards***

# VARIABLE THREAD GAGES *TRI-ROLL SYSTEM*

Zero System Variable Gages are available for external and internal thread applications. The external thread applications are covered by the segment and Tri-Roll units and the internal applications by the ITC unit.

## Precision

- Rigid construction and constant gage pressure guarantee consistent and precise readings.

## Qualitative Readings

- The Tri-Roll not only indicates whether a threaded part is within assigned limits, it also shows the exact position of the pitch diameter within a tolerance range. In addition, the Tri-Roll will check size and out of roundness of plain cylindrical parts.

## Repeatability

- Fixed mounting of the lower rolls assures a solid support for the work piece. Only the upper roll actuates the indicator, thereby providing repeatable readings.

## Easy to set

- No adjustment required on the lower rolls means that no adjustment is required when changing from one thread size to another.

## Wide Gaging Range

- Both the ITC and the Tri-Roll are able to inspect a wide range of parts with a single frame.

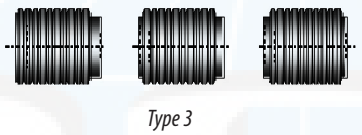
## Adaptability

- The variable thread system can be used to measure plain diameters and can be used with the "Zero Spindle" gage system.

## Economical with Long Work Life

- The variable thread gage system provides longer life of the tooling and thus reduces cost.

## Selecting Gage Rolls

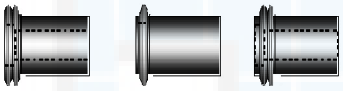


*Type 3*

***Full Profile-Functional Diameter Size***
Full Profile-Functional Diameter Size Full ribbed rolls for functional sizes coarser than 48 T.P.I *(For 48 T.P.I and finer the ribs locate on alternate threads)*

*Type 4*

***Cone & Vee Single Element Pitch Diameter***
Two ribs ("vee type") on lower rolls (1 and 3) One rib ("cone type") on upper roll (2) Flank contact limited to .1 pitch.

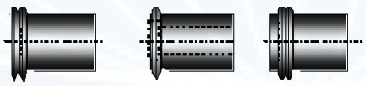


*Type 5*

***"Best Wire" Size Radius Single Element Pitch Diameter***
Single ribs only with "Best Wire" size radius for any given pitch (T.P.I)

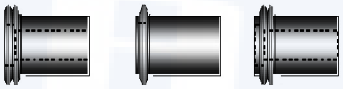
*Type 6*

***Plain Rolls Thread Major Diameter and Plain Cylindrical Parts***
Straight cylindrical rolls for checking diameter and out of roundness.



*Type 7*

***Minor Diameter***
(55° included angle) Two full profile "vee" rolls (1 and 3) and one full profile cone roll (2)



*Type 8*

***Lead/Flank Angle***
Two full profile "vee rolls (1 and 3) with outside flanks relieved and one full profile cone roll (2)

## Functional Flank Angle Variation

By mounting multiple gaging frames on the same base and using functional elements on one frame and using pitch diameter elements on the other frame differential gaging can be made easy by making quick machine adjustments before bad product is produced.

## Product Acceptability

### System 21

System 21 provides for interchangeable assembly with respect to functional size only. Functional size must be measured at the maximum material limit within the length of standard gaging elements. The characteristic known as NO GO functional diameter must also be verified. This can be accomplished by using fixed limit gaging or variable gaging with functional elements.

### System 21A

*(for metric threads in accordance with ANSI B1.18M)*

System 21A provides for interchangeable assembly with functional size verified at the maximum material limit using standard length gaging elements. This can be accomplished using fixed limit gaging or variable gaging with functional elements. System 21A also states that the minimum material limit (minimum pitch diameter) must be verified by inspecting two thread flank locations over the length of the thread. This can be accomplished by using variable gaging or thread roll snap gages with pitch diameter elements.

### System 22

System 22 provides for the interchangeable assembly with functional size verified at the maximum material limit using standard length gaging elements. This can be accomplished using fixed limit gaging or variable gaging with functional diameter elements. System 22 also states that the minimum material limit (minimum pitch diameter) must be verified over the full length of the thread. This can be accomplished using variable gaging with pitch diameter elements.

### System 23

System 23 provides for interchangeable assembly with functional size verified at the maximum material limit using standard length gaging elements and minimum material limit (minimum pitch diameter) must be verified over the full length of the thread. The gaging requirements for SYSTEM 22 would also apply here but in SYSTEM 23 other thread characteristics such as lead, flank angles, taper and roundness must have to be independently verified. Only thread characteristics, which are specified, will have to be inspected for SYSTEM 23 compliance.

## STC Comparator


### Precision

Ball slide construction and constant gaging pressure assure precise reading through linear travel of the ball slide.

### Definitive

Helical path seating and 60% peripheral contact provide functional size position within the pitch diameter tolerance assigned.

### Gaging Range

Single frame covers a size range of #10 through $^{3}/_{4}$".

### Versatile

Segments are easily changed with positive mounting pin alignment.

### Economical

Reduced gaging time compared to Go/NoGo gages.

## ITC Comparator

### Precision

Rigid construction and constant gaging pressure assure precise readings.

### Definitive

The ITC reads the actual size of the pitch diameter showing its position in relation to the pitch diameter tolerance assigned.

### Gaging Range

Single frame covers a size range of #10 through $2\,^{1}/_{2}$", Larger frames are available up to 8"

### Versatile

The positive alignment feature of the frame allows segments to be easily changed with positive mounting pin alignment.

### Economical

Reduced gaging time compared to Go/NoGo gages.

# ZERO SPINDLE

A COMPLETE INSPECTION SYSTEM FOR INSPECTING CONCENTRICITY, SQUARENESS, ROUNDNESS AND DIAMETER.

## THE ZERO SPINDLE SYSTEM FEATURES:

- Precision spindles to less than .000025" T.I.R.
- Precision arbors for internal locating plain, threaded and spline diameters.
- Precision chucks for internal and external location plain and threaded diameters.
- Precision magnetic and tapped hole face plates.
- Everything you need to build you own Zero Spindle inspection fixtures.

### Accurate

To less than .000025"

### Rugged

Sturdy enough for the production floor, needs no pampering.

### Versatile

Combine with arbors, chucks, face plates, lead locks and specially designed fixtures.

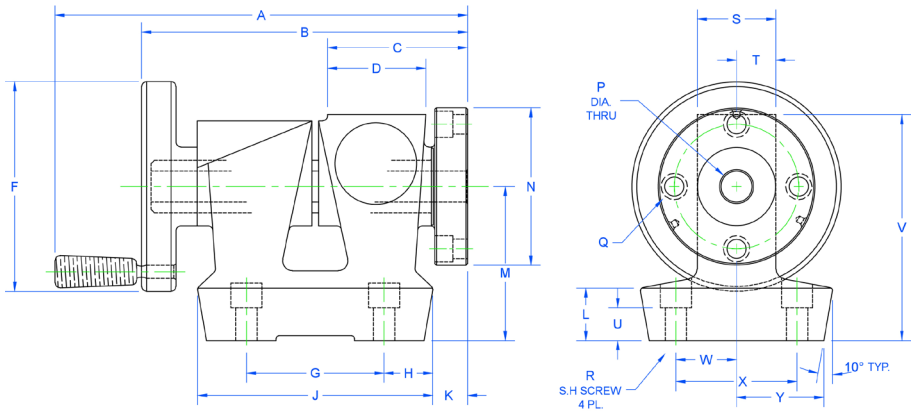
### Economical

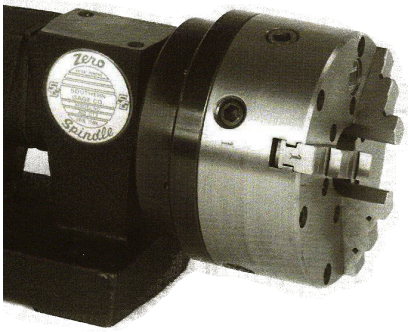
Laboratory accuracy on the shop floor.

| Model No. | A | B | C | D | F | G | H | J | K | L | M | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AD-012 | 6.567 | 5.005 | 2.099 | 1.375 | 3.25 | 2.250 | .562 | 3.375 | .599 | .750 | 2.187 | 2.2500 / 2.2498 |
| AD-013 | 7.879 | 6.317 | 2.739 | 1.875 | 4.00 | 2.625 | .937 | 4.500 | .724 | 1.000 | 2.937 | 3.0000 / 2.9998 |
| AD-014 | 9.723 | 7.723 | 3.333 | 2.375 | 5.50 | 3.562 | 1.031 | 5.625 | .786 | 1.125 | 3.875 | 3.7500 / 3.7498 |
| AD-015 | 10.942 | 8.942 | 3.864 | 2.875 | 6.50 | 4.375 | 1.187 | 6.750 | .786 | 1.250 | 5.250 | 4.5000 / 4.4998 |

| P | Q | R dia. scr. | S | T | U | V | W | X | Y | Z | WEIGHT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| .375 | (3) 1/4" SOC. HD. SCR. ON 1.687 BC | 5/16" | 1.125 | .562 | .437 | 3.312 | .906 | 1.812 | 1.250 | 2.500 | 4-1/2"# |
| .593 | (4) 5/16" SOC. HD. SCR. ON 2.375 BC | 3/8" | 1.500 | .750 | .625 | 4.312 | 1.156 | 2.312 | 1.562 | 3.125 | 9-3/4"# |
| .781 | (4) 3/8" SOC. HD. SCR. ON 2.875 BC | 3/8" | 1.875 | .937 | .812 | 5.375 | 1.375 | 2.750 | 1.812 | 3.625 | 18# |
| 1.000 | (4) 3/8" SOC. HD. SCR. ON 3.625 BC | 1/2" | 2.250 | 1.125 | .812 | 6.875 | 1.750 | 3.500 | 2.250 | 4.500 | 29-1/2"# |

GSG can design and build a turn key system to measure your parts. As an option we can build a gage fixture to your designs.





## ZERO SPINDLE COMPONENTS TO CHECK PARTS HELD ON OUTSIDE DIAMETERS OR MALE THREADS

**ZERO SPINDLES:**

* AD-012 "M" = 2.187"
* AD-013 "M" = 2.937"
* AD-014 "M" = 3.875"
* AD-015 "M" = 5.250"
* WITH CENTRALIZING COLLAR
* WITH SPINDLE LOCK
* SPINDLE CAN BE MOTORIZED

**ODC COLLET CHUCK**

* WIDE GRIP LENGTH
* INTERCHANGEABLE COLLETS
* PART STOPS AVAILABLE

**CHUCKS**

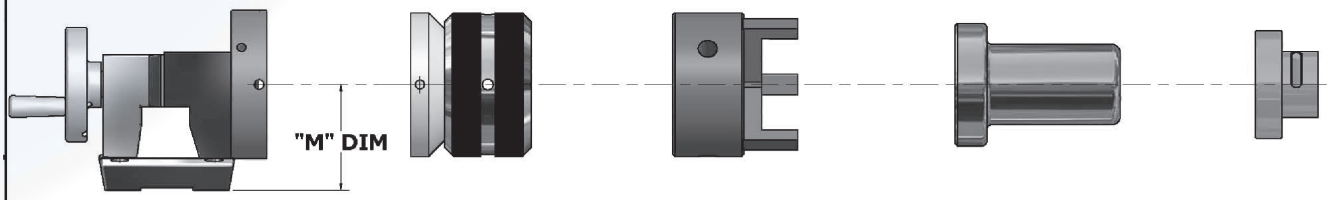
* 3 JAW CHUCKS STANDARD
* 4 JAW CHUCKS FOR THIN PARTS
* 3.5" TO 8.0" SCROLL CHUCK
* INTERNAL / EXTERNAL JAWS
* FULL CIRCLE WELDED JAWS

**COLLET CHUCKS**

* PRECISION 5C
* PRECISION 1C
* PART STOPS

**OFF-LEAD THREAD ARBOR**

* MALE THREADS
* METRIC AND INCH




| OUTSIDE DIAMETERS EFFECTED | .50 TO 5.0 INCHES | .125 TO 10.0 INCHES | .016 TO 1.062 INCHES | .250 TO 6.0 " THREADS |
|---|---|---|---|---|
| MAX PART TOLERANCE | NONE | NONE | REF. COLLET SPECS | PER THREAD SPECS |
| ACCURACY | .0003" TIR | .0001" TIR | .0001" TIR | .0001 " TIR |
| METHOD OF ACTUATION | ROTATE NUT TO SECURE | CHUCK KEY | DRAW BAR | HANDLE & DRAW BAR |

**ALL GAGING SYSTEMS CAN ACCOMODATE:**

* A SERIES OF POT CHUCKS FOR DIFFERENT PARTS USING ONE SPINDLE
* ADDITION OF A THREAD CHECKING ATTACHMENT
* SPECIFIC PART STOPS
* ETCHED INDEX DIALS
* ZERO SPINDLE CAN BE VERTICAL MOUNTED TO EASE PART LOADING
* ADDITIONAL COMPONENTS AVAILABLE: MAGNETIC, AIR CHUCKS, ETC..

DRAWN | CHECKED | QA | MFG | APPROVED

GLASTONBURY SOUTHERN GAGE
800-251-4243 GSGage.com

TITLE: ZERO SPINDLE O.D. COMPONENTS

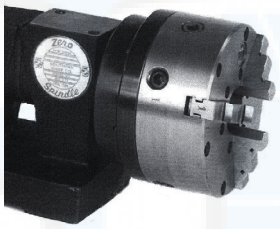
SIZE: C | DWG NO: 5-26-2005 DDG | REV

SCALE | SHEET 1 OF 1

The GSG Zero spindle offers various methods of holding a part on the outside feature during rotation. The charts show the 4 major methods: Collet, 3-4 Jaw Chuck, and external off Lead Lock. These methods can be combined with various measurement methods and provide the user with a robust and repeatable way of inspecting ovality, run-out, diameter and true position of round parts.

# ZERO SPINDLE ID INSPECTION

The GSG Zero spindle offers various methods of holding a part on the inside feature during rotation. The charts show the 4 major methods: Collet, push arbor, 3-4 Jaw Chuck, and internal off Lead Lock. These methods can be combined with various measurement methods and provide the user with a robust and repeatable way of inspecting ovality, run-out, diameter and true position of round parts.



## ZERO SPINDLE COMPONENTS TO CHECK PARTS HELD ON INSIDE DIAMETERS OR FEMALE THREADS

**ZERO SPINDLES:**

* AD-012 "M" = 2.187"
* AD-013 "M" = 2.937"
* AD-014 "M" = 3.875"
* AD-015 "M" = 5.250"
* WITH CENTRALIZING COLLAR
* WITH SPINDLE LOCK
* SPINDLE CAN BE MOTORIZED

**TORK-LOK ARBORS**

* WITH EXPANDABLE COLLETS
* SPLINE CUT COLLETS

**PUSH ARBORS**

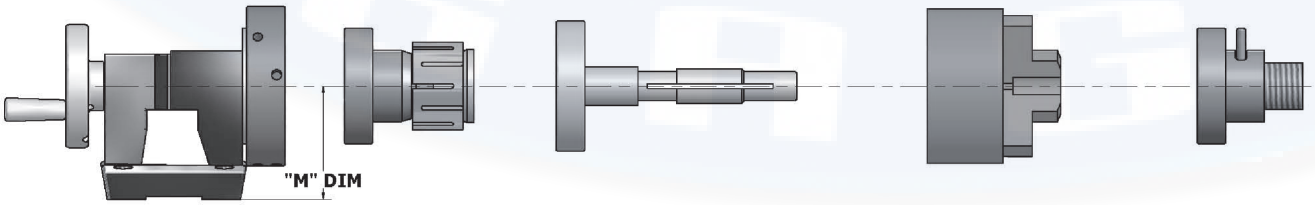
* DIAPHRAGM
* DUAL FLEX
* THREAD CUT
* SPLINE CUT

**CHUCKS**

* 3 JAW OR 4 JAW CHUCKS
* 3.5 TO 8.0 " SCROLL CHUCK
* INTERNAL / EXTERNAL JAWS
* SPLIT THREAD RINGS
* FULL CIRCLE WELDED JAWS

**OFF-LEAD THREAD CHUCK**

* FEMALE THREADS
* METRIC AND INCH




| INSIDE DIAMETERS AVALIABLE | .50 TO 5.0 INCHES | .25 TO 3.00 INCH | 1.0 TO 12.0 USING WELDED JAWS | .18 TO 8.0 INCH THREADS |
|---|---|---|---|---|
| MAX PART TOLERANCE | .015 " | .003 TO .004 " | NONE | PER THREAD SPEC |
| ACCURACY | .0005 " TIR | .0001 " TIR | .0001 " TIR | .0001 " TIR |
| MODE OF ACTUATION | HANDLE AND DRAW BAR | NONE | CHUCK KEY | ACTUATING HANDLE |

**ALL GAGING SYSTEMS CAN ACCOMODATE:**

* A SERIES OF POT CHUCKS FOR DIFFERENT PARTS USING ONE SPINDLE
* ADDITION OF A THREAD CHECKING ATTACHMENT
* SPECIFIC PART STOPS
* ETCHED INDEX DIALS
* ZERO SPINDLE CAN BE MOUNTED FOR VERTICAL LOADING
* ADDITIONAL COMPONENTS AVAILABLE: MAGNETIC, AIR CHUCKS, ETC..

| | | |
|---|---|---|
| DRAWN | | GLASTONBURY SOUTHERN GAGE 800-251-4243 GSGage.com |
| CHECKED | | TITLE: ZERO SPINDLE COMPONENTS |
| QA | | |
| MFG | | |
| APPROVED | | SIZE C / DWG NO 5-26-2005 DDG / REV |
| | | SCALE / SHEET 1 OF 1 |

## *Model "A" Style 104*
***Precision***

## *Model "C" Style 108*
***Precision***

## *Model "MC" Style 102*
*(Midget Style C)*
***Precision***

- AGD Snap Gages offer a quick attribute method of checking an OD, groove diameter or width by having the go and no-go elements in line.
- Gaging surfaces are hardened, ground & lapped Tool Steel.
- Marking discs are supplied on all snap gages.

## *Special Hole Gages*

**GSG has the technical expertise and manufacturing capabilities to meet your special gage requirements.**

*Some of the available gages are:*

- Square and Hex Plug Gages
- Concentricity Gages
- Flush Pin Gages
- Alignment Gages
- Template Gages
- Other Special Gages

## *Production Services*

- GSG's production department specializes in tight tolerance grinding, honing and lapping of inside and outside diameters. Quantities can be one to thousands of pieces holding size to .000020" with straightness requirements of .000020" to .000050" depending on length. Slip fits maintained between inside and outside diameters to clearances of .000020". Shaft diameters range in size from $^{1}/_{4}$" to $^{3}/_{4}$" and up to nine inches long.
- Customer can choose to do all of the machining first and leave stock for GSG to finish, alternatively GSG can do complete project.
- Material can be Tool Steel, Stainless Steel, Carbide, Chrome or other types of material.
- Rods can be plain or include threaded holes, grooves or other features.

# FREQUENTLY ASKED QUESTIONS *FAQS*

**Are the quantity price breaks on stock items?**
No. Stock items are manufactured in large quantities based on yearly sales. The "price break" is already in the stock price list.

**What's the difference in Steel, Chrome & Carbide?**
Gages are manufactured from Tool Steel and hardened to 58 - 62 Rc, unless otherwise specified by the customer.
Chrome is a plating process that increases the hardness/wearablity and protects the gage from corrosion.
Carbide is a sintered metal with a harder wear surface than Steel and Chrome with a comparable hardness of 79 - 81 Rc, but it is also brittle.

**What is the difference between Adjustable Thread Rings and Solid Thread Rings?**
Adjustable Thread Rings are as the name implies, adjustable. As the ring gage is used it will wear outside the allowable tolerance but can be re-adjusted back into tolerance increasing its wear life. In the US, Solid Thread Rings are usually master rings used for setting Internal Thread Comparators. Outside the US, the standard design of working gages is a solid ring. The Adjustable Thread Ring is an American design.

**What is A2LA?**
A2LA is The American Association for Laboratory Accreditation. This accreditation means an indpendant qualified party audited and appraised GSG's lab to ISO 17025. A2LA is recognized throughout the world as a registrar for laboratories. GSG is one of very few gage manufacturers that has this level of accreditation for our laboratories.

**What are "Part Type Masters"?**
Part Type Masters are used to set up gaging systems typically in a manufacturing line. Due to GSG's unique capability to manufacture part masters with very close, gage-like tolerances, we have developed this market to serve gage system manufacturers. Typical masters including brake drums, rotors, connecting rods, crank shafts, pistons of all sizes, etc., are furnished to the auto industry, but many other industries can improve their processes by using part masters.

**What is API?**
API is the American Petroleum Institute.
Typical specification include:
Spec 5B - Casing, Tubing & Line Pipe Threads
Spec 7 - Rotary Drill Stem Elements
Spec 11B - Sucker Rod

**What is Helical Coil (STI)?**
Helical Coil plug gages are used to check threaded holes prior to inserting a Screw Thread Insert (STI).

**How can I lenghten the life of my gage?**
A longer gage life can be obtained by making sure the gages are handled and stored properly. Gages should be handled like any precision tool or measuring device that is required to inspect close tolerances. Mishandling and poor storage can cause nicks or other deformities which will destroy the gage. When storing gages make sure the gage surfaces are protected and lubricated to prevent corrosion.

## What is uncertainty?

Many people talk about uncertainty, what does that mean? When we discuss uncertainty, we in the dimensional measuring field, are talking about the influences that affect the measurement being made. Some of the affects are the environment, equipment, methods, personnel, instrument used, procedure, etc.

**Some examples are:**

The room in which the measurement is being performed: We say that the temperature is 68 degrees plus or minus 1 degree, however the temperature at the measuring surface could be at 67 or 69 degrees. That difference could make a large difference in the true measured size. For example steel moves at 6.3 millionths per degree per inch size difference (co efficiency of expansion) in steel. A steel disc 1.000" class XX (+/-.000015") diameter could measure .999994" or 1.000006" respectfully. Half of the tolerance is lost by only considering uncertainty in temperature. Imagine the measurement not taken in a controlled environment!

**Equipment:**

You could measure the same disc using any instrument you choose. A highly accurate measuring instrument measuring in millionths of an inch would typically produce a lower uncertainty than a vernier caliper measuring in thousandths of an inch. No one can tell the customer what instrument they will use, however the uncertainty measuring with a vernier caliper would be quite large and well outside the tolerance of the 1.000" disc. For example the uncertainty using the highly accurate measuring instrument measuring in millionths of an inch might be .000005" and the vernier caliper might be .003" inches. Neither method is wrong; however ignoring the uncertainty may mean the measurement is unusable.

**Certification Requirements Misconceptions**

There are several common misconceptions of what is required on a calibration certificate for Inspection, Measurement, and Test Equipment (IM&TE) according to ISO-17025, or ANSI/NCSL Z540-1. The requirements for a calibration certificate are listed in the previously mentioned standards in a section specific and only for calibration certificates. Misconceptions arise because the sections in the standards that apply to the 'Quality System' supporting the IM&TE are incorrectly applied to the calibration certificate.

Some calibration labs and companies have designed their calibration certificate to supply anything and everything their customers might want whether listed in the properly applied section of the standards or listed in other and improperly applied sections of the standards. This eliminates the questions that arise from their customers, and may be some of the source if not fuel for the misconceptions. Glastonbury Southern Gage takes a very active role in many ANSI standards writing committees, and organizations like AMTMA, and we believe the standards should be applied properly as written because they were conceived, written and published to create consistency in industry.

GSG provides a table of comparisons of the two standards for calibration certificates, included is a column for ISO 10012-1, which is for the 'Quality (Calibration) System' supporting the IM&TE, not the certificate. These comparisons are available on our website.

The most common misconception is that the certificate must include the instrument used to obtain the calibration results, and its calibration information. However, it is not an item in the requirements lists for a certificate. This misconception appears to result from the requirement that a certificate has a 'Traceability Statement,' and the Quality System have 'the source of the calibration used to obtain traceability.' To help people understand the application of this requirement we have added a sentence to our certifications that states " The user's calibration source for NIST traceability is GSG."

In conclusion, we at GSG would like to offer our services in interpreting and applying these calibration standards. Any customer you have that is demanding things not required by the standards, a list can be obtained from GSG. If this doesn't solve the problem, have them get out their copy of the standard and find the requirement they are demanding. You will discover they are in a section other than the appropriate section for calibration certificates. If you need assistance in helping them understand which section they should be looking in or how to properly apply the requirements they are looking at, we will be more than happy to talk with them.

For that group of customers who have designed their quality system without adhering to the standard, and now require more than the standards do for calibration certificates, we will be glad to furnish a calibration certificate with any and all information the customer desires. Have your customer list all the additional items they want on the certificate, be sure they are clearly stated on your request for quote so the appropriate costs can be added for this additional work. Be sure also that this same list is prominently displayed on your purchase order, because special handling is required to comply with these special requests. If you would like to discuss our fees for these special services, please contact GSG at 800-251-4243.

GSG has over 4,000 thread gages in stock, including the variable thread gage systems. A short list of some of the standard gages are shown below, others sizes are also available.

## Common Inch and Metric Thread Sizes Available in Stock for Thread Rings and Taperlock Plugs Also Chrome Plugs

| Class 2B or 3B (Plugs) and 2A or 3A (Rings) | | | Class 6H (Plugs) and 6g (Rings) | |
|---|---|---|---|---|
| 0-80 UNF | 3/8"-24 UNF | 1 1/16"-12 UN | M1.6 X 0.35 | M17.0 X 1.00 |
| 1-64 UNC | 3/8"-32 UNEF | 1 1/16"-18 UNEF | M1.8 X 0.35 | M18.0 X 2.50 |
| 1-72 UNF | 7/16"-14 UNC | 1 1/8"-7 UNC | M2.0 X 0.40 | M18.0 X 1.50 |
| 2-56 UNC | 7/16"-20 UNF | 1 1/8"-12 UNF | M2.2 X 0.45 | M20.0 X 2.50 |
| 2-64 UNF | 7/16"-28 UNEF | 1 1/8"-18 UNEF | M2.5 X 0.45 | M20.0 X 1.50 |
| 3-48 UNC | 1/2"-13 UNC | 1 3/16"-12 UN | M3.0 X 0.50 | M22.0 X 2.50 |
| 3-56 UNF | 1/2"-20 UNF | 1 3/16"-18 UNEF | M3.5 X 0.60 | M22.0 X 1.50 |
| 4-40 UNC | 1/2"-28 UNEF | 1 1/4"-7 UNC | M4.0 X 0.70 | M24.0 X 3.00 |
| 4-48 UNF | 9/16"-12 UNC | 1 1/4"-12 UNF | M4.5 X 0.75 | M24.0 X 2.00 |
| 5-40 UNC | 9/16"-18 UNF | 1 1/4"-18 UNEF | M5.0 X 0.80 | M27.0 X 3.00 |
| 5-44 UNF | 9/16"-24 UNEF | 1 5/16"-12 UN | M6.0 X 1.00 | M27.0 X 2.00 |
| 6-32 UNC | 5/8"-11 UNC | 1 5/16"-18 UNEF | M7.0 X 1.00 | M30.0 X 3.50 |
| 6-40 UNF | 5/8"-18 UNF | 1 3/8"-6 UNC | M8.0 X 1.25 | M30.0 X 2.00 |
| 8-32 UNC | 5/8"-24 UNEF | 1 3/8"-12 UNF | M8.0 X 1.00 | M30.0 X 1.50 |
| 8-36 UNF | 11/16"-24 UNEF | 1 3/8"-18 UNEF | M10.0 X 1.00 | M33.0 X 3.50 |
| 10-24 UNC | 3/4"-10 UNC | 1 7/16"-12 UN | M10.0 X 1.50 | M33.0 X 2.00 |
| 10-32 UNF | 3/4"-16 UNF | 1 7/16"-18 UNEF | M10.0 X 1.25 | M35.0 X 1.50 |
| 12-24 UNC | 3/4"-20 UNEF | 1 1/2"-6 UNC | M12.0 X 1.75 | M36.0 X 4.00 |
| 12-28 UNF | 13/16"-20 UNEF | 1 1/2"-12 UNF | M12.0 X 1.50 | M36.0 X 3.00 |
| 12-32 UNEF | 7/8"-9 UNC | 1 1/2"-18 UNEF | M12.0 X 1.25 | M36.0 X 2.00 |
| 1/4"-20 UNC | 7/8"-14 UNF | STOCK SIZES UP TO 2.5" | M12.0 X 1.00 | M39.0 X 4.00 |
| 1/4"-28 UNF | 7/8"-20 UNEF | | M14.0 X 2.00 | M39.0 X 3.00 |
| 1/4"-32 UNEF | 15/16"-20 UNEF | | M14.0 X 1.50 | M39.0 X 2.00 |
| 5/16"-18 UNC | 1/8" UNC | | M14.0 X 1.00 | |
| 5/16"-24 UNF | 1-12 UNF | | M15.0 X 1.00 | |
| 5/16"-32 UNEF | 1-14 UNS | | M16.0 X 2.00 | |
| 3/8"-16 UNC | 1-20 UNEF | | M16.0 X 1.50 | |

## Common Inch and Metric Thread Sizes Available in Stock for Reversible Plugs Chrome and Steel

| Class 2B or 3B | | | Class 6H | |
|---|---|---|---|---|
| 0-80 UNF | 8-36 UNF | 7/16"-20 UNF | M1.6 X 0.35 | M12.0 X 1.75 |
| 1-64 UNC | 10-24 UNC | 1/2"-13 UNC | M2.0 X 0.40 | M12.0 X 1.50 |
| 1-72 UNF | 10-32 UNF | 1/2"-20 UNF | M2.5 X 0.45 | M12.0 X 1.25 |
| 2-56 UNC | 12-24 UNC | 9/16"-18 UNF | M3.0 X 0.50 | M12.0 X 1.00 |
| 3-48 UNC | 12-28 UNF | 5/8"-11 UNC | M3.5 X 0.60 | M14.0 X 2.00 |
| 3-56 UNF | 1/4"-20 UNC | 5/8"-18 UNF | M4.0 X 0.70 | M14.0 X 1.50 |
| 4-40 UNC | 1/4"-28 UNF | 3/4"-10 UNC | M5.0 X 0.80 | M16.0 X 2.00 |
| 4-48 UNF | 5/16"-18 UNC | 3/4"-16 UNF | M6.0 X 1.00 | M16.0 X 1.50 |
| 5-40 UNC | 5/16"-24 UNF | | M8.0 X 1.25 | M18.0 X 1.50 |
| 6-32 UNC | 3/8"-16 UNC | | M8.0 X 1.00 | |
| 6-40 UNF | 3/8"-24 UNF | | M10.0 X 1.50 | |
| 8-32 UNC | 7/16"-14 UNC | | M10.0 X 1.25 | |

## NPT - Working Gages
## L-1 Ring Gage and Plug Gage With Basic Step

| | | | |
|---|---|---|---|
| 1/16"-27 | 1/2"-14 | 1 1/2"-11 1/2" | 3 1/2"-8 |
| 1/8"-27 | 3/4"-14 | 2-11 1/2" | 4-8 |
| 1/4"-18 | 1-11 1/2" | 2 1/2"-8 | 5-8 |
| 3/8"-18 | 1 1/4"-11 1/2" | 3-8 | 6-8 |

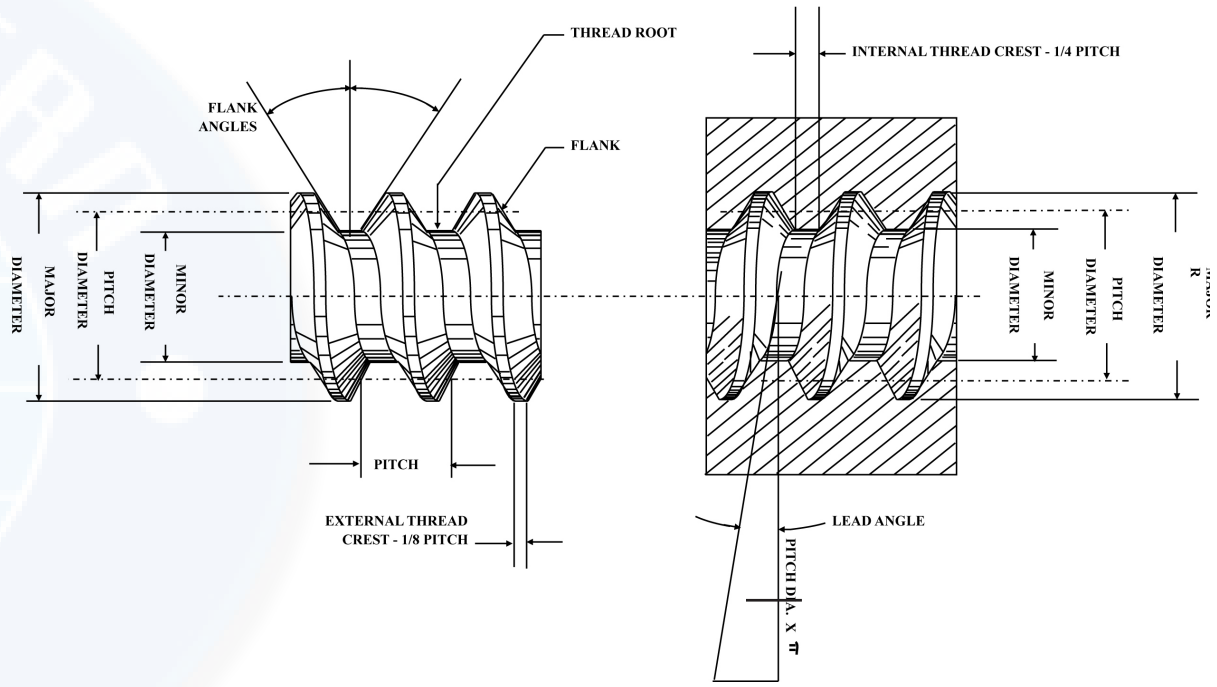
## Taper Pipe Threads - NPTF and ANPT - Working Gages

| L-1 Ring and Plug Gage Basic Step | | L-2 L-3 Ring and Plug Gage Basic Step | | Plain Taper Ring and Plug 6 Step | |
|---|---|---|---|---|---|
| 1/16"-27 | 1/4"-18 | 1/2"-14 | 1-11 1/2" | 1 1/2"-11 1/2" | 2 1/2"-8 |
| 1/8"-27 | 3/8"-18 | 3/4"-14 | 1 1/4"-11 1/2" | 2-11 1/2" | 3-8 |

**A COMPLETE LIST OF OUR PRODUCTS WITH EDP NUMBERS AND PRICES IS AVAILABLE IN OUR PRICE BOOK AND ON OUR WEB SITE.**

**GSG also stocks many other items such as: Variable Thread components, Surveillance Masters, Cylindrical Blanks, Hole Location Gages, Zero Spindle Components etc.**

This simplified drawing of an external and internal thread illustrates basic thread geometry. This illustration helps to visualize the critical dimensions, which must be controlled for correct thread form.




1. Unified Inch Screw Threads: per ASME B1.1
Federal Std H28/2
Military Std MIL-S-7742D

Nominal Size (Basic Major Diameter expressed as a fraction, decimal or machine screw number).
Number of Threads per Inch (TPI).
Thread Form & Series (UN, UNC, UNF, UNEF, or UNS.
Class of Fit (1A,2A, or 3A external) (1b, 2B, or 3B internal (or SPL for special).
Gaging System per ASME B1.3M (21,22, or 23).

**1/4 - 20 UNC - 2A (21)**

**2. Inch "J" Series Screw Threads: per Military Standard MIL-S-8879C (25 July 1991).**

Nominal Size (Basic Major Diameter expressed as a 4-place inch decimal ONLY).
Number of Threads per Inch (TPI)
Thread Form & Series (UNJ, UNJC, UNJF, UNEF, or UNJS).
Class of Fit (3A external, 3B internal).
Application Category (Safety Critical or Other Thread).
Military Standard Number

**.2500 - 20 UNJC - 3A Safety Critical Thread MIL-S-8879**

3. Metric Screw Threads: per ASME B1.13M
Federal Std H28/21

Metric Thread Symbol, ISO 68 Metric Thread Form.
Normal Size (Basic Major Diameter in millimeters)
Pitch (in millimeters)
Tolerance Class
Gaging System per ASME B1.3M (21,22, or 23)

**M 6 X 1 - 4g6g (22)**

Allowance
Tolerance
Major Dia. Ext. Thd,. or Minor Dia. Int. Thd.
Allowance
Tolerance
Pitch Diameter

Standard Allowance Grades:
Internal Threads G and **H** shown as capital letter.
External Threads e, f, **g** and **h** shown as lower case letter.

Standard Tolerance Grades:
Internal Threads
Pitch and Minor Diameter 4, 5, **6**, 7 and 8.

External Threads
Pitch Diameter 3,**4**,5,**6**,7,8 and 9.
Major Diameter 4, 6 and 8.

The most common tolerance and allowance Grades for standard series threads are shown in **bold print**.

# THREAD ALLOWANCES

A feature, which must be considered, is the allowance. This computed amount is subtracted from the basic pitch diameter to attain an adjusted maximum size for the external product. The purpose of this is to guarantee ease of assembling the internal and external products. For National class 1 and Unified classes 1A and 2A, the allowance is included. For National classes 2 and 3, and Unified class 3A have an allowance of zero. National classes 4 & 5 are a special case designed to create an interference fit having the allowance added to the maximum instead of subtracted.

The number designation in National and Unified Series determines the size of the product tolerance or window. The larger the number, the smaller the manufacturing window for the product.

## National Series

In the National Series screw thread the class 2 was designed as the 'Nuts & Bolts' fit. The class 1 is also a 'Nuts & Bolts' fit but with an allowance factor between the products creating a guaranteed assembly scenario. Class 3 is the 'Machine' fit. Classes 4 & 5 are 'Interference' fit.

## Unified Series

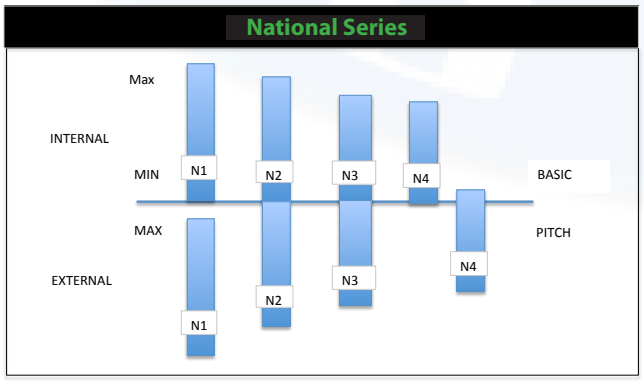
In the Unified National Series the internal product minimum size, which is also the size of the Go plug gage, is always the basic pitch diameter. The internal product maximum size, which is also the size of the Nogo gage, varies with the class. The external product maximum size, which is also the size of the Go ring gage, is basic pitch diameter or basic pitch diameter minus the allowance. The external product minimum size, which is also the size of the Nogo ring gage, varies with the class.

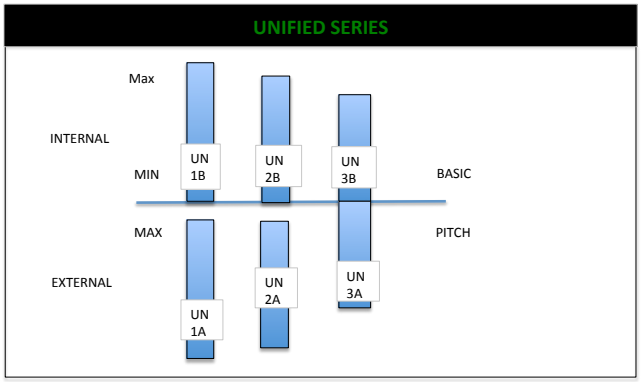
The 2A / 2B fit is generally referred to as the 'nuts and bolts fit' because of the guaranteed gap between the mating parts, where tightness is accomplished by contact against a face. The class 1A / 1B is also a 'Nuts & Bolts' larger manufacturing window and coined as 'Quick Assembly.'

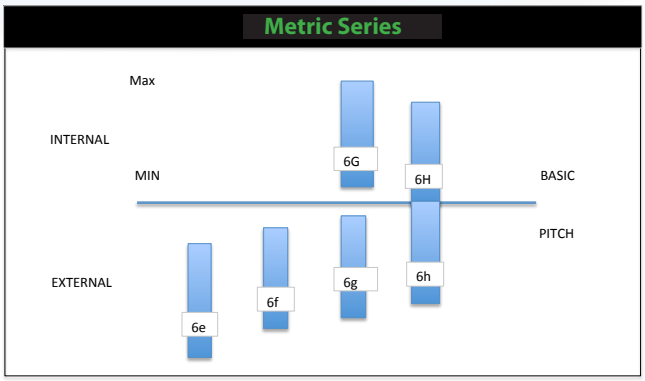
The 3A / 3B fit is generally referred to as the 'machine fit' because it usually gives a tighter fit of the threads of the mating parts. There is no class 4. Class 4 was retained but moved to a different standard more commensurate to its application. The 'g' & 'H' are commonly confused with the unified method of denoting internal and external of 'A' & 'B'. Here the metric uses a method that is not present in the inch series. The internal and external threads in metrics are denoted by the case of the letter used, lower case for external, and upper case for internal. The letter used denotes the amount of allowance adjustment applied to the basic size. For external threads, allowances available are 'e, f, g, & h'. For internal threads, allowances available are 'G & H'.

## Metric

Here again we see a difference in the inch and metric systems. In the Unified, there is only one allowance available and it is only applied to the external thread. For metric, you can apply allowances to the internal also. In both the internal and external the 'h or H' signifies an allowance factor of zero. The 'G' is the only allowance for internal threads and the 'g' is the smallest allowance available for external, the 'f' being more, and the 'e' being the greatest allowance.



**Allowance**
The minimum clearance between two mating parts. The variations from the basic size which are prescribed to permit the desired amount of play in a metal-to-metal fit.

**Basic Size**
The theoretical size (usually the same as the nominal size), from which the design size limits are derived by the application of tolerances and allowances.

**Clearance**
The radial distance between an external diameter and an internal diameter.

**Convolute**
Removal of the incomplete threads at the end faces of a threaded part.

**Crest**
The top of the thread form. The major diameter of an external thread, or the minor diameter of an internal thread.

**Fit**
The term used to designate the tightness or looseness of two mating parts, resulting from a combination of tolerances and allowances applied to the basic size of the parts.

**Flanks**
The sides of the thread form or groove, connecting the crest and the root.

**Flank Angle**
The angle between the flank and a line perpendicular to the axis of the thread. Also referred to as half angle or lead angle. Some exceptions to this definition will be encountered, such as tapered thread flank angles measured perpendicular to the taper, and should be noted.

**FUNCTIONAL DIAMETER**
The actual (measured) pitch diameter of a thread adjusted by the cumulative effects of lead error and angle error, which is always added to external threads and subtracted from internal threads.

**INCLUDED ANGLE**
Total of the two flank angles of a thread form.

**LEAD**
The distance advanced by a thread when rotated 360 degrees on its mating thread.

**LIMITS**
The largest and smallest extremes in the size of a dimension.

**MAJOR DIAMETER**
The largest diameter of a thread form. The root diameter of an internal thread and the crest diameter of an external thread.

**MINOR DIAMETER**
The smallest diameter of a thread form. The bore or crest diameter of an internal thread and the root diameter of an external thread.

**NOMENCLATURE**
In relation to a thread, the complete identification, including the nominal size, threads per inch or pitch, thread series, class of fit, and possibly a designation for internal or external.

**NOMINAL SIZE**
The size used for purposes of identification. Usually the same as the basic size.

**Pitch**
The distance between corresponding points on adjacent threads. The reciprocal of threads per inch.

**Pitch Diameter**
The theoretical diametrical plane which passes through a thread at the point where the width of the thread tooth and groove are equal.

**RELIEF**
Removal of the material from a portion of the surface or diameter to avoid contact with the mating part when it is engaged.

**REFERENCE GAGE**
A master gage generally held to close tolerance limits which is preserved for a periodic comparison with working gages. A truncated seating plug is a reference gage that is used to inspect as well as set an adjustable thread ring.

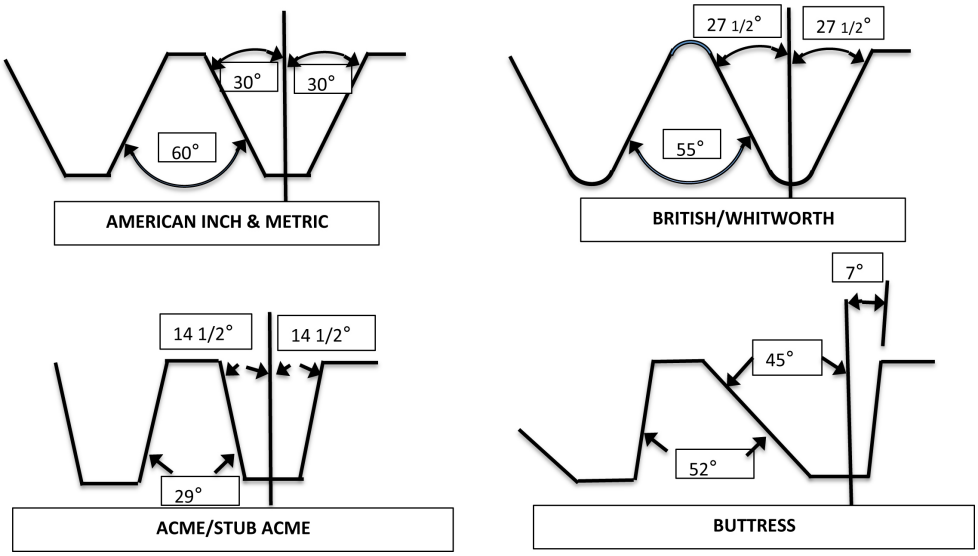
**ROOT**
The bottom of the thread form. The major diameter of an external thread and the minor diameter on an internal thread.

**THREAD ANGLE**
The included angle of the thread form, which has two thread flanks as sides.

**TOLERANCE**
The amount of variation permitted from the designated dimension, or the difference between the minimum and maximum dimension.

**TRUNCATE**
To remove the crest of a thread, thus reduce its height, usually done to guarantee non-interference.

***Basic Thread Forms***



# SETTING OF SOUTHERN STYLE RINGS

## 1.0 PURPOSE
To establish a procedure for the inspection and setting of Southern Style thread ring gages.

## 2.0 SCOPE
This specification defines the requirements for the inspection and setting of Southern Style thread ring gages in the A2LA area.

## 3.0 RESPONSIBILITY
Inspectors are responsible for following this procedure when inspecting Southern Style thread rings.

## 4.0 DEFINITIONS
None

## 5.0 PROCEDURE

### *5.1 EQUIPMENT REQUIRED*
Master thread setting gage, Sealing Wax, Kim wipes, Instrument oil, Screw drivers, Isopropyl alcohol,Bristle Brush

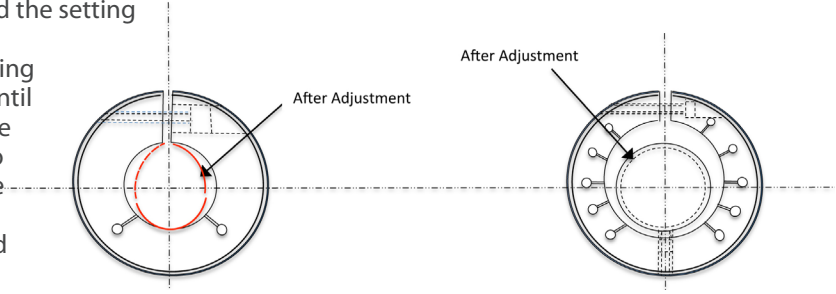
### *5.2 CLEAN*
Thoroughly clean the threads with a bristle brush and solvent, wipe clean with isopropyl alcohol and clean with kim wipe. Visually inspect the thread ring for nicks, dings or foreign material buildup.

### *5.3 INSPECT ID*
*5.3.1 ID's below .500 inch*
Mark a tapered pin and insert into ID. Seat and turn ring to mark size. Measure marked point on tapered pin with mics. and record the size.
*5.3.2 ID's above .500 inch.*
Measure ID size and record size.

### *5.4 INSPECT PD*
*5.4.1*
Lubricate the setting master plug with a thin film of light viscosity oil before inserting into the ring gage.
*5.4.2*
Turn the ring onto the setting plug 1 $^{1}/_{2}$" to 2 threads at the front. If ring will not go onto setting plug go to operation 5.5.
There should be some resistance or drag even at this short engagement. To test for taper or bellmouth, place the ring on its face on a workbench and test for shake or looseness with the setting plug, being very careful not to damage the end threads.
*5.4.3* Turn ring further onto the truncated section, remembering the feel at the 1 $^{1}/_{2}$" to 2 thread engagement. The drag should remain approximately the same although it may be slightly greater at full engagement due to more flank contact.
*5.4.4* Remove the ring from the setting plug and repeat operations 5.4.2 & 5.4.3 on the opposite side of the thread ring gage. The feel should be approximately the same for both ends.
*5.4.5* The fit should be approximately the same on both sides of the ring to insure proper straightness. Remember if a setting plug is manufactured or worn smaller at the front, it will falsely indicate taper or bellmouth in the ring gage. Setting plugs must be reasonably straight.
*5.4.6* Turn the ring gage from the truncated section onto the full form section at the back. The drag should be approximately the same on both sections which insures good flank angle contact.
*5.4.7* If at this point nothing is found which indicates a problem skip to operation 5.8.

### 5.5 SET RING
NOTE: If ring will go onto setting plug skip to operation 5.5.3.
*5.5.1* Turn the locking screw counter-clockwise $^{1}/_{4}$" turn.
*5.5.2* Turn the adjusting screw clockwise $^{1}/_{8}$" turn maximum to enlarge ring PD. Repeat, if necessary, until ring will go onto the setting plug.
*5.5.3* Turn the ring gage onto the setting plug truncated section so that approximately one thread of setting plug extends beyond the ring. (This will promote more uniform wear over the entire thread length of the setting plug.)
*5.5.4* Turn the locking screw counter-clockwise to loosened or clockwise to tighten until there is a slight drag between the ring and the setting plug.
*5.5.5* Turn the locking screw clockwise until tight. This locks the adjusting screw so that the size of the ring gage remains fixed. There should be noticeable drag between the ring and setting plug.
NOTE: Operations 5.5.3 - 5.5.5 may need to be repeated more than once to obtain the proper drag or feel.
*5.5.6* Turn the ring gage from the truncated section onto the full form section at the back. The drag should be approximately the same on both sections which insures good flank angle contact.






### 5.6 INSPECT PD
Repeat section 5.4.1 through 5.4.7.

### 5.7 INSPECT ID
*5.7.1* Repeat section 5.3
NOTE: If an adjustment was necessary to establish the proper feel on the setting plug use the following formula to obtain the as found pitch diameter. Setting plug pitch diameter plus ID size before adjustment minus ID size after adjustment.

### 5.8 SEAL
Cover the adjusting and locking screws with sealing wax to prevent unauthorized tampering with the setting of the ring gage.

### Use Of Go Thread Gages

The Go gage should pass completely across or onto the product threads. Application of force to engage the Go gage member with the product indicates the product is larger (ring gage) or smaller (plug gage) than the allowable size. Forcing the Go gage to engage with the product will alter the size of the product making it acceptable but wear the gage unnecessarily resulting in a sharp decrease in the life of the Go gage.

### Use Of NoGo Thread Gages

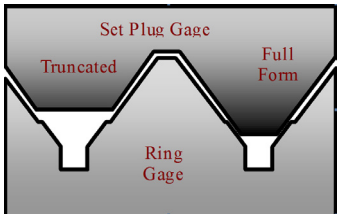
**Inch: Not more than three complete turns**
**Metric: Definite drag before the second turn**
NOTE: Modification of the above requirements may be necessary when the product is thin having few complete threads or when the product is of a material that may stretch or give. For inch threads, the NoGo should never go beyond the third thread or less if modified. For metric threads the NoGo could theoretically go the full length but should not be continued once the definite drag is felt. If the NoGo engages with the product more than the specified requirements the product is smaller - (ring gage) or larger (plug gage) than the allowable size.

### Setting Of AGD Ring Gages

**Always check the ring and set plug thoroughly for cleanliness, nicks, dings or foreign material buildup.**

### INSPECTING RING

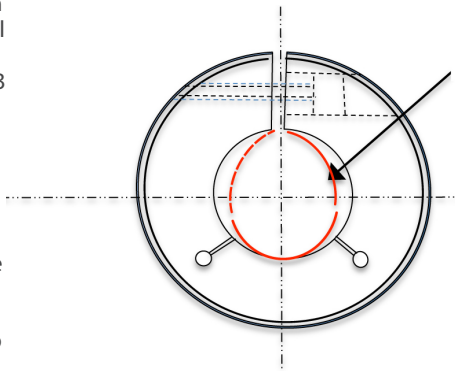
**1)** Ensure the setting plug is the correct size and class.
**2)** Lubricate the setting master plug with a thin film of light viscosity oil before inserting into the ring gage.
**3)** Turn the ring onto the setting plug 1 $^{1}/_{2}$" to 2 threads at the front. If ring will not go onto setting plug go to operation 2 "Setting Ring". There should be some resistance or drag even at this short engagement. To test for taper or bellmouth, place the ring on its face on a workbench and test for shake or looseness with the setting plug, being very careful not to damage the end threads.
**4)** Turn ring further onto the truncated section, remembering the feel at the 1 $^{1}/_{2}$" to 2 thread engagement. The drag should remain approximately the same although it may be slightly greater at full engagement due to more flank contact.
**5)** Remove the ring from the setting plug and repeat operations 3 & 4 on the opposite side of the thread ring gage.
**6)** The fit should be approximately the same on both sides of the ring to insure proper straightness. Remember if a setting plug is manufactured or worn smaller at the front, it will falsely indicate taper or bellmouth in the ring gage. Setting plugs must be reasonably straight. Turn the ring gage from the truncated section onto the full form section at the back. The drag should be approximately the same on both sections which insures good flank angle contact.
**7)** If at this point nothing is found which indicates a problem skip to sealing the gage.




### SETTING RING

**1)** Turn the locking screw counter-clockwise until it is loosened.
**2)** Turn the adjusting screw clockwise, this will open the ring to a larger pitch diameter than the setting plug.
**3)** Turn the ring gage onto the setting plug truncated section so that approximately one thread of setting plug extends beyond the ring. (This will promote uniform wear over the entire thread length of the setting plug.)
**4)** If it has not already been done, turn the locking screw counter-clockwise until it is loosened. Turn the adjusting screw counter-clockwise to tighten or clockwise to loosen until there is a slight drag between the ring and the setting plug.
**5)** Turn the locking screw clockwise until tight. This locks the adjusting screw so that the size of the ring gage remains fixed. There should be noticeable drag between the ring and setting plug. ***NOTE: Operations 3 to 5 may need to be repeated more than once to obtain the proper drag or feel.***
**6)** Turn the ring gage from the truncated section onto the full form section at the back. The drag should be approximately the same on both sections which insures good flank angle contact.

***Important Notes:***
The minor diameter of the ring gage should be measured with either a bore gage, internal measuring machine or fixed limit Go/NoGo gages. It is highly recommended that the adjusting and locking screws be covered with sealing wax to prevent
unauthorized tampering with the setting of the ring gage.




## Proper Handling And Storage OF Gages

- Gages are an important part of your overall manufacturing process.
- Gages should always be stored in a secure place, protected from possible misuse or damage.
- When stored, use an oil-wax based dip seal to protect the gages from rust or damage.
- Gages should be handled with care and not forced into or onto the part being checked.
- Any alterations should be done by gage making professionals due to material displacement and the need for re-calibrations after the alteration is complete.
- When Shipping gages, they should be packaged separately with sufficient packaging material to prevent rust or damage by freight carriers.

**Properly handled and stored gages will result in longer gage life and consistent product quality.**

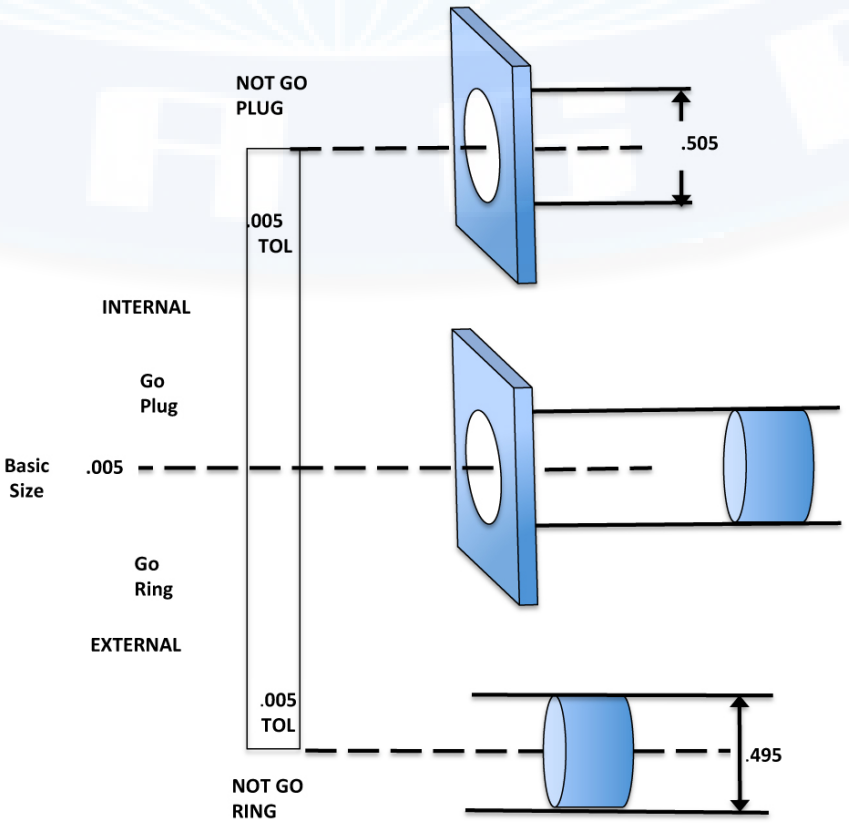
# TOLERANCE CHARTS

| GAGEMAKERS TOLERANCE CHART | | | | | | |
|---|---|---|---|---|---|---|
| Above | To & Incld | CL-XXX | CL-XX | CL-X | CL-Y | CL-Z |
| 0.010"<br>.254mm | 0.825"<br>20.95mm | 0.00001<br>0.25um | 0.00002<br>0.5um | 0.00004<br>1.0um | 0.00007<br>1.75um | 0.0001<br>2.5um |
| 0.825"<br>20.95mm | 1.510"<br>38.35mm | 0.000015<br>0.38um | 0.00003<br>0.75um | 0.00006<br>1.5um | 0.00009<br>2.25um | 0.00012<br>3.0um |
| 1.510"<br>38.35mm | 2.510"<br>63.75mm | 0.00002<br>0.50um | 0.00004<br>1.00um | 0.00008<br>2.0um | 0.00012<br>3.0um | 0.00016<br>4.0um |
| 2.510"<br>63.75mm | 4.510"<br>114.55mm | 0.000025<br>0.63um | 0.00005<br>1.25um | 0.0001<br>2.5um | 0.00015<br>3.75um | 0.0002<br>5.0um |
| 4.510"<br>114.50mm | 6.510"<br>165.35mm | 0.000033<br>0.83um | 0.000065<br>1.625um | 0.00013<br>3.25um | 0.00019<br>4.75um | 0.00025<br>6.25um |
| 6.510"<br>165.35mm | 9.010"<br>228.85mm | 0.00004<br>1.00um | 0.00008<br>2.00um | 0.00016<br>4.0um | 0.00024<br>6.0um | 0.00032<br>8.0um |
| 9.010"<br>228.85mm | 12.010"<br>305.05mm | 0.00005<br>1.25um | 0.0001<br>2.5um | 0.0002<br>5.0um | 0.0003<br>7.5um | 0.0004<br>10um |
| 12.010"<br>305.05mm | 15.010"<br>381.25mm | 0.000075<br>1.88um | 0.00015<br>3.75um | 0.0003<br>7.5um | 0.00045<br>11.25um | 0.0006<br>15um |
| 15.010"<br>381.25mm | 18.010"<br>457.45mm | 0.0001<br>2.5um | 0.0002<br>5um | 0.0004<br>10um | 0.0006<br>15um | 0.0008<br>20um |
| 18.010"<br>457.45mm | 21.010"<br>533.65mm | 0.000125<br>3.13um | 0.00025<br>6.25um | 0.0005<br>12.5um | 0.00075<br>18.75um | 0.001<br>25um |
| 21.010"<br>533.65mm | 24.010"<br>609.85mm | | 0.0003<br>7.50um | 0.0006<br>15um | 0.0009<br>23um | 0.0012<br>30um |
| 24.010"<br>609.85mm | 27.010"<br>686.05mm | | 0.00035<br>8.90um | 0.0007<br>18um | 0.00105<br>27um | 0.0014<br>36um |
| 27.010"<br>686.05mm | 30.010"<br>762.25mm | | 0.0004<br>10.00um | 0.0008<br>20um | 0.0012<br>30um | 0.0016<br>41um |

## STANDARD PLUG AND RING GAGE CLASSES FOR PRODUCT TOLERANCES

The chart of Product Tolerances for plain plug and ring gages may be used as a guide for recommended gage tolerance. This assumes a given product tolerance. Wear allowance and other similar concerns should be included when gage specifications are being defined. These are left for the user to determine. Plain plug gages normally use a plus tolerance to be considered the "Go" and a minus tolerance constitutes the "Nogo" status. Ring gages normally use a minus tolerance to be considered "Go" and a plus tolerance for the "Nogo". These descriptions are fitting with normal practice that allows 10% of the product tolerance to be equally divided between "Go" and "Nogo" conditions.

| | CLASS OF GAGE FOR SIZE RANGE | | | |
|---|---|---|---|---|
| PRODUCT TOLERANCE | .010-<br>.825" | .825"-<br>1.51 | 1.510"<br>2.510" | 2.510"<br>4.510" |
| .0002" | XXX | | | |
| .0003" | XXX | | | |
| .0004" | XX | XX | | |
| .0005" | XX | XX | | |
| .0006" | XX | XX | XX | |
| .0007" | X | XX | XX | |
| .0008" | X | XX | XX | XX |
| .0009" | X | XX | XX | XX |
| .0010" | X | X | XX | XX |
| .0012" | Y | X | XX | XX |
| .0014" | Y | X | X | XX |
| .0016" | Y | Y | X | X |
| .0018" | Z | Y | X | X |
| .0020" | | Y | X | X |
| .0022" | | Z | Y | X |
| .0024" | | | Y | X |
| .0026" | | | Y | Y |
| .0028" | | | Y | Y |
| .0030" | | | Z | Y |
| .0032" | | | | Y |
| .0034" | | | | Y |
| .0036" | | | | Z |



# PITCH DIAMETER CHART

| BASIC THREAD DESIGNATION | DIMENSIONS IN MILLIMETERS | | | | | | | DIMENSIONS IN INCHES | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NOMINAL O.D. | PITCH | MAJOR DIA. | | PITCH DIA. | | MINOR DIA. | NOMINAL O.D. | THREADS PER INCH | MAJOR DIA. | | PITCH DIA. | | MINOR DIA. |
| | | | MAX. | MIN. | MAX. GO | MIN. LO | (FLAT ROOT) MAX. | | | MAX. | MIN. | MAX. GO | MIN. | (FLAT ROOT) MAX. |
| M1.6x0.35 | 1.6 | 0.35 | 1.581 | 1.496 | 1.354 | 1.291 | 1.202 | .06299 | 72.57 | .06224 | .05890 | .05331 | .05083 | .04732 |
| M2x0.4 | 2.0 | 0.40 | 1.981 | 1.886 | 1.721 | 1.654 | 1.548 | .07874 | 63.50 | .07799 | .07425 | .06776 | .06512 | .06094 |
| M2.5x0.45 | 2.5 | 0.45 | 2.480 | 2.380 | 2.188 | 2.117 | 1.993 | .09843 | 56.44 | .09764 | .09370 | .08614 | .08335 | .07846 |
| M3x0.5 | 3.0 | 0.50 | 2.980 | 2.874 | 2.655 | 2.580 | 2.439 | .11811 | 50.80 | .11732 | .11315 | .10453 | .10157 | .09602 |
| M3.5x0.6 | 3.5 | 0.60 | 3.479 | 3.354 | 3.089 | 3.004 | 2.829 | .13780 | 42.33 | .13697 | .13205 | .12161 | .11827 | .11138 |
| M4x0.7 | 4.0 | 0.70 | 3.978 | 3.838 | 3.523 | 3.433 | 3.220 | .15748 | 36.29 | .15661 | .15110 | .13870 | .13516 | .12677 |
| M5x0.8 | 5.0 | 0.80 | 4.976 | 4.826 | 4.456 | 4.361 | 4.110 | .19685 | 31.75 | .19591 | .19000 | .17543 | .17169 | .16181 |
| M6x1 | 6.0 | 1.00 | 5.974 | 5.794 | 5.324 | 5.212 | 4.891 | .23622 | 25.40 | .23520 | .22811 | .20961 | .20520 | .19256 |
| M8x1.25 | 8.0 | 1.25 | 7.972 | 7.760 | 7.160 | 7.042 | 6.619 | .31496 | 20.32 | .31386 | .30551 | .28189 | .27724 | .26059 |
| M8x1 | 8.0 | 1.00 | 7.974 | 7.794 | 7.324 | 7.212 | 6.891 | .31496 | 25.40 | .31394 | .30685 | .28835 | .28394 | .27130 |
| M10x1.5 | 10.0 | 1.50 | 9.968 | 9.732 | 8.994 | 8.862 | 8.344 | .39370 | 16.93 | .39244 | .38315 | .35409 | .34890 | .32850 |
| M10x1.25 | 10.0 | 1.25 | 9.972 | 9.760 | 9.160 | 9.042 | 8.619 | .39370 | 20.32 | .39260 | .38425 | .36063 | .35598 | .33933 |
| M10x0.75 | 10.0 | 0.75 | 9.978 | 9.838 | 9.491 | 9.391 | 9.166 | .39370 | 33.87 | .39283 | .38732 | .37366 | .36972 | .36087 |
| M12x1.75 | 12.0 | 1.75 | 11.966 | 11.701 | 10.829 | 10.679 | 10.072 | .47244 | 14.51 | .47110 | .46067 | .42634 | .42043 | .39654 |
| M12x1.5 | 12.0 | 1.50 | 11.968 | 11.732 | 10.994 | 10.854 | 10.344 | .47244 | 16.93 | .47118 | .46189 | .43283 | .42732 | .40724 |
| M12x1.25 | 12.0 | 1.25 | 11.972 | 11.760 | 11.160 | 11.028 | 10.619 | .47244 | 20.32 | .47134 | .46299 | .43937 | .43417 | .41807 |
| M12x1 | 12.0 | 1.00 | 11.974 | 11.794 | 11.324 | 11.206 | 10.891 | .47244 | 25.40 | .47142 | .46433 | .44583 | .44118 | .42878 |
| M14x2 | 14.0 | 2.00 | 13.962 | 13.682 | 12.663 | 12.503 | 11.797 | .55118 | 12.70 | .54969 | .53866 | .49854 | .49224 | .46445 |
| M14x1.5 | 14.0 | 1.50 | 13.968 | 13.732 | 12.994 | 12.854 | 12.344 | .55118 | 16.93 | .54992 | .54063 | .51157 | .50606 | .48598 |
| M15x1 | 15.0 | 1.00 | 14.974 | 14.794 | 14.324 | 14.206 | 13.891 | .59055 | 25.40 | .58953 | .58244 | .56394 | .55929 | .54689 |
| M16x2 | 16.0 | 2.00 | 15.962 | 15.682 | 14.663 | 14.503 | 13.797 | .62992 | 12.70 | .62843 | .61740 | .57728 | .57098 | .54319 |
| M16x1.5 | 16.0 | 1.50 | 15.968 | 15.732 | 14.994 | 14.854 | 14.344 | .62992 | 16.93 | .62866 | .61937 | .59031 | .58480 | .56472 |
| M17x1 | 17.0 | 1.00 | 16.974 | 16.794 | 16.324 | 16.206 | 15.891 | .66929 | 25.40 | .66827 | .66118 | .64268 | .63803 | .62563 |
| M18x1.5 | 18.0 | 1.50 | 17.968 | 17.732 | 16.994 | 16.854 | 16.344 | .70866 | 16.93 | .70740 | .69811 | .66906 | .66354 | .64346 |
| M20x2.5 | 20.0 | 2.50 | 19.958 | 19.623 | 18.334 | 18.164 | 17.252 | .78740 | 10.16 | .78575 | .77256 | .72181 | .71512 | .67921 |
| M20x1.5 | 20.0 | 1.50 | 19.968 | 19.732 | 18.994 | 18.854 | 18.344 | .78740 | 16.93 | .78614 | .77685 | .74780 | .74228 | .72220 |
| M20x1 | 20.0 | 1.00 | 19.974 | 19.794 | 19.324 | 19.206 | 18.891 | .78740 | 25.40 | .78638 | .77929 | .76079 | .75614 | .74374 |
| M22x2.5 | 22.0 | 2.50 | 21.958 | 21.623 | 20.334 | 20.164 | 19.252 | .86614 | 10.16 | .86449 | .85130 | .80055 | .79386 | .75795 |
| M22x1.5 | 22.0 | 1.50 | 21.968 | 21.732 | 20.994 | 20.854 | 20.344 | .86614 | 16.93 | .86488 | .85559 | .82654 | .82102 | .80094 |
| M24x3 | 24.0 | 3.00 | 23.952 | 23.577 | 22.003 | 21.803 | 20.704 | .94488 | 8.47 | .94299 | .92823 | .86626 | .85839 | .81512 |
| M24x2 | 24.0 | 2.00 | 23.962 | 23.682 | 22.663 | 22.493 | 21.797 | .94488 | 12.70 | .94339 | .93236 | .89224 | .88555 | .85815 |
| M25x1.5 | 25.0 | 1.50 | 24.968 | 24.732 | 23.994 | 23.844 | 23.344 | .98425 | 16.93 | .98299 | .97370 | .94465 | .93874 | .91906 |
| M27x3 | 27.0 | 3.00 | 26.952 | 26.577 | 25.003 | 24.803 | 23.744 | 1.06299 | 8.47 | 1.06110 | 1.04634 | .98437 | .97650 | .93480 |
| M27x2 | 27.0 | 2.00 | 26.962 | 26.682 | 25.663 | 25.493 | 24.797 | 1.06299 | 12.70 | 1.06150 | 1.05047 | 1.01035 | 1.00366 | .97626 |
| M30x3.5 | 30.0 | 3.50 | 29.947 | 29.522 | 27.674 | 27.462 | 26.158 | 1.18110 | 7.26 | 1.17902 | 1.16228 | 1.08953 | 1.08118 | 1.02984 |
| M30x2 | 30.0 | 2.00 | 29.962 | 29.682 | 28.663 | 28.493 | 27.797 | 1.18110 | 12.70 | 1.17961 | 1.16858 | 1.12846 | 1.12177 | 1.09437 |
| M30x1.5 | 30.0 | 1.50 | 29.968 | 29.732 | 28.994 | 28.844 | 28.344 | 1.18110 | 16.93 | 1.17984 | 1.17055 | 1.14150 | 1.13559 | 1.11591 |
| M33x2 | 33.0 | 2.00 | 32.962 | 32.682 | 31.663 | 31.493 | 30.797 | 1.29921 | 12.70 | 1.29772 | 1.28669 | 1.24657 | 1.23988 | 1.21248 |
| M35x1.5 | 35.0 | 1.50 | 34.968 | 34.732 | 33.994 | 33.844 | 33.344 | 1.37795 | 16.93 | 1.37669 | 1.36740 | 1.33835 | 1.33244 | 1.31276 |
| M36x4 | 36.0 | 4.00 | 35.940 | 35.465 | 33.342 | 33.118 | 31.610 | 1.41732 | 6.35 | 1.41496 | 1.39626 | 1.31268 | 1.30386 | 1.24449 |
| M36x2 | 36.0 | 2.00 | 35.962 | 35.682 | 34.663 | 34.493 | 33.797 | 1.41732 | 12.70 | 1.41583 | 1.40480 | 1.36469 | 1.35799 | 1.33059 |
| M39x2 | 39.0 | 2.00 | 38.962 | 38.682 | 37.663 | 37.493 | 36.797 | 1.53543 | 12.70 | 1.53394 | 1.52291 | 1.48280 | 1.47610 | 1.44870 |

# PITCH DIAMETER CHART

| BASIC THREAD DESIGNATION | DIMENSIONS IN MILLIMETERS | | | | | | | DIMENSIONS IN INCHES | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NOMINAL O.D. | PITCH | MAJOR DIA. | PITCH DIA. | | MINOR DIA. | | NOMINAL O.D. | THREADS PER INCH | MAJOR DIA. | PITCH DIA. | | MINOR DIA. | |
| | | | MIN. (MUST CLEAR) | MIN. GO | MAX. HI | MIN. | MAX. | | | MIN. (MUST CLEAR) | MIN. GO | MAX. HI | MIN. | MAX. |
| M1.6x0.35 | 1.6 | 0.35 | 1.600 | 1.373 | 1.458 | 1.221 | 1.321 | .06299 | 72.57 | .06299 | .05406 | .05740 | .04807 | .05201 |
| M2x0.4 | 2.0 | 0.40 | 2.000 | 1.740 | 1.830 | 1.567 | 1.679 | .07874 | 63.50 | .07874 | .06850 | .07205 | .06169 | .06610 |
| M2.5x0.45 | 2.5 | 0.45 | 2.500 | 2.208 | 2.303 | 2.013 | 2.138 | .09843 | 56.44 | .09843 | .08693 | .09067 | .07925 | .08417 |
| M3x0.5 | 3.0 | 0.50 | 3.000 | 2.675 | 2.775 | 2.459 | 2.599 | .11811 | 50.80 | .11811 | .10531 | .10925 | .09681 | .10232 |
| M3.5x0.6 | 3.5 | 0.60 | 3.500 | 3.110 | 3.222 | 2.850 | 3.010 | .13780 | 42.33 | .13780 | .12244 | .12685 | .11220 | .11850 |
| M4x0.7 | 4.0 | 0.70 | 4.000 | 3.545 | 3.663 | 3.242 | 3.422 | .15748 | 36.29 | .15748 | .13957 | .14421 | .12764 | .13472 |
| M5x0.8 | 5.0 | 0.80 | 5.000 | 4.480 | 4.605 | 4.134 | 4.334 | .19685 | 31.75 | .19685 | .17638 | .18130 | .16276 | .17063 |
| M6x1 | 6.0 | 1.00 | 6.000 | 5.350 | 5.500 | 4.917 | 5.153 | .23622 | 25.40 | .23622 | .21063 | .21654 | .19358 | .20287 |
| M8x1.25 | 8.0 | 1.25 | 8.000 | 7.188 | 7.348 | 6.647 | 6.912 | .31496 | 20.32 | .31496 | .28299 | .28929 | .26169 | .27213 |
| M8x1 | 8.0 | 1.00 | 8.000 | 7.350 | 7.500 | 6.917 | 7.153 | .31496 | 25.40 | .31496 | .28937 | .29528 | .27232 | .28161 |
| M10x1.5 | 10.0 | 1.50 | 10.000 | 9.026 | 9.206 | 8.376 | 8.676 | .39370 | 16.93 | .39370 | .35535 | .36244 | .32976 | .34157 |
| M10x1.25 | 10.0 | 1.25 | 10.000 | 9.188 | 9.348 | 8.647 | 8.912 | .39370 | 20.32 | .39370 | .36173 | .36803 | .34043 | .35087 |
| M10.0.75 | 10.0 | 0.75 | 10.000 | 9.513 | 9.645 | 9.188 | 9.378 | .39370 | 33.87 | .39370 | .37453 | .37972 | .36173 | .36921 |
| M12x1.75 | 12.0 | 1.75 | 12.000 | 10.863 | 11.063 | 10.106 | 10.441 | .47244 | 14.51 | .47244 | .42768 | .43555 | .39787 | .41106 |
| M12x1.5 | 12.0 | 1.50 | 12.000 | 11.026 | 11.216 | 10.376 | 10.676 | .47244 | 16.93 | .47244 | .43409 | .44157 | .40850 | .42031 |
| M12x1.25 | 12.0 | 1.25 | 12.000 | 11.188 | 11.368 | 10.647 | 10.912 | .47244 | 20.32 | .47244 | .44047 | .44756 | .41917 | .42961 |
| M12x1 | 12.0 | 1.00 | 12.000 | 11.350 | 11.510 | 10.917 | 11.153 | .47244 | 25.40 | .47244 | .44685 | .45315 | .42980 | .43909 |
| M14x2 | 14.0 | 2.00 | 14.000 | 12.701 | 12.913 | 11.835 | 12.210 | .55118 | 12.70 | .55118 | .50004 | .50839 | .46594 | .48071 |
| M14x1.5 | 14.0 | 1.50 | 14.000 | 13.026 | 13.216 | 12.376 | 12.676 | .55118 | 16.93 | .55118 | .51283 | .52031 | .48724 | .49906 |
| M15x1 | 15.0 | 1.00 | 15.000 | 14.350 | 14.510 | 13.917 | 14.153 | .59055 | 25.40 | .59055 | .56496 | .57126 | .54791 | .55720 |
| M16x2 | 16.0 | 2.00 | 16.000 | 14.701 | 14.913 | 13.835 | 14.210 | .62992 | 12.70 | .62992 | .57878 | .58713 | .54469 | .55945 |
| M16x1.5 | 16.0 | 1.50 | 16.000 | 15.026 | 15.216 | 14.376 | 14.676 | .62992 | 16.93 | .62992 | .59157 | .59906 | .56598 | .57780 |
| M17x1 | 17.0 | 1.00 | 17.000 | 16.350 | 16.510 | 15.917 | 16.153 | .66929 | 25.40 | .66929 | .64370 | .65000 | .61886 | .63594 |
| M18x1.5 | 18.0 | 1.50 | 18.000 | 17.026 | 17.216 | 16.376 | 16.676 | .70866 | 16.93 | .70866 | .67031 | .67780 | .64472 | .65654 |
| M20x2.5 | 20.0 | 2.50 | 20.000 | 18.376 | 18.600 | 17.294 | 17.744 | .78740 | 10.16 | .78740 | .72346 | .73228 | .68087 | .69858 |
| M20x1.5 | 20.0 | 1.50 | 20.000 | 19.026 | 19.216 | 18.376 | 18.676 | .78740 | 16.93 | .78740 | .74906 | .75654 | .72346 | .73528 |
| M20x1 | 20.0 | 1.00 | 20.000 | 19.350 | 19.510 | 18.917 | 19.153 | .78740 | 25.40 | .78740 | .76181 | .76811 | .74476 | .75406 |
| M22x2.5 | 22.0 | 2.50 | 22.000 | 20.376 | 20.600 | 19.294 | 19.744 | .86614 | 10.16 | .86614 | .80220 | .81102 | .75961 | .77732 |
| M22x1.5 | 22.0 | 1.50 | 22.000 | 21.026 | 21.216 | 20.376 | 20.676 | .86614 | 16.93 | .86614 | .82780 | .83528 | .80220 | .81402 |
| M24x3 | 24.0 | 3.00 | 24.000 | 22.051 | 22.316 | 20.752 | 21.252 | .94488 | 8.47 | .94488 | .86815 | .87858 | .81701 | .83669 |
| M24x2 | 24.0 | 2.00 | 24.000 | 22.701 | 22.925 | 21.835 | 22.210 | .94488 | 12.70 | .94488 | .89374 | .90256 | .85965 | .87441 |
| M25x1.5 | 25.0 | 1.50 | 25.000 | 24.026 | 24.226 | 23.376 | 23.676 | .98425 | 16.93 | .98425 | .94591 | .95378 | .92031 | .93213 |
| M27x3 | 27.0 | 3.00 | 27.000 | 25.051 | 25.316 | 23.752 | 24.252 | 1.06299 | 8.47 | 1.06299 | .98626 | .99669 | .93512 | .95480 |
| M27x2 | 27.0 | 2.00 | 27.000 | 25.701 | 25.925 | 24.835 | 25.210 | 1.06299 | 12.70 | 1.06299 | 1.01185 | 1.02067 | .97776 | .99252 |
| M30x3.5 | 30.0 | 3.50 | 30.000 | 27.727 | 28.007 | 26.211 | 26.771 | 1.18110 | 7.26 | 1.18110 | 1.09161 | 1.10264 | 1.03193 | 1.05398 |
| M30x2 | 30.0 | 2.00 | 30.000 | 28.701 | 28.925 | 27.835 | 28.210 | 1.18110 | 12.70 | 1.18110 | 1.12996 | 1.13878 | 1.09587 | 1.11063 |
| M30x1.5 | 30.0 | 1.50 | 30.000 | 29.026 | 29.226 | 28.376 | 28.676 | 1.18110 | 16.93 | 1.18110 | 1.14276 | 1.15063 | 1.11717 | 1.12898 |
| M33x2 | 33.0 | 2.00 | 33.000 | 31.701 | 31.925 | 30.835 | 31.210 | 1.29921 | 12.70 | 1.29921 | 1.24807 | 1.25689 | 1.21398 | 1.22874 |
| M35x1.5 | 35.0 | 1.50 | 35.000 | 34.026 | 34.226 | 33.376 | 33.676 | 1.37795 | 16.93 | 1.37795 | 1.33961 | 1.34748 | 1.31402 | 1.32559 |
| M36x4 | 36.0 | 4.00 | 36.000 | 33.402 | 33.702 | 31.670 | 32.270 | 1.41732 | 6.35 | 1.41732 | 1.31504 | 1.32685 | 1.24685 | 1.27047 |
| M36x2 | 36.0 | 2.00 | 36.000 | 34.701 | 34.925 | 33.835 | 34.210 | 1.41732 | 12.70 | 1.41732 | 1.36618 | 1.37500 | 1.33209 | 1.34685 |
| M39x2 | 39.0 | 2.00 | 39.000 | 37.701 | 37.925 | 36.835 | 37.210 | 1.53543 | 12.70 | 1.53543 | 1.48429 | 1.49311 | 1.45020 | 1.46496 |

# METRIC DIAMETER CHART

| NOMINAL SIZE | AMERICAN NATIONAL | | | UNIFIED | | | | NOMINAL SIZE | AMERICAN NATIONAL | | | UNIFIED | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GO CL. 2 & 3 | NO GO | | GO | | NO GO | | | GO CL. 2 & 3 | NO GO | | GO | | NO GO | |
| | | CL. 2 | CL. 3 | CL. 3A | CL. 2A | CL. 2A | CL. 3A | | | CL. 2 | CL. 3 | CL. 3A | CL. 2A | CL. 2A | CL. 3A |
| #0-80 NF, UNF | .0519 | .0502 | .0506 | .0519 | .0514 | .0496 | .0506 | 9/16-24 NEF, UNEF | .5354 | .5314 | .5326 | .5354 | .5342 | .5303 | .5325 |
| #1-64 NC, UNC | .0629 | .0610 | .0615 | .0629 | .0623 | .0603 | .0614 | 5/8- 11 NC, UNC | .5660 | .5601 | .5618 | .5660 | .5644 | .5589 | .5619 |
| #1-72 NF, UNF | .0640 | .0622 | .0627 | .0640 | .0634 | .0615 | .0626 | 5/8-18 NF, UNF | .5889 | .5848 | .5859 | .5889 | .5875 | .5828 | .5854 |
| #2-56 NC, UNC | .0744 | .0724 | .0729 | .0744 | .0738 | .0717 | .0728 | 5/8-24 NEF, UNEF | .5979 | .5938 | .5950 | .5979 | .5967 | .5927 | .5949 |
| #2-64 NF, UNF | .0759 | .0740 | .0745 | .0759 | .0753 | .0733 | .0744 | 11/16-24 NEF, UNEF | .6604 | .6563 | .6575 | .6604 | .6592 | .6552 | .6574 |
| #3-48 NC, UNC | .0855 | .0833 | .0839 | .0855 | .0848 | .0825 | .0838 | 3/4-10 NC, UNC | .6850 | .6786 | .6805 | .6850 | .6832 | .6773 | .6806 |
| #3-56 NF, UNF | .0874 | .0854 | .0859 | .0874 | .0867 | .0845 | .0858 | 3/4-16 NF, UNF | .7094 | .7049 | .7062 | .7094 | .7079 | .7029 | .7056 |
| #4-40 NC, UNC | .0958 | .0934 | .0941 | .0958 | .0950 | .0925 | .0939 | 3/4-20 NEF, UNEF | .7175 | .7129 | .7143 | .7175 | .7162 | .7118 | .7142 |
| #4-48 NF, UNF | .0985 | .0963 | .0969 | .0985 | .0978 | .0954 | .0967 | 13/16-20 NEF, UNEF | .7800 | .7754 | .7768 | .7800 | .7787 | .7743 | .7767 |
| #5-40 NC, UNC | .1088 | .1064 | .1071 | .1088 | .1080 | .1054 | .1069 | 7/8-9 NC, UNC | .8028 | .7958 | .7979 | .8028 | .8009 | .7946 | .7981 |
| #5-44 NF, UNF | .1102 | .1079 | .1086 | .1102 | .1095 | .1070 | .1083 | 7/8-14 NF, UNF | .8286 | .8237 | .8250 | .8286 | .8270 | .8216 | .8245 |
| #6-32 NC, UNC | .1177 | .1150 | .1158 | .1177 | .1169 | .1141 | .1156 | 7/8-20 NEF, UNEF | .8425 | .8378 | .8392 | .8425 | .8412 | .8368 | .8392 |
| #6-40 NF, UNF | .1218 | .1194 | .1201 | .1218 | .1210 | .1184 | .1198 | 15/16-20 NEF, UNEF | .9050 | .9003 | .9017 | .9050 | .9036 | .8991 | .9016 |
| #8-32 NC, UNC | .1437 | .1410 | .1418 | .1437 | .1428 | .1399 | .1415 | 1"-8 NC, UNC | .9188 | .9112 | .9134 | .9188 | .9168 | .9100 | .9137 |
| #8-36 NF, UNF | .1460 | .1435 | .1442 | .1460 | .1452 | .1424 | .1439 | 1"-12 N, UNF | .9459 | .9403 | .9419 | .9459 | .9441 | .9382 | .9415 |
| #10-24 NC, UNC | .1629 | .1596 | .1605 | .1629 | .1619 | .1586 | .1604 | 1"-14 NS, UNS | .9536 | .9487 | .9500 | .9536 | .9519 | .9463 | .9494 |
| #10-32 NF, UNF | .1697 | .1670 | .1678 | .1697 | .1688 | .1658 | .1674 | 1"-20 NEF, UNEF | .9675 | .9627 | .9641 | .9675 | .9661 | .9616 | .9641 |
| #12-24 NC, UNC | .1889 | .1856 | .1865 | .1889 | .1879 | .1845 | .1863 | 1 1/16-12 N, UN | 1.0084 | 1.0028 | 1.0044 | 1.0084 | 1.0067 | 1.0010 | 1.0042 |
| #12-28 NF, UNF | .1928 | .1897 | .1906 | .1928 | .1918 | .1886 | .1904 | 1 1/16-18 NEF, UNEF | 1.0264 | 1.0213 | 1.0228 | 1.0264 | 1.0250 | 1.0203 | 1.0228 |
| #12-32 NEF, UNEF | .1957 | .1926 | .1935 | .1957 | .1948 | .1917 | .1933 | 1 1/8-7 NC, UNC | 1.0322 | 1.0237 | 1.0263 | 1.0322 | 1.0300 | 1.0228 | 1.0268 |
| 1/4-20 NC, UNC | .2175 | .2139 | .2149 | .2175 | .2164 | .2127 | .2147 | 1 1/8-12 NF, UNF | 1.0709 | 1.0653 | 1.0669 | 1.0709 | 1.0691 | 1.0631 | 1.0664 |
| 1/4-28 NF, UNF | .2268 | .2237 | .2246 | .2268 | .2258 | .2225 | .2243 | 1 1/8-18 NEF, UNEF | 1.0889 | 1.0837 | 1.0853 | 1.0889 | 1.0875 | 1.0828 | 1.0853 |
| 1/4-32 NEF, UNEF | .2297 | .2265 | .2275 | .2297 | .2287 | .2255 | .2273 | 1 3/16-12 N, UN | 1.1334 | 1.1278 | 1.1294 | 1.1334 | 1.1317 | 1.1259 | 1.1291 |
| 5/16-18 NC, UNC | .2764 | .2723 | .2734 | .2764 | .2752 | .2712 | .2734 | 1 1/16-18 NEF, UNEF | 1.1514 | 1.1462 | 1.1478 | 1.1514 | 1.1499 | 1.1450 | 1.1478 |
| 5/16-24 NF, UNF | .2854 | .2821 | .2830 | .2854 | .2843 | .2806 | .2827 | 1 1/4-7 NC, UNC | 1.1572 | 1.1487 | 1.1513 | 1.1572 | 1.1550 | 1.1476 | 1.1517 |
| 5/16-32 NEF, UNEF | .2922 | .2889 | .2899 | .2922 | .2912 | .2880 | .2898 | 1 1/4-12 NF, UNF | 1.1959 | 1.1903 | 1.1919 | 1.1959 | 1.1941 | 1.1879 | 1.1913 |
| 3/8-16 NC, UNC | .3344 | .3299 | .3312 | .3344 | .3331 | .3287 | .3311 | 1 1/4-18 NEF, UNEF | 1.2139 | 1.2086 | 1.2102 | 1.2139 | 1.2124 | 1.2075 | 1.2103 |
| 3/8-24 NF, UNF | .3479 | .3446 | .3455 | .3479 | .3468 | .3430 | .3450 | 1 5/16-12 N, UN | 1.2584 | 1.2528 | 1.2544 | 1.2584 | 1.2567 | 1.2509 | 1.2541 |
| 3/8-32 NEF, UNEF | .3547 | .3513 | .3523 | .3547 | .3537 | .3503 | .3522 | 1 5/16-18 NEF, UNEF | 1.2764 | 1.2711 | 1.2727 | 1.2764 | 1.2749 | 1.2700 | 1.2728 |
| 7/16-14 NC, UNC | .3911 | .3862 | .3875 | .3911 | .3897 | .3850 | .3876 | 1 3/8-6 NC, UNC | 1.2667 | 1.2566 | 1.2596 | 1.2667 | 1.2643 | 1.2563 | 1.2607 |
| 7/16-20 NF, UNF | .4050 | .4014 | .4024 | .4050 | .4037 | .3995 | .4019 | 1 3/8-12 NF, UNF | 1.3209 | 1.3153 | 1.3169 | 1.3209 | 1.3190 | 1.3127 | 1.3162 |
| 7/16-28 NEF, UNEF | .4143 | .4107 | .4118 | .4143 | .4132 | .4096 | .4116 | 1 3/8-18 NEF, UNEF | 1.3389 | 1.3335 | 1.3351 | 1.3389 | 1.3374 | 1.3325 | 1.3353 |
| 1/2-12 N, UN | .4459 | .4403 | .4419 | .4459 | .4443 | .4389 | .4419 | 1 7/16-12 N, UN | 1.3834 | 1.3778 | 1.3794 | 1.3834 | 1.3816 | 1.3757 | 1.3790 |
| 1/2-13 NC, UNC | .4500 | .4448 | .4463 | .4500 | .4485 | .4435 | .4463 | 1 7/16-18 NEF, UNEF | 1.4014 | 1.3960 | 1.3976 | 1.4014 | 1.3999 | 1.3949 | 1.3977 |
| 1/2-20 NF, UNF | .4675 | .4639 | .4649 | .4675 | .4662 | .4619 | .4643 | 1 1/2-6 NC, UNC | 1.3917 | 1.3816 | 1.3846 | 1.3917 | 1.3893 | 1.3812 | 1.3856 |
| 1/2-28 NEF, UNEF | .4768 | .4731 | .4742 | .4768 | .4757 | .4720 | .4740 | 1 1/2-12 NF, UNF | 1.4459 | 1.4403 | 1.4419 | 1.4459 | 1.4440 | 1.4376 | 1.4411 |
| 9/16-12 NC, UNC | .5084 | .5028 | .5044 | .5084 | .5068 | .5016 | .5045 | 1 1/2-18 NEF, UNEF | 1.4639 | 1.4584 | 1.4601 | 1.4639 | 1.4624 | 1.4574 | 1.4602 |
| 9/16-18 NF, UNF | .5264 | .5223 | .5234 | .5264 | .5250 | .5205 | .5230 | Above taken from Fed. Std. H-28-1957, Part 1 / ANSI B1.1-1997 | | | | | | | |

# METRIC DIAMETER CHART

| NOMINAL SIZE | GO BASIC ALL CLASSES ALL SERIES | NO GO | | | | NOMINAL SIZE | GO BASIC ALL CLASSES ALL SERIES | NO GO | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AMERICAN NATIONAL | | UNIFIED | | | | AMERICAN NATIONAL | | UNIFIED | |
| | | CL. 2 | CL. 3 | CL. 2B | CL. 3B | | | CL. 2 | CL. 3 | CL. 2B | CL. 3B |
| #0-80 NF, UNF | .0519 | .0536 | .0532 | .0542 | .0536 | 9/16-24 NEF, UNEF | .5354 | .5394 | .5382 | .5405 | .5392 |
| #1-64 NC, UNC | .0629 | .0648 | .0643 | .0655 | .0648 | 5/8-11 NC, UNC | .5660 | .5719 | .5702 | .5732 | .5714 |
| #1-72 NF, UNF | .0640 | .0658 | .0653 | .0665 | .0659 | 5/8-18 NF, UNF | .5889 | .5930 | .5919 | .5949 | .5934 |
| #2-56 NC, UNC | .0744 | .0764 | .0759 | .0772 | .0765 | 5/8-24 NEF, UNEF | .5979 | .6020 | .6008 | .6031 | .6018 |
| #2-64 NF, UNF | .0759 | .0778 | .0773 | .0786 | .0779 | 11/16-24 NEF, UNEF | .6604 | .6645 | .6633 | .6656 | .6643 |
| #3-48 NC, UNC | .0855 | .0877 | .0871 | .0885 | .0877 | 3/4-10 NC, UNC | .6850 | .6914 | .6895 | .6927 | .6907 |
| #3-56 NF, UNF | .0874 | .0894 | .0889 | .0902 | .0895 | 3/4-16 NF, UNF | .7094 | .7139 | .7126 | .7159 | .7143 |
| #4-40 NC, UNC | .0958 | .0982 | .0975 | .0991 | .0982 | 3/4-20 NEF, UNEF | .7175 | .7221 | .7207 | .7232 | .7218 |
| #4-48 NF, UNF | .0985 | .1007 | .1001 | .1016 | .1008 | 13/16-20 NEF, UNEF | .7800 | .7846 | .7832 | .7857 | .7843 |
| #5-40 NC, UNC | .1088 | .1112 | .1105 | .1121 | .1113 | 7/8-9 NC, UNC | .8028 | .8098 | .8077 | .8110 | .8089 |
| #5-44 NF, UNF | .1102 | .1125 | .1118 | .1134 | .1126 | 7/8-14 NF, UNF | .8286 | .8335 | .8322 | .8356 | .8339 |
| #6-32 NC, UNC | .1177 | .1204 | .1196 | .1214 | .1204 | 7/8-20 NEF, UNEF | .8425 | .8472 | .8458 | .8482 | .8468 |
| #6-40 NF, UNF | .1218 | .1242 | .1235 | .1252 | .1243 | 15/16-20 NEF, UNEF | .9050 | .9097 | .9083 | .9109 | .9094 |
| #8-32 NC, UNC | .1437 | .1464 | .1456 | .1475 | .1465 | 1"-8 NC, UNC | .9188 | .9264 | .9242 | .9276 | .9254 |
| #8-36 NF, UNF | .1460 | .1485 | .1478 | .1496 | .1487 | 1"-12 N, UNF | .9459 | .9515 | .9499 | .9535 | .9516 |
| #10-24 NC, UNC | .1629 | .1662 | .1653 | .1672 | .1661 | 1"-14 NS, UNS | .9536 | .9585 | .9572 | .9609 | .9590 |
| #10-32 NF, UNF | .1697 | .1724 | .1716 | .1736 | .1726 | 1"-20 NEF, UNEF | .9675 | .9723 | .9709 | .9734 | .9719 |
| #12-24 NC, UNC | .1889 | .1922 | .1913 | .1933 | .1922 | 1 1/16-12 N, UN | 1.0084 | 1.0140 | 1.0124 | 1.0158 | 1.0139 |
| #12-28 NF, UNF | .1928 | .1959 | .1950 | .1970 | .1959 | 1 1/16-18 NEF, UNEF | 1.0264 | 1.0315 | 1.0300 | 1.0326 | 1.0310 |
| #12-32 NEF, UNEF | .1957 | .1988 | .1979 | .1998 | .1988 | 1 1/8-7 NC, UNC | 1.0322 | 1.0407 | 1.0381 | 1.0416 | 1.0393 |
| 1/4-20 NC, UNC | .2175 | .2211 | .2201 | .2224 | .2211 | 1 1/8-12 NF, UNF | 1.0709 | 1.0765 | 1.0749 | 1.0787 | 1.0768 |
| 1/4-28 NF, UNF | .2268 | .2299 | .2290 | .2311 | .2300 | 1 1/8-18 NEF, UNEF | 1.0889 | 1.0941 | 1.0925 | 1.0951 | 1.0935 |
| 1/4-32 NEF, UNEF | .2297 | .2329 | .2319 | .2339 | .2328 | 1 3/16-12 N, UN | 1.1334 | 1.1390 | 1.1374 | 1.1409 | 1.1390 |
| 5/16-18 NC, UNC | .2764 | .2805 | .2794 | .2817 | .2803 | 1 3/16-18 NEF, UNEF | 1.1514 | 1.1566 | 1.1550 | 1.1577 | 1.1561 |
| 5/16-24 NF, UNF | .2854 | .2887 | .2878 | .2902 | .2890 | 1 1/4-7 NC, UNC | 1.1572 | 1.1657 | 1.1631 | 1.1668 | 1.1644 |
| 5/16-32 NEF, UNEF | .2922 | .2955 | .2945 | .2964 | .2953 | 1 1/4-12 NF, UNF | 1.1959 | 1.2015 | 1.1999 | 1.2039 | 1.2019 |
| 3/8-16 NC, UNC | .3344 | .3389 | .3376 | .3401 | .3387 | 1 1/4-18 NEF, UNEF | 1.2139 | 1.2192 | 1.2176 | 1.2202 | 1.2186 |
| 3/8-24 NF, UNF | .3479 | .3512 | .3503 | .3528 | .3516 | 1 5/16-12 N, UN | 1.2584 | 1.2640 | 1.2624 | 1.2659 | 1.2640 |
| 3/8-32 NEF, UNEF | .3547 | .3581 | .3571 | .3591 | .3580 | 1 5/16-18 NEF, UNEF | 1.2764 | 1.2817 | 1.2801 | 1.2827 | 1.2811 |
| 7/16-14 NC, UNC | .3911 | .3960 | .3947 | .3972 | .3957 | 1 3/8-6 NC, UNC | 1.2667 | 1.2768 | 1.2738 | 1.2771 | 1.2745 |
| 7/16-20 NF, UNF | .4050 | .4086 | .4076 | .4104 | .4091 | 1 3/8-12 NF, UNF | 1.3209 | 1.3265 | 1.3249 | 1.3291 | 1.3270 |
| 7/16-28 NEF, UNEF | .4143 | .4179 | .4168 | .4189 | .4178 | 1 3/8-18 NEF, UNEF | 1.3389 | 1.3443 | 1.3427 | 1.3452 | 1.3436 |
| 1/2-12 N, UN | .4459 | .4515 | .4499 | .4529 | .4511 | 1 7/16-12 N, UN | 1.3834 | 1.3890 | 1.3874 | 1.3910 | 1.3891 |
| 1/2-13 NC, UNC | .4500 | .4552 | .4537 | .4565 | .4548 | 1 7/16-18 NEF, UNEF | 1.4014 | 1.4068 | 1.4052 | 1.4079 | 1.4062 |
| 1/2-20 NF, UNF | .4675 | .4711 | .4701 | .4731 | .4717 | 1 1/2-6 NC, UNC | 1.3917 | 1.4018 | 1.3988 | 1.4022 | 1.3996 |
| 1/2-28 NEF, UNEF | .4768 | .4805 | .4794 | .4816 | .4804 | 1 1/2-12 NF, UNF | 1.4459 | 1.4515 | 1.4499 | 1.4542 | 1.4522 |
| 9/16-12 NC, UNC | .5084 | .5140 | .5124 | .5152 | .5135 | 1 1/2-18 NEF, UNEF | 1.4639 | 1.4694 | 1.4677 | 1.4704 | 1.4687 |
| 9/16-18 NF, UNF | .5264 | .5305 | .5294 | .5323 | .5308 | Above taken from Fed. Std. H-28-1957, Part 1 / ANSI B1.1-1997 | | | | | |

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