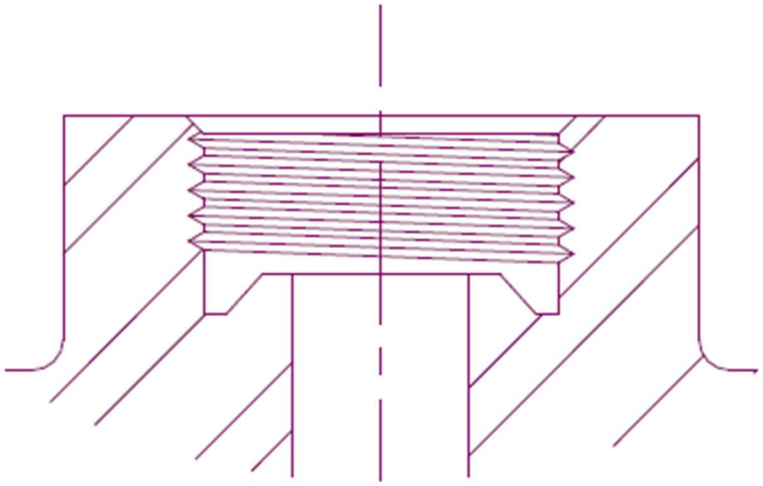
HEMCO
The Longer Lasting Gage

www.hemcogages.com | 616-396-4604
455 Douglas Ave, Holland, MI 49424 USA

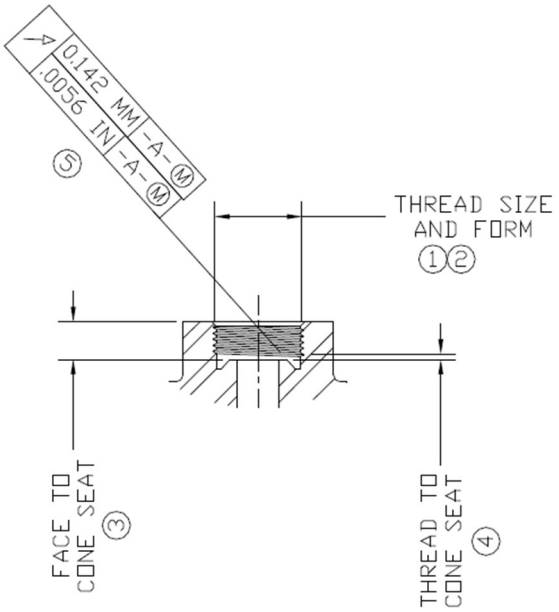
GAGES & GAGING FOR INVERTED FLARED TYPE FITTING

SAE J512 REV. APR97
AUTOMOTIVE TUBE FITTING



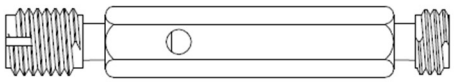
SECTION 1: SUGGESTED GAGING FOR INVERTED FLARED FITTING

THREAD SIZE			
NOMINAL TUBE DIAMETER	NOMINAL THREAD SIZE CLASS 2B	NOMINAL TUBE DIAMETER	NOMINAL THREAD SIZE CLASS 2B
1/8	5/16-28	3/8	5/8-18
3/16	3/8-24	7/16	11/16-18
1/4	7/16-24	1/2	3/4-18
5/16	½-20	5/8	7/8-18
		3/4	1-1/16-16



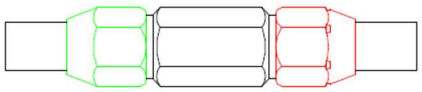
1:1 Gage 1 - "B" Functional Thread Size

- **Feature Checked** - The internal thread's functional size which is manufactured in accordance with ANSI B1.1. (Reference SAE J512 Table 6 Column B)
- **Gaging Method** - Standard Go / NoGo Class 2B thread plug gage manufactured in accordance with ANSI B1.2.
- **Product Acceptance** - The product is considered acceptable when the Go gage member enters freely and the NoGo gage member does not.



1:2 Gage 2 -"B" Thread Minor Diameter

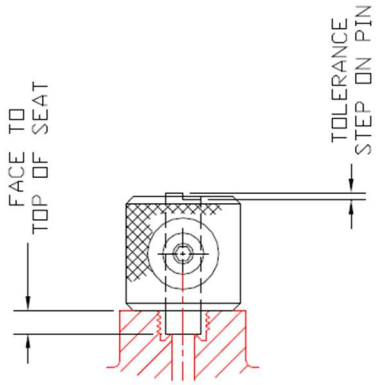
- **Feature Checked** - The internal threads minor diameter manufactured in accordance with ANSI B1.1, Copper Alloy fittings are manufactured to Class 3B tolerances, Steel fittings are manufactured to Class 2B tolerances. (Reference SAE J512 Table 6 Column B)
- **Gaging Method** - Go / NoGo Class Z cylindrical plug gage.
- **Product Acceptance** - The product is considered within tolerance when the Go Gage enters freely and the NoGo member does not.



www.hemcogages.com | 616-396-4604
455 Douglas Ave, Holland, MI 49424 USA

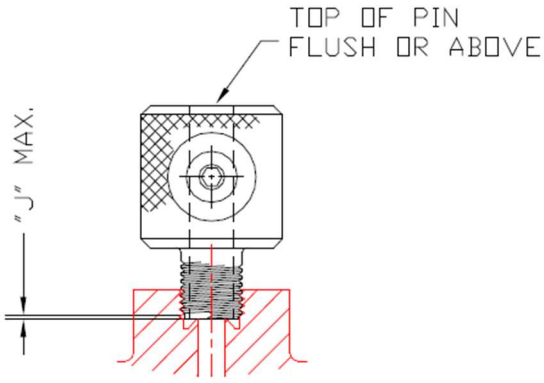
1:3 Gage 3 - "K" Face of Part to Top of Seat

- **Feature Checked** - The distance of the product's face to the top of the cone seat face which is controlled within a tolerance of +0.25/-0.13mm. (Reference SAE J512 Table 6 Column K)
- **Gaging Method** - A basic Flushpin Gage with a step on the pin representing the minimum and maximum limits of the part tolerance.
- **Product Acceptance** - Place the Flushpin Gage on the product's face with the pin contacting the top of the cone seat face. The product will be considered within tolerance when the maximum step on the pin is above the face of the barrel and the minimum step on the pin is below the face of the barrel.



1:4 Gage 4 - "J" Thread Depth Maximum to Top of Seat

- **Feature Checked** - The maximum distance of the full thread depth to the top of the cone seat face. (Reference SAE J512 Table 6 Column J)
- **Gaging Method** - A special threaded Flushpin with the face of the pin representing the maximum distance allowed.
- **Product Acceptance** - Turn the threaded Flushpin Gage into the product until it stops at the full depth of the complete thread. With the pin resting on the top of the cone seat face, the top of the pin must be flush or protruding from the barrel for the product to be considered within tolerance.



1:5 Gage 5 - Run out of Tapered Seat to Internal Thread

- **Feature Checked** - The total run out of the cone seat to the internal thread which is allowed 0.127mm.
- **Gaging Method** - An indicating gage which locates on the internal threads and has a stylus which, when rotated, sweeps the entire tapered cone seat diameter indicating total run out.
- **Product Acceptance** – General operating procedure.

    1. Assure the Gage and the fitting are clean. The threaded end of the indicating gage shall be assembled into the fitting as far as the thread will permit. Do not over tighten.

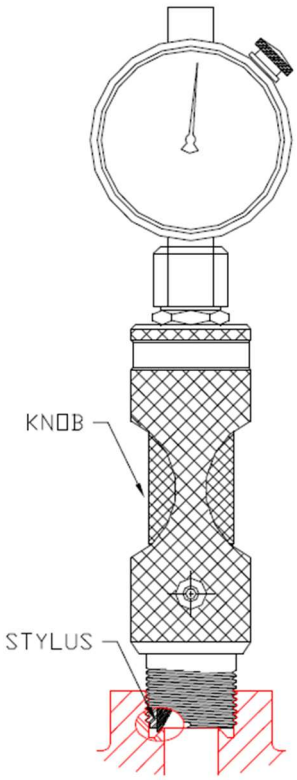
www.hemcogages.com | 616-396-4604
455 Douglas Ave, Holland, MI 49424 USA

2. The indicator gage shall then be zeroed. Slowly rotate the stylus through a complete 360 degree rotation by twisting the knurled collar through the finger notches in the gage body, while observing the total indicator movement.

3. The total indicator movement throughout the rotation of the stylus shall be read and recorded. The indicator reading shall not exceed a total movement of plus or minus 0.142mm for the fitting to be deemed acceptable.

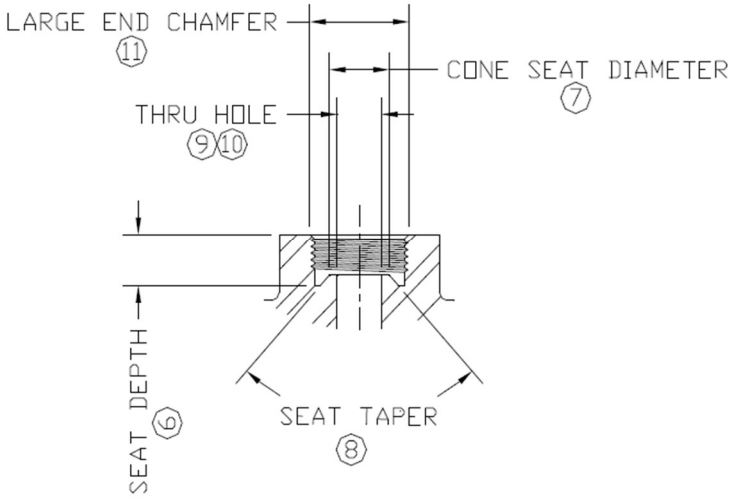
   The measured deviation is in a plane perpendicular to the plane of the cone seat. The true concentricity variation therefore, may be determined from the following table or by multiplying the dial indicator reading by the tangent of 42 degrees or .9004.

CONE SEAT CONCENTRICITY			
DIAL READING MM	CONCENTRICITY MM	DIAL READING INCH	CONCENTRICITY INCH
0.01	0.009	.0005	.00045
0.02	0.018	.0010	.00090
0.03	0.027	.0015	.00135
0.04	0.036	.0020	.00180
0.05	0.045	.0025	.00225
0.06	0.054	.0030	.00270
0.07	0.063	.0035	.00315
0.08	0.072	.0040	.00360
0.09	0.081	.0045	.00405
0.10	0.090	.0050	.00450
0.11	0.099	.0055	.00495
0.12	0.108	.0060	.00540
0.13	0.117	.0065	.00585
0.14	0.126	.0075	.00675
0.15	0.135	.0080	.00720
0.16	0.144	.0085	.00765
0.17	0.153	.0090	.00810
0.18	0.162	.0095	.00855
0.19	0.171	.0100	.00900
0.20	0.180	.0150	.01350



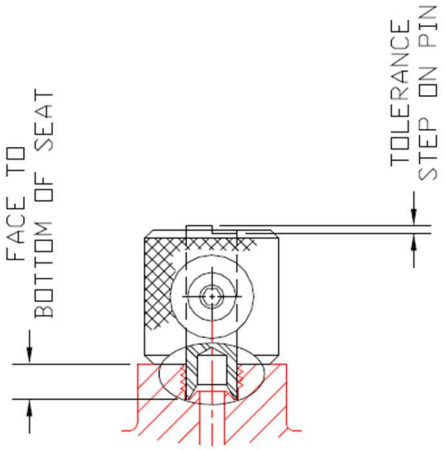
www.hemcogages.com | 616-396-4604
455 Douglas Ave, Holland, MI 49424 USA

SECTION 2: ADDITIONAL GAGING FOR OPTIONAL INVERTED FLARED FITTING



2:1 Gage 6 - "I" Face of Part to Bottom of Seat

- **Feature Checked** - The distance from the products face to the bottom of the cone seat, which is controlled within a tolerance of +0.25/-0.13mm (Reference SAE J512 Table 6 Column I).
- **Gaging Method** - A basic Flushpin gage with the bottom of the pin relieved to clear the cone seat, and having a step on the top of the pin representing the minimum and maximum limits of the part tolerance.
- **Product Acceptance** - Place the Flushpin gage on the product's face with the pin contacting the face at the bottom of the cone seat. The product will be considered within tolerance when the maximum step on the pin is above the face of the barrel and the minimum step on the pin is below the barrel's face.



2:2 Gage 7 - "E" Cone Seat Diameter

- **Feature Checked** - Diameter at the cone seat face (Reference SAE J512 Table 6 Column E)
- **Gaging Method** – Utilizes Indicating Gage #1 of a two gage set and a setting master. The indicating gage #1 has a controlled internal bore sized to locate near the cone seat taper's small end face, and utilizes an indicator to measure the distance of this established datum diameter to the cone seat face.

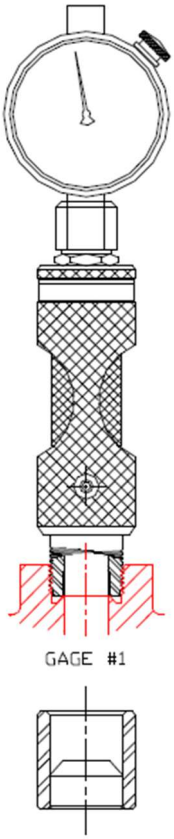
- **Product Acceptance** - General Operating Procedure:

  1. Assuring that both the indicating gage and its setting master are clean, insert the indicting gage into the setting master and zero the indicator.

  2. The threaded end of the indicating gage shall be assembled into the fitting until the gage's internal bore contacts the tapered seat. Do not over tighten.

  3. The indicator reading shall not exceed a total movement of plus or minus 0.028mm. The measured deviation is in a plane perpendicular to the plane of the cone seat. The true diameter variation may be determined from the following table or by multiplying the dial indicator reading by the tangent of 42 degrees X 2, or 1.800. Record the reading as a + or - deviation.

CONE SEAT DIAMETER			
DIAL READING MM	CONE DIAMETER MM	DIAL READING INCH	CONE DIAMETER INCH
-0.036	+0.065	-.0016	+.00288
-0.032	+0.058	-.0014	+.00252
-0.028	+0.050	-.0012	+.00216
-0.024	+0.043	-.0011	+.00198
-0.020	+0.036	-.0010	+.00180
-0.016	+0.029	-.0008	+.00144
-0.012	+0.022	-.0006	+.00108
-0.008	+0.014	-.0004	+.00072
-0.004	+0.007	-.0002	+.00036
0.000	0.000	.0000	.00000
+0.004	-0.007	+.0002	-.00036
+0.008	-0.014	+.0004	-.00072
+0.012	-0.022	+.0006	-.00108
+0.016	-0.029	+.0008	-.00144
+0.020	-0.036	+.0010	-.00180
+0.024	-0.043	+.0011	-.00198
+0.028	-0.050	+.0012	-.00216
+0.032	-0.058	+.0014	-.00252
+0.036	-0.065	+.0016	-.00288



2:3 Gage 8 - 42 Degree +/- 1 Degree Cone Taper

- **Feature Checked** - 42 degree +/- 1 degree cone seat angle. (Reference SAE J512 Figure 5A -7D)

- **Gaging Method** - Utilizes Indicating Gage #2 of a two-gage set and a setting master. Indicating Gage #2 has a controlled internal bore sized to locate near the cone seat taper's large end and utilizes an indicator to measure the distance of this established datum diameter to the cone seat face. A difference in readings taken from Gage #1 and Gage #2 determines the actual taper.
- **Product Acceptance** - The gaging of the cone seat taper utilizes comparative readings of a 2-gage set and its setting master. Gage 1 is an indicating gage with a threaded barrel having an internal bore controlled to contact approximately 0.25mm (.010") from the top of the cone seat face. Gage 2 is an indicating gage with a threaded barrel having an internal bore controlled to contact approximately 1.27mm (.050") from the top of the cone seat face.

  If the differential reading in the two gages falls within the limits specified on the provided chart, the product's cone taper is deemed acceptable.

- **General Operating Procedure**:

  1. Assuring that both of the indicating gages and the setting master are clean, insert the indicting gage into the setting master and zero the indicator.

  2. The threaded end of the indicating gage #1 shall be assembled into the fitting until the gage's internal bore contacts the tapered seat. Do not over tighten.

  3. Record the actual indicator reading as a + or - reading.

  4. The threaded end of the indicating gage #2 shall be assembled into the fitting until the gage's internal bore contacts the tapered seat. Do not over tighten.

  5. Record the actual indicator reading as a + or - reading.

  6. Calculate the total difference in indicator readings between Gage #1 and #2 and use the table below to determine the true taper variation.

CONE SEAT TAPER			
INDICATOR DEVIATION MM	CONE TAPER DEGREE	INDICATOR DEVIATION INCH	CONE TAPER DEGREE
+0.044	43.2	+.0022	43.5
+0.040	43.1	+.0020	43.4
+0.036	43.0	+.0018	43.3
+0.032	42.9	+.0016	43.1
+0.028	42.8	+.0014	43.0
+0.024	42.7	+.0012	42.8
+0.020	42.6	+.0010	42.7
+0.016	42.4	+.0008	42.6
+0.012	42.3	+.0006	42.4
+0.008	42.2	+.0004	42.3
+0.004	42.1	+.0002	42.1
0.000	42.0	.0000	42.0

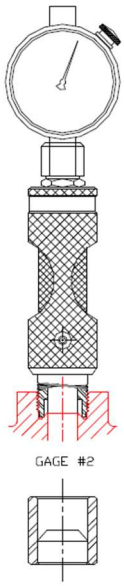
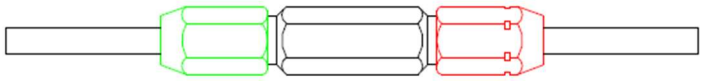


Table Continued on Next Page

CONE SEAT TAPER			
INDICATOR DEVIATION MM	CONE TAPER DEGREE	INDICATOR DEVIATION INCH	CONE TAPER DEGREE
-0.004	41.9	-.0002	41.9
-0.008	41.8	-.0004	41.7
-0.012	41.7	-.0006	41.6
-0.016	41.6	-.0008	41.4
-0.020	41.4	-.0010	41.3
-0.024	41.3	-.0012	41.2
-0.028	41.2	-.0014	41.0
-0.032	41.1	-.0016	40.9
-0.036	41.0	-.0018	40.7
-0.040	40.9	-.0020	40.6
-0.044	40.8	-.0022	40.5

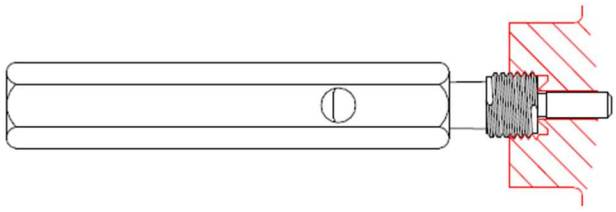
2:4 Gage 9 - "D" Thru Hole Diameter

- **Feature Checked** - Thru hole diameter (Reference SAE J512 Table 6 Column D).
- **Gaging Method** - Go / No-Go Class Z cylindrical plug gage.
  Product Acceptance - The product is considered within tolerance when the Go Gage enters freely and the No-Go member does not.



2:5 Gage 10 - Position of Thru Hole to Internal Thread

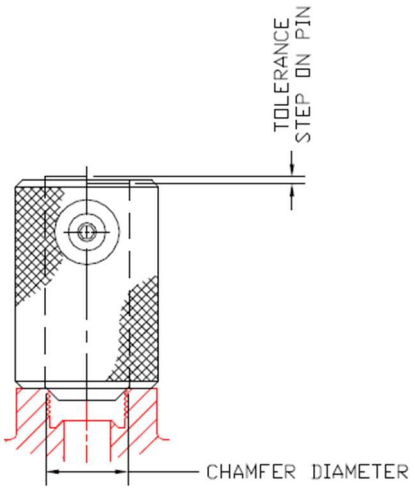
- **Feature Checked** - Position of thru hole relative to the internal thread.
- **Gaging Method** – True position gage having a threaded portion equal to the Go thread size and form, and a plain portion equal to the Go thru hole size minus the positional tolerance.
- **Product Acceptance** – The functional location of the thru hole is found to be within the product limits when the positional gage is inserted freely without interference.



www.hemcogages.com | 616-396-4604
455 Douglas Ave, Holland, MI 49424 USA

2:6 Gage 11 - “U” Large End Chamfer of Internal Thread

- **Feature Checked** – 90 degree chamfer diameter of the entrance of the internal thread. (Reference SAE J512 Table 6 Column U)
- **Gaging Method** – A chamfer type Flushpin Gage with the bottom of the pin having a 90 degree taper to match the products 90 degree taper and a step on the pin representing the minimum and maximum limits of the product tolerance.
- **Product Acceptance** - Place the Flushpin Gage on the product’s face with the pin’s chamfer contacting the chamfer of the product. The product will be considered within tolerance when the maximum step on the pin is above the face of the barrel and the minimum step on the pin is below the barrel’s face.



This article contains select information referencing the following standards, and is to be used only as a reference. The following standards should always be consulted for final manufacturing and gaging decisions.

- SAE J512 Automotive Tube Fittings.
- ANSI B1.1 UN Series threaded product.
- ANSI B1.2 UN Series gaging.