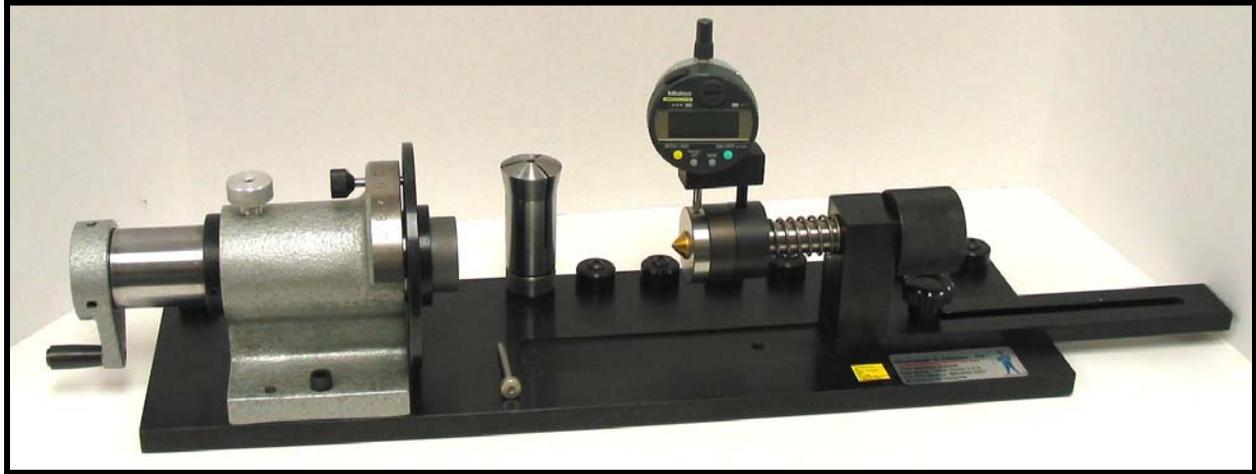
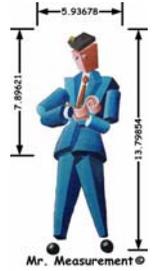




Greenslade Recess TIR Gaging® System Patent # 5,182,865



Gage Application:

The Recess TIR® Gage is designed to make the measurement of the concentricity of the screw's drive system and head O.D. to its shank fast, easy, accurate, repeatable and reproducible. This gage uses a single conical measuring element to measure the TIR® of all internal drives except slot to the screw's shank. The TIR® of slots to the screw's shank can be measured with a single "Slot Measuring Element". The TIR® of a screw's shank to an external hex head or hex washer head can be measured with "Hex Measuring Elements". In these cases a different element is required for each external hex size.

Gage R&R:

The *Gage R&R Study* results for the Recess "TIR" Gage yielded 9.23% when using the General Motors Gage R&R Procedure on #8 Type AB in accordance with ANSI/ASME B18.6.4.

Gage Size Range Capacity:

#0 through 7/8 inch (M1.5 through M20).

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Gage Standard Equipment:

- *Spindle, tail assembly, and indicator mounted on a base.
 - *Recess Measuring Element (one size covers all sizes).
 - *Eleven collets from 3/32 to 1/4 (2.4mm to 6.3mm).
- (Note: Any collet within the gage's range can be substituted).

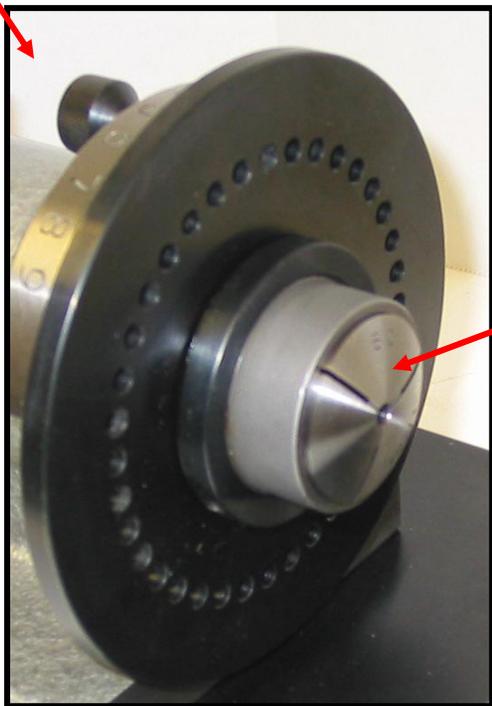
Optional Gage Accessories:

- *Slot Measuring Element (one element covers all sizes).
- *Hex Head Measuring Elements (different size for each size hex).

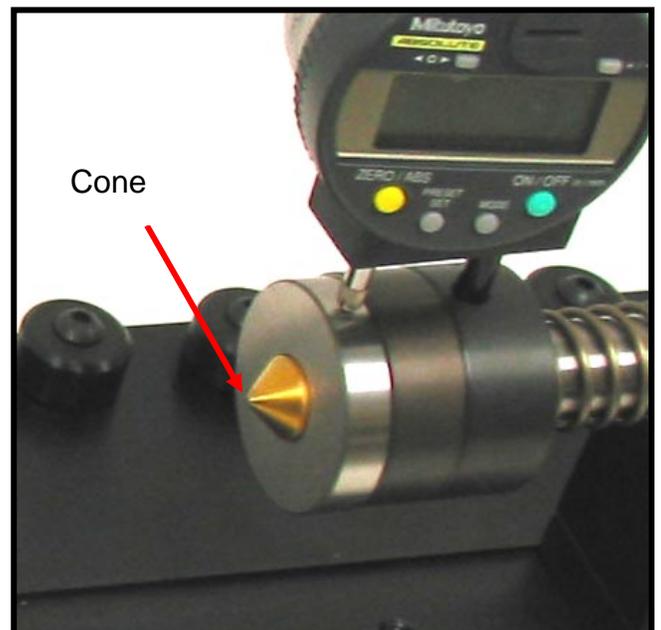
Operating Procedure for Measuring Recess TIR®:

1. Before starting the test, place a light coating of oil on the back surface of the TIR® element that contacts the tail assembly and on the cone of the element.
2. Lock the faceplate into position by sliding the lock pin through the top of the spindle.
3. Select the collet closest to the screw's size and place it in the spindle. Rotate the spindle handle counter-clockwise until the collet starts to thread into the spindle.

Lock pin



Collet



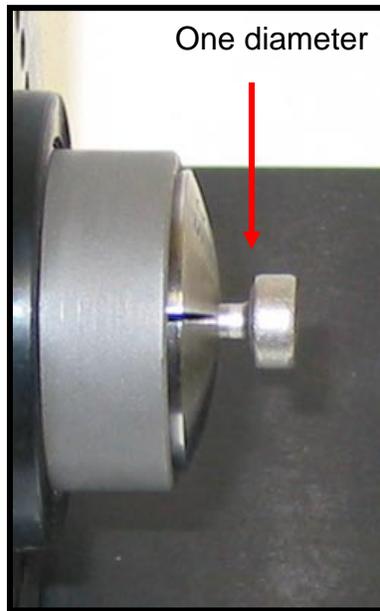
Cone

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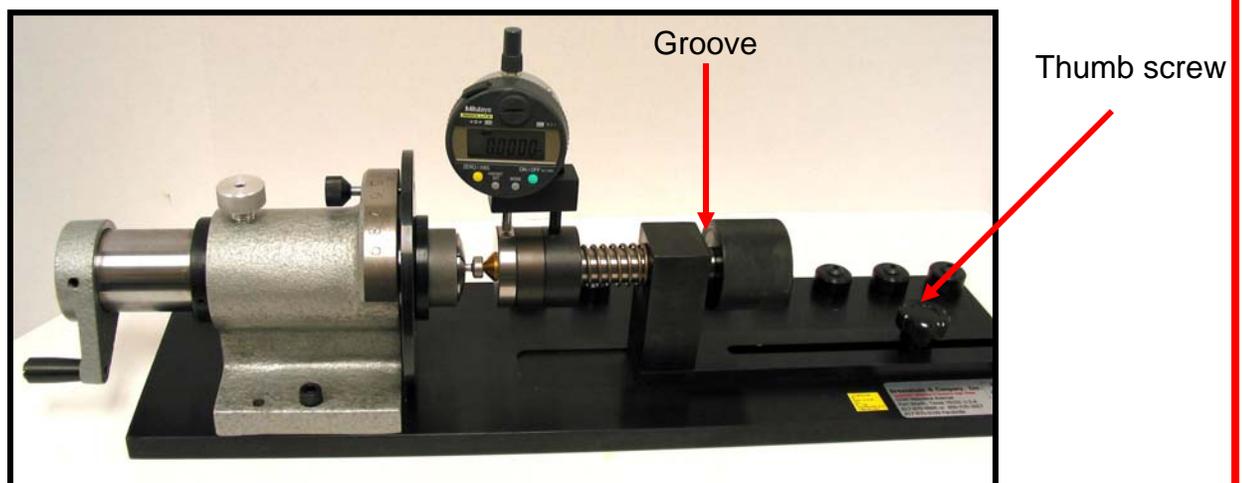
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- Place the screw into the collet so that the distance from the underside of the screw's head is approximately one body diameter's distance from the face of the collet. Rotate the spindle handle counter-clockwise until the collet is clamping the screw tightly. **(Note: If the screw has a trilobular body shape the lobes (high points) of the body must be in contact with the solid section of the collet and not in the collet's grooves!)**



- Loosen the thumb screw on the tail assembly and slide it to the left until the TIR[®] element is engaged in the screw's recess and the assembly spring is compressed so that the first of the two grooves on the assembly's shaft is visible as it protrudes out the left side of the assembly body. If you can see both lines, you have compressed the spring too far. Tighten the thumbscrew to secure its position.

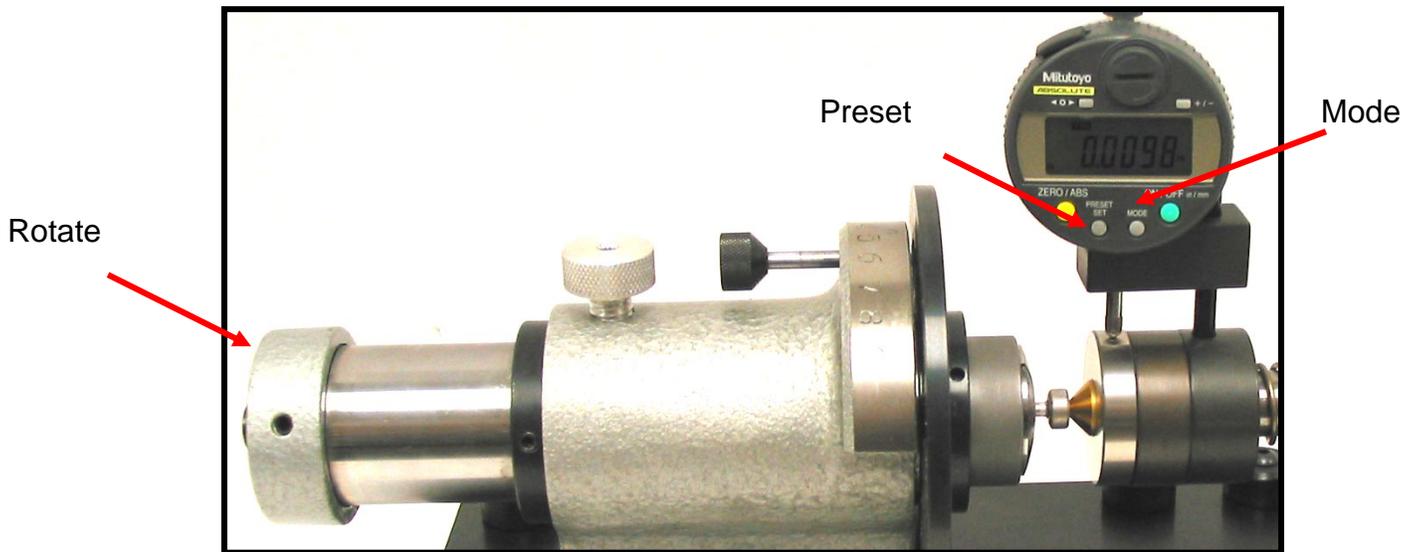


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6. Turn indicator "ON". Press "MODE" button four times until "TIR" is blinking on the display. This activates the "TIR", total indicator reading or the "FIM" full indicator movement mode. The indicator should be reading ".0000". If it is not press and release the "Preset/Set" button once quickly. (543-263)
7. Disengage the lock pin and rotate the spindle handle three times in both directions, disregarding the indicator reading. Press the "Preset/Set" button to again make the indicator read ".0000".



8. **Rotate the handle three times clockwise and three times counterclockwise and note the indicator reading.** Press the "Preset/Set" button again and repeat this procedure until you obtain the same reading two successive times. When this occurs, record the TIR[®] reading for that screw. (Note: To obtain repeatable results the procedure of rotating the spindle three times in both directions before taking a reading is absolutely essential!)
9. Loosen the thumbscrew on the tail assembly and slide it all the way to the right. Engage the lock pin and rotate the spindle handle clockwise until the collet loosens enough to remove the screw from the collet.

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Operating Procedure for Measuring Slot TIR®:

1. With the tail assembly to the far right, lift the recess element and pull it to the left. It will disengage from the tail assembly. Insert the head of the shoulder screw on the back of the "Slot Element" into the enlarged hole in the tail assembly. Allow the element to settle downward when the back of the element contacts the face of the tail assembly.
2. Follow the procedure above for selecting and installing the collet and for securing the screw into it.
3. Slide the tail assembly to the left until the "Slot Element" engages the screw's slot and the tail assembly spring is slightly compressed. Tighten the thumbscrew to secure the tail assembly into position. By grasping the "Slot Element" and the spring-loaded pad between your thumb and forefinger slide the "Slot Element" so that it is centered with the spring-loaded pad.
4. See that the indicator is in the normal reading mode. This can be assured by turning the indicator off and then on again.
5. Remove the lock pin. Rotate the spindle until the indicator point is setting on the horizontal line on the side of the "Slot Element".
6. Press the *Preset/Set* button so that "0.0000" appears on the display.
7. Grasp the "Slot Element" and pull it to the right compressing the spring until the element is no longer engaged in the screw slot. Rotate the spindle handle 180° and slowly release the "Slot Element" so that it again engages the screw's slot. Rotate the spindle until the indicator point is again setting on the line on the side of the element. The indicated reading is the TIR®.
8. Repeat steps 6 & 7 until you obtain the same reading two times in succession.

Operating Procedure for Measuring Hex Head TIR®:

1. Remove the measuring element as described previously and install the correct size "Hex Measuring Element" into the tail assembly.
2. Follow steps 2 through 9 of the *Operating Procedure for Measuring Recess TIR®*. The results obtained are the screw's *Shank to Hex TIR®*.

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Operating Procedure for Measuring Head O.D. TIR[®]:

1. Completely remove the measuring element from the tail assembly.
2. Select and install the collet and secure the screw as described in *Operating Procedure for Measuring Recess TIR[®]*.
3. Slide the tail assembly to the left and raise the indicator point to clear the outside of the screw's head. When the tail assembly is positioned so that the indicator point can rest on the outer diameter of the screw's head, secure the assembly with the thumbscrew.
4. Follow steps 6 through 9 of the *Operating Procedures for Measuring Recess TIR[®]*. The results obtained are the screw's *Shank to Head O.D. TIR[®]*.

Gage R&R Study Procedure:

1. Insert lock pin on top of spindle through faceplate to lock plate into position.
2. Select the closest collet size, which is larger than the screws to be inspected.
3. Place the collet in the spindle and rotate the spindle handle counter-clockwise until the collet starts to thread into the spindle.
4. Place a small mark at a position one body diameter from the underside of the screw's head.
5. Number the screws 1 through 10.
6. The first operator should place the first screw into the collet so that the mark on the screw is at the face of the collet and the mark is facing toward the size stamped in the face of the collet. Rotate the spindle handle counter-clockwise until the collet is clamping the screw tightly.

The lock pin can be removed and the spindle handle rotated until the size stamp is at the 12 o'clock position in the spindle. Then re-install the lock pin. Note which hole number this corresponds to on the backside of the faceplate so that the collet and screw position can be started from the same position for every test.

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7. Loosen the thumbscrew on the tail assembly on the right and slide the assembly to the left until the TIR[®] element is engaged in the screw's recess and the assembly's spring is slightly compressed. Tighten the thumbscrew to secure the tail assembly into position.

NOTE: Before starting the tests place a light coating of oil on the back surface on

the TIR[®] element that contacts the tail assembly. Also apply a light oil coating on the cone of the element with your finger or a rag.

8. Press the *ON/CLR* button once to activate the TIR[®] function.

NOTE: Be sure the TIR function is active. If not refer to *OPERATING PROCEDURES FOR RECESS TIR section #6*.

9. Disengage the lock pin and rotate the spindle handle three revolutions clockwise and then three revolutions counter-clockwise. Disregard the indicator reading and press the *Preset/Set* button again to make the indicator read "0.0000".
10. Now rotate the handle three times in each direction and note the indicator reading. Press *Preset/Set* again and repeat this procedure until you obtain the same reading two successive times. Once achieved, record the reading for that screw sample.
11. Loosen the thumbscrews on the tail assembly and slide it all the way to the right.
12. Rotate the spindle until the collet size is at the 12 o'clock position and engage the lock pin again. Rotate the spindle handle clockwise until the collet loosens enough to remove the screw from the collet.
13. Remove the screw from the collet and place the next screw in the collet and repeat steps 7 through 12 until Operator #1 has tested all ten screws.
14. Have Operator #2 use the same procedure as above for all ten screws and record all results.
15. Have Operator #1 do the entire test again and record all results.
16. Have Operator #2 do the entire test again and record all results.
17. Use these forty recorded values in the Gage R&R Study formula and calculate the results.

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