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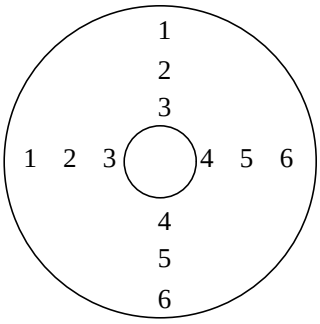
Monitoring & Measuring Plate Flatness

The Model 92031 Flatness Gauge Kit is designed to help the user maintain plate flatness by periodically taking measurements of the plate shape following processing. The gauge utilizes digital micrometer that is initially zeroed on a granite leveling plate. The gauge is then placed onto the lapping plate and a measurement taken. This provides a direct measurement of how much the plate has deviated from the zero position. Measuring various points along the lapping plate surface provides a picture of the overall shape of the lapping plate.

Figure 1: Model 92031 Flatness Gauge Kit showing the flatness gauge and granite leveling plate.



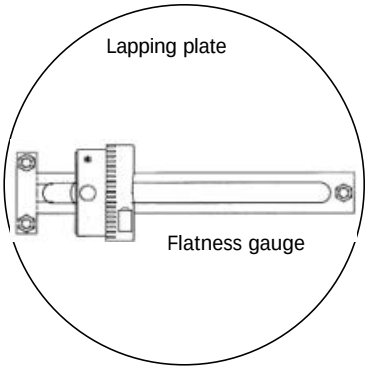


Figure 2: Schematic illustration of the locations used for measuring plate flatness (far left) and the orientation of the flatness gauge on the lapping plate during measurements.

Basic Operation

1. Using the Model 92031 Flatness Gauge Kit measure several points across the plate. A minimum of two lines of six points across the diameter of the plate is recommended. See Figure 2 for an illustration of the measurement technique.

- Fix the measurement gauge into a position along the rail.
- Place the Flatness Gauge (measurement gauge and rail) onto the granite leveling stone.
- Zero the measurement gauge.
- The granite leveling stone is used as a reference surface.
- Now place the Flatness Gauge onto the surface to be measured.
- The readout on the measurement gauge gives a numerical indicator of the measured surfaces flatness in relation to the granite leveling block. A single measurement point is not a good indicator of a surfaces flatness but multiple points along a line are better.

2. Evaluate the measurement data collected and determine which plate shape(s) are most similar. **Refer to diagram shown on the following pages for determination of plate shape.**

3. According to the plate shape observed, determine the positioning of the conditioning ring. Unless the plate is convex then usually it's best to start with the ring centered (as shown in Figure 2A). **(For copper composite plates only! its important to note that on a perfectly flat plate if a conditioning ring is centered it will cause the plate to take on a convex shape.**

4. Wet the entire lapping plate with water. Then setup a slow water drip onto the lapping plate.

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5. Set polishing machine parameters so complementary rotation direction of wheel and conditioning ring are achieved. Also, rotation speeds should be similar. If using the Model 920 the workstation rotation speed is at the maximum setting of 10 and the wheel speed is adjusted to match (usually between 1-2 dial setting).

6. Initially run the conditioning process for 5-15 minutes and then check flatness with measurement gauge. Then adjust conditioning time accordingly. Use the plate shape as a guide for plate conditioning, noting how quickly specific plate shapes change over time.

7. If the lapping plate exhibits a combination of several shapes its best to run the process with a centered conditioning ring and reducing the combination shaping until a convex shape is obtained. Once this has been achieved, then move the ring to the inside to flat the plates shape and create the desired shape. This process typically would take around 30 minutes.

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Determining Plate Flatness (Shapes)

Using the flatness gauge for measuring various points on the lapping plate and relating these to the plate shape, proper conditioning can be completed in a short amount of time. Below are common plate shapes that would be seen from measurement data taken from the plate surface.

PLATE SHAPE	DESCRIPTION		SAMPLE DATA SET (MICRONS)	
 FLAT	This shape is met to tolerances +/- 2.54 µm. It is not the prefered starting shape for composite plates. Slightly concave from the flat surface is ideal for starting.		1. 1 2. 2 3. - 1	4. 2 5. -1 6. 1
 CONCAVE	This shape occurs when material is removed faster from the inside diameter of the plate than outside.		1. 6 2. 3 3. 2	4. 2 5. 3 6. 6
 CONVEX	This shape occurs when material is removed faster on the outside diameter of the plate.		1. 2 2. 7 3. 10	4. 11 5. 6 6. 2
 LOW in the MIDDLE	This is a typical shape incurred after a specimen has been lapping for a significant amount of time.		1. 2 2. -7 3. 1	4. 2 5. -8 6. 2
 TILTED	This is a not a typical shape which occurs by itself. Usually it's seen in conjunction with one of the other shapes.		1. 0 2. 10 3. 17	4. 20 5. 25 6. 30
 WAVY	This is a case where the plate has a wave around the diameter of the plate.		1. 3 2. 0 3. 7	4. 15 5. 18 6. 21

NOTE: When measuring the plate flatness, remember that the plate tolerance for flatness is + / - 2.54 microns. Therefore, readings between -2 and +2 microns show the plate to be flat and within the desired specification.