"Anchoring Technique"

   An anchoring technique was developed after discussions with Dr. Greg Hetland about measuring small arcs (reference "The Estimation of Measurement Uncertainty of Small Circular Features Measured by Coordinate Measuring Machines", Dri. Greg Hetland). His study proves that there will always be uncertainty when measuring small arc segments even on a perfect part. Therefore, it is recommended that other methods be utilized when reporting results on small arc segments.

   The most common method would be to use a profile tolerance. However, an anchoring technique has been developed and tested using the OGP's inherent targets (or tools). The method works by first picking up a repeatable feature and then using it to anchor against before measuring the desired feature. In this case, the point radius of the fuel injector was used as an anchor and the 0.5mm radius is the desired feature we are measuring.

We begin by anchoring to the point radius. Figure 1 depicts this radius on the part.
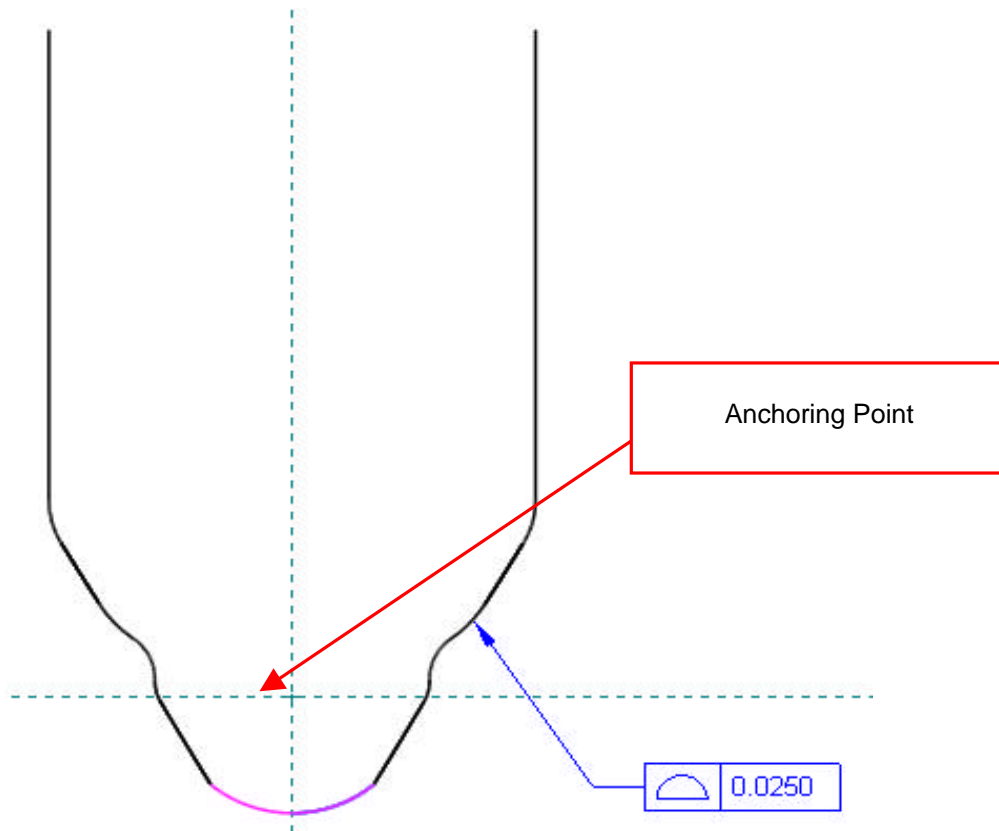
Anchoring Point

0.0250

Figure 1. Depiction of the point radius (highlighted above) used to anchor against.

Next we create an origin at the center of the point radius. The origin repeats in position as does the radius reading. From this anchoring point, we create a center point from nominal for the 0.5mm radius. Refer to Figure 2 below.
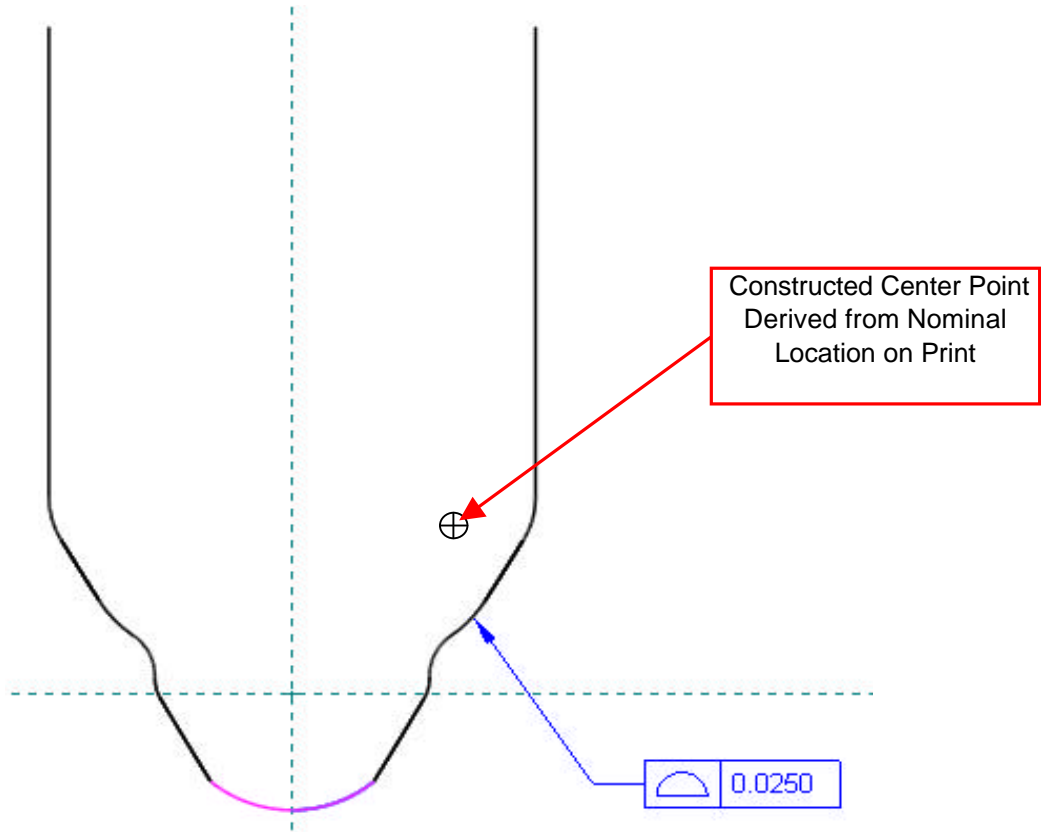

Constructed Center Point Derived from Nominal Location on Print

0.0250

Figure 2. Depiction of the constructed point used to position the OGP prior to measurement.

Finally, the a point is used to set a new origin. Then a point on the radius is picked up using the OGP's Edge Finder target. This point is picked up in radial units. The "R" value is then reported as the radius of the feature.

The data reveals that this method repeated the 0.5mm radius value within 0.0042mm on the Avant and 0.0019mm on the Quest (worst case scenerio). We would suspect better repeatability from the Quest, as the data proves, due to the Quest's superior optics. Data for the point radius was taken using only the Avant system, due to time constraints. Note that the point radius repeated within 0.0052mm. Theoretically, a more repeatable feature can utilized for anchoring which should lead to improved repeatability for the desired feature.