

Free-State Variation¹

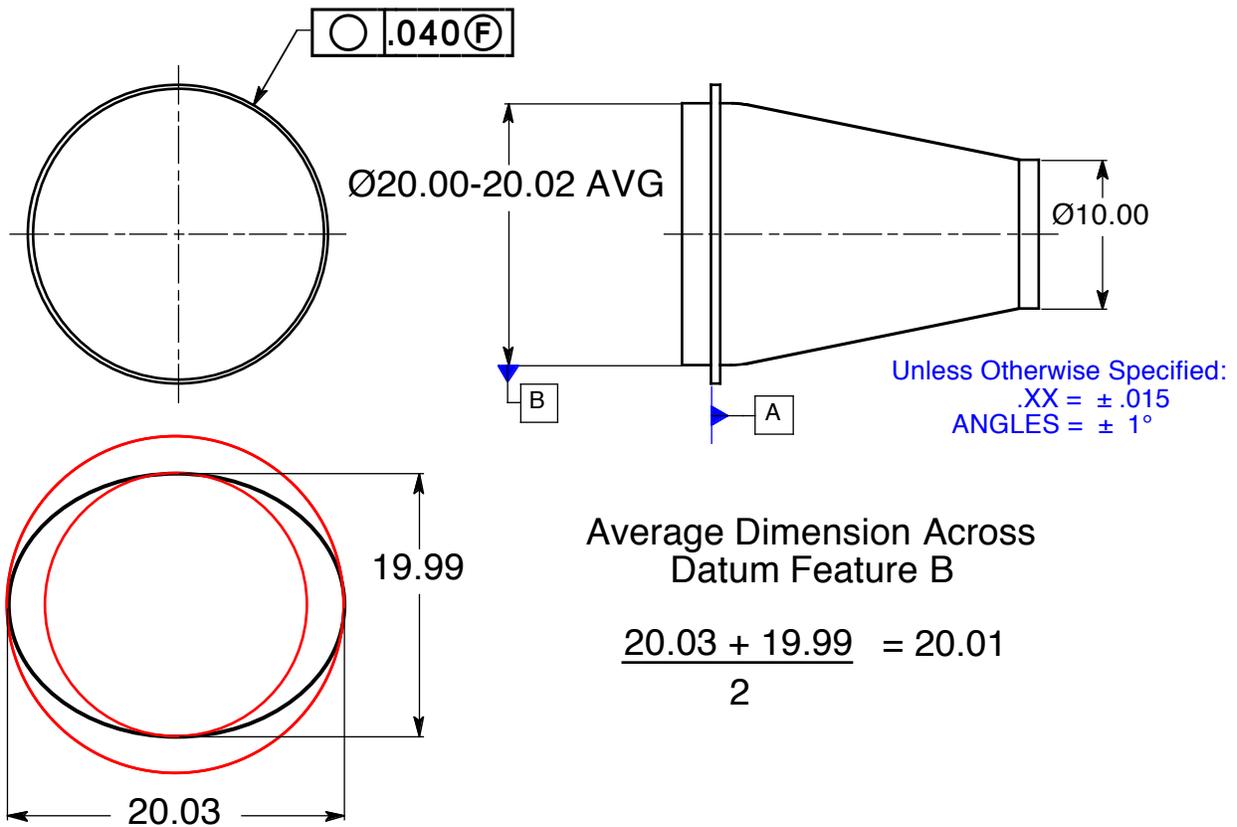
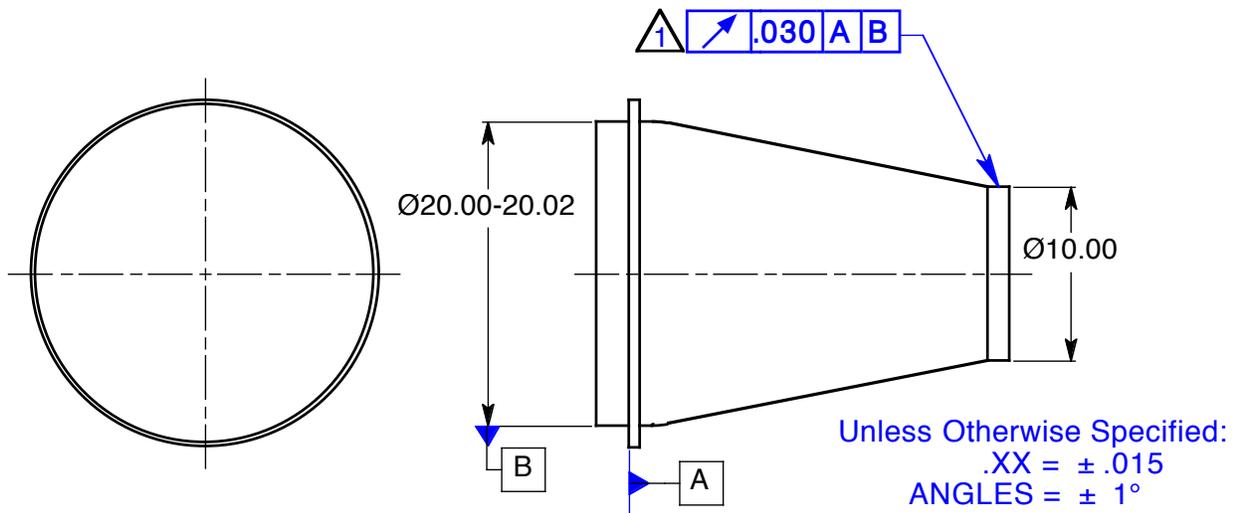


Figure 5-12 The circularity of this flexible part is to be measured in the free state.

Where a form or location tolerance is specified for a feature in the free state, the free state symbol is placed inside the feature control frame following the tolerance and any modifiers. A size dimension and tolerance is specified, followed by the abbreviation AVG indicating that the tolerance applies to the average of measurements. In Fig. 5-12, for clarity, only two measurements are shown, but a minimum of four measurements must be taken to insure the accuracy of an average diameter. If the average measurement falls inside the tolerance range, the dimension is in tolerance.

¹Cogorno, Gene R., *Geometric Dimensioning and Tolerancing for Mechanical Design, Second Edition*, McGraw-Hill, New York, 2011, p. 79.



1 The runout tolerance applies when datum feature A is mounted against a flat surface fastened with 10 – .250–20 UNC screws torqued to 8–12 foot-pounds while restraining datum feature B within its specified MMC size.

Figure 5-13 This flexible part must be restrained before measuring the runout.

Where features are to be controlled for orientation, location, or runout in the restrained condition, a note must clearly state which features are to be restrained, how they are to be restrained, and to what extent they are to be restrained. Fig. 5-13 contains an example of a note specifying the restrained condition for the runout control. The restrained condition should simulate the actual assembly of the part.