

Rules

Three dimensioning and tolerancing rules defined by the 2009 standard¹

Rule #1 – Limits of Size Prescribe Variations of Form

Rule #1 states that for an individual regular feature of size, where only a tolerance of size is specified, the limits of size prescribe the extent to which variations in its geometric form, as well as its size, are allowed. No element of a feature of size shall extend beyond the maximum material condition boundary (envelope) of perfect form. The local form tolerance increases as the actual local size of the feature departs from MMC toward LMC. There is no perfect form boundary requirement at LMC.

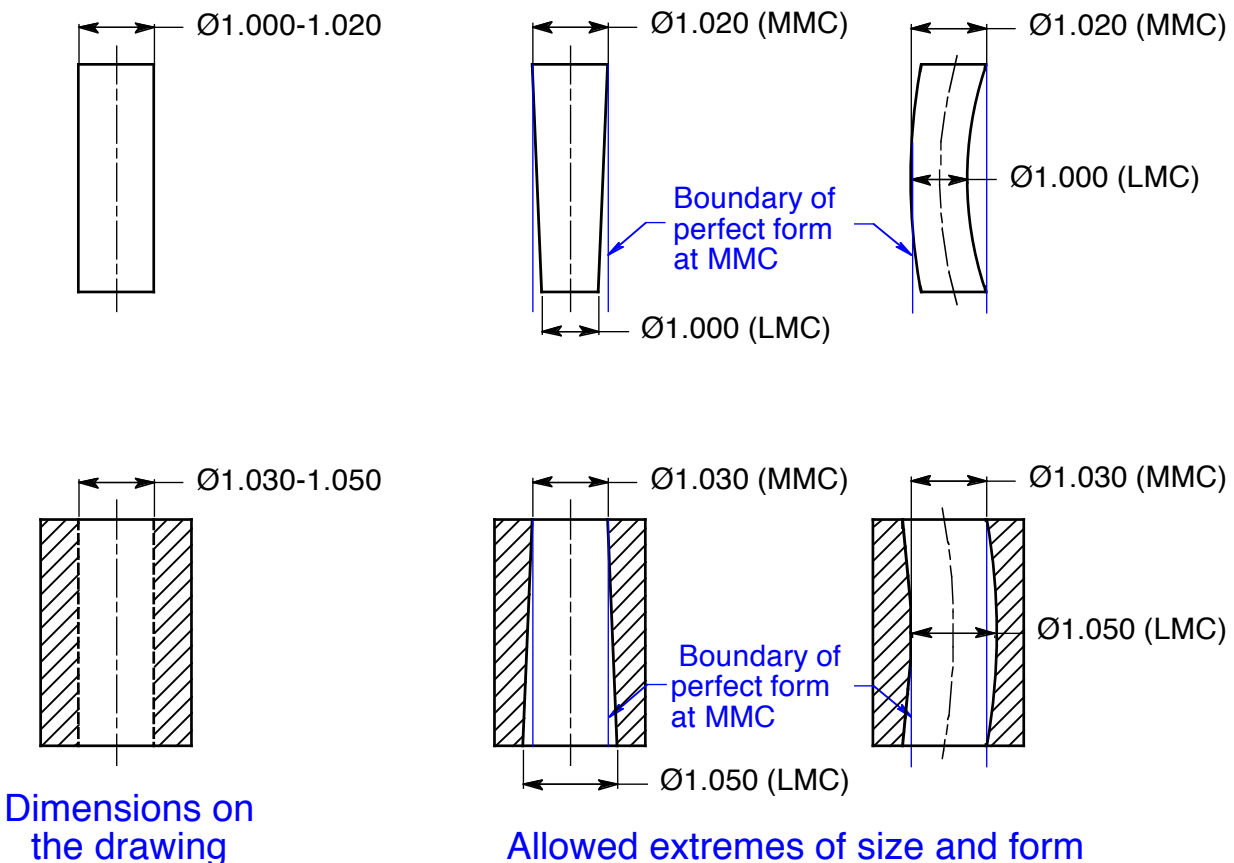


Figure 3-29 Rule #1 – examples of size and form variations allowed by the size tolerance

In Fig. 3-29, the maximum material condition of the pin is 1.020. The pin may in no way fall outside this MMC boundary or envelope of perfect form. That is, if the pin is produced at a diameter of 1.020 at each and every cross section, it must not be bowed in any way. If the pin is produced at a diameter of 1.010, it may be out of straightness and/or out of circularity by a total

of .010. If the pin is produced at a diameter of 1.000, its least material condition, it may vary the full .020 tolerance from perfect form.

Rule #1 does not apply to stock or to features subject to free-state variation in the unrestrained condition. When the word *stock* is specified on a drawing, it indicates bar, plate, sheet, etc. as it comes from the supplier. Stock items are manufactured to industry or government standards and are not controlled by rule #1. Stock is used as is, unless otherwise specified by a geometric tolerance or a note. Rule #1 does not apply to parts that are flexible and are to be measured in their free-state.

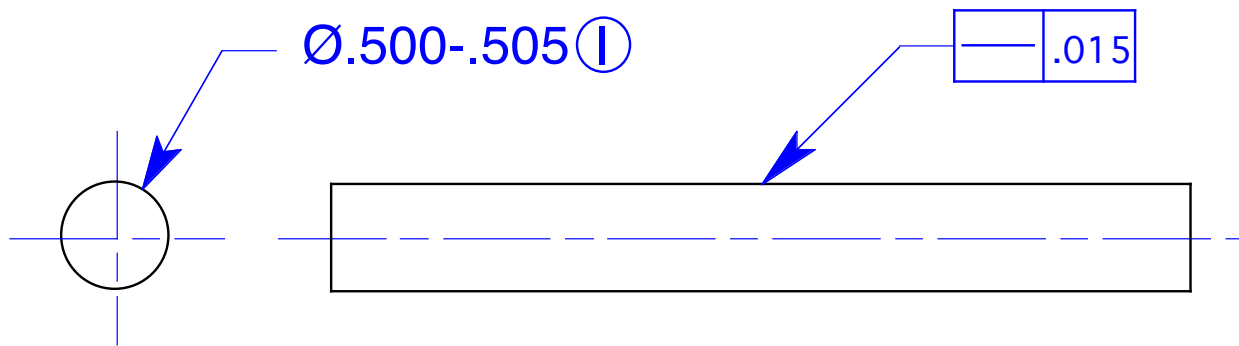


Figure 3-30 Independence symbol

Perfect form at MMC is not required if it is desired to allow the surface(s) of a feature to exceed the boundary of perfect form at MMC. In such cases, the Independency symbol circle I may be placed next to the appropriate dimension or notation. However, a supplementary form tolerance(s) may be required to limit excessive variations of form, as shown in Fig. 3-30.

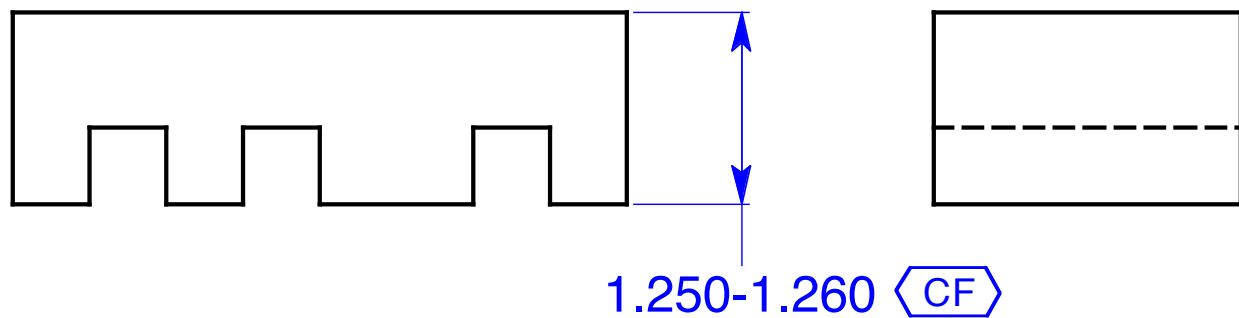


Figure 3-33 Continuous feature symbol

The continuous feature symbol or the note, CONTINUOUS FEATURE, is used to identify a group of two or more features of size where there is a requirement that they be treated geometrically as a single feature of size. When using the Continuous feature symbol, extension lines across the interrupted surface may or may not be shown; however, extension lines by themselves do not indicate a continuous feature. See Fig. 3-33.

¹Cogorno, Gene R., *Geometric Dimensioning and Tolerancing for Mechanical Design, Second Edition*, McGraw-Hill, New York, 2011, p. 36.

Rule #2 – Applicability of modifiers in feature control frames

MMC, RFS, and LMC may be applied in feature control frames following geometric tolerance values of features of size, and MMB, RMB, and LMB may be applied in feature control frames following datum features of size.

Rule #2 states that in feature control frames, the *regardless of feature size (RFS) modifier* automatically applies to individual tolerances of features of size and the *regardless of material boundary (RMB) modifier* automatically applies to datum features of size. MMC/MMB and LMC/LMB are specified for features of size where they are required.

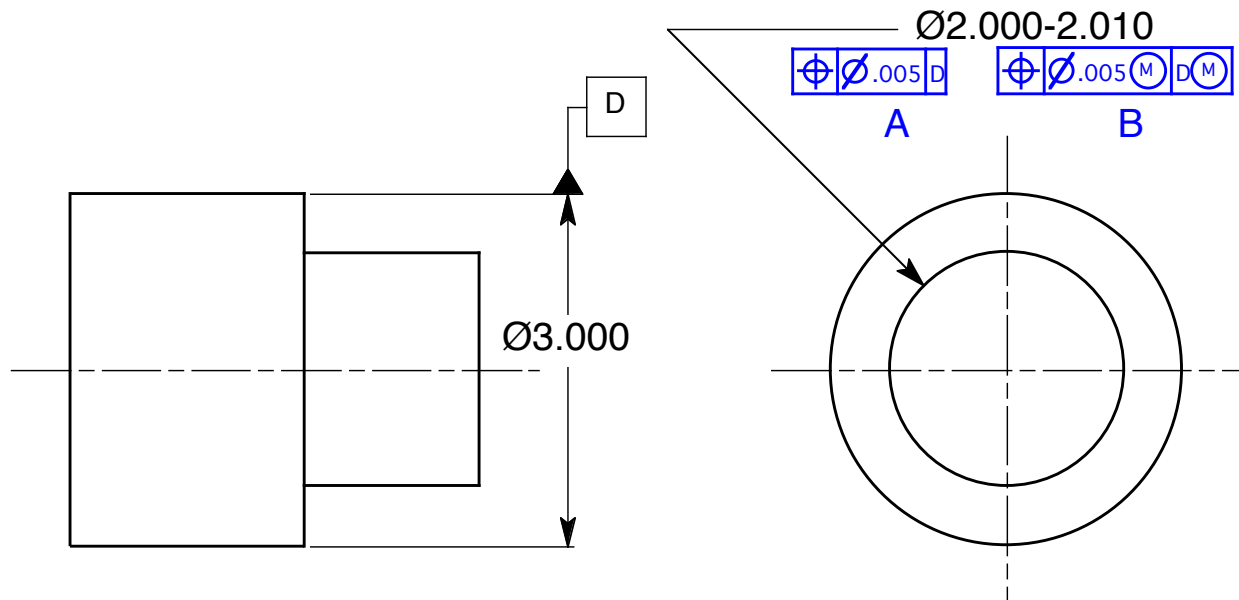


Figure 3-34 Feature control frames specified with RFS and MMC.

In Fig. 3-34, both the feature being controlled and the datum feature are features of size. The feature control frame labeled *A* has no material condition modifiers. Consequently, the coaxiality tolerance in feature control frame *A* applies at RFS, and the datum feature *D* applies at RMB. If the controlled feature is toleranced with feature control frame *A*, the tolerance is .005 no matter what diameter it happens to be between 2.000 and 2.010, and datum feature *D* must make physical contact with the gage during inspection. For the feature control frame labeled *B*, MMC applies to the tolerance and MMB applies to datum feature *D*. MMC allows a bonus tolerance for the controlled feature, and MMB allows a shift tolerance to apply to datum feature *D*.

The Pitch Diameter Rule

Each tolerance of orientation or position and datum reference specified for screw threads applies to the axis of the thread derived from the pitch diameter. Exceptions to this rule may be specified by placing a note, such as MAJOR DIA or MINOR DIA beneath the feature control frame or beneath or adjacent to the datum feature symbol.

Each tolerance of orientation or position and datum reference specified for gears and splines must designate the specific feature, such as MAJOR DIA, PITCH DIA, or MINOR DIA at which each applies. A note is placed beneath the feature control frame or beneath or adjacent to the datum feature symbol.