TECHNICAL TRAINING CONSULTANTS
856 SALT LAKE COURT SAN JOSE, CA 95133 (408) 251-5329

Specifying the Position Control[1]

Since the position tolerance only controls one or more features of size, such as pins, holes, tabs, and slots, the feature control frame is always associated with a size dimension. In Fig. 7-2, the hole is oriented and located with the position control. In this case, the feature control frame is placed beneath the local note describing the diameter and size tolerance of the hole. The true position of the hole, the theoretically perfect location of the axis, is specified with basic dimensions from the datum features indicated in the feature control frame. Once the feature control frame is assigned, an imaginary tolerance zone is defined and located about true position. The datum features are identified by datum feature symbols. Datum features A, B, and C identify the datum reference frame in which the part is to be positioned for processing.

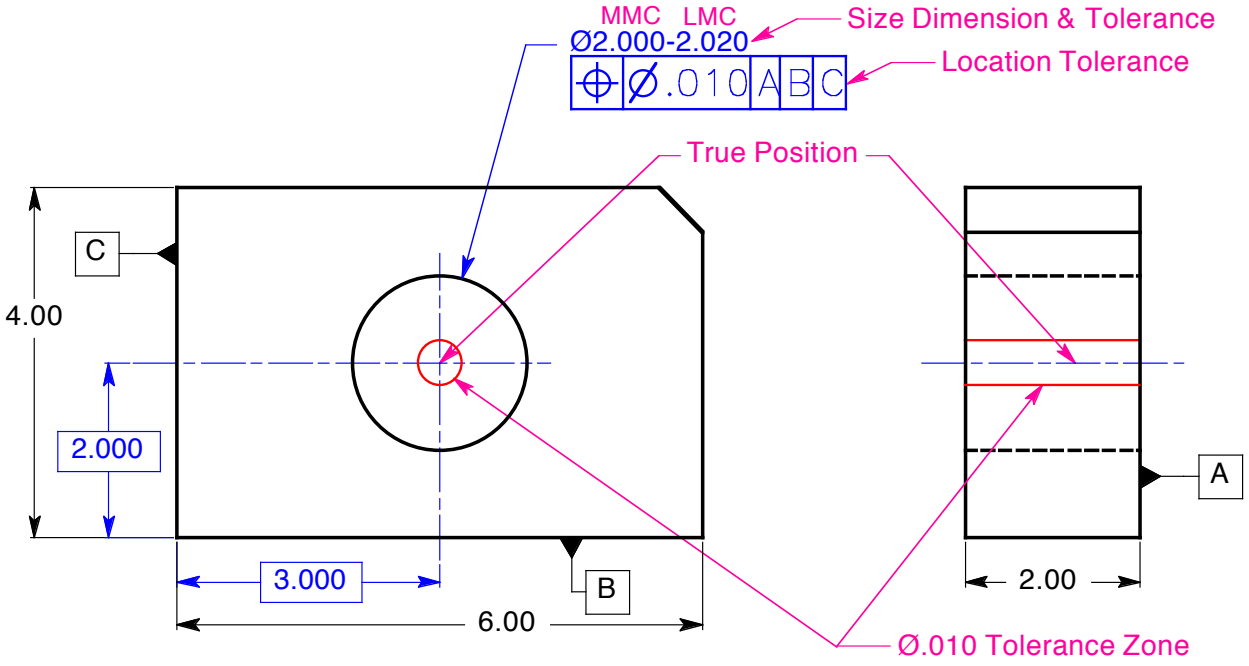

Figure 7-2 Location of a feature of size with a position tolerance at RFS

Specifying the Position Tolerance at Regardless of Feature Size

The feature control frame is the sentence in the geometric dimensioning and tolerancing (GD&T) language; it must be specified correctly in order to communicate design requirements. The feature control frame in Fig. 7-2 tells the location tolerancing story for the hole in this part. The diameter symbol and the tolerance specify a cylindrical tolerance zone, .010 in diameter, the full length of the feature, perfectly perpendicular to datum feature A, and located about true position. True position is located a basic 2.000 inches up from datum feature B and a basic 3.000 inches over from datum feature C. Regardless of feature size (RFS) automatically applies for features of size where no material condition symbol is specified.

Since no material condition symbol is specified in the feature control frame in Fig. 7-2, the RFS modifier automatically applies to the orientation and location tolerance of the hole. In other words, the position tolerance zone is .010 in diameter no matter what size the hole happens to be between 2.000 and 2.020 in diameter. No bonus tolerance is allowed. Tolerance zones are theoretical and do not appear on drawings. However, tolerance zones have been shown here for illustration purposes only.

Tolerance Zones for the Position Control

- The position tolerance only controls one or more **features of size** such as pins, holes, tabs, and slots. **A Feature of Size** is a feature that has a size dimension. A feature of size takes one of five forms:
  1. A cylindrical surface
  2. Two opposed parallel planar surfaces
  3. A spherical surface
  4. A circular element
  5. A set of two opposed parallel elements
- Each feature geometry is controlled with a particular tolerance zone shape:
  1. The axis of a cylinder, either a hole or a pin, is controlled with a **cylindrical tolerance zone** such as those shown in Fig. 7-3. A diameter symbol precedes the tolerance in the feature control frame.

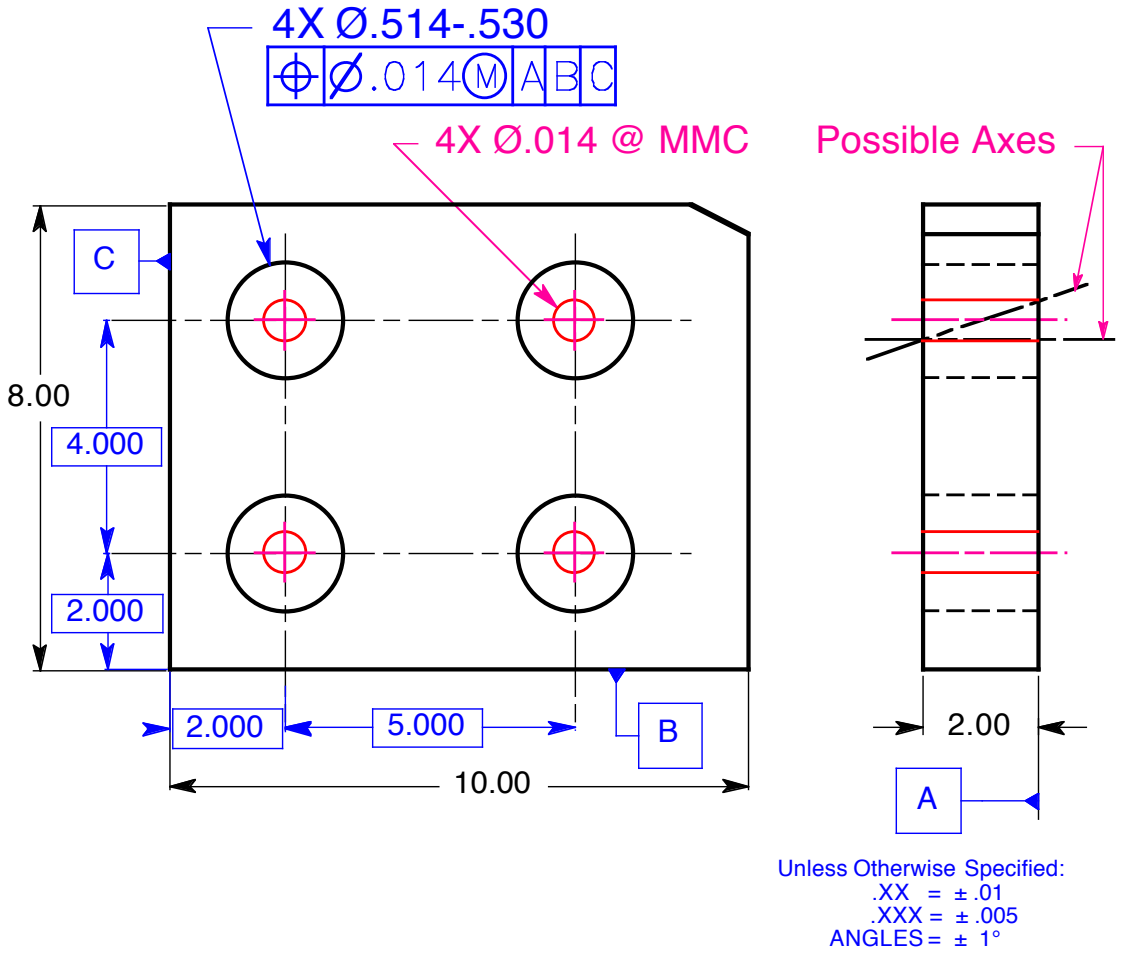

Figure 7-3 Axes are controlled with cylindrical tolerance zones.

The cylindrical tolerance zone is one of the great benefits of the Geometric Dimensioning and Tolerancing system. Unlike the rectangular tolerance zone, the cylindrical tolerance zone establishes a uniform tolerance zone shape. The cylindrical tolerance zone has the same distance in all direction from the axis to the tolerance zone boundary. The tolerance zone extends the full length of the feature. It is easy to calculate the tolerance between two cylindrical features when using the cylindrical tolerance zone. The tolerance for a shaft is the difference between the maximum material condition of the bearing and the maximum material condition of the mating shaft, Fig. 7-3A.

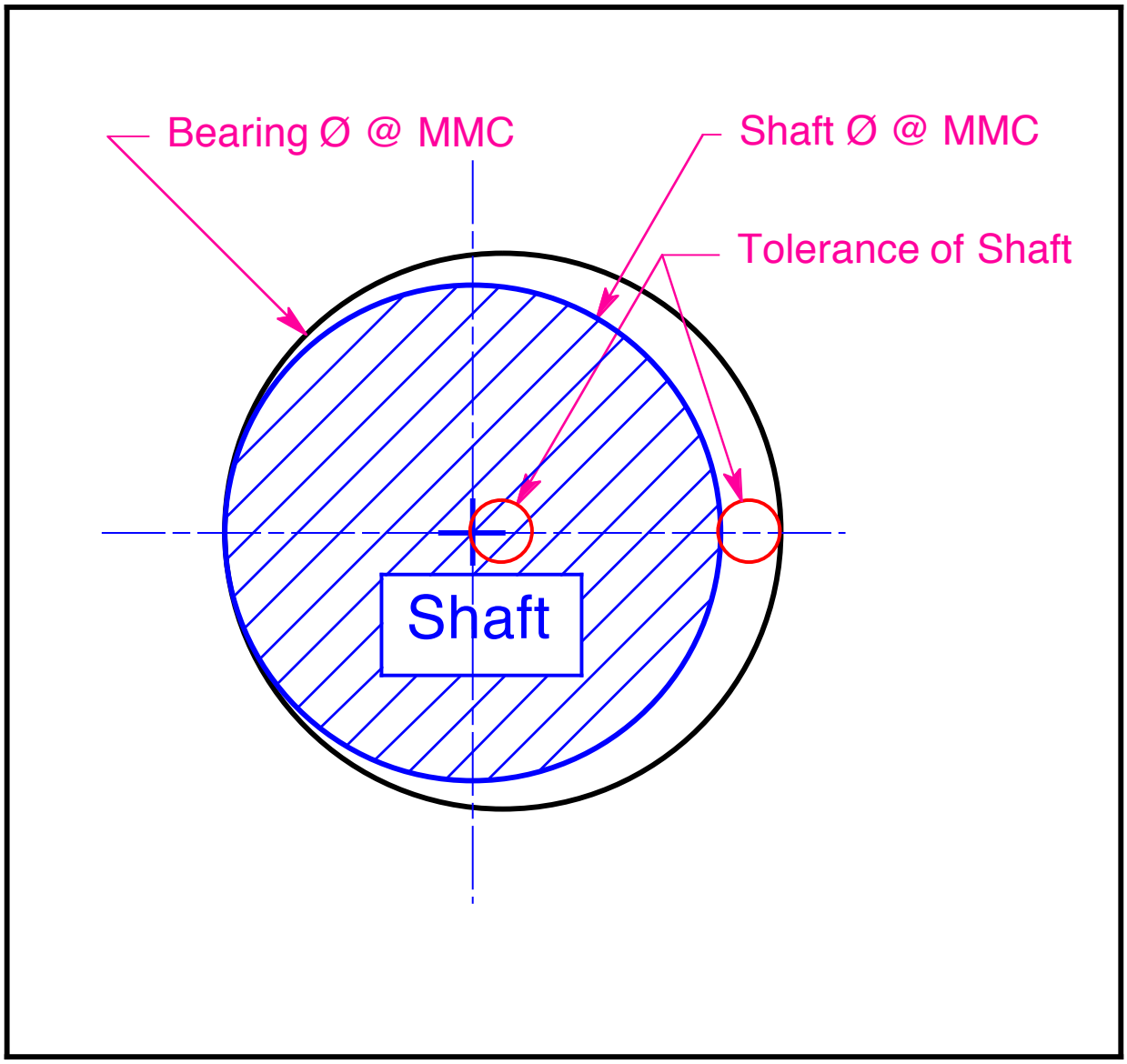

Figure 7-3A The tolerance between a bearing and its mating shaft

2. The center point of a sphere is controlled with a **spherical tolerance zone**, Fig. 7-4. An **S** is placed in front of the diameter symbol preceding the tolerance in the feature control frame. The symbol for a spherical diameter is SØ.

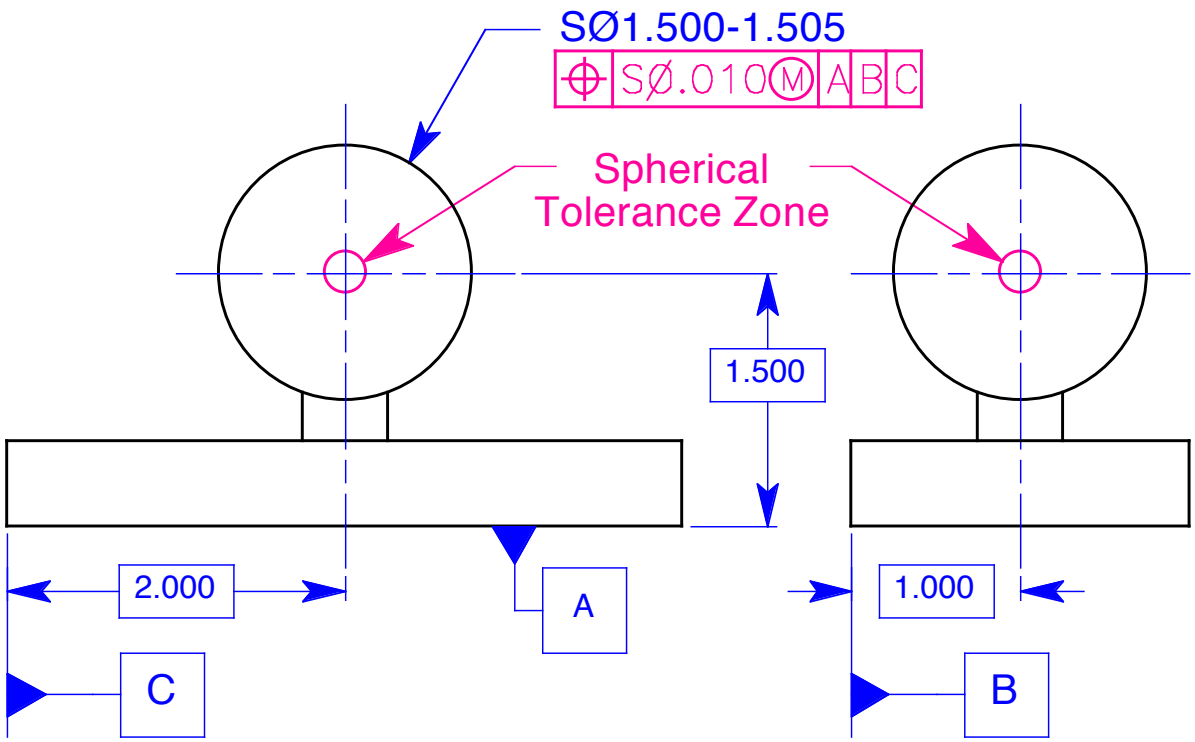

Figure 7-4 The center point of a sphere is controlled with a spherical tolerance zone.

3. The center plane of two opposed parallel planar surfaces is controlled with a tolerance zone that consists of **two parallel planes**, also known as a slab-like tolerance zone, evenly disposed about the datum's center plane, Fig. 7-5. There is no symbol for the shape of this tolerance zone.

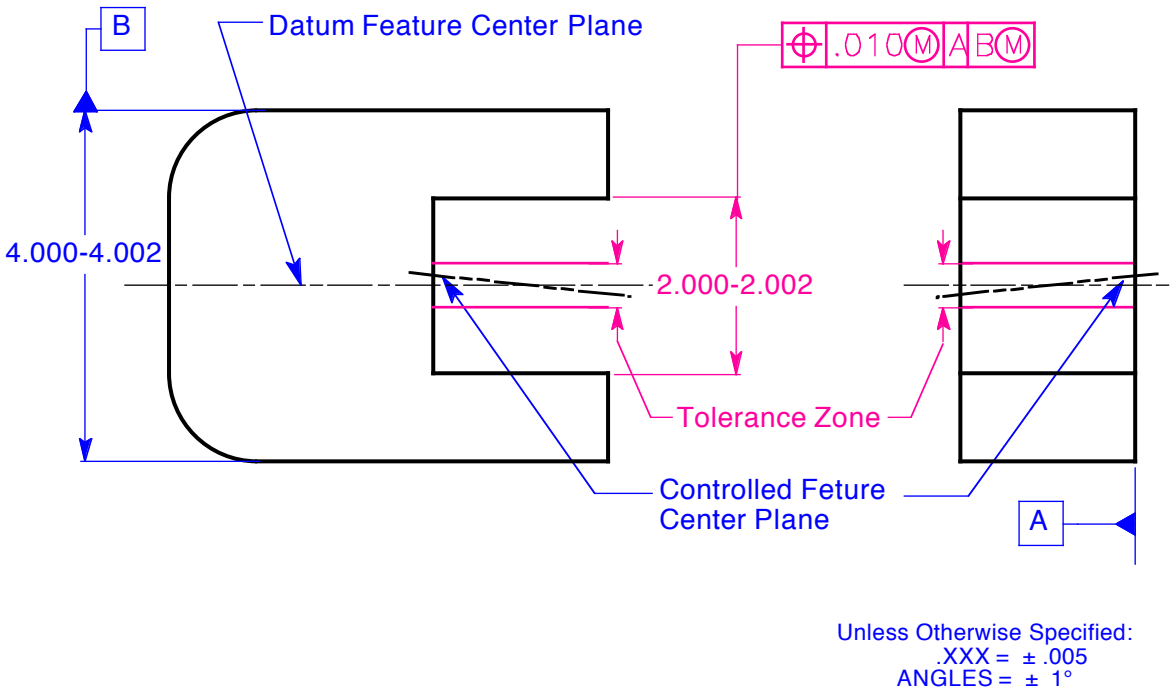

Figure 7-5 A center plane is controlled with a tolerance zone that consists of the distance between two parallel planes.

4. The circular element is controlled with the space between **two concentric circles**.
5. The centerline of two opposed parallel elements is controlled with the space between **two parallel lines**. These last two tolerane zone shapes are very uncommon. They are usually determined by datum targets. There are no symbols for these tolerance zone shapes.

[1]Cogorno, Gene R., ***Geometric Dimensioning and Tolerancing for Mechanical Design, Second Edition***, McGraw-Hill, New York, 2011, p. 106.