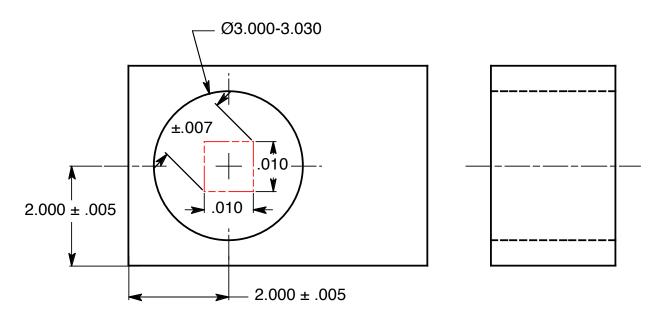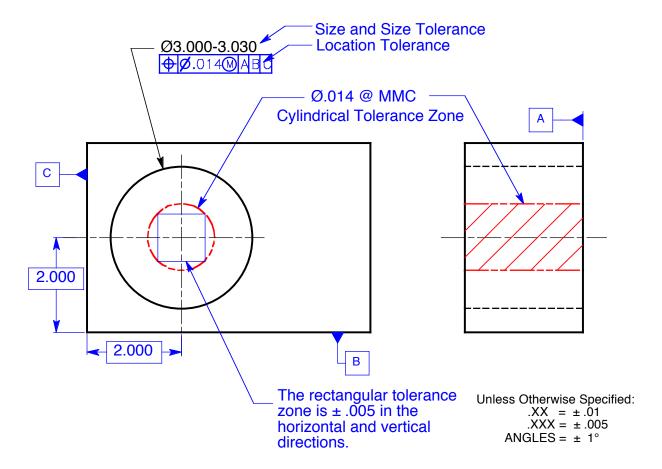# Imaginary GD&T Concepts[1]

Figure 1-1 The traditional plus or minus tolerance zone

The Rectangular Tolerance Zone

The location of the hole in Fig. 1-1 is 2.000 ± .005 in both the X and Y directions. Nowhere is it specified that the 2.000 dimension is perfect and imaginary, but it is thought of as if it were absolute. The tolerance is specified within the ± .005. If the axis of the hole exceeds 2.000 ± .005 in either the X or Y direction, the feature is out of tolerance. Consequently the 2.000 dimension is thought of as a perfect dimension therefore imaginary. The rectangular tolerance zone is also considered absolute. If the axis of the hole falls outside of the rectangle, the hole is out of location tolerance.

[1]Cogorno, Gene R., *Geometric Dimensioning and Tolerancing for Mechanical Design, Second Edition*, McGraw-Hill, New York, 2011, p. 30.

Ø3.000-3.030 — **Size and Size Tolerance**

⊕ | Ø.014 Ⓜ | A | B | C — **Location Tolerance**

Ø.014 @ MMC
Cylindrical Tolerance Zone

C

A

2.000

2.000

B

The rectangular tolerance zone is ± .005 in the horizontal and vertical directions.

Unless Otherwise Specified:
.XX = ± .01
.XXX = ± .005
ANGLES = ± 1°

Figure 1-2 The rectangular tolerance zone converted to a cylindrical tolerance zone

The Cylindrical Tolerance Zone

In Fig. 1-2, the cylindrical tolerance zone is defined as a perfect cylinder, at the perfect diameter specified in the feature control frame, and located the perfect basic dimensions from datum features A and B. Since the tolerance zone and the basic dimensions are perfect, they are imaginary. Some individuals think these perfect concepts are absurd because inspection measurements are not perfect. Inspection measurements don't have to be perfect. Inspection measurements, infact, include the manufacturing error and all of the possible measurement errors. (Hopefully, measurement errors are very small compared with the specified tolerance.) If the inspection measurement, including all of its imperfections, falls within the perfect cylindrical tolerance zone, the feature is within tolerance.

Axis

An axis is a **theoretically perfect** centerline of a symetrical feature created by the intersection of two planes at a 90° angle to each other.

A typical axis is a centerline through the center of a cylinder. The axis is invisible and intangible; but, its location can be determined by measuring the diameter of the cylinder and dividing it by two. In spite of the fact that it is imaginary, the axis is an important concept used in the manufacturing process.

Basic Dimension

Basic dimensions are **theoretically perfect** dimensions. Basic dimensions are used to define or position tolerance zones. Title block tolerances do not apply to basic dimensions.

Datum

A datum is a **theoretically perfect** point, axis, line, plane, or combination thereof derived from the theoretical datum feature simulator. A datum is the origin from which the location or geometric characteristics of features of a part are established.

Tolerance Zone

The tolerance zone is a **theoretically perfect** boundary of an area or volume established by limits of size or a geometric tolerance within which a controlled element may very.

True Position

True position is the **theoretically perfect** location of a feature of size, as established by basic dimensions. Tolerance zones are located at true position.

True Profile

True profile is the **theoretically perfect** profile on a drawing defined by basic dimensions or a digital data file. Tolerance zones are located about the true profile.

These perfect concepts are important tools used in the design, manufacture, and inspection of manufactured parts.