Composite Profile Tolerancing[1]

A composite profile feature control frame has one profile symbol that applies to the two horizontal segments that follow. The upper segment, called the *profile-locating control*, governs the location relationship between the datum features and the profile. It acts like any other profile control. The lower segment, referred to as the *profile-refinement control*, is a smaller tolerance than the profile-locating control and governs the size, form, and orientation relationships of the profile. The smaller tolerance zone need not fall entirely inside the larger tolerance zone, but any portion of the smaller tolerance zone that lies outside the larger tolerance zone is unusable. The actual feature profile must fall completely inside both profile tolerance zones.

Figure 12-14A A composite profile feature control frame

Datum features in the lower segment of a composite feature control frame must satisfy two conditions:

- Datum features in the lower segment of the feature control frame must repeat the datum features in the upper segment. If only one datum feature is repeated, it would be the primary datum feature; if two datum features were repeated, they would be the primary and secondary datum features; etc.

- Datum features in the lower segment only control orientation.

[1]Cogorno, Gene R., *Geometric Dimensioning and Tolerancing for Mechanical Design, Second Edition*, McGraw-Hill, New York, 2011, p. 204.

3X R1.000

R3.500

| ⌀ | ◠ | .040 | A | B | C |
| | | .010 | A | | |

10.000

5.000

2.500

2.500

C

6.000

B

11.000

2.000

A

.XX = ± .03
.XXX = ± .010
Angle = ± 1°

The .040 wide
Tolerance Zone

The .010 wide
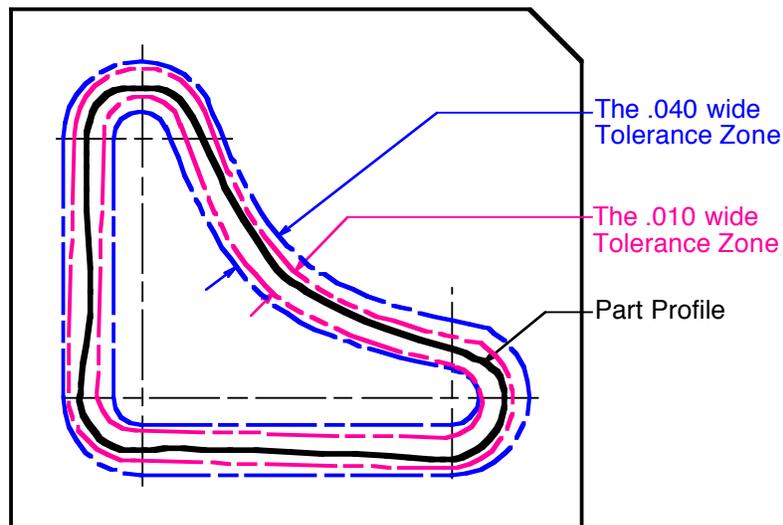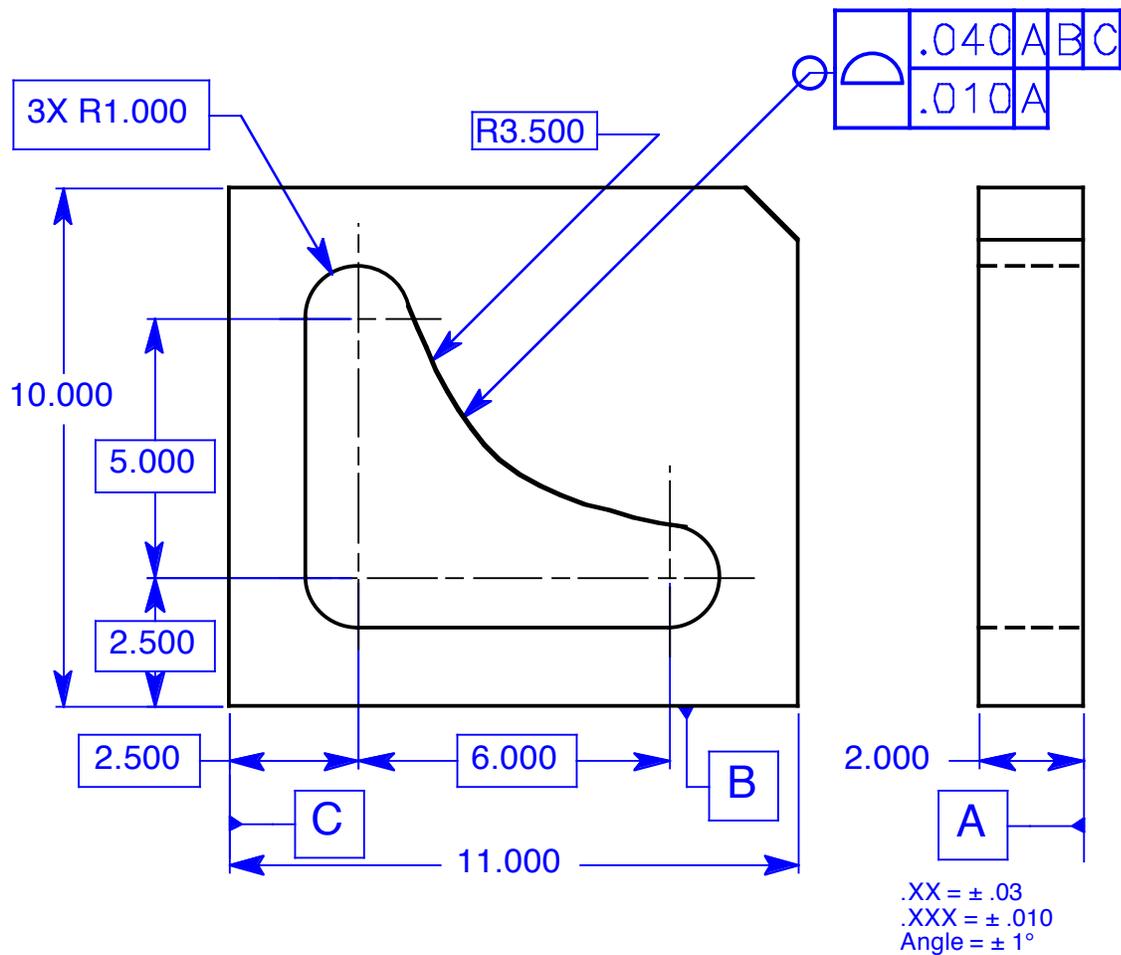Tolerance Zone

Part Profile

Figure 12-14 A feature controlled with composite profile tolerancing

The profile in Fig. 12-14 must fall within the .010 tolerance zone governing size, form, and orientation to datum feature A. The entire profile, however, may float around within the larger tolerance zone of .040 located to datum features B and C.

A composite profile also may be used to control orientation to a larger tolerance with a refinement of size and form to a smaller tolerance in the lower segment of the feature control frame, as shown in Fig. 12-15. The upper segment governs the orientation relationship between the profile and datum feature A. The lower segment is a smaller tolerance than the profile-orienting control and governs the size and form relationship of the profile. The smaller tolerance zone need not fall entirely inside the larger tolerance zone, but any portion of the smaller tolerance zone that lies outside the larger tolerance zone is unusable. The feature profile must fall completely inside both profile tolerance zones.
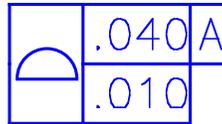
⌓	.040	A
	.010	

Figure 12-15 Composite profile tolerancing used only to control size, form, and orientation.
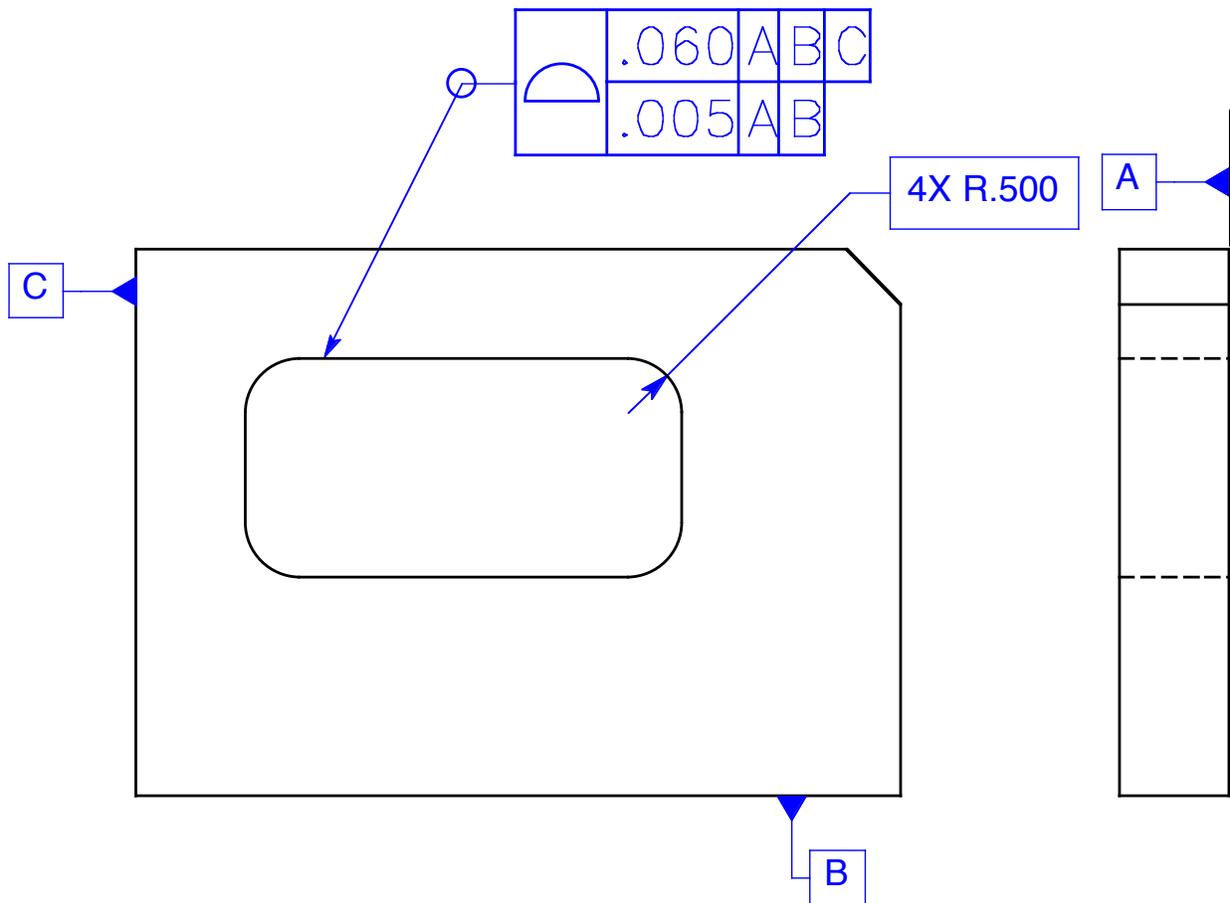

Figure 12-16 A composite profile tolerance with two datum features repeated in the lower segment of the feature control frame

A second datum feature may be repeated in the lower segment of the composite feature control frame, as shown in Fig. 12-16. Both datum features in the lower segment of the feature control frame only control orientation. Since datum reference A in the upper segment only controls orientation, that is, perpendicularly to datum feature A, it is not surprising that datum reference A in the lower segment is a refinement of perpendicularity to datum feature A. When datum feature B is included in the lower segment, the .005-wide tolerance zone must remain parallel to datum feature B. In other words, the smaller tolerance zone is allowed to translate left and right and up and down but may not rotate about an axis perpendicular to datum feature A. The smaller tolerance zone must remain parallel to datum feature B at all times and the feature profile must fall completely inside both profile tolerance zones, as shown in Fig. 12-16A.

The .060 Wide Tolerance Zone

The .005 Wide Tolerance Zone Parallel to Datum Feature B
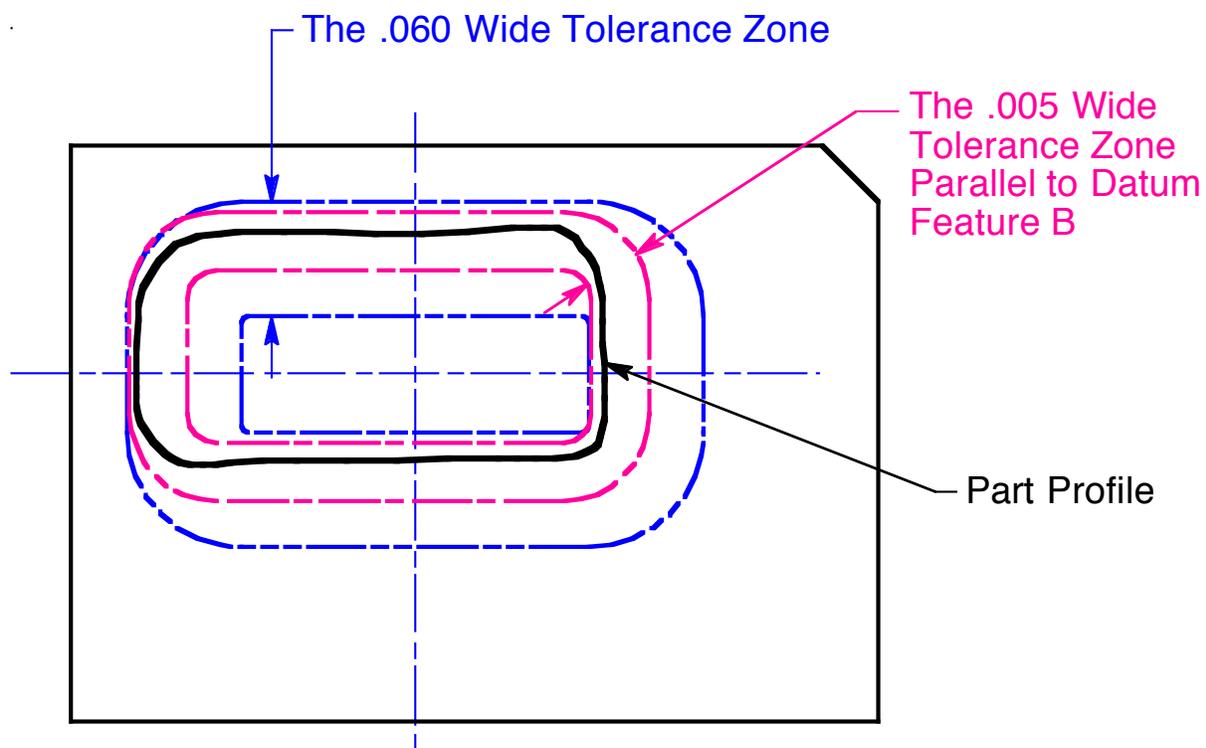
Part Profile

Figure 12-16A Two tolerance zones generated by the composite profile tolerance with two datum features repeated in the lower segment of the feature control frame

Multiple Single-Segment Profile Tolerancing

The profile in Fig. 12-17 is toleranced with a multiple single-segment feature control frame. In this example, the lower segment refines the profile, just as does the lower segment of the composite feature control frame, but the datum features behave differently. The lower segment of a multiple single-segment feature control frame acts just like any other profile control. If datum feature C had been included

in the lower segment, the upper segment would be meaningless, and the entire profile would be controlled to the tighter tolerance of .005. In Fig. 12-17, the lower segment of the multiple single-segment feature control frame controls profile size, form, orientation perpendicular to datum feature A, and location to datum feature B within a .005-wide profile tolerance zone. In other words, the actual profile must fit inside the profile-refinement tolerance, be perpendicular to datum feature A, and be located a basic 2.000 inches from datum feature B within a tolerance of .005. The upper segment, the profile-locating control, allows the actual feature profile to translate back and forth within a profile tolerance of .060 relative to datum feature C. That is, the refinement tolerance zone may translate left and right but may not translate up and down or rotate in any direction.
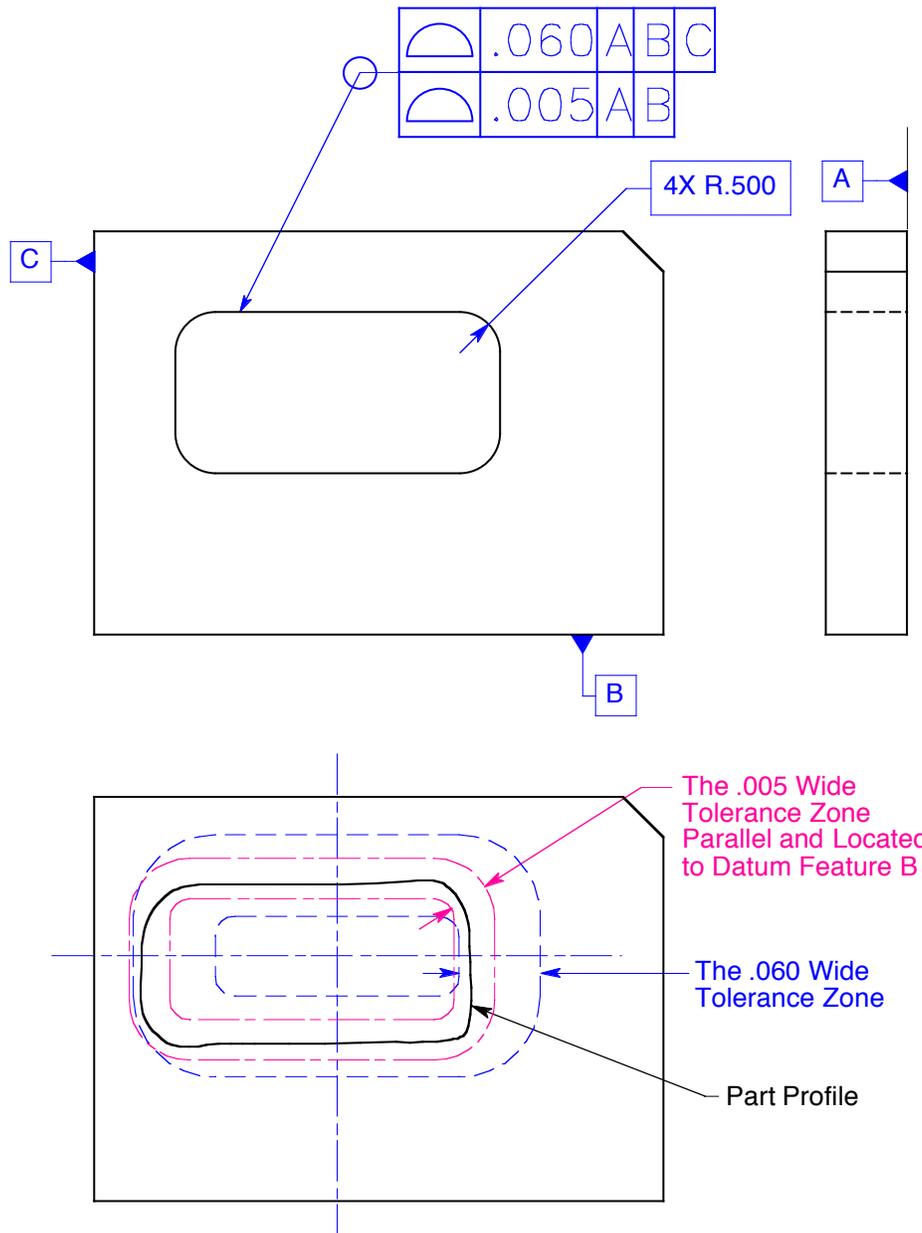
Figure 12-17 A multiple single-segment profile tolerance