Multiple Patterns of Features[1]

This part has two patterns of holes that are required to be treated as one composite pattern. They are to be located to common datum features with a Ø.010 cylinderical tolerance zone. They must also to be located to each other, perpendicular to datum feature A, and parallel to datum feature B with a Ø.002 cylinderal tolerance zone as a refinement to the Ø.010 location control.
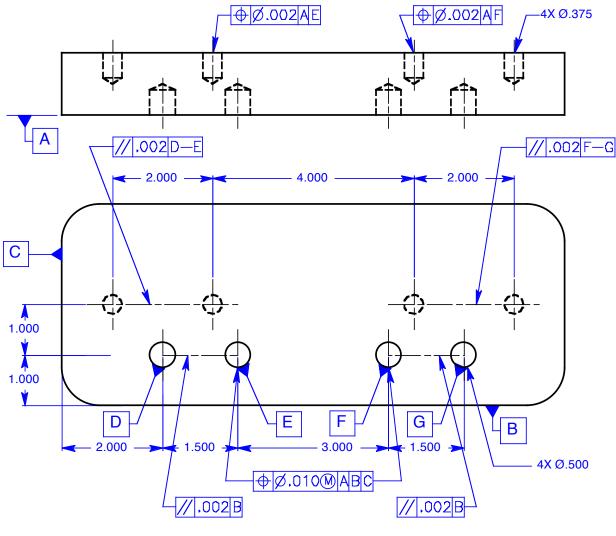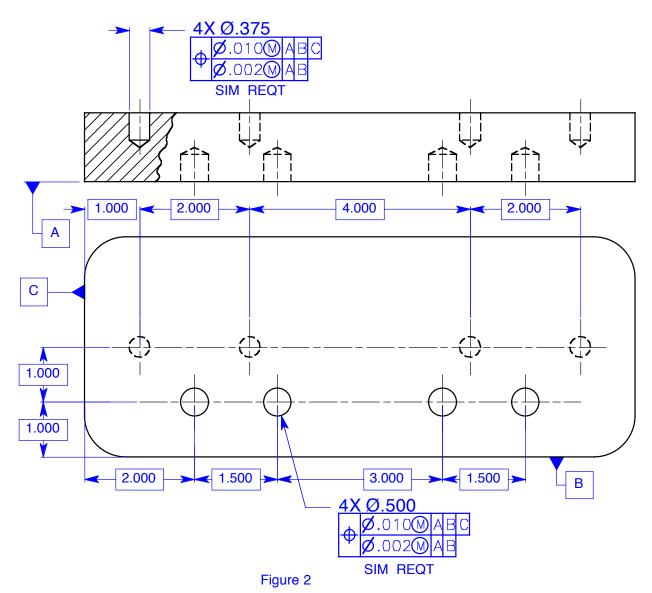

Figure 1

There are several problems with this drawing. First, the hole locating dimensions must be basic. Second, the position tolerances should be associated with the size dimension of the features. Third, a tolerance is never applied to imaginary lines or planes such as center planes between features. And finally, the ½ inch holes are toleranced parallel to datum feature B within a tolerance of .002 at RFS, but only toleranced perpendicular to datum feature A within a Ø.010 cylinderical tolerance zone at MMC. The stated requirement is that the holes must be perpendicular to datum feature A and parallel to datum feature B within the smaller tolerance.

4X Ø.375

⊕	Ø.010 Ⓜ A B C
	Ø.002 Ⓜ A B

SIM REQT

1.000   2.000   4.000   2.000

A

C

1.000

1.000

4X Ø.500

⊕	Ø.010 Ⓜ A B C
	Ø.002 Ⓜ A B

SIM REQT

2.000   1.500   3.000   1.500

B

Figure 2

The tolerancing in Figure 2 is a much better solution to the drawing requirements. Since both hole patterns are located to the same datum features, in the same order of precedence, with basic dimensions, they are considered to be one composite pattern of features with respect to the upper segment of the composite feature control frame. That is, both patterns are located to datum features B and C and to each other within a cylindrical tolerance zone of Ø.010 at MMC. The lower segment of each feature control frame requires each hole to be located to every other hole in its respective pattern, perpendicular to datum feature A, and parallel to datum feature B within the smaller tolerance of Ø.002 at MMC. Since the simultaneous requirement note, SIM REQT, has been placed beneath each feature control frame, both patterns are to be treated as one composite pattern with respect to the lower segment of the feature control frame. This means that all holes in both patterns are located to each other, perpendicular to datum feature A, and parallel to datum feature B within the same small tolerance; but at the same time, both patterns, treated as one composite pattern, are allowed to translate up and down and back and forth within the larger cylinderical tolerance zone Ø.010 at MMC.

[1]Cogorno, Gene R., *Geometric Dimensioning and Tolerancing for Mechanical Design, Second Edition*, McGraw-Hill, New York, 2011, p. 140