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A Pattern of Features Located to a Second Pattern of Features

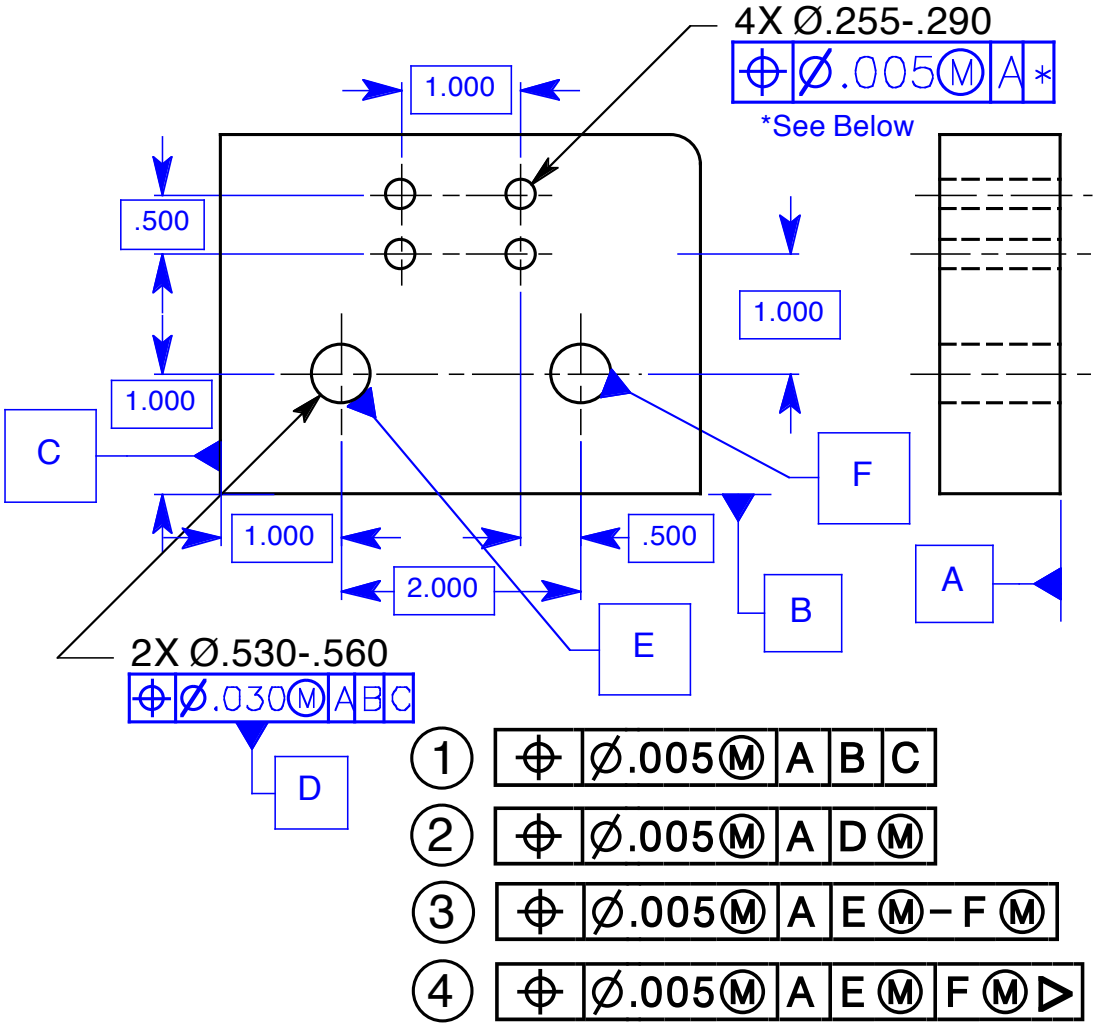

Figure 14-14 A four-hole pattern located to a two-hole pattern

There are several ways of specifying datum features to control the two patterns of features shown in Fig. 14-14. In this drawing, the two-hole pattern is positioned to plane surface datum features. The two 1⁄2-inch-diameter holes are perpendicular to datum feature A, basically located up from datum feature B and over from datum feature C within the tolerance specified in the feature control frame.

[1]Cogorno, Gene R., ***Geometric Dimensioning and Tolerancing for Mechanical Design, Second Edition***, McGraw-Hill, New York, 2011, p. 241.

Now that the two-hole pattern is positioned, what is the best way to tolerance the four-hole pattern? The simplest and most straightforward way of tolerancing the four-hole pattern is to control it to the same datum reference frame, datum features A, B, and C, the established datum reference frame shown in feature control frame number 1 (Fig. 14-14). Where possible, it is best to use only one datum reference frame to control both patterns.

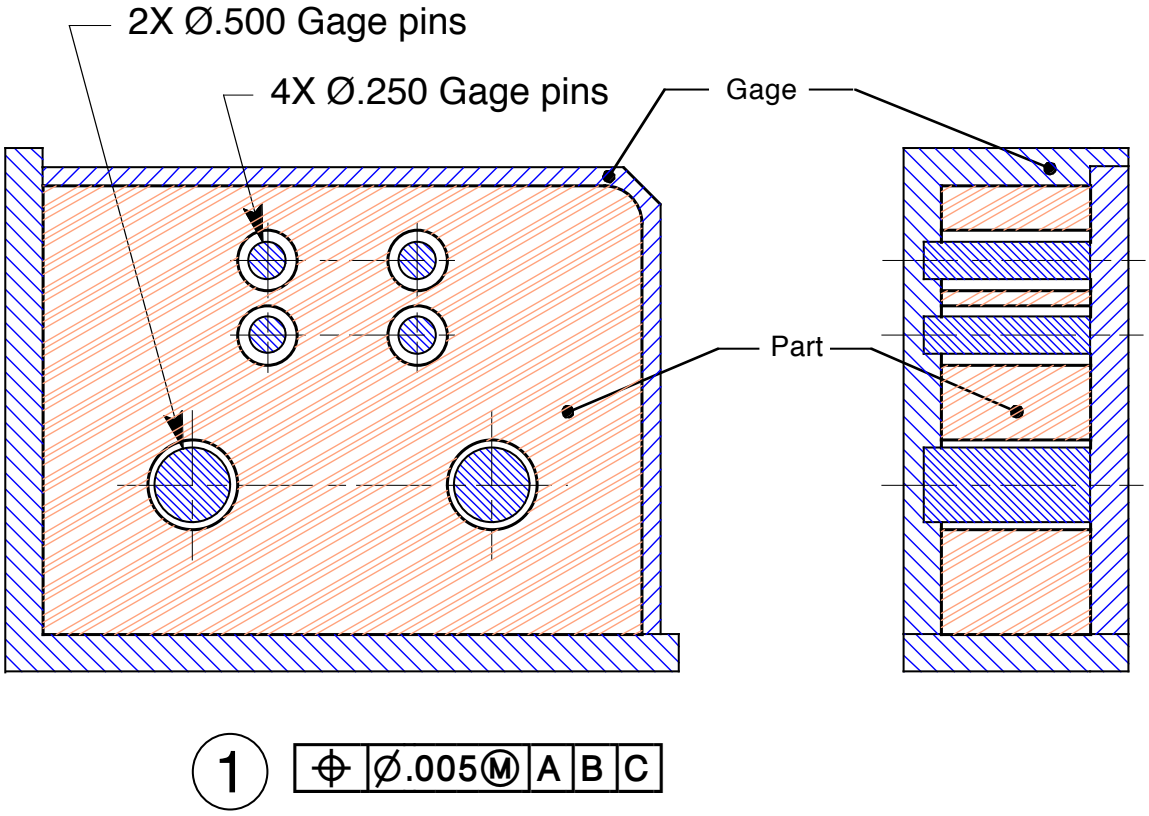

Figure 14-15 Gaging two patterns of features located to plane surface datum features.

In Fig. 14-15, the part with two hole patterns controlled to each other through the datum reference frame is shown in a gage designed to inspect the locations of both patterns relative to datum features A, B, and C. If both patterns are toleranced to the same datum features, in the same order of precedence, and at the same material conditions, the patterns are to be considered one composite pattern of features. Since one pattern has cylindrical tolerance zones .030 in diameter at MMC and the other has cylindrical tolerance zones .005 in diameter at MMC, the two patterns will be located within a cylindrical tolerance of .035 at MMC to each other. If the tolerance between patterns must be smaller then .035, one or both of the tolerances can be reduced.

If a large location tolerance between the two-hole pattern and datum reference frame A, B, and C and a small location tolerance between the two-hole and the four-hole patterns is required, one of the patterns may be the locating datum feature. In Fig.

14-14, the two-hole pattern is identified as datum feature D. If the four-hole pattern is toleranced with feature control frame number 2 shown in Fig. 14-14, the tolerance zones of the holes in the four-hole pattern are to be perpendicular to datum feature A, located to each other, and located to datum feature D at MMB with basic dimensions. That is, both holes in the two-hole pattern act as one datum feature controlling the location and clocking of the four-hole pattern. This part is shown in Fig. 14-16 on a gage designed to inspect the holes in the four-hole pattern perpendicular to datum feature A and located to each other and to the two-hole pattern, datum feature D at MMB within the tolerance specified.

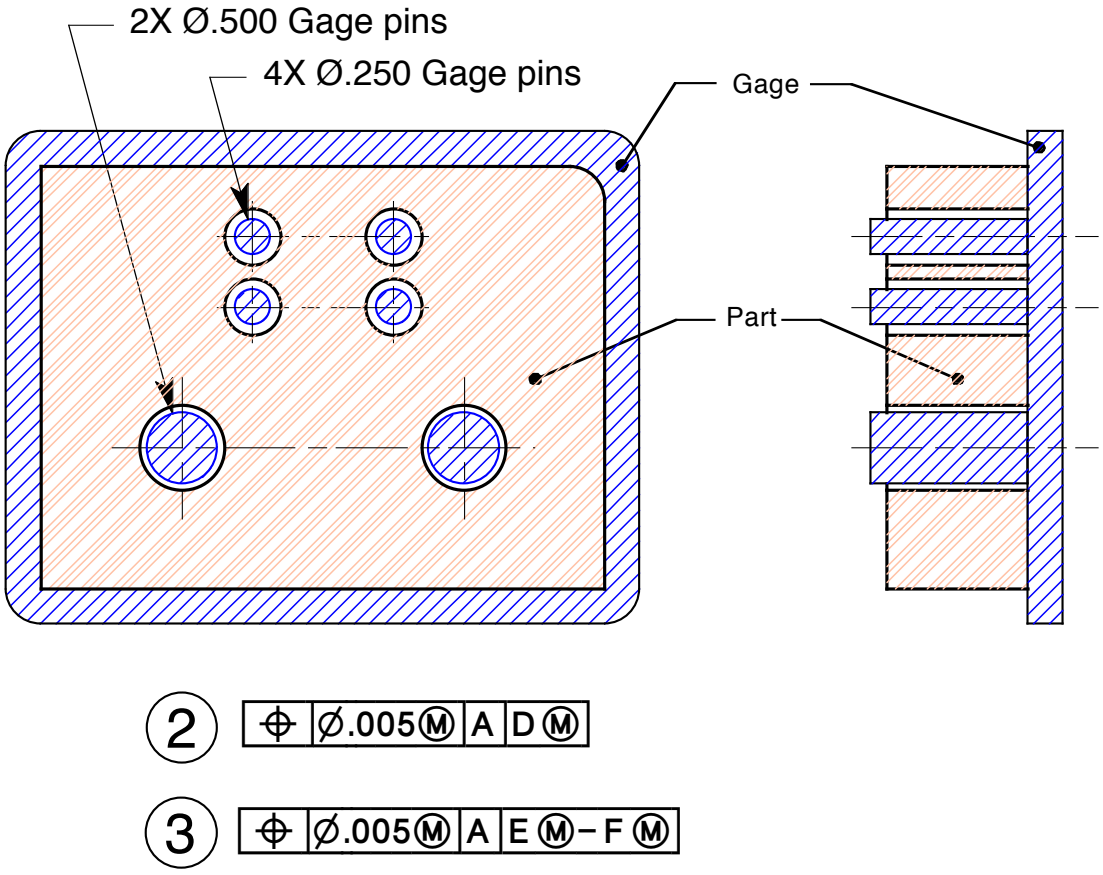

Figure 14-16 Gaging one pattern of features located to a second pattern of features

Feature control frame number 3 in Fig. 14-14 is equivalent to feature control frame number 2. If the four-hole pattern on the drawing is controlled with feature control frame number 3, the tolerance zones of the four holes must be perpendicular to datum feature A and located to each other and datum feature E at MMB–F at MMB with basic dimensions. Datum features E and F are of equal value beause they are in the same datum compartment. Datum feature E at MMB–F at MMB in feature control frame number 3 can be inspected with the same gage as datum feature D at MMB in feature control frame number 2 shown in Fig. 14-16.

Feature control frame number 4 in Fig. 14-14 is similar to feature control frame number 3 except that datum feature E, the secondary datum feature, is more important than datum feature F, the tertiary datum feature, because datum feature E precedes datum feature F in a separate compartment. As a result, datum feature E is the locating feature, and datum feature F is the clocking feature. That is, the function of datum feature F is only to prevent the part from rotating about datum feature E.

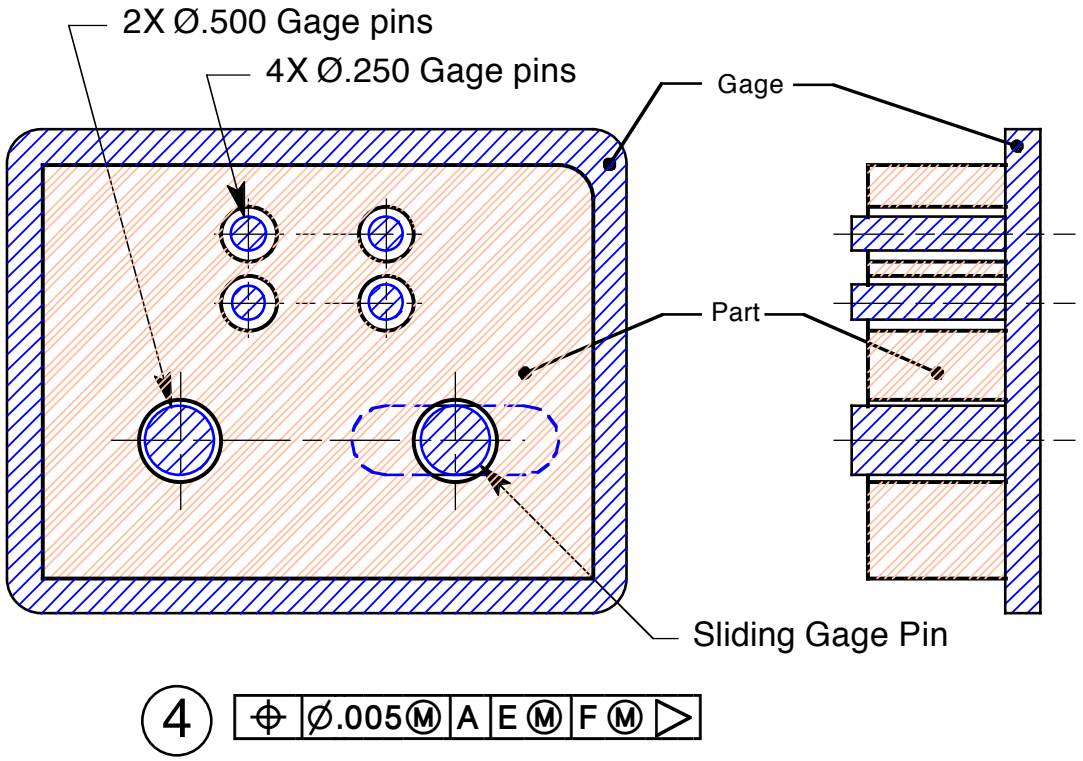

Figure 14-17 Gaging a pattern of features located to a feature of size and clocked to a second feature of size specified with the translation symbol

The translation modifier symbol was introduced in the 2009 dimensioning and tolerancing standard and has been included in feature control frame number 4 following datum feature F. This symbol unlocks the basic 2.000 dimension between the two datum feature simulators and allows datum feature simulator F to translate within the specified geometric tolerance to fully engage the feature illustrated on the gage in Fig. 14-17. If the translation modifier symbol had not been included in the fourth feature control frame, the basic 2.000 dimension would lock datum feature simulator F in place, requiring a gage such as the one in Fig. 14-16 to inspect the part. Consequently, without the translation symbol, the four-hole pattern would be located to both datum features E and F shown in the fourth feature control frame without the translation modifier. The result would be equivalent to the second and third feature control frames. (Gages are used here for illustration purposes only; parts toleranced with geometric dimensioning and tolerancing may be inspected with any appropriate inspection technique.)