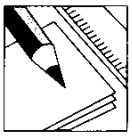


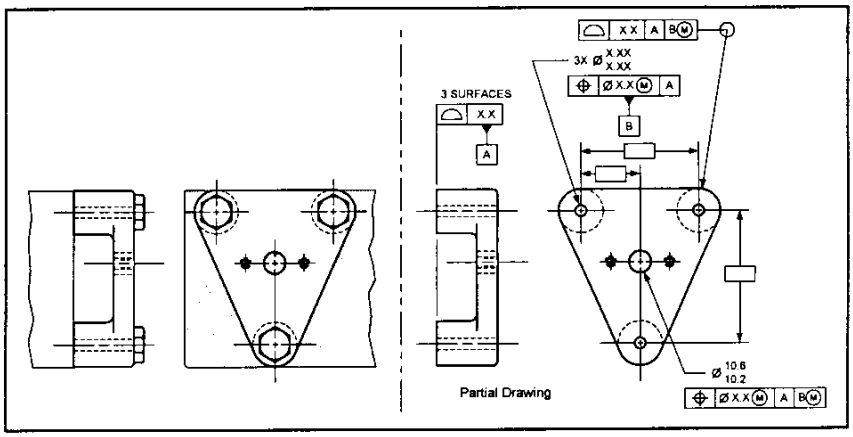
Design Tip

When a pattern of parallel cylinders (e. g. a hole pattern) are used as a primary datum feature, a position control is used to control the spacing of the cylinders within the pattern. When a pattern of parallel cylinders is used as a secondary or tertiary datum feature, a position control should be used to control the spacing of the cylinders within the pattern and the orientation of the pattern to the higher ranking datums.

6. Pattern of Parallel Cylinders as a Datum Feature

Using a pattern of parallel cylinders (e.g. diametrical features of size, like a pattern of dowel pins or a pattern of holes) as a datum feature is a familiar practice in industry. The pattern of parallel cylinders is designated as a datum feature by applying a datum identification symbol to the size dimension of the pattern of cylinders. An example of specifying a pattern of cylinders as a datum feature is shown in Figure 14-12.

When a pattern of parallel cylinders (a hole pattern) is used as a datum feature, any feature control frames that reference the datum feature must include under which material condition (MMC or LMC) the datum feature simulator is to be constructed. The method for indicating the material condition is by specifying an MMC or LMC modifier in the datum portion of the feature control frame.



14-12 Pattern of Parallel Cylinders as a Datum Feature

Author's Comment

In this type of dimensioning, the hole pattern is not defined relative to the outside edges of the part. The hole pattern is the origin of measurement. The outside surfaces of the part are dimensioned from the hole pattern. Often the outside surfaces are described with basic dimensions, and profile controls are used to relate the outside surfaces to the hole pattern.

When to Use Pattern of Parallel Cylinders (e.g. Hole Pattern) as a Datum Feature

There are two common applications where a pattern of parallel cylinders is used as a datum feature:

- When the part is located by the pattern of cylinders in its assembly
- When describing a functional relationship between a part feature and a datum axis created from the pattern of cylinders

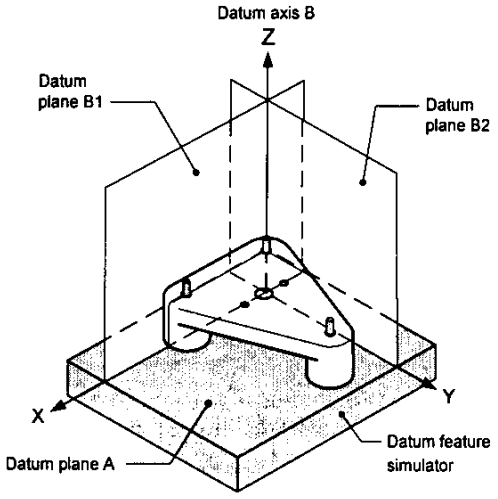
In Figure 14-13, the pattern of parallel cylinders (hole pattern) locates the part in its assembly. When a hole pattern locates the part and is used as a datum feature, it is usually referenced as a secondary datum feature. When a hole pattern is used as a secondary datum feature, it restricts the part movement in three directions. It serves as both a secondary and tertiary datum feature; therefore, no tertiary datum feature is used.

The Datum Reference Frame

It is important to be able to visualize the datum feature simulator, datum axis, datum planes, and datum reference frame for inspecting a geometric tolerance. When a pattern of parallel cylinders is used as a secondary datum feature, the pattern is most often referenced at MMC. The datum feature simulator is a pattern of virtual condition gage pins. A datum axis exists at the center of each virtual condition gage pin. Since the gage pins are considered to be theoretically perfect, measurements can be taken from any one of these datum axes. Figure 14-13 shows the datum plane and datum axes for the datums referenced in the position control in Figure 14-12.

Degrees of Freedom Constrained

A part in space has six degrees of freedom. When inspecting a geometric tolerance, some or all of the degrees of freedom must be constrained. Some geometric tolerances only require three degrees of freedom to be restrained, while other geometric tolerances require all six degrees of freedom to be restrained. The number of degrees of freedom that are constrained when inspecting a geometric tolerance depends upon three factors: the type of datum feature, the number of datums referenced, and the sequence of the datum references. Whenever a geometric tolerance references a planar surface as the primary datum feature and a pattern of parallel cylinders as a secondary datum feature, all six degrees of freedom are constrained.



Using the TOP control applied to the 10.2-10.6 dia. in Figure 14-12

Degree of freedom	Constrained
Movement along the X axis	YES
Movement along the Y axis	YES
Movement along the Z axis	YES
Rotation around the X axis	YES
Rotation around the Y axis	YES
Rotation around the Z axis	YES

14-13 Degrees of Freedom Constrained

Author's Comment

When a hole pattern is used as a datum feature, it is almost always referenced at MMC or LMC. If a hole pattern that is used as a datum feature is referenced at RFS, it is extremely difficult (or impossible) to create a repeatable datum axis.

Author's Comment

When a feature of size datum feature is referenced at MMC or LMC, a datum shift is permissible. Even though a datum shift (movement) may be present, the part is considered constrained.

Author's Comment

Datum axis B could be shown passing through any one of the holes.