Profile Controls

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Profile Controls

Sections:

1. Introduction
2. General Information on Profile
3. Profile of a Surface
4. Profile of a Line
5. Part Calculations
6. Summary
7. References

Introduction

There are two types of profile controls: profile of a surface and profile of a line.
Profile of a surface is considered the most powerful control in the geometric tolerancing system. It can be used to control the size, location, orientation, and form of a part feature. Profile of a surface or line can be used to tolerance planar surfaces, cylinders, cones, curves, and irregular curves.

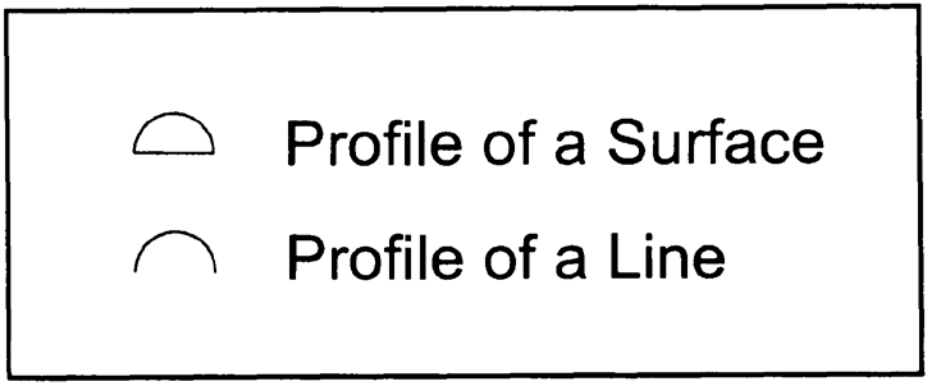


FIGURE 12-1 Profile Controls

General Information on Profile

Profile Terminology

A unique aspect of profile controls is that they can be specified with a datum reference (as a datum-related control) or without a datum (as a form control). When datums are referenced, the profile tolerance zone is related to the datum reference frame. When no datums are referenced, the profile tolerance zone applies where the part surface actually exists.

A **profile** is the **outline of a part feature in a given plane**. A true profile is the exact profile of a part feature as described by basic dimensions. A profile control is a geometric tolerance that specifies a uniform boundary along the true profile that the elements of the surface must lie within. A profile of a line control is a type of profile control that applies to line elements of the toleranced surface. Whenever a profile control is used, it is associated with a true profile (a surface defined with basic dimensions). The true profile may be located with basic or toleranced dimensions relative to the datums referenced in the profile control.

General Information on Profile

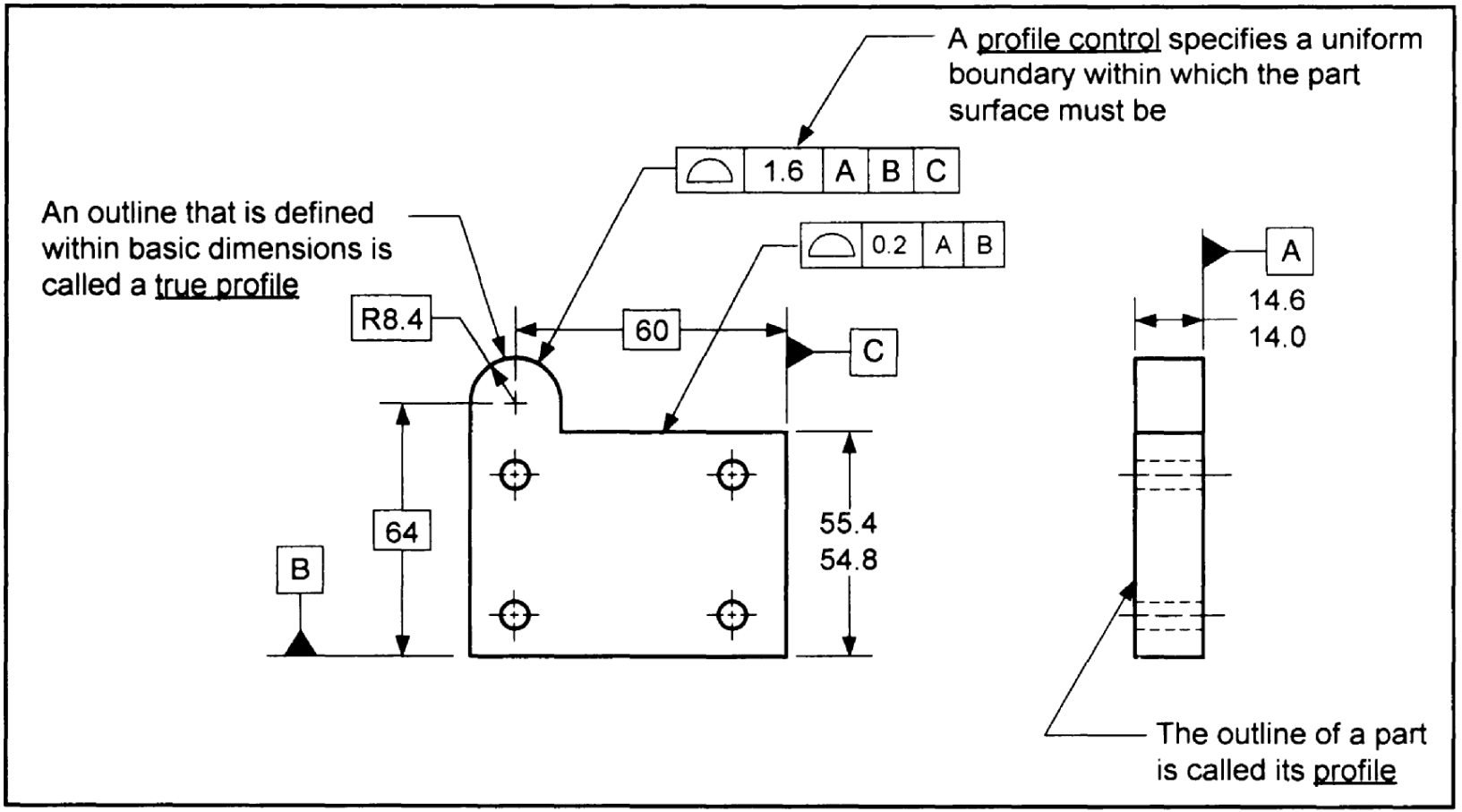


FIGURE 12-2 Profile Control

General Information on Profile

Profile Tolerance Zones

When a profile of a surface control is specified, the tolerance zone is a uniform boundary (a 3-D tolerance zone). It applies for the full length, width, and depth of the surface. When a profile of a line control is specified, the tolerance zone is two uniform lines (a 2-D tolerance zone). It applies for the full length of the surface.

Unless otherwise indicated, where a profile control (surface or line) is associated with a feature, the tolerance zone is a bilateral tolerance zone with equal distribution. This is the most common tolerance zone used with profile. However, when using profile controls (surface or line), three other distributions are permissible:

1. Bilateral tolerance zone (unequal distribution)
2. Unilateral tolerance zone (outside)
3. Unilateral tolerance zone (inside)

General Information on Profile

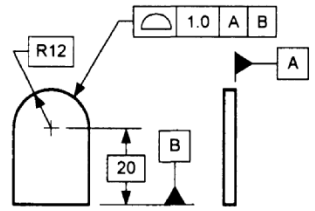
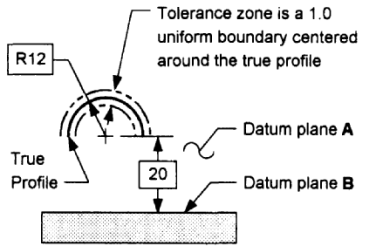
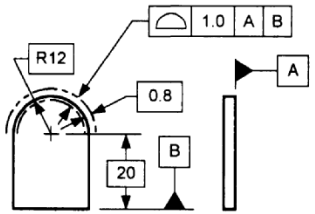
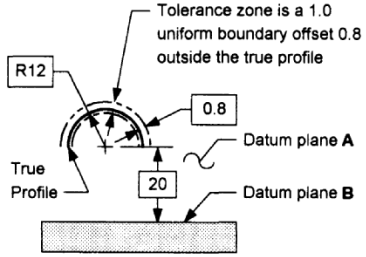
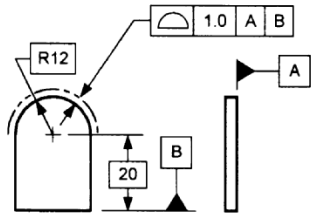
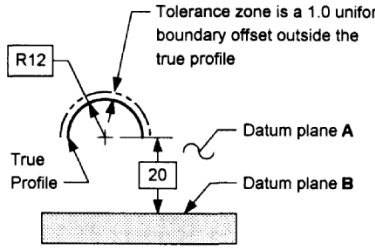
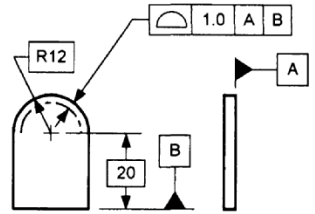
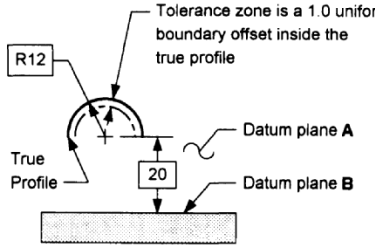
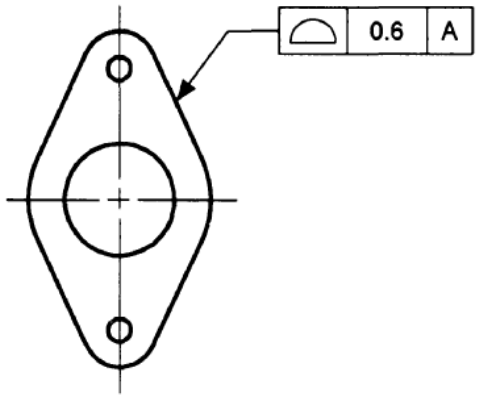
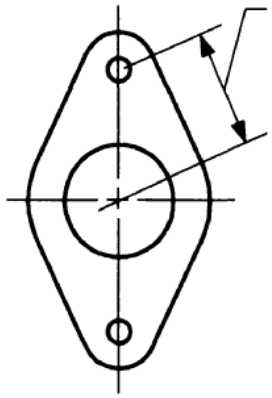
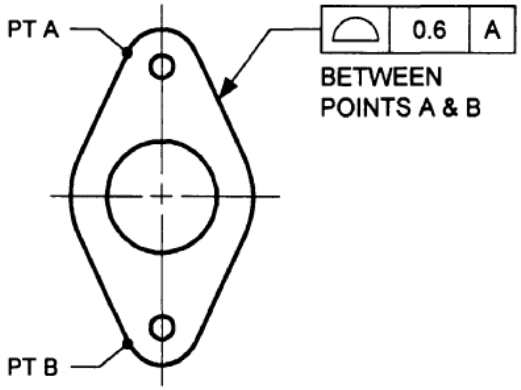
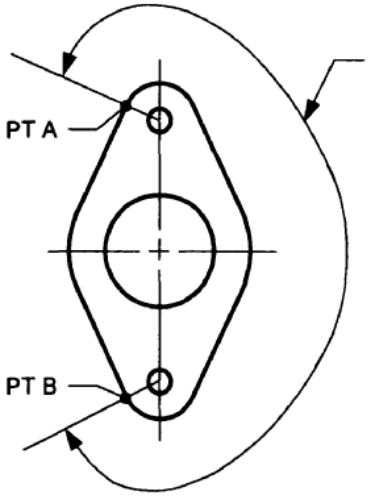
PROFILE TOLERANCE ZONE SPECIFICATION	INTERPRETATION	COMMENTS
DEFAULT Bilateral - Equal distribution 		• The most common application of profile
OPTIONAL Bilateral - Unequal distribution 		• Use of phantom lines and basic dimension specify the amount of unequal distribution
OPTIONAL Unilateral - Outside 		• Use of a phantom line denotes the direction the tolerance zone is offset
OPTIONAL Unilateral - Inside 		• Use of a phantom line denotes the direction the tolerance zone is offset

FIGURE 12-3 Profile Tolerance Zone

General Information on Profile

PROFILE SPECIFICATION	TOLERANCE ZONE COVERAGE
DEFAULT - Leader line touches a surface **A** 	
OPTIONAL - Use of a note to extend tolerance zone coverage **B** 	

General Information on Profile

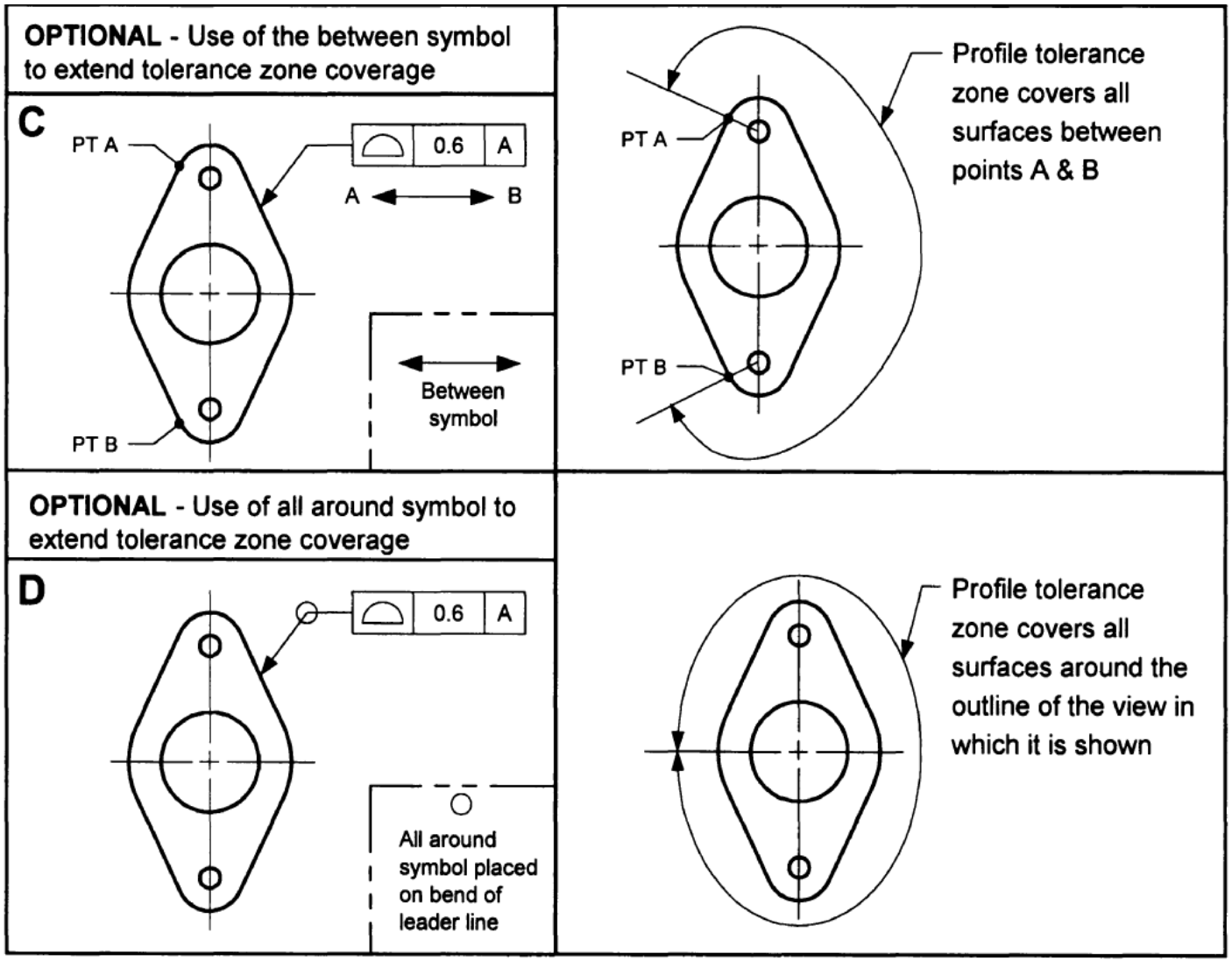


FIGURE 12-4 Profile Control Tolerance Zone Coverage

General Information on Profile

Advantages of Profile

In comparison to coordinate tolerancing, profile tolerancing offers many advantage. Three important advantages are:

1. It provides a clear definition of the tolerance zone.
2. It communicates the datums and datum sequence.
3. It eliminates accumulation of tolerances.

General Information on Profile

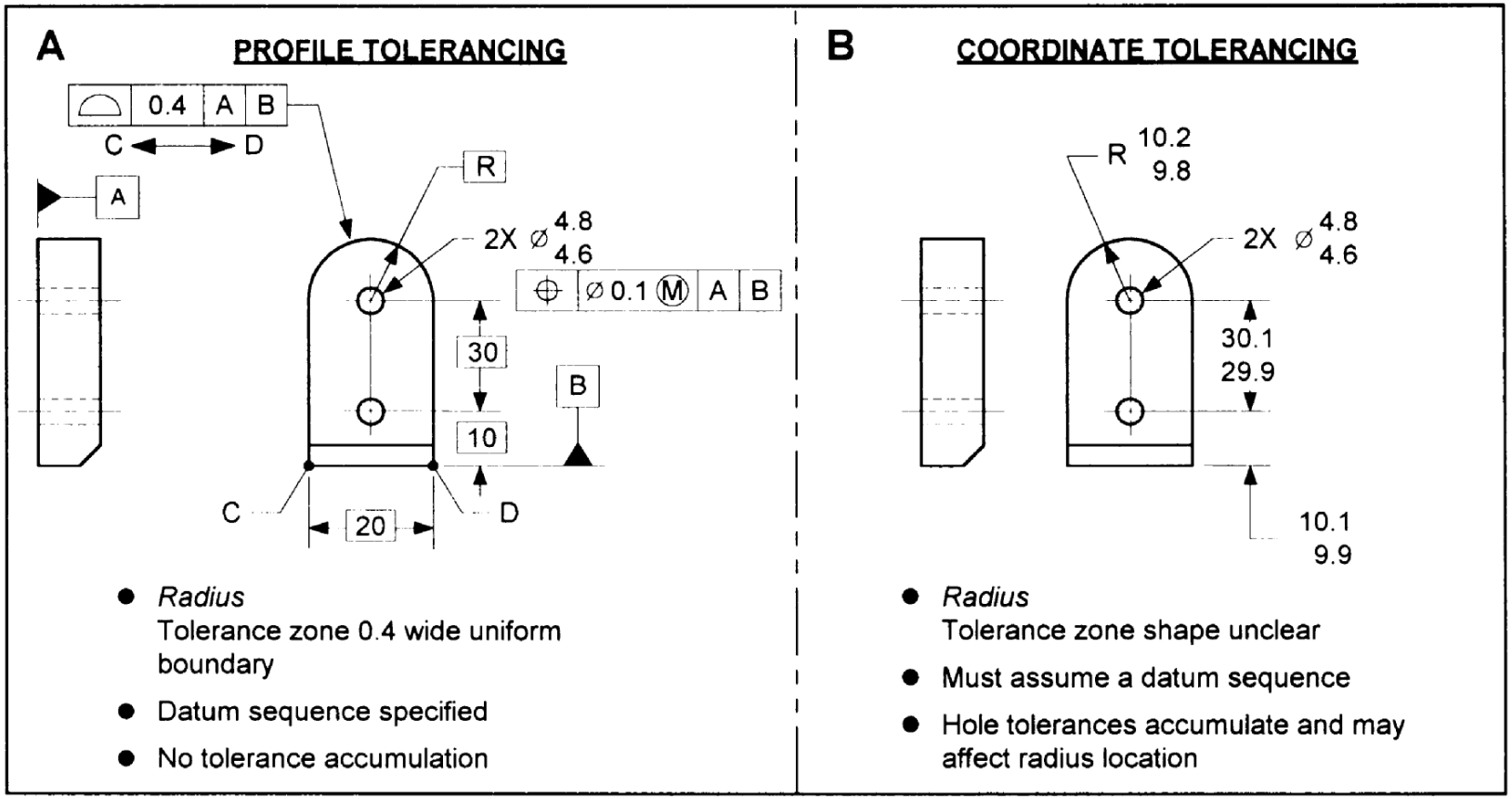


FIGURE 12-5 Advantages of Profile

Profile of a Surface

A profile of a surface control is a geometric tolerance that limits the amount of error a surface can have relative to its true profile. Common applications for profile of a surface controls include controlling - either independently or in combination - the size, location, orientation and form

1. Planar, curved, or irregular surfaces
2. Polygons
3. Cylinders, surfaces of revolution, or cones
4. Coplanar surfaces

Profile of a Surface

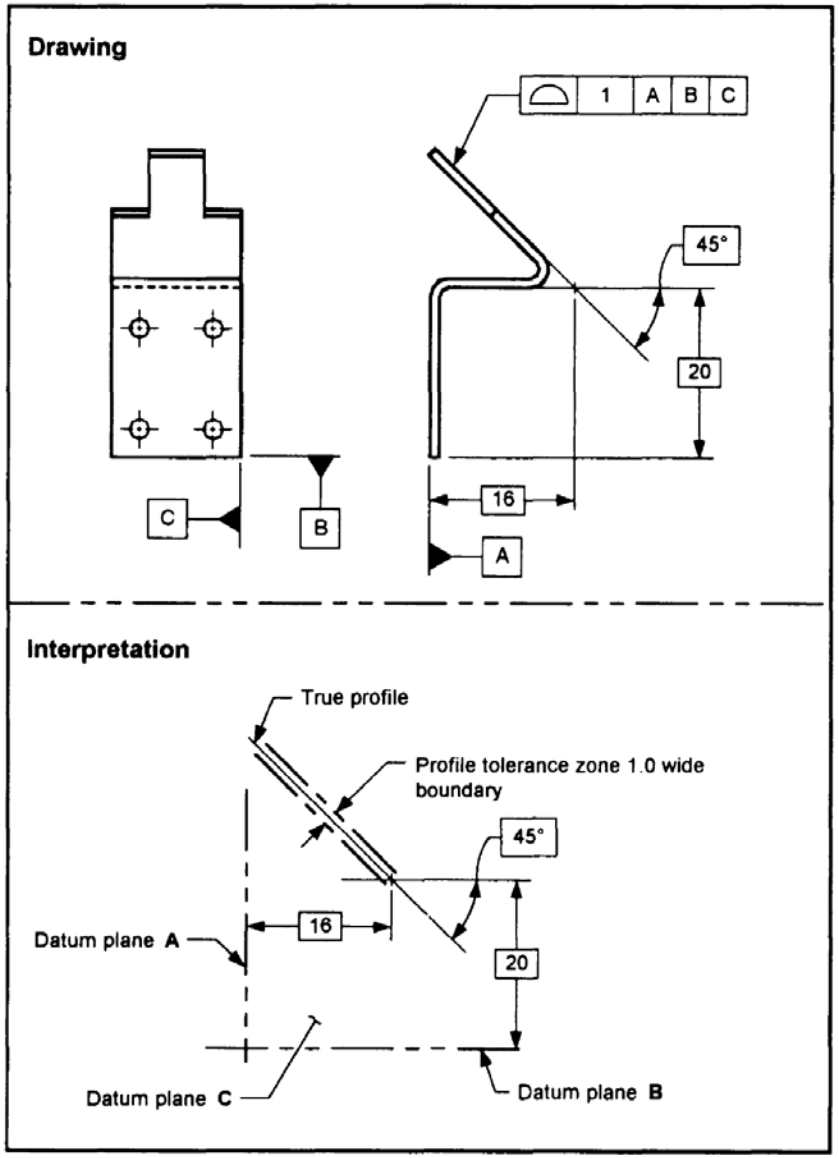


FIGURE 12-6 Profile Used to Tolerance a Surface Location

Profile of a Surface

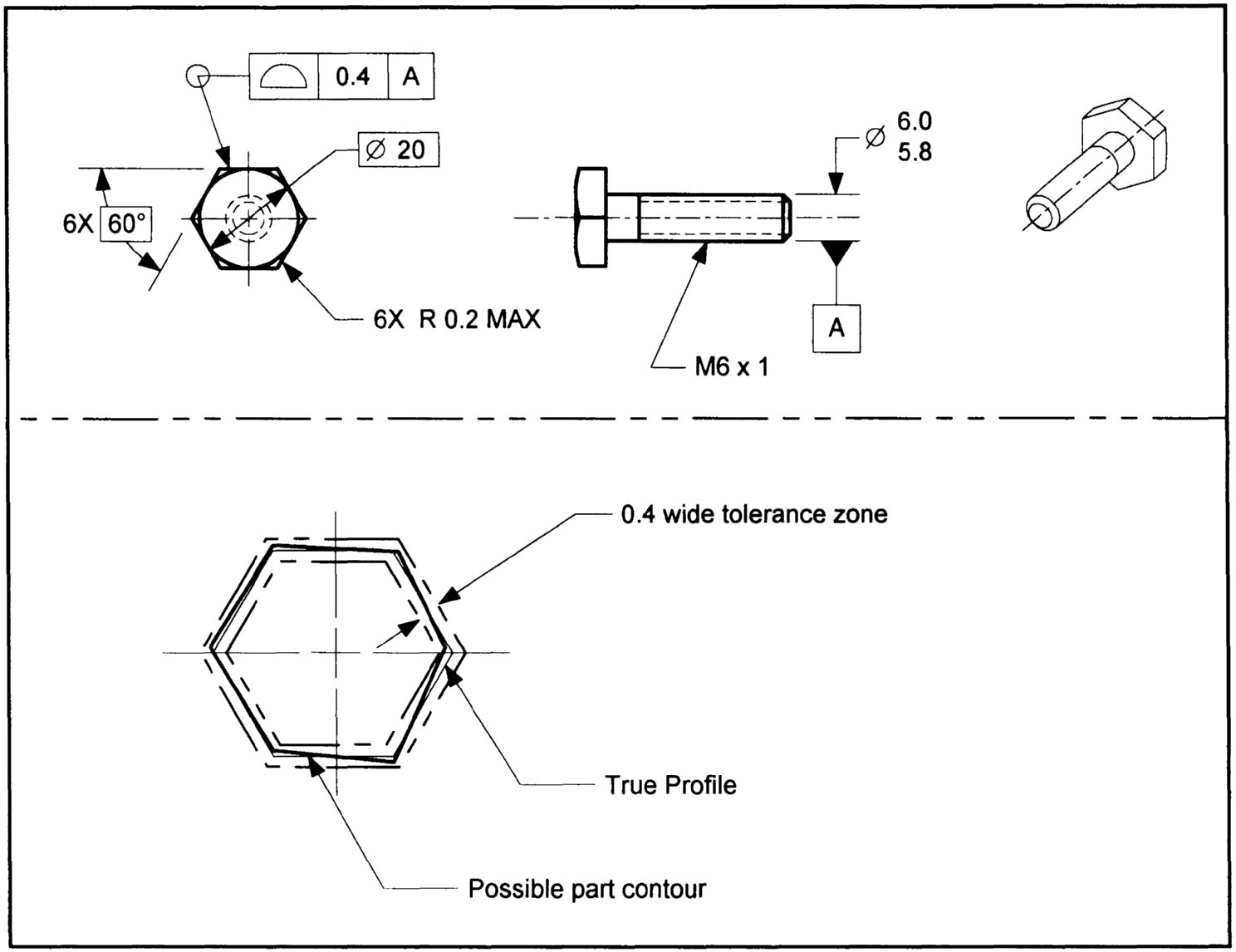


FIGURE 12-7 Profile Used to Tolerance a Polygon

Profile of a Surface

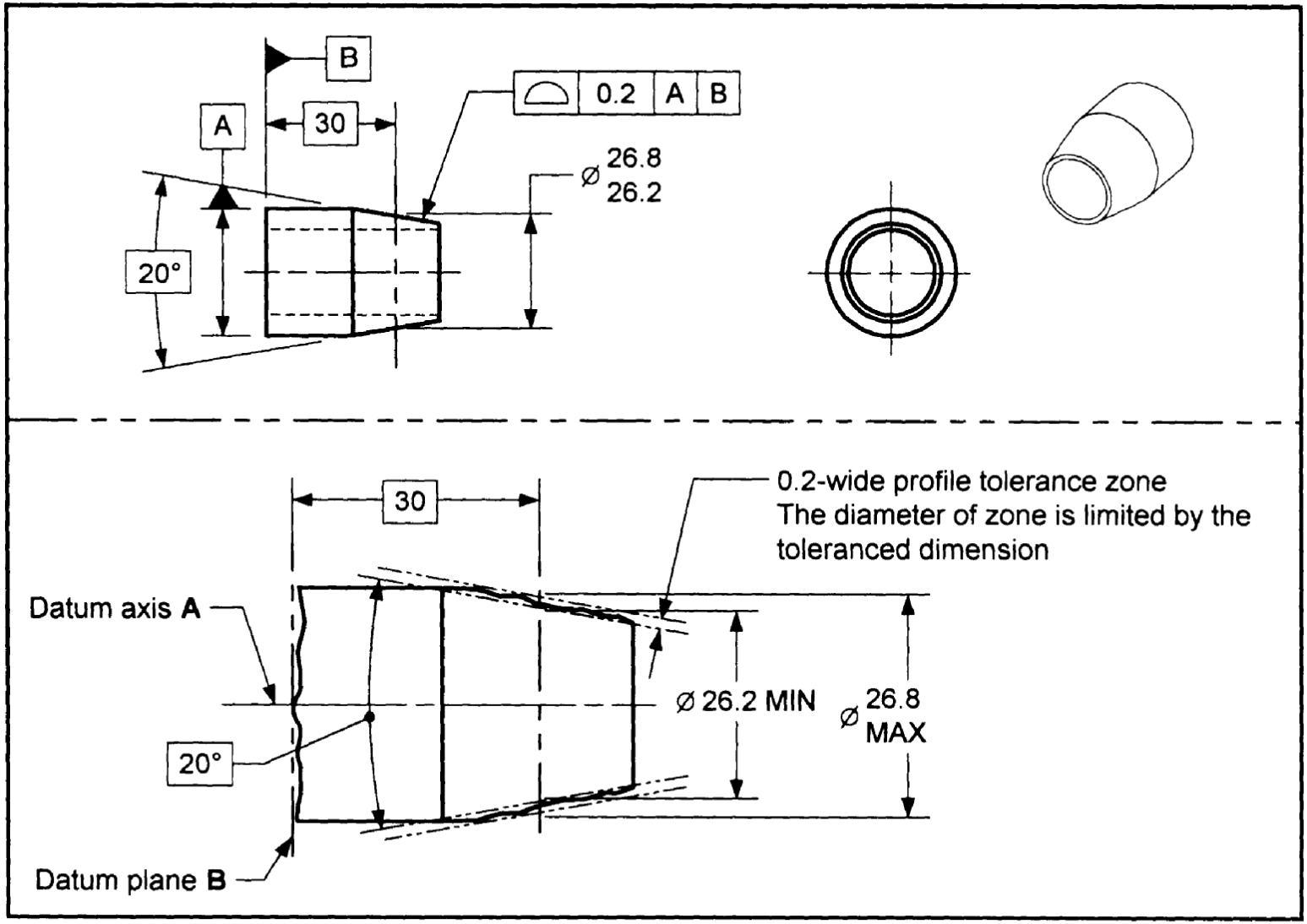


FIGURE 12-8 Profile Used to Tolerance a Conical Feature

Profile of a Surface

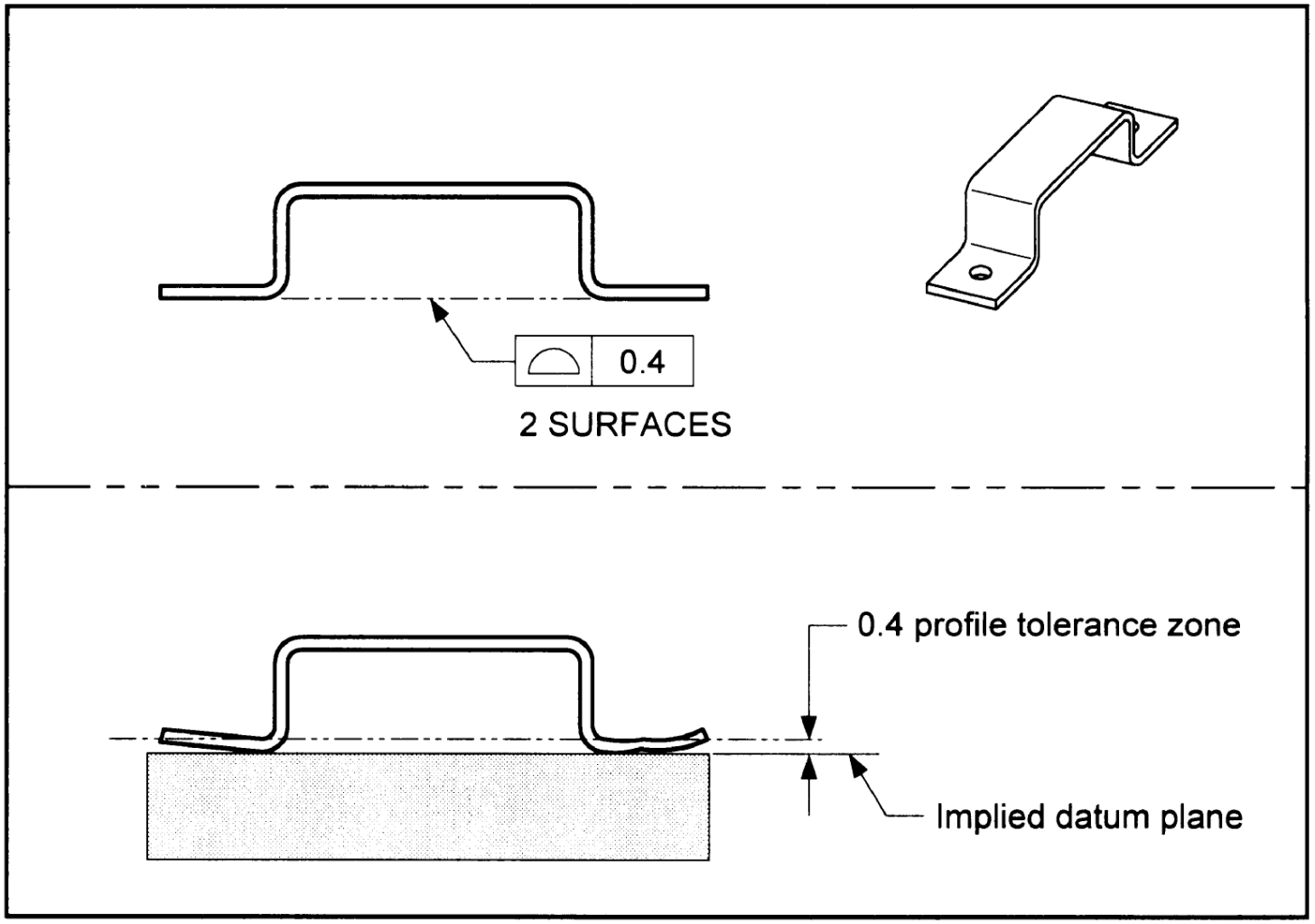


FIGURE 12-9 Profile Used to Tolerance Coplanar Surfaces

Profile of a Surface

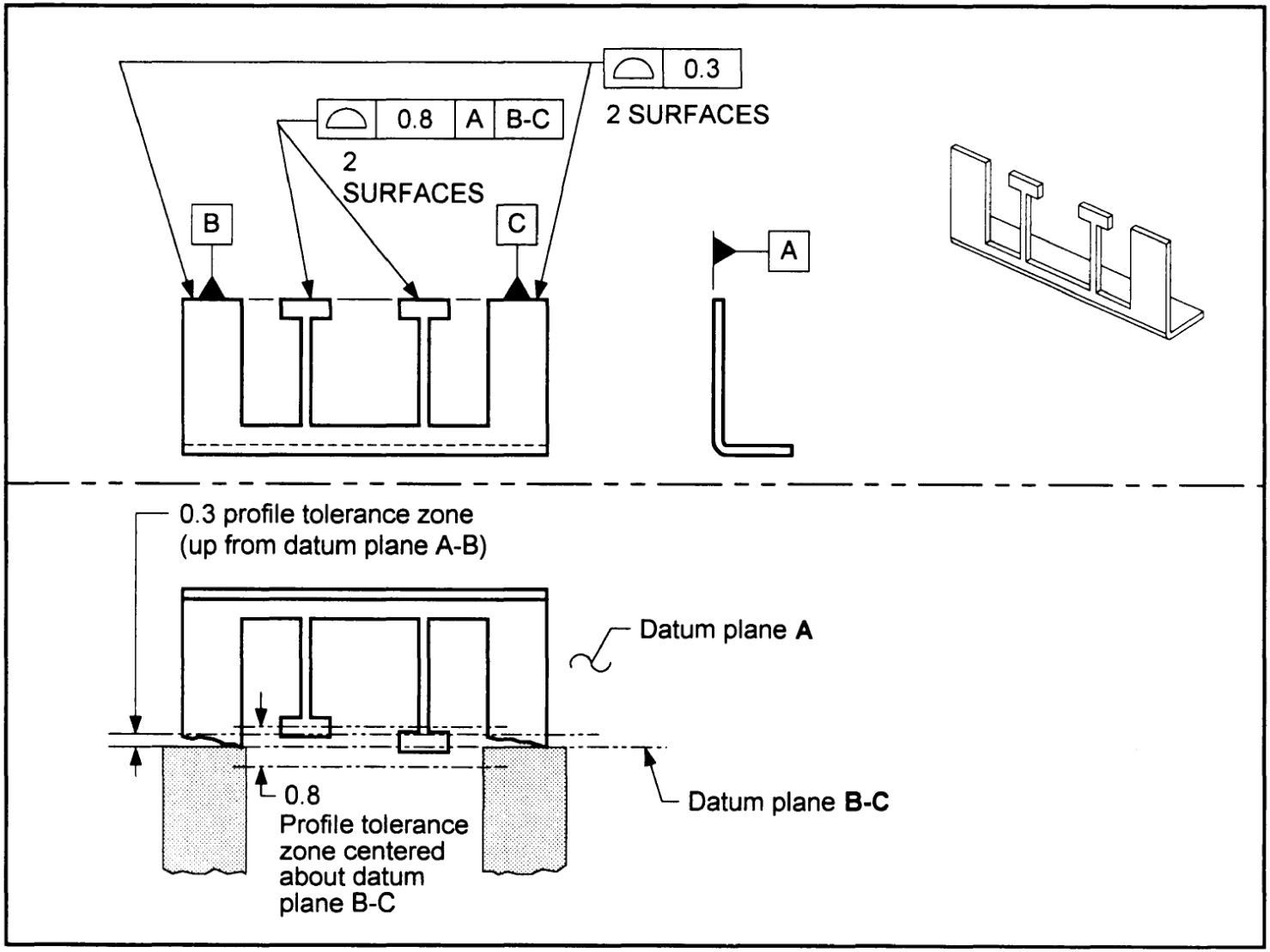


FIGURE 12-10 Profile Used to Tolerance Multiple Coplanar Surfaces

Profile of a Surface

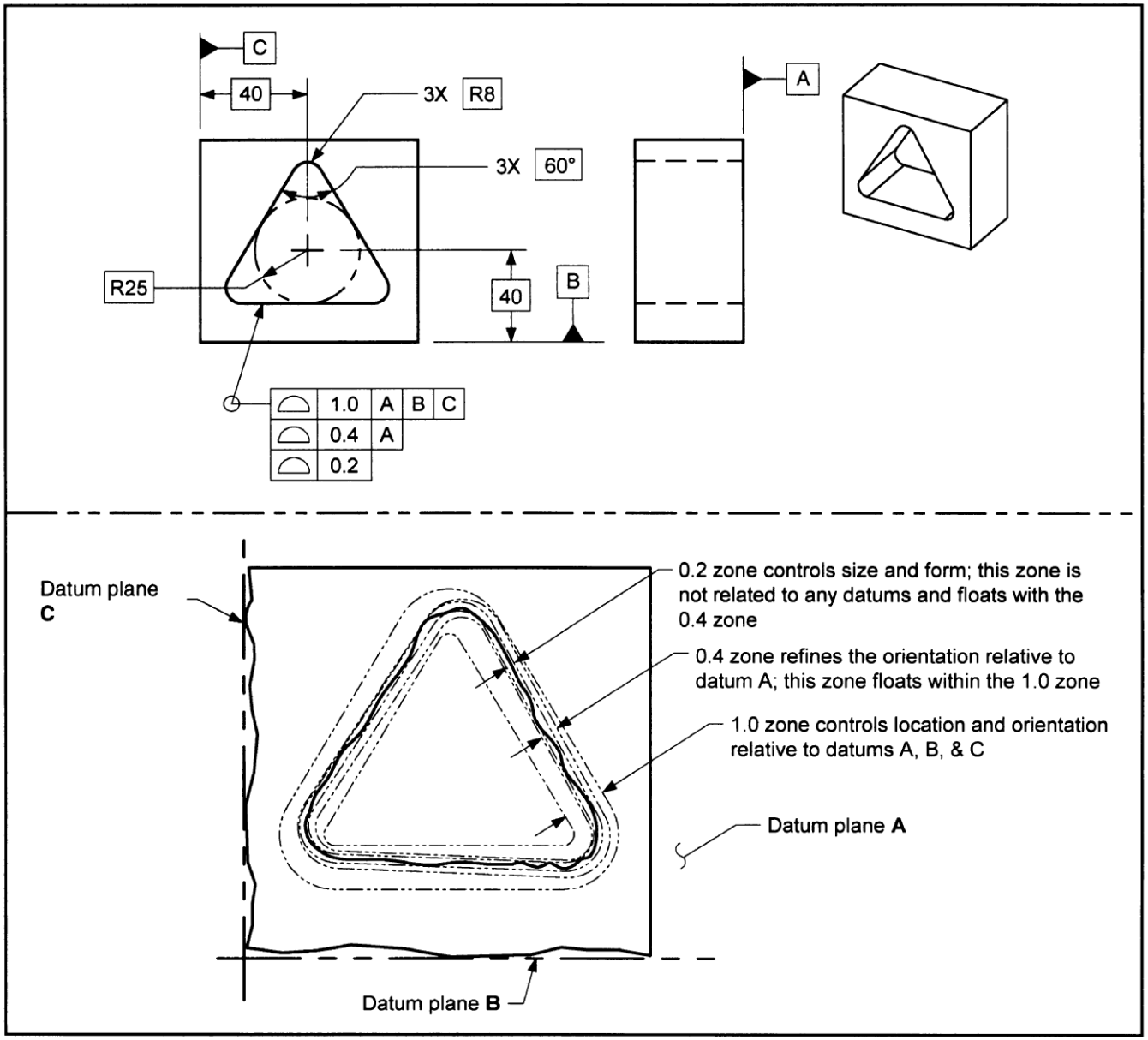


FIGURE 12-11 Multiple Single-Segment Profile Callout Application

Profile of a Surface

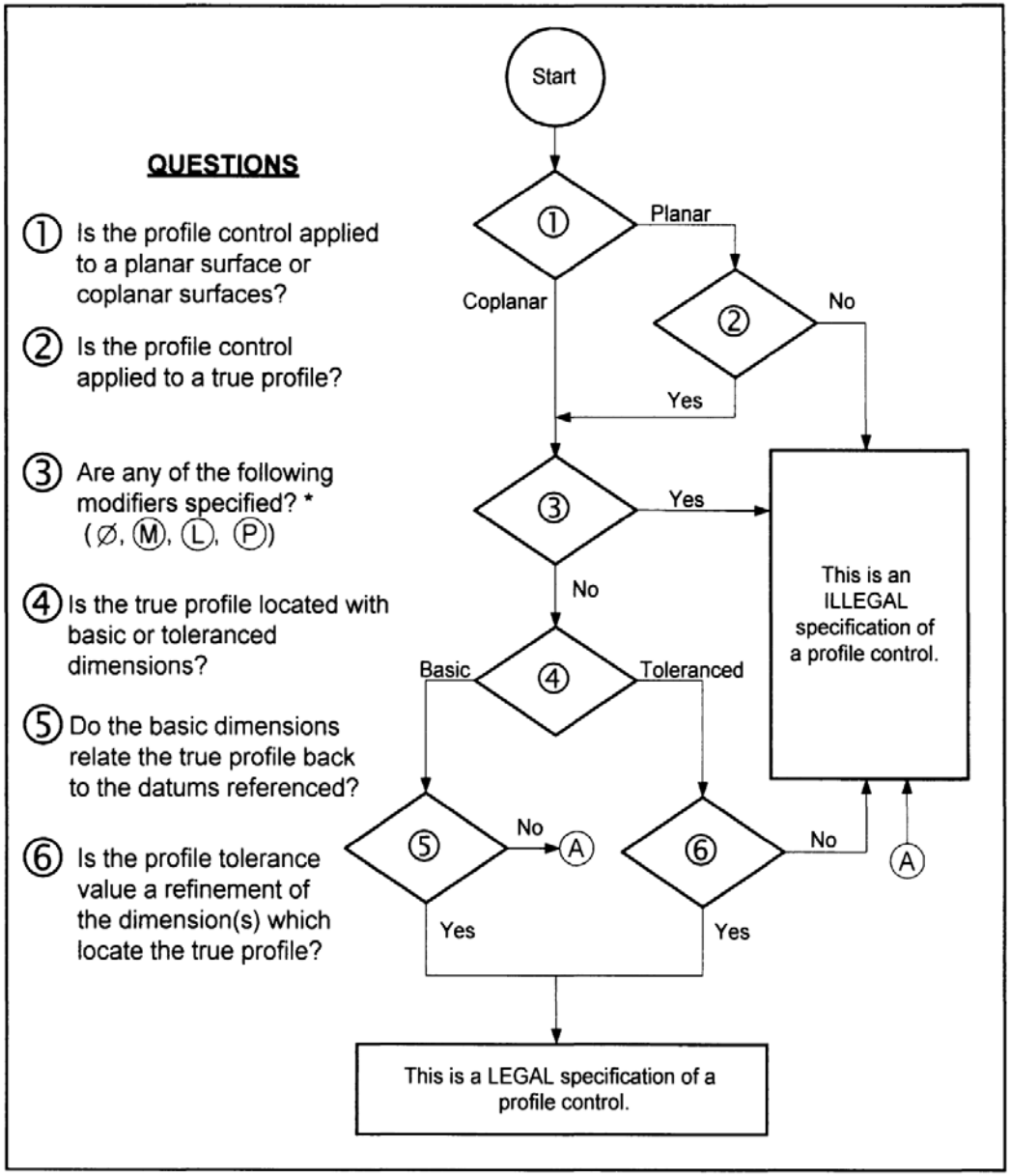


FIGURE 12-12 Legal Specification Flowchart for Profile of a Surface

Profile of a Surface

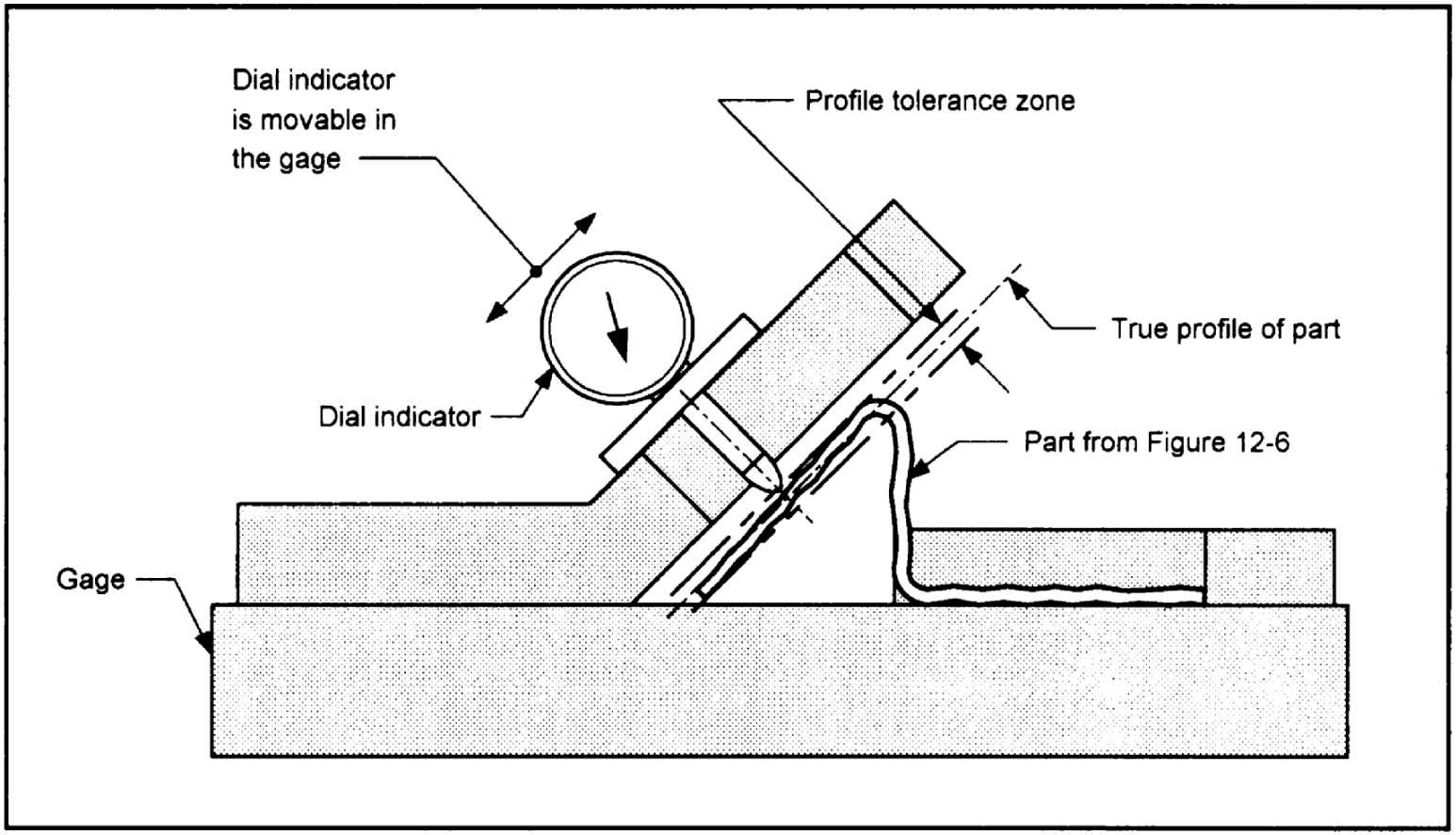


FIGURE 12-13 Inspecting Profile of a Surface

Profile of a Line

The basic concepts of profile of a surface and profile of a line are similar. The primary difference is that the tolerance zone for profile of a surface is three-dimensional, and the tolerance zone for profile of a line is two-dimensional. A **profile of a line control** is a **geometric tolerance that limits the amount of error for line elements relative to their true profile**. The tolerance zone is established in the same manner as surface profile. The tolerance zone is two-dimensional; it is two uniform lines applied at any cross section of the surface. Profile of a line provides a control in one direction only. Therefore, profile of a line is often used as part of a multiple single-segment control for a surface. It is common to use both a profile of a surface and a profile of a line control on the same surface. Another common method of applying profile of a line is as a refinement of a coordinate tolerance.

Profile of a Line

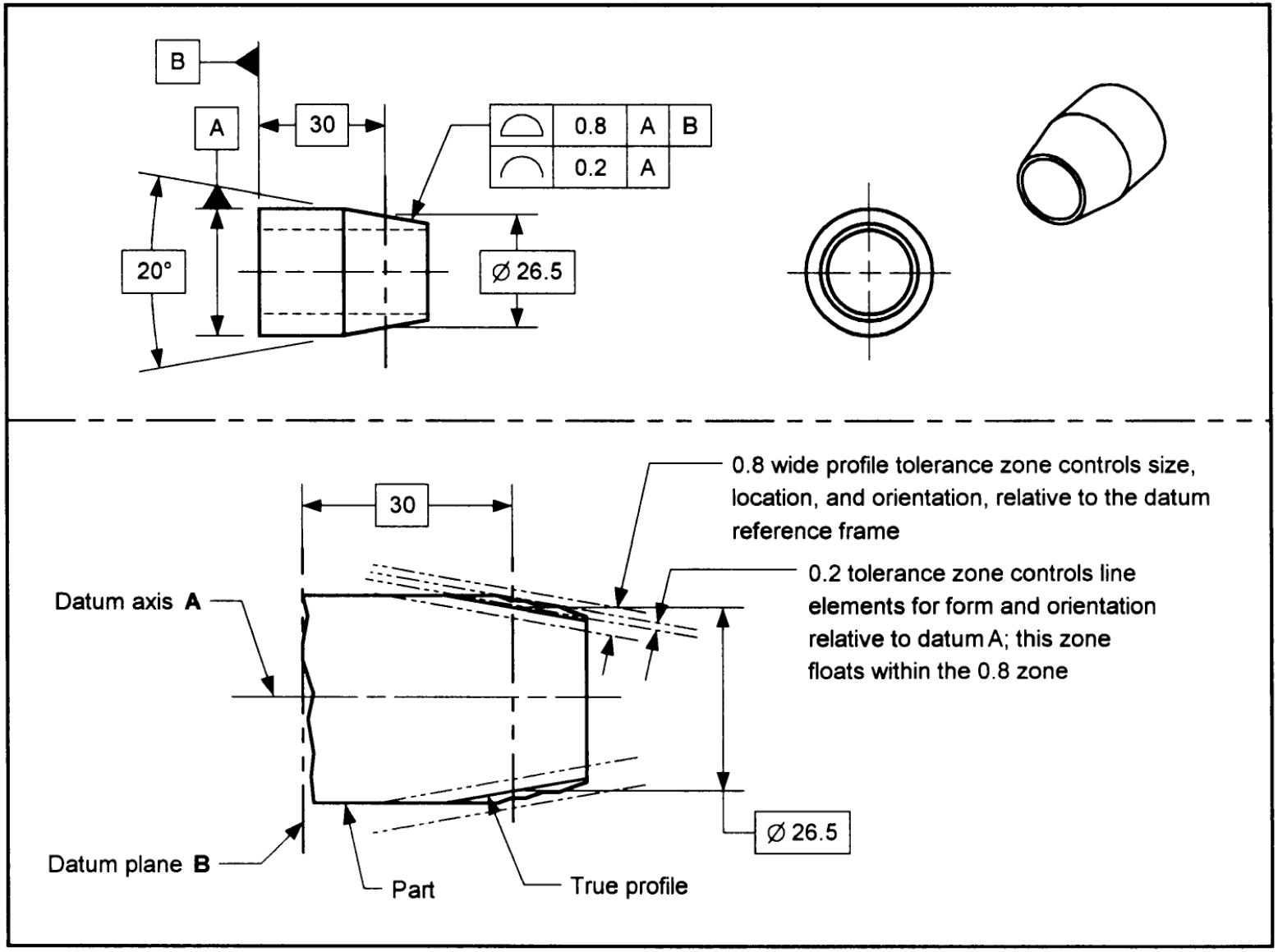


FIGURE 12-14 Profile of a Line Used in a Multiple Single-Segment Profile Control

Profile of a Line

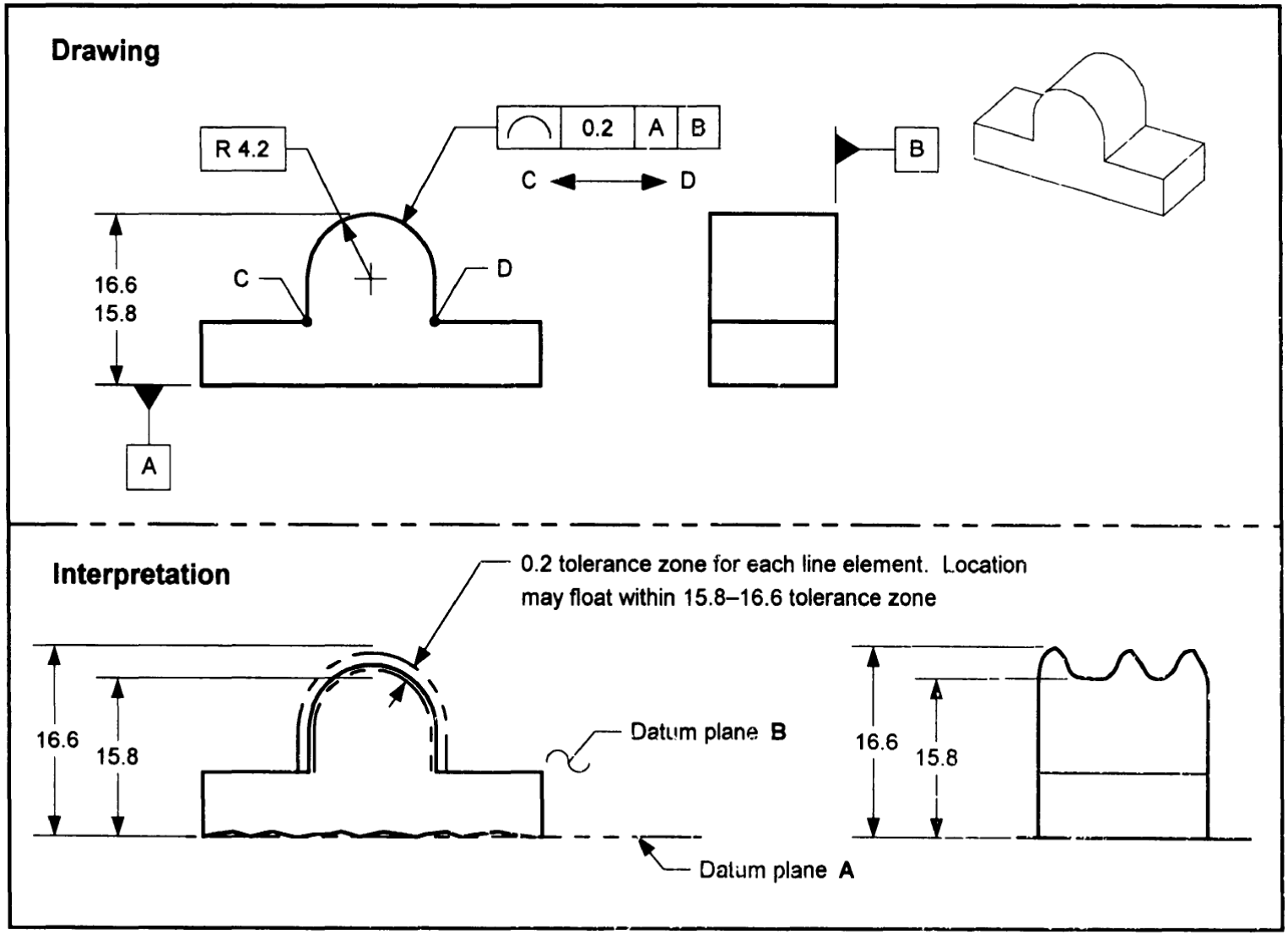


FIGURE 12-15 Profile of a Line Used with a Coordinate Tolerance

Profile of a Line

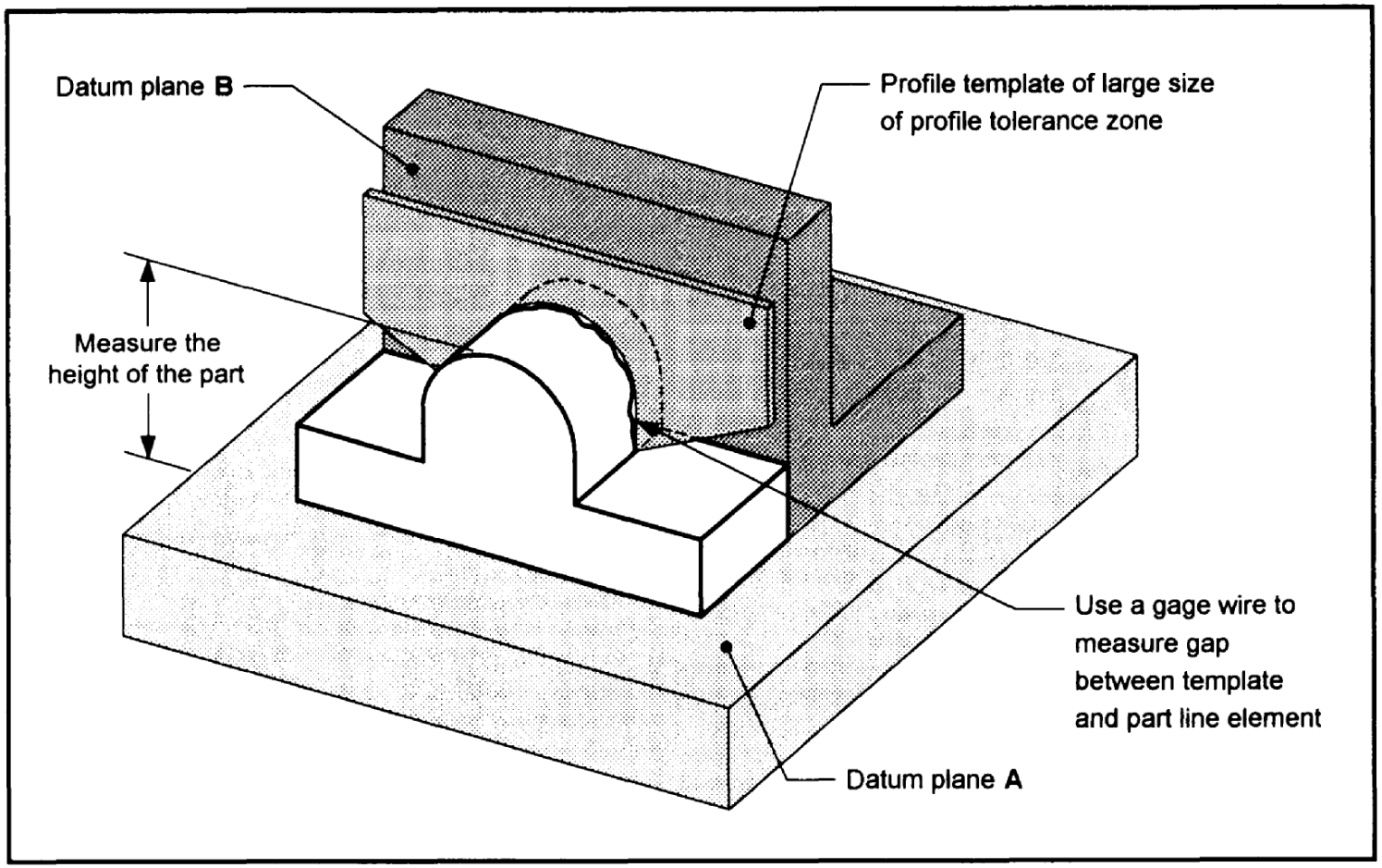


FIGURE 12-16 Inspecting Profile of a Line

Part Calculations

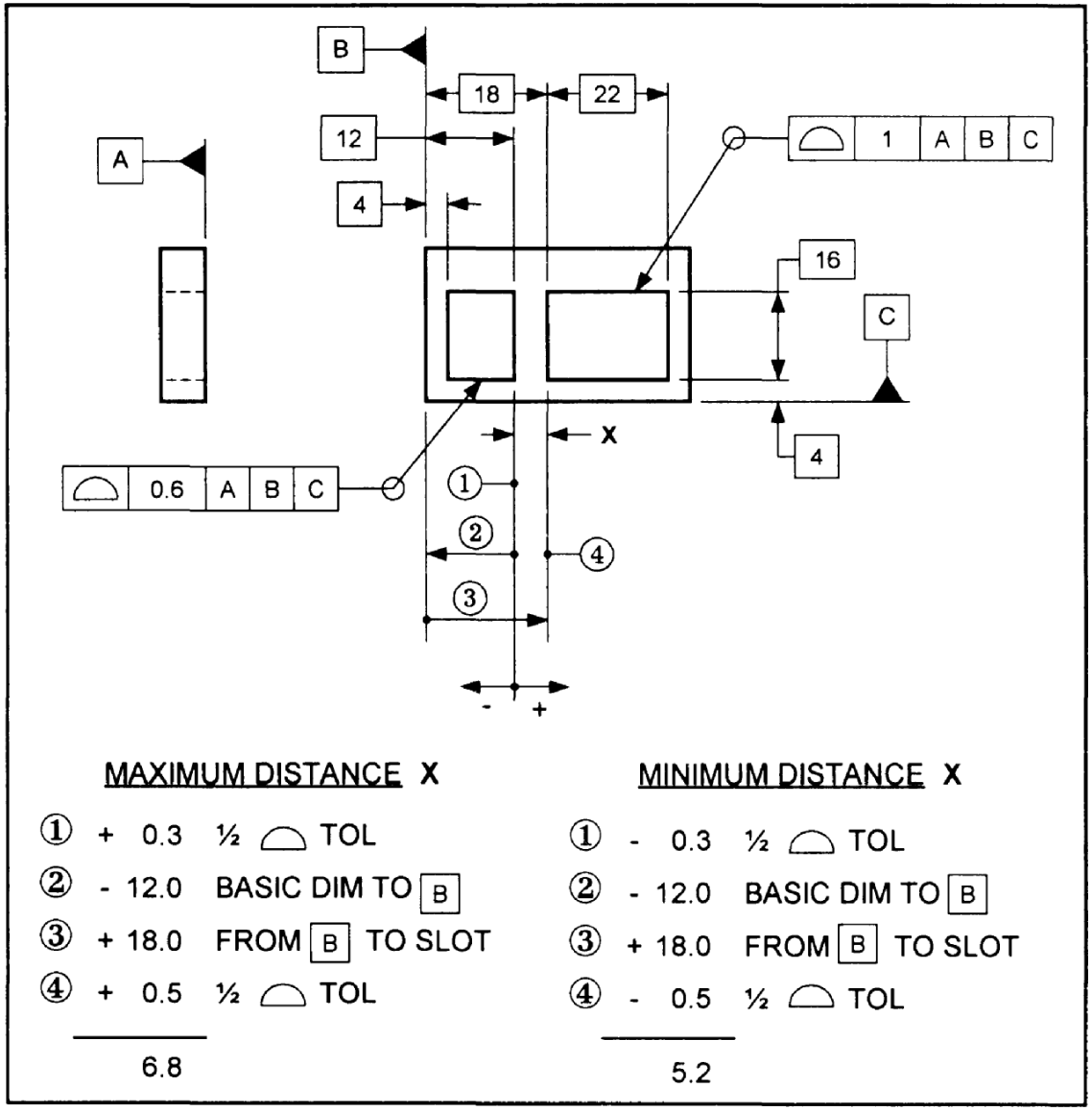


FIGURE 12-17 Part Calculations Involving Profile

Summary

Symbol	Datum reference required	Can be applied to a		Can use Ⓜ or Ⓛ modifier	Can be applied at RFS	Override Rule #1	Can use bonus tolerance concepts	Can use datum shift concepts
		Surface	FOS					
⌓	Yes*	Yes	No	No●	Yes**	No■	No	Yes
⌒	Yes*	Yes	No	No●	Yes**	No■	No	Yes

* Can be used with or without a datum reference
** Is automatic per Rule #2
■ Must be applied to a true profile therefore Rule #1doesn't apply
● These modifiers may be used in the datum portion of the feature control frame

FIGURE 12-18 Summarization of Profile Controls

References

http://www.etinews.com/gdt_glossary.html
http://www.draftingzone.com/shoppingzone/dmpgt.pdf
http://www.engineersedge.com/gdt.htm