



GEOMETRIC DIMENSIONING & TOLERANCING

Method of Instruction: Instructor & Projected Presentation

This workshop is an introduction to geometric dimensioning and tolerancing. The course is based on Dimensioning and Tolerancing ASME Y14.5-2009 standard.

Audience:

Any individual involved in designing, manufacturing, inspecting and purchasing parts and assemblies. *This class may be a good refresher for engineers.*

Training Time: 8 hours – delivered in two 4-hour sessions.

Prerequisites:

Basic math and basic understanding of engineering drawings. Blueprint reading skills and working understanding of common measuring devices suggested.

Program Content:

Students will get a thorough introduction to the Y14.5 standard. The principal objective is to give those who are required to interpret blueprints the skills to understand the basics of geometric dimensioning and tolerancing.

<ul style="list-style-type: none">• Introduction to ASME Y14.5-2009• The Datum System• Coordinate Tolerancing vs. GD&T• Datum Reference Frame• GD&T Symbols• Degrees of Freedom• Basic Dimensions• Parallelism• Material Conditions• Perpendicularity• Feature Control Frame• Angularity	<ul style="list-style-type: none">• Rules of GD&T• Position• Virtual Condition• Concentricity• Bonus Tolerance• Symmetry• Straightness• Runout• Flatness• Profile• Circularity• Cylindricity
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Geometric Dimensioning and Tolerancing

Topic areas covered during this 8 hr. class include:

Introduction to ASME Y14.5-2009 15 minutes

Published by the American Society of Mechanical Engineers, this Standard establishes uniform practices for stating and interpreting dimensioning, tolerancing, and related requirements for use on engineering drawings.

Coordinate Tolerancing vs. GD&T 20 minutes

Coordinate tolerancing is a dimensioning method where variation between two part features of size is controlled by linear dimensions with plus-minus tolerances. Geometric dimensioning and tolerancing (GD&T) is a symbolic language used on drawings to clearly define design intent, describing part geometry and its allowable variation; in other words is a method of defining parts based on how they function.

GD&T Symbols 20 minutes

The geometric characteristic symbols are a set of 14 symbols, divided into five group types, used to describe the geometry attributes of a part.

Basic Dimensions 15 minutes

A basic dimension is a theoretically exact dimension value applied to the size or location of a feature.

Material Conditions 15 minutes

A geometric tolerance can be specified to apply at the largest, smallest or actual size of a feature of size.

Feature Control Frame 20 minutes

A feature control frame is a box that is divided into compartments in which the geometric characteristic symbol, tolerance value, modifiers, and datum references are placed

Rules of GD&T 20 minutes

Rule # 1: The form of an individual regular feature of size is controlled by its limits of size. Rule # 2: Where no modifying symbol is specified, RFS applies with respect to the individual tolerance.

Virtual Condition 20minutes

Depending on function, a feature may be controlled with a size tolerance and a geometric control. The geometric control may also include a MMC. When a MMC is applied to the feature, it creates a boundary in which the feature must be contained. This boundary is used to find the worst case clearance for two parts fitting together.



Bonus Tolerance **15 minutes**

A bonus tolerance is a potential additional tolerance for a geometric tolerance. Where a geometric tolerance at MMC (or LMC) is applied to a feature of size dimension, a bonus tolerance is permissible.

Form Tolerance Characteristics

Straightness **15 minutes**

Straightness is a condition where an element of a surface or an axis is a straight line.

Flatness **15 minutes**

Flatness is the condition of a surface or derived median plane having all elements in one plane.

Circularity **15 minutes**

Circularity is a condition of a surface where all points of the surface intersected by any plane perpendicular to an axis are equidistant from that axis.

Cylindricity **15 minutes**

Cylindricity is a condition of a surface of revolution in which all points of the surface are equidistant from a common axis.

The Datum System **20 minutes**

The datum system is a set of symbols and rules on how to constrain a part to establish a relationship between the part and geometric tolerance zones.

Datum Reference Frame **30 minutes**

Parts are mated to the datum reference frame so measurements, processing and calculations can be made.

Degrees of Freedom **10 minutes**

A datum reference frame establishes 6 Degrees of Freedom, three translations and three rotations.

Orientation Tolerance Characteristics

Parallelism **20 minutes**

Parallelism is the condition of a surface, axis, or center plane, oriented at 180° to the datum reference frame.

Perpendicularity **15 minutes**

Perpendicularity is the condition of a surface, axis, or center plane oriented at 90° to a datum plane or datum axis.



Angularity **15 minutes**

Angularity is the condition of a surface, axis, or center plane oriented at a specified angle from a datum plane or datum axis.

Location Tolerance Characteristics

Position **30 minutes**

True position is a theoretical exact location and orientation of a feature of size defined by basic dimensions.

Concentricity **15 minutes**

Concentricity is a three dimensional control, controlling opposing median points relative to a referenced datum axis.

Symmetry **15 minutes**

Symmetry is the condition where the median points of all opposed elements of a feature are congruent with the datum axis or center plane.

Runout Tolerance Characteristics

Runout **20 minutes**

Runout is the surface variation that occurs relative to a rotation axis.

Profile Tolerance Characteristics

Profile **30 minutes**

Profile of a Line is the condition permitting a uniform amount of profile variation, either unilaterally or bilaterally, along a line element of a feature. Profile of a Surface is the condition permitting a uniform amount of profile variation, either unilaterally or bilaterally, on a surface.

Breaks 40minutes total for the 2 days.