

# Training Title: 3-Day “Basics of GD&T”

## COURSE CONTENTS

### GD&T Introduction

- What is GD&T? Why use GD&T?
- How does GD&T work?
- Comparison of GD&T with CD&T (Coordinate Dimensioning and Tolerancing)

### Part Features, Feature of Size, Non-size Features

- What are Part Features?
- Features of Size
- Non-Size Features

### 14 GD&T Symbols

- Feature Control Frame(FCF) and its placement
- How to read FCFs?
- Modifier symbols: MMC, LMC, RFS
- When to use MMC, LMC and RFS modifier in design (correct applications)
- Bonus tolerance calculations
- Rule # 1 and Rule # 2
- Tolerances Zones

### Virtual Condition Boundary

- Importance of Virtual condition in designs
- Virtual condition calculations on MMC basis
- Use virtual condition for mating parts as well to design fixed gauges
- 100% interchangeability guarantee in design phase itself by using virtual condition correctly
- Class room exercise for virtual condition

### Form Tolerances

- Flatness tolerance
- Straightness tolerance
- Circularity Tolerance
- Cylindricity Tolerance
- When to use Form Tolerance?
- Relationship between Rule # 1 and form tolerance controls
- Inspection methods to verify form tolerances
- Design recommendation on why to use form tolerances **only when required** to ensure successful design intent

### Datums

- What is datum?
- Six Degrees of Freedom
- Datum Reference Frame (Cartesian coordinate system)
- Datum Feature Selection, Functional Hierarchy
- Datum feature identification / placements and interpretation
- Datum plane, datum axis, Datum center plane
- Physical datum feature simulators
- 3-2-1 principle
- Datum feature qualification
- Importance of Datum Precedence
- Select datum features according to the design intent

## Orientation Tolerances

- How it works? How to apply it?
- Perpendicularity tolerance
- Parallelism tolerance
- Angularity tolerance
- Applied to a planar feature
- Applied to feature of size
- When do we use Orientation Tolerance?
- Datums for Orientation Control
- Inspection methods to verify orientation tolerances
- Difference between parallelism and Flatness
- Class room exercise for orientation tolerance

## Location Tolerances:

### A) Position Tolerance

- How it works? How to apply it?
- Tolerance zone shapes
- Position tolerance for cylindrical features on MMC, LMC and RFS basis
- Detailed table calculations for position tolerance on MMC, LMC and RFS
- Position on Boundary basis for rectangular or oblong slots
- Zero tolerance at MMC basis
- Datums for Position Control
- Inspection methods to verify position tolerances
- Class room exercise for position

### B) Runout Tolerances

- How it works? How to apply it?
- Circular Runout Tolerance
- Total Run out Tolerance
- Datums for Run out Controls
- Inspection methods to verify runout tolerances

### C) Profile Tolerances

- How it works? How to apply it?
- Profile of a Line Tolerance
- Profile of a Surface Tolerance
- 4 types of Profile Tolerance Zone
  - Bi-lateral
  - Unilateral - IN (Un-equally Disposed)
  - Unilateral - OUT(Un-equally Disposed)
  - Bi-lateral Un-equal(Un-equally Disposed)
- Controlling extent of profile tolerance
- Datums for Profile Controls
- Inspection methods to verify Profile tolerances
- Class room exercise for profile

### D) Concentricity & Symmetry Tolerances

- How it works? How to apply it?
- Concentricity Tolerance
- Symmetry Tolerance
- Tolerance zone shapes
- Datums for concentricity & symmetry controls
- Inspection methods to verify concentricity & symmetry tolerances
- Why to **avoid** using Concentricity and Symmetry for small and inexpensive part designs

## Case Studies & Review of “Your Company” drawings:

- Case studies in general and specific to your company / products
- Review existing **Your Company** drawings
- Discussion on the correct and incorrect use of GD&T on your existing drawings
- GD&T best practices for inspection and manufacturing
- Understand the internal competition between 14 GD&T symbols and select the most appropriate and inexpensive GD&T symbol.

### Contact:

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