

Scope, Definitions, and General Dimensioning

- Fundamental Rules
- Units of Measure
- Types of Dimensioning
- Application of Dimensions
- Dimensioning Features
- Location of Features

General Tolerancing and Related Principles

- Direct Tolerancing Methods
- Tolerance Expression
- Interpretation of Limits
- Single Limits
- Tolerance Accumulation
- Limits of Size
- Applicability of Modifiers on Geometric Tolerance Values and Datum Feature References
- Screw Threads
- Gears and Splines
- Boundary Conditions
- Angular Surfaces
- Conical Tapers
- Flat Tapers
- Radius
- Tangent Plane
- Statistical Tolerancing

Symbology

- General Symbology
- Use of Notes to Supplement Symbols
- Feature Control Frame Symbols
- Feature Control Frame Placement
- Definition of the Tolerance Zone

Actual Mating Material Envelopes

- Related Actual mating envelope
- Unrelated Actual mating envelope

GD&T: What, Where, When, Why.. ?

- Introduction to GD&T. What is GD&T and NOT?
- Feature Control Frame (FCF) and its placement
- How to read FCFs?
- Part Features, Feature of Size, Non-size Features
- Modifier symbols: MMC, LMC, RFS
- When to use MMC, LMC and RFS modifier in design
- Bonus tolerance calculations
- Rule # 1 and Rule # 2

Datums

- What is datum?
- Six Degrees of Freedom
- 3-2-1 Principle
- Datum Reference Frame (DRF)
- Datum Feature Selection, Functional Hierarchy
- Datum feature identification / placements and interpretation
- Datum plane, datum axis, Datum center plane
- Datum feature simulators
- Datum feature qualification
- Datum Precedence
- Select datum features according to the design intent
- Partial Datum
- Coaxial and Co-planar datums
- Inclined Datum Features
- New datum features: Conical, Linear extruded shape, Complex Shape
- Temporary datums
- Datum Targets: Points, Line, Area
- Individual datums (Repetitive Patterns of Features)
- Primary datum feature with Position tolerance
- Datum Feature Shift (or Datum Shift)

Virtual Condition & Resultant Condition Boundary

- Importance of Virtual condition & Resultant condition in designs
- Virtual condition and Resultant Condition calculations on MMC basis,
- Use virtual condition for mating parts as well to design fixed gauges
- 100% interchangeability guarantee in design phase itself
- Exercise for virtual condition & Resultant condition

16 Fundamental Rules of Dimensioning / Tolerancing

Gauges to verify Geometrical tolerances

- Functional / Fixed Gauges:
 - Go-Gauges / No Go-Gauges
 - Functional Gauges (Also known as Attribute / Fixed / Receiving / Qualifying gauges)
 - Gauge design exercises
- Variable Gauges
- Various geometrical tolerance inspection tools

Form Tolerances

- Straightness tolerance for line elements
- Straightness tolerance for surface elements
- Straightness tolerance with MMC modifier
- Flatness tolerance for single planar feature
- Flatness tolerance with MMC modifier
- Flatness tolerance on unit-basis
- Circularity Tolerance
- Circularity in free state condition
- Cylindricity Tolerance
- Inspection methods to verify form tolerances

Orientation Tolerances

- Perpendicularity tolerance
- Perpendicularity tolerances with multiple datums
- Perpendicularity tolerances applied to feature of size
- Parallelism tolerance
- Parallelism tolerances applied to feature of size
- Tangent modifier
- Angularity tolerance
- Angularity tolerances applied to a feature of size
 - Applied to a planar feature
 - Applied to feature of size
 - Applied to a cylindrical or width type feature
- Orientation tolerances in multiple segment (combined) feature control frame
- Inspection methods to verify orientation tolerances

Location Tolerances

A) Position Tolerance

- How to apply? Tolerance zone shapes
- Position tolerance for cylindrical features (holes / shafts) 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
- Projected Tolerance Zone
- Bi-Directional Tolerancing for pattern of features
- Composite Position tolerancing:
 - Pattern-locating Tolerance Zone Framework (PLTZF)
 - Feature-relating Tolerance Zone Framework (FRTZF)
 - FRTZF with Zero datum / 1 datum / 2 datums / 3 datums
 - Composite tolerance for Linear Coaxial Feature Alignment
- Rules of composite tolerancing
- Two Segment position tolerances
- Floating Fastener Formula and calculations
- Fixed Fastener Formula and calculations
- Inspection methods to verify position tolerances
- Exercises for position

B) Runout Tolerances

- Circular Runout Tolerance
- Total Run out Tolerance for cylindrical feature
- Total Run out Tolerance for planar feature
- Runout tolerance with co-axial datum
- Inspection methods to verify runout tolerances

C) Profile Tolerances

- Profile of a Line Tolerance
- Profile of a Surface Tolerance
- 4 types of Profile Tolerance Zones
 - Bi-lateral
 - Unilateral – IN (Unequally Disposed)
 - Unilateral – OUT (Unequally Disposed)
 - Bi-lateral Un-equal (Unequally Disposed)
- Controlling extent of profile tolerance:
 - Between symbol
- All-around and all-over modifiers
- Multi-segment or combined profile tolerance
- Composite tolerances: PLTZF & FRTZF
 - FRTZF with no datum / 1 datum / 2 datums / 3 datums
- Profile on a Unit Basis
- Profile on a planar surface
- Inspection methods to verify Profile tolerances
- Exercise for profile

D) Concentricity & Symmetry Tolerances

- Concentricity Tolerance
- How to use position tolerance instead of concentricity
- How to use runout tolerance instead of concentricity
- Symmetry Tolerance
- How to use position tolerance instead of symmetry
- Inspection methods to verify concentricity & symmetry tolerances

Contact

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Thank You !