CADSAGA

"ISO GPS Geometrical Tolerancing with Tol Stack-up Analysis"

Course Contents

Training will be delivered according to these latest ISO GPS Standards:

- ISO 8015:2011
- ISO 1101:2017
- ISO 5458:2018
- ISO 5459:2011
- ISO 2692:2014
- ISO 1660:2017
- ISO 2768-1: 1989
- ISO 22081: 2021
- ISO 14405-1: 2016
- ISO 14405-2: 2018
- and other related ISO GPS standards

ISO GPS Introduction

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

14 Geometrical Specifications (ISO GPS Symbols)

- Tolerance indicator (Frame) and its placement
- How to read tolerance indicator?
- Modifier symbols: MMR, LMR, RFS
- When to use MMR, LMR and RFS modifier in design (correct applications)
- Bonus tolerance calculations
- Independency Principle (Default)
- Invoke Envelope principle

Maximum Material Virtual Condition (MMVC)

- MMVC calculations
- 100% interchangeability and MMVC
- Classroom exercise for MMVC

Form Specifications

- Flatness specification
- Straightness specification
- Roundness specification
- Cylindricity specification
- CZ Modifier on flatness
- Relationship between Envelope principle and form specifications
- Inspection methods to verify form specifications

Datums

- What is datum?
- Six Degrees of Freedom
- Datum System (Cartesian coordinate system)
- Datum Feature Selection, Functional Hierarchy
- Datum feature identification / placements and interpretation
- Datum plane, datum axis, Datum median 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 Specifications

- How it works? How to apply it?
- Perpendicularity specification
- Parallelism specification
- Angularity specification
- Applied to a planar feature
- Applied to feature of size
- Inspection methods to verify orientation specifications
- Classroom exercise for orientation specifications

Location Specifications

A) Position Specification

- How it works? How to apply it?
- Tolerance zone shapes
- Position for cylindrical features on MMR, LMR and RFS basis
- Detailed table calculations for position specification on MMR, LMR and RFS
- CZ Modifier
- SZ Modifier
- Position applied to nominally flat or planar surface
- Inspection methods to verify position specification
- Classroom exercise for position

C) Coaxiality, Concentricity & Symmetry Specifications

- How it works? How to apply it?
- Coaxiality specification
- Symmetry specification
- Inspection methods to verify concentricity & symmetry specification

B) Profile Specifications

- How it works? How to apply it?
- Line Profile specification
- Surface profile specification
- Profile Tolerance Zone: Bi-lateral type
- UF Modifier
- Controlling extent of profile specification
- All-around profile specification
- Inspection methods to verify Profile specifications
- Classroom exercise for profile

D) Run-out Specifications

- How it works? How to apply it?
- Circular run-out specification - Radial
- Total run-out specification – Radial
- Inspection methods to verify run-out specifications

"Tolerance Stack-up Analysis"

Importance of Tol. Stack-up Analysis

- Why, when and how
- Introduction of Two-Column method of doing stack-up analysis
- Introduction to Tolerance Stack-up Analysis :
  - Coordinate dimensioning and tolerancing stacks
  - GD&T stacks
  - Worst case stacks
  - Statistical tolerancing stacks: RSS and MRSS
- Methodical steps involved in any stack-up analysis :
  - Loop diagram creation
  - Universal sign language of tolerance stack-up analysis
  - Identification of correct dimensional contributors (vectors)
  - Correct stack table filling according to Two-column method
  - How to convert and enter various geometric tolerances into the stack table
  - Drawing improvements to reduce adverse impact on tolerance stack

Part Level Stack-up Analysis

- Part stack using coordinate dimensioning and tolerancing
- Part stack using position
- Part stack using bi-lateral profile
- Part stack using circular runout
- Part stack using total runout
- Part stack using concentricity tolerance
- Part stack using symmetry tolerance
- Part stack using position with bonus (planar & RFS datums)
- Part stack using position with bonus tolerance (MMC)
- Part stack using form controls applied to a feature
- Part stack using orientation control applied to a feature without size

Assembly Level Stack-up Analysis

- Assembly stacks using coordinate dimensioning and tolerancing
- Assembly stacks using position
- Assembly stacks using position (Floating fastener assembly stack)
- Assembly stack using bi-lateral profile
- Assembly stack using total runout
- Stack using form controls applied to a feature
- Stack using orientation controls applied to a feature without size
- Introduction to Statistical Tolerancing:
  - RSS (Root Sum Square) stack concept
  - MRSS (Modified Root Sum Square) stack concept
- Comparison between Worst-case method, RSS & MRSS methods
- Assembly stack using statistical tolerancing

Contact

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Thank You !