Course ID
TOL-GDT
Course Duration
2 days

Course Title
Tolerance Stack Analysis Using GD&T

Related Courses

- Geometric Dimensioning & Tolerancing (GD&T): 3-Day Workshop (GDT3D, 3 days)
- Statistical Tolerance Analysis: A Comprehensive Workshop (S-TOL-ANAL, 2 days)

Aimed At

This course is aimed at those involved in mechanical design, manufacturing, or inspection who need to perform calculations from drawings, either in creating new designs or verifying dimensional data from prints. Product engineers, manufacturing engineers, quality managers, and CAD designers will all benefit.

Group Size

5-25

Prerequisites

- Print Reading Workshop for Engineers and Support Personnel (PRINTREAD, 1 day)
- Geometric Dimensioning and Tolerancing: A Comprehensive Workshop (GDT, 2 days)

Participants should have a basic knowledge of blueprint reading. Knowledge of GD&T is also strongly recommended.

Course in a Nutshell

This course teaches a methodical approach to calculating dimensional stacks for both parts and assemblies. Using a simple spreadsheet format, participants will learn how to determine the stack path and then transfer the numbers in the correct sequence to be calculated for maximum and minimum values. Our comprehensive approach factors in both traditional tolerances and geometric tolerances (GD&T), including the elusive “bonus” tolerance.

Other topics include: calculating the resultant condition, knowing when to ignore a tolerance, and how to implement a statistical approach to stacks (root-sum-square and its variants).

If sample prints are provided, the course can be taught as a hands-on workshop at no added cost.

Customize It!

Based on the experience of your group, and the types of products you work with, we can customize the course to your specific needs, including any existing formats you have for performing stacks. We also encourage participants to bring actual prints/drawings to the course for discussion and sample calculations.

While the course is mainly designed around the ASME Y14.5 standard, it can be customized to accommodate other standards, such as internal company standards for your prints.

Learn How To

- Avoid "winging it" when performing stacks
- Determine which dimensions to include in a stack
- Tabulate the dimensions in the proper order
- Factor in geometric tolerances, including "bonus" and "shift"
- Perform stacks for assemblies, including any clearances

Course Outline

- Introduction
  - What are tolerance stacks?
  - Fundamental rules and assumptions
  - Review of geometric dimensioning and tolerancing
- Virtual Condition
  - Definitions: local size vs. envelope; feature of size
  - Material conditions: MMC, LMC, RFS
  - Virtual condition for internal and external features
  - *Practice exercises*
  - Resultant condition
- Stacks with Coordinate Dimensions
  - Basic steps in calculating a stack
  - Review of the stack form
  - Examples of single-part stacks
  - *Practice exercises*
- Stacks with Runout and Concentricity
  - Review of runout and concentricity
  - Transferring tolerances to the stack form
  - *Examples and exercises*

- Position Tolerances in Stacks
  - Review of position RFS
  - Applying position in the stack form
  - The “bonus” tolerance concept
  - Factoring bonus tolerance into the stack form
  - *Examples and exercises*
  - The “shift” tolerance concept
  - Factoring shift tolerance into the stack form
  - *Examples and exercises*

- Stacks with Profile
  - Review of profile of a line and profile of a surface
  - Bilateral and unilateral tolerancing
  - *Examples and exercises*

- Stacks with Form Controls
  - Review of flatness, straightness, circularity, cylindricity
  - Rule #1: Size controls form
  - “To” or “thru” rule
  - “Adjacent” or “offset” rule
  - Filling in the stack form
  - *Examples and exercises*

- Stacks with Orientation Controls
  - Review of parallelism, perpendicularity, angularity
  - Filling in the stack form
  - *Examples and exercises*

- Statistical Methods
  - When to justify statistical methods
  - Brief statistics review
  - The “root sum square” (RSS) formula
  - Modified RSS formulas (Bender and Gilson formulas)
  - Monte Carlo simulation

- Wrap-up and Review of Drawings
  - Review sample drawings
  - Evaluations

How You Will Learn

- A seasoned instructor with 20+ years of engineering and teaching experience will present this course in an interactive lecture format.
- Along with the lecture, we will use many practice problems to help you understand and use the concepts taught. If sample prints are provided, the course can be turned into a hands-on workshop at no added cost.
- We will use meaningful and relevant examples and analogies to simplify the more complex areas of the course.
- You will receive a printed Participant Handbook which will help you remember and retain what you learned in class and apply it to your job.

Revised *f-3Lnz*