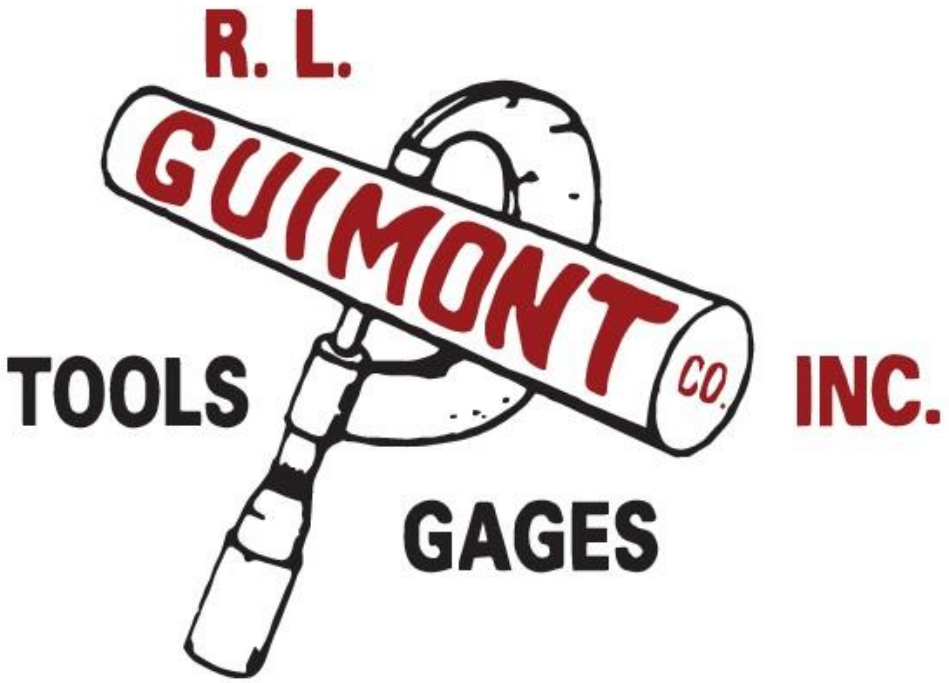
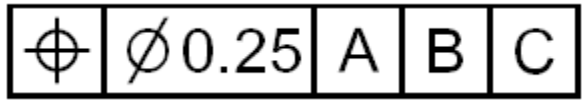


Best Fit of a Bore Pattern

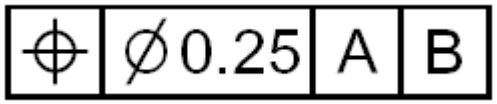
Checking simultaneous requirements

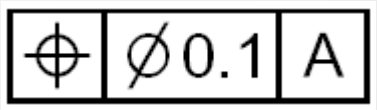
Possible Position Callouts

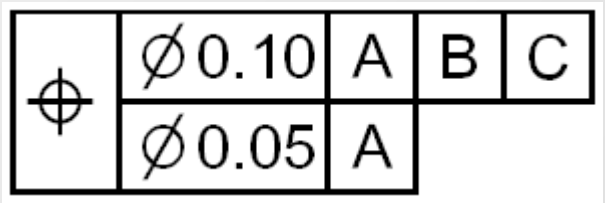
- Calypso Does a great job with these

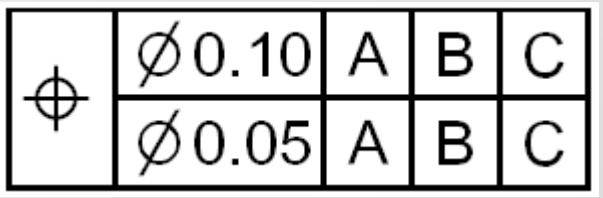


- How does Calypso do with these?



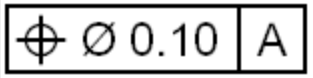






Not so good…these all allow for mobility (fitting)

Calypso Calculation

- For any true position, the standard method in Calypso will calculate it exactly how the template is filled out…without regard for any other true positions that share the same DRF
- Example: 6x 

  - 6 true positions, 6 different fits
  - Rule of simultaneous evaluation states that all 6 holes have to be evaluated at the same time.

Best Fit of Bore Pattern

- Best Fit of Bore Pattern is used to check multiple features simultaneously
- Allows for:
  - Translation/Rotation of a pattern
  - Alignments based on translation/rotation
  - Functional Fit Information
  - Plotted Results

Considerations

- The datum reference frame is used strictly to create a coordinate system to report the location of the features
- It is up to the programmer to "decode" the Datum Reference Frame (DRF) to determine how the pattern is allowed to move to achieve the fit
- There are 4 fit methods, each with pros & cons

Decoding DRF's

- A, B, & C are planes
- How can it move?

It Can't

- A & C are planes, B is a bore
- How can it move?

It Can't

- In both cases the DRF is fully constrained so it can't move

Decoding DRF's

- A is a plane
- How can it move?

Rotate around A & translate along A (X&Y)

- A is a bore
- How can it move?

Rotate around A

Decoding DRF's

- A is a plane, B is a bore
- How can it move?

Rotate around B

- A & B are planes
- How can it move?

Translate along B

Fitting Methods

- Gauss (without MMC/LMC on references)
- Minimum (without MMC/LMC on references)
- View Tolerance (with MMC/LMC on references)
- L1 (without MMC/LMC on references)

Gauss

- Least Square or Gauss Best Fit
- This method calculates the average best fit pattern such that the sum of the distances squared between a calculated (ideal) position and the actual position is at a minimum.
- Each element of the pattern carries equal weight in determining the position and orientation of the pattern center.
- Good analytical method for dialing in a machining process but not for inspecting a part for functional fit.
- Does not apply material conditions on datums

Minimum

- Minimum Error Best Fit (Tschebyscheff)
- This methods calculates a pattern such that the smallest maximum deviation occurs between an element's calculated (ideal) position and it's actual position. It wants to minimize error for all elements regardless of the reference features.
- Outliers have a greater impact upon the result with Minimum Error Best Fit.
- Simulates a Go/No Go Gage which makes it good for assembly support.
- Note: The Tschebysceff algorithm used here may not catch every opportunity but will never buy a bad part.
- Does not apply material conditions on datums

View Tolerance

- Tolerance-2D-Best-Fit
- Applies the Minimum Error Best Fit with additional "Zeiss" math to most closely simulate a Go/No Go gage. Called "Tolerance" Best Fit because its' goal is to iterate all elements into tolerance, if possible.
- A drawback may be that this math is not textbook and may present challenges to users during an audit.
- Possible offset and rotation is limited by the reference features.
- This is the best option for inspecting a part for functional fit.
- This is the only fit method that will use MMC/LMC on the datum features

L1

- L1-2D-Best Fit
- This method is similar to the Least Squares or Gauss Best Fit but is less influenced by outliers and has proven to yield better results for dialing in a machining process. Again also not for inspecting a part for functional fit.
- Minimizes the sum of the deviations
- Does not apply material conditions on datums

Best Fit Matrix

	Process Control	Functional
Good	Gauss	Minimum
Better	L1	View Tolerance