CNC Manufacturing

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Agenda

- How we process your model
- Design considerations for machining
- CAD considerations
- Inspection

- What information is available?
- Cad File
 - Native
 - Neutral
- Drawing
 - Paper
 - Electronic
 - Raster
 - Vector
- Text Data
 - Quantity
 - Target Dates
 - Special Requirements

- Minimum to Manufacture Drawings
 - Should accompany all models
 - Information to include:
 - Standards controlled features (Ports, Threads, etc)
 - Critical Tolerances
 - Material
 - Surface Finishes
 - Post processing
 - plating
 - paint
 - heat treat

Determining the process

- Turning
- Milling
- Combination



- Overall shape and Material
- Faces w/features (Origins/Orientations)
- Tolerance/Critical Features
- Tools required to form features
- Work Holding
- Quantity
- Lead Time

- Overall shape and Material
 - Commercial Material
 - Not all sizes are easily available especially metric
 - Verify tolerance won't require next size bigger
 - Cut length must include kerf and cutoff

- Faces w/features (Origins/Orientations)
- Tolerance/Critical Features
- Tools required to form features
- Work Holding







Design considerations

- Thru holes are better than blind holes
 - Highest cost, shallow blind thread in thin section
- Thin flat floors are expensive
 - Requires vacuum fixture
- Depth of pocket / hole to tool Φ
 - 3:1 is best
- Width / Depth of flange
 - 3:1 4:1 max
- Simple shapes

Design considerations



Design considerations

- Commercial Material
 - Call out commercial material if that's what you intend to be used.
 - A dimension of $3.0 \pm .010$ is not the same as 3'' COM'L
- Be aware of warpage
 - Removing material can release stresses.
 - A 1" COM'L bar with a large pocket cut in it will not give you a straight part. Make the height 0.97 to allow for decking on both sides.

- Make model robust
 - Allow suppression of features
- Make it easy to understand
 - Make fillets & rounds at the end
 - Label your features
 - Use Folders
 - Use notes to tell us what you're thinking



- Be careful of features tied to draft
- Be careful of related features tied to different parents





Inspection

- How should a feature be measured?
- What's important?

Inspection

- Zeros are not free = .500"vs .5"
 - Can increase the feature's cost several fold
- Theoretical corners are fine on a drawing, but how do we measure on the shop floor?
- Avoid dimensions to un-machined faces
 - Identify a datum point if required

Datum Point



How do we use solid models?

- First for quoting
 - Almost any 3D file
- Then for processing
 With CAMWorks and ProCAD
- And designing fixtures
 - Configurations are key
- Finally for Inspection
 - Sometimes an inspection drawing
 - Other times import of IGES inspection data





