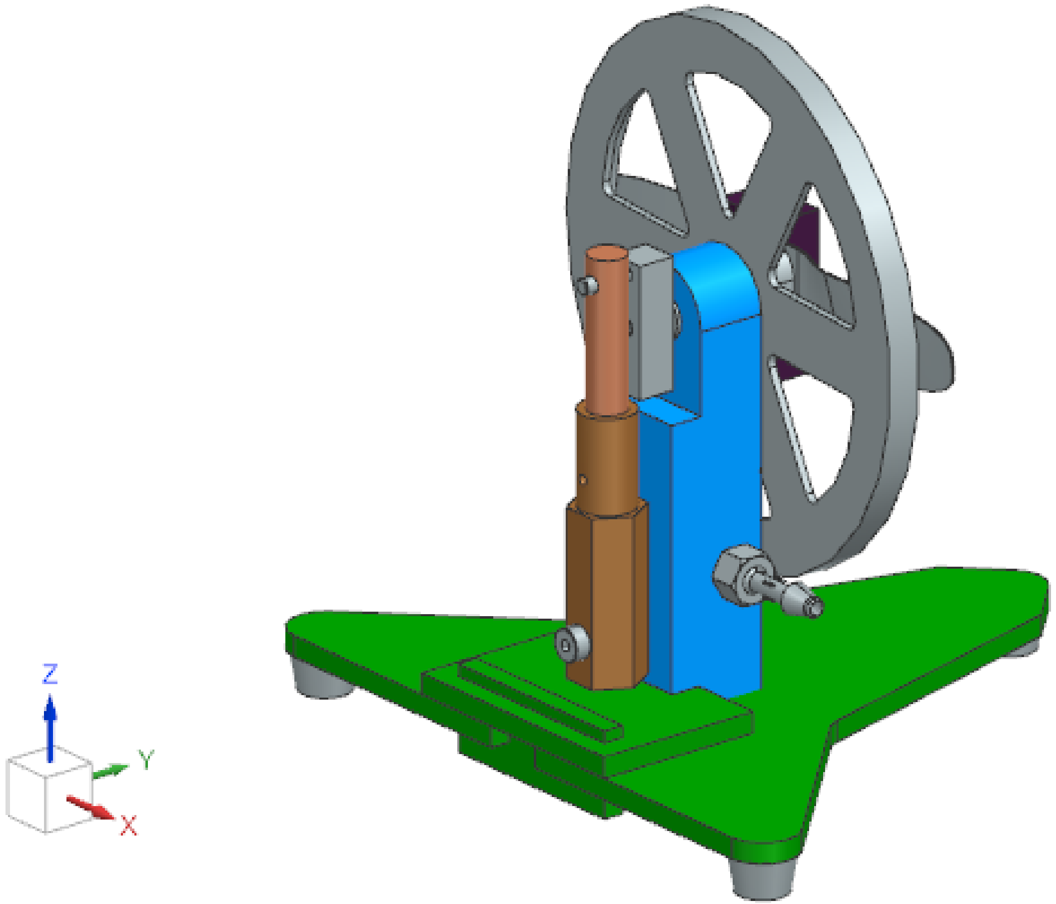
Linh Vu
12/5/2022
Project 1 – Report

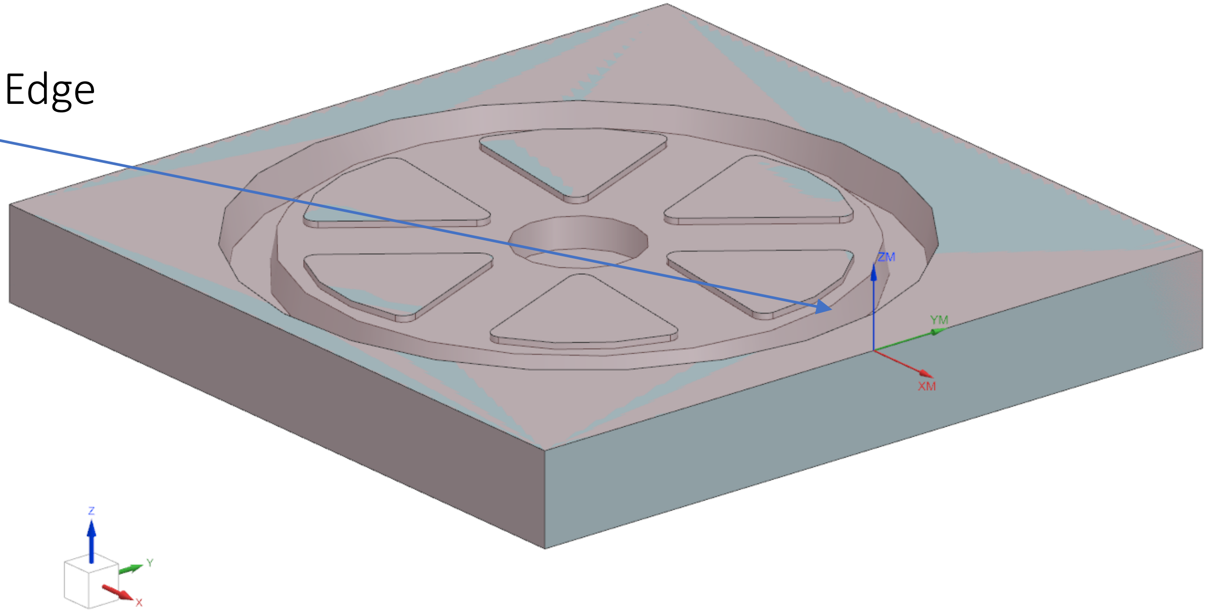
CAD model (NX) - Trimetric



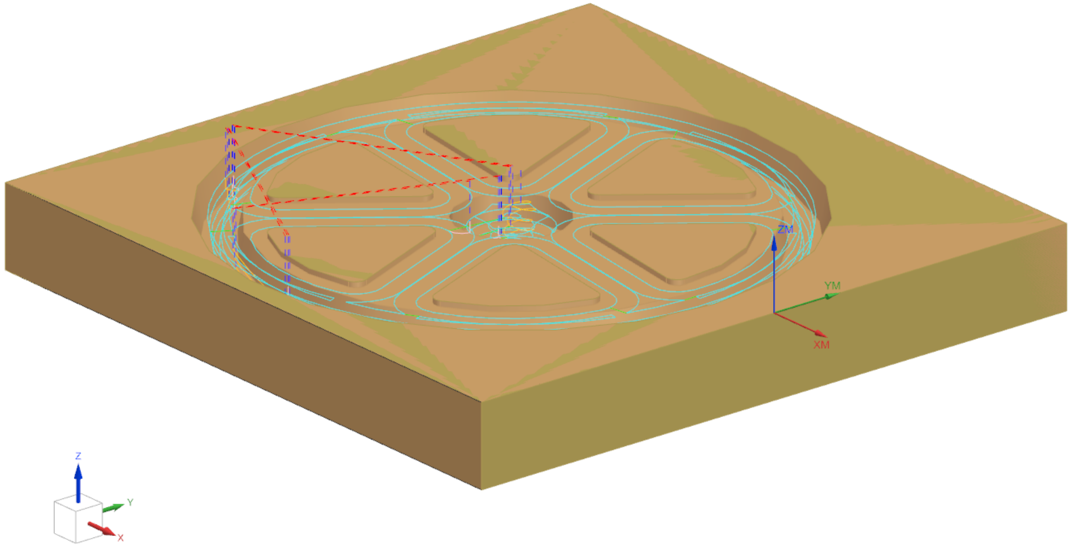
Full model (actual)

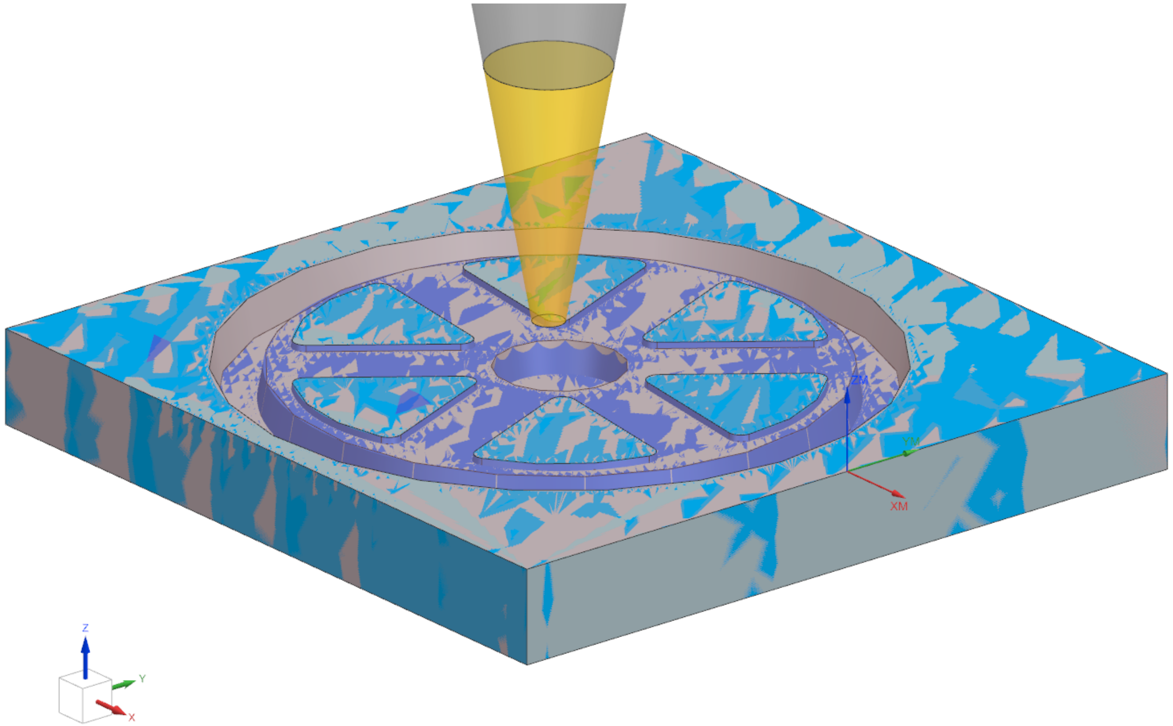
Date: 9/25/2022
Name: Linh Vu
Tool: T 0.25 x 10D
Stock: 6x6x0.75
Description: Mold Cavity

MCS
Centered On Edge



Program Data
Program Run: 09/25/2022 21:27:36
Total Envelope:
X: -5.293 -0.707
Y: -2.654 1.994
Z: -0.300 0.394
Maximum Feedrate: 150.000
Minimum Z at Rapid: -0.200 VERIFY





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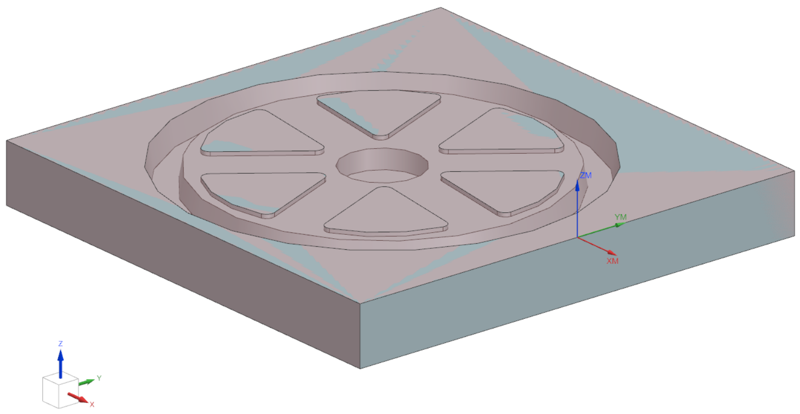
Casted part weight: W_{casted} = 8.416 [lbf]
CAD part weight: W_{CAD} = 19.118 [lbf]
Percent error compared to CAD weight: %error = 55.98 %

$$\%error = \left|\frac{W_{casted} - W_{CAD}}{W_{CAD}} 100\%\right|$$

Casting mold (NX)



Casting mold (cut)

Casted part

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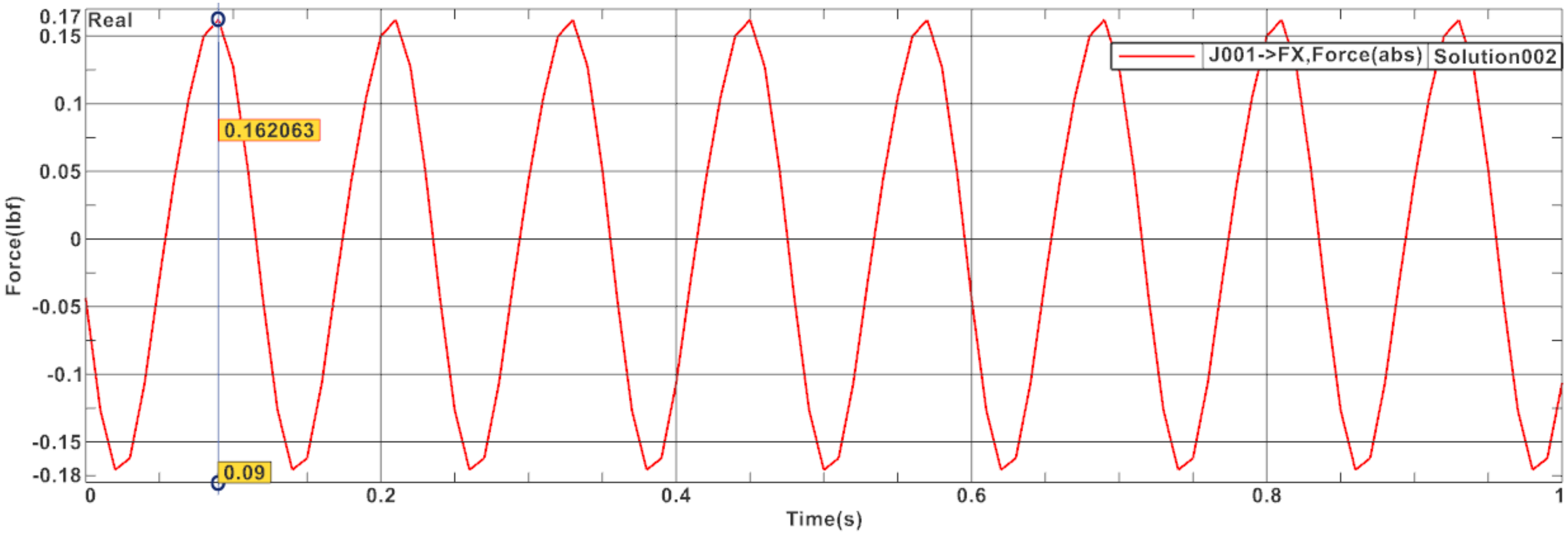
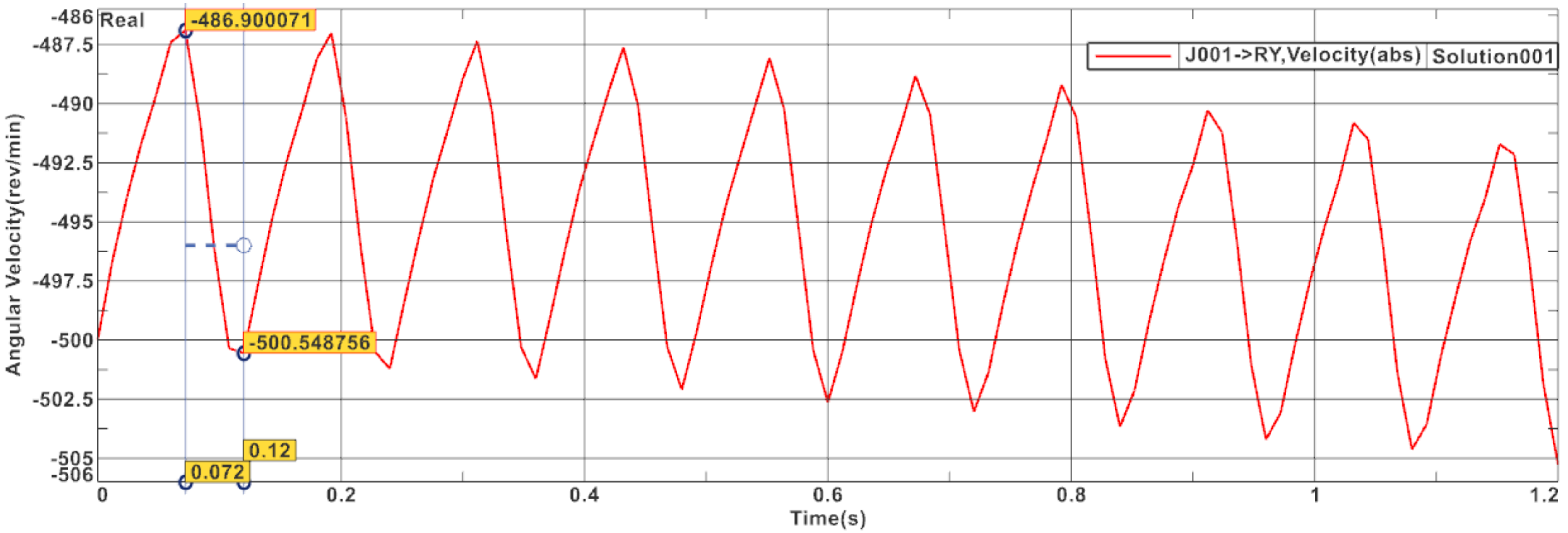
Total mass: m = 1.307 [lbm]
Friction co-efficient: μ = 0.1
Friction force between the feet and surface: F_{fr} = m $\cdot$ μ = 0.1307 [lbf]
The maximum lateral force in x direction: $F_{x,max}$ = 0.162 [lbf]
→ The system will not slide on the surface since $F_{x,max} < F_{fr}$



Angular velocity 1: ω_1 = -486.90 [rev/min]
Angular velocity 2: ω_2 = -500.55 [rev/min]
Co-efficient of speed fluctuation: $\frac{\omega_2 - \omega_1}{\omega_1}$ = 0.028
Iyy inertia of the crank shaft: Iyy = 0.02144 lbm.in^2

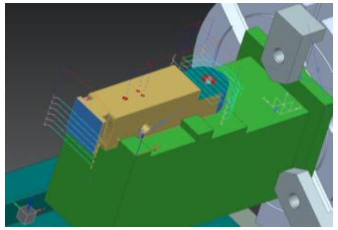


Mechanical Engineering
University of Rochester

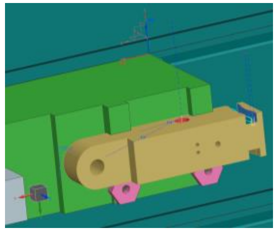
Linh Vu

11/2/2022

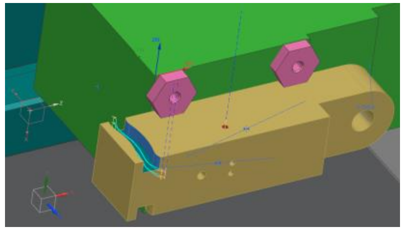
Project 1 – 4Axis CNC



MCS_1



MCS_2



MCS_3

```
O0856 (PROGRAM)
( Date          : Wed Nov  2 12:51:17 2022 )
( Programmer    : maili )
( Part File Name: C:\Users\maili\Documents\NXX\4Axis_2022v1\lvu4_0c00002C_setup_1.prt )
( Path Name   : FACE_BOTTOM )
N0010 G00 G91 G28 Z0.0
G40 G17 G49 G98 G80 G90
( Tool Number: 6 )
( Tool Name   : F0.50MILL  Tool Diameter: 0.5000  Tool Length: 1.7500 )
T06 M06
S4000 M03
G00 G54 X-7.3102 Y-.875 A0.0 M08
```

Title	T...	Tool	Tool Description	Description	T...	Time	Geometry	Method	Feed	Speed
NC_PROGRAM				setup_haas_milling		00:08:18				
Unused Items				setup_haas_milling		00:00:00				
PROGRAM				PROGRAM		00:08:18				
FACE_BOTTOM		F0.50MILL	Milling Tool-5 Parameters	WALL_PROFILING	6	00:00:29	MCS_1	MILL_FINISH	30 ipm	4000 rpm
CUT_STEP		F0.50MILL	Milling Tool-5 Parameters	FLOOR_WALL	6	00:00:46	MCS_1	MILL_FINISH	20 ipm	4000 rpm
FACE_TOP		F0.50MILL	Milling Tool-5 Parameters	WALL_PROFILING	6	00:00:32	MCS_1	MILL_FINISH	30 ipm	4000 rpm
SPOT_TOP		CENTERDRILL	Centerdrill	SPOT_DRILLING	1	00:00:27	MCS_1	DRILL_METHOD	2.5 ipm	4000 rpm
SPOT_INLET_PORT		CENTERDRILL	Centerdrill	SPOT_DRILLING	1	00:00:08	MCS_2	DRILL_METHOD	2.5 ipm	4000 rpm
SPOT_EXIT_PORT		CENTERDRILL	Centerdrill	SPOT_DRILLING	1	00:00:07	MCS_3	DRILL_METHOD	2.5 ipm	4000 rpm
DRILL_MANIFOLD		DRILL_43	Drilling Tool	DRILLING	2	00:00:17	MCS_1	DRILL_METHOD	5 ipm	4000 rpm
DILL_EXHAUST		DRILL_43	Drilling Tool	DRILLING	2	00:00:08	MCS_3	DRILL_METHOD	5 ipm	4000 rpm
DRILL_CRANKMOUNT		DRILL_29	Drilling Tool	DRILLING	3	00:00:09	MCS_1	DRILL_METHOD	6 ipm	4000 rpm
DRILL_BEARING_PILOT		DRILL_29	Drilling Tool	DRILLING	3	00:00:10	MCS_1	DRILL_METHOD	6 ipm	4000 rpm
DRILL_NPT_PILOT		DRILL_29	Drilling Tool	DRILLING	3	00:00:11	MCS_2	DRILL_METHOD	6 ipm	4000 rpm
DRILL_NPT		DRILL_R	Drilling Tool	DRILLING	4	00:00:16	MCS_2	DRILL_METHOD	4 ipm	2000 rpm
BEARING_MOUNT		F0.25MILL	Milling Tool-5 Parameters	HOLE_MILLING	5	00:02:05	MCS_1	MILL_FINISH	4 ipm	4000 rpm
PROFILE_SLOT_A		F0.25MILL	Milling Tool-5 Parameters	WALL_FLOOR_PROFILING	5	00:00:30	MCS_2	MILL_FINISH	13.5 ipm	4000 rpm
PROFILE_SLOT_B		F0.25MILL	Milling Tool-5 Parameters	WALL_FLOOR_PROFILING	5	00:00:30	MCS_3	MILL_FINISH	13.5 ipm	4000 rpm
TAP_CRANKMOUNT		TAP_8-32	Tap	TAPPING	7	00:00:09	MCS_1	DRILL_METHOD	4 ipm	128 rpm
PROGRAM_TRAIL				PROGRAM_TRAIL		00:00:00				

Title	Path	Tool	Geometry	Method
GEOMETRY				
Unused Items				
MCS_MAIN				
WORKPIECE				
MCS_1				
FACE_BOTTOM	✓	F0.50MILL	MCS_1	MILL_FINISH
CUT_STEP	✓	F0.50MILL	MCS_1	MILL_FINISH
FACE_TOP	✓	F0.50MILL	MCS_1	MILL_FINISH
SPOT_TOP	✓	CENTERDRILL	MCS_1	DRILL_METHOD
DRILL_MANIFOL...	✓	DRILL_43	MCS_1	DRILL_METHOD
DRILL_CRANKM...	✓	DRILL_29	MCS_1	DRILL_METHOD
DRILL_BEARING...	✓	DRILL_29	MCS_1	DRILL_METHOD
BEARING_MOU...	✓	F0.25MILL	MCS_1	MILL_FINISH
TAP_CRANKMO...	✓	TAP_8-32	MCS_1	DRILL_METHOD
MCS_2				
SPOT_INLET_PO...	✓	CENTERDRILL	MCS_2	DRILL_METHOD
DRILL_NPT_PILOT	✓	DRILL_29	MCS_2	DRILL_METHOD
DRILL_NPT	✓	DRILL_R	MCS_2	DRILL_METHOD
PROFILE_SLOT_A	✓	F0.25MILL	MCS_2	MILL_FINISH
MCS_3				
SPOT_EXIT_PORT	✓	CENTERDRILL	MCS_3	DRILL_METHOD
DILL_EXHAUST	✓	DRILL_43	MCS_3	DRILL_METHOD
PROFILE_SLOT_B	✓	F0.25MILL	MCS_3	MILL_FINISH

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Composite layup on mold
with breather layer

Completed composite layup

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1. The pivot point in Zone 2B is the center of the largest hole on the part, dimensioning 0.3125-in in diameter. The qualitative factors that contribute to the location and size variation of the pivot point can be the two end surfaces of the cylinder are not squared perfectly, or the radius of the edge finder might not be considered when zero the axis.
2. Typically, an edge finder has a diameter of 0.2”. Therefore, when zeroing the axis to find the edge, a distance of 0.1” must be considered. This step is varied, therefore, **a tightest tolerance of 0.02”** should be reasonable for the position value.
3. The 3 critical dimensions would affect the performance of this cylinder part if not held tightly are the **two positions of the 0.094”-diameter holes and the depth of 0.3125” for one of them**. A good performance means the air can come in and out of these two small holes corresponding with the up and down motion of the crank shaft, or the two half rotations of the wheel. These two small holes being positioned precisely allowing the air to come in and out precisely, and the depth of one of them determine whether the air is fully transmitted to the motion of the crank shaft.
4. **The length and diameter of the hexagon cross-section part and the outer diameter of the round part** are the 3 dimensions that could be looser since those being bigger or smaller do not affect the air flow, or the motion of the crank shaft inside. Moreover, the variance of these dimensions can be addressed by the lengths of the crank assy detail.
5. The rotational inertia determines how difficult it is to rotate the part, or for the part to change its rotational velocity. Therefore, it is aimed to **decrease the inertia**. A larger inertia meaning the major of mass is distributed further away from the rotational axis, causing more fluctuation. Therefore, having a smaller inertia leads to having a smaller coefficient of fluctuation. This also means having a **better performance with less fluctuation and more rotation**.

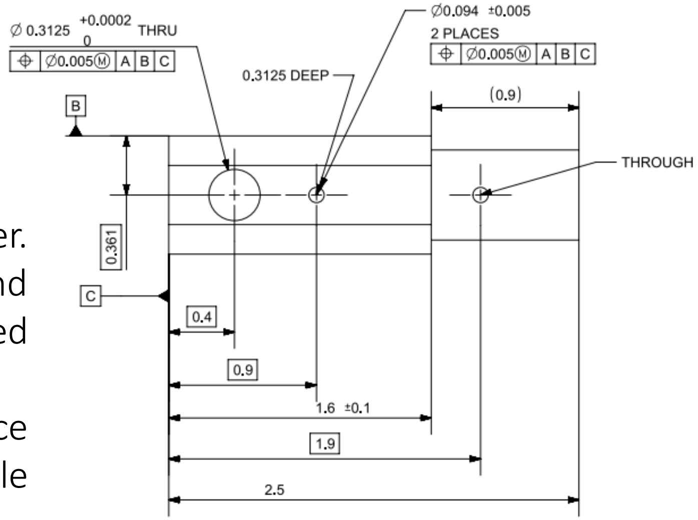

Fig. 1 – 0c00003 part in 2D drawing

Fig. 2 – 0c00003 part in NX