April 18th 2016

Module three
Metrology
Hands on Activity

Goal: The goal of these activities is to explore the concepts developed in module three of the introduction to fabrication course.

Activity One:

The goal of this activity is to measure bolt sizes and pitch. Get better acquainted with tools that help with metrology and measurement.

1. Retrieve the handout titled "Bolt size and pitch" for recording results
2. In the toolkit, there is a container of XXX bolts, as well as the gauge needed for measuring. Each bolt is numbered.
3. In the correct boxes, fill in the information required for each bolt.
4. We will learn more about bolt types and other fasteners in the next module

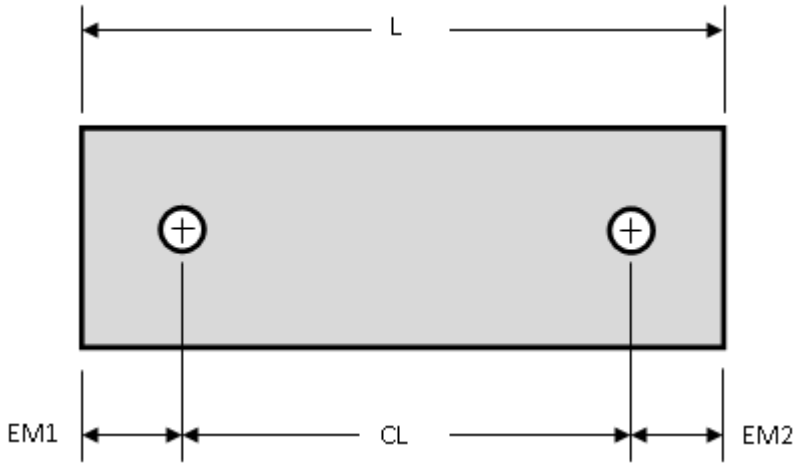
Table 1: Activity one Table

Bolt Number	Units (Metric or Imperial)	Diameter	Pitch Angle	Length of Bolt
1				
2				
3				

Activity Two:

This activity helps to learn about tolerances and measuring. There is also a component of assembly to this activity. We will be discussing assembly and order of operations in much more detail during the last half of this class, but this is a good introduction.

1. Consider the simple plate pictured below. There are two holes shown on the sketch. We are going to assume three geometric features in this particular view that require precision
   i. Length of the bar (L)
   ii. Hole centerline spacing (especially important if this is a mating part through which two fasteners are attached)(CL)
   iii. Hole edge margin (Without knowing more, we will assume edge margin of both holes is equally important) (EM1 and EM2)



2. There are four more drawings on the next page. Nominally, all four should produce the same part. In reality, the tolerances will play a role in feature location. Fill in Table 2 with the maximum and minimum feature values that correspond to the pictures on the next page.

Table 2: Activity two part one

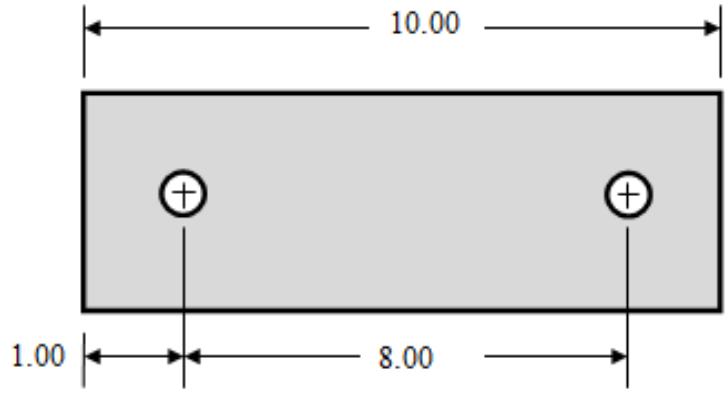
Drawing	L (min/max)	CL (min/max)	EM1 (min/max)	EM2 (min/max)
Dwg 1				
Dwg 2				
Dwg 3	9.80/10.20	7.80/8.20	0.90/1.10	0.90/1.10
Dwg 4				

3. Dimensioning and tolerance can affect order of operation, or the order in which each feature is added during the manufacturing process. It is likely that this part will be cut from bar stock of an appropriate width. Therefore, to make this part, three operations are required. Cutting the raw stock to length L, drilling one hole and then the other. For each of the drawings, fill in Table 3 by stating which operation is done in what order. Why does order of operations matter?

Table 3: Activity three part two

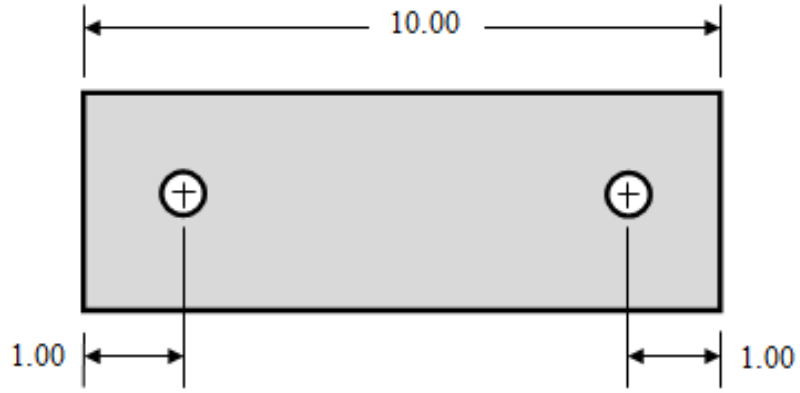
Drawing	Cut bar length	Drill left hole	Drill right hole
Dwg 1			
Dwg 2			
Dwg 3	second	first	third
Dwg 4			

Dwg 1



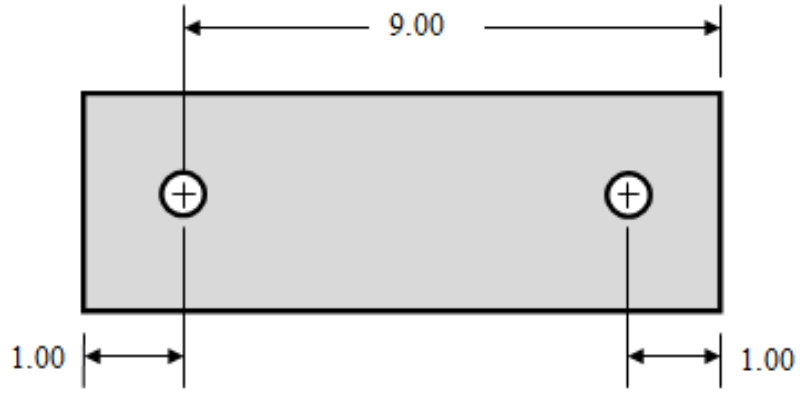
TOL: x.xx +/- 0.10

Dwg 2



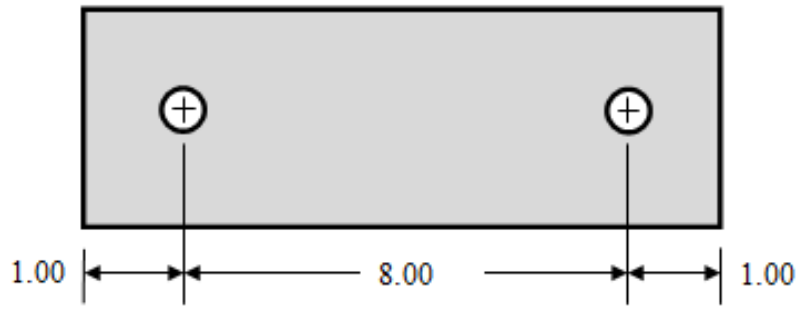
TOL: x.xx +/- 0.10

Dwg 3



TOL: x.xx +/- 0.10

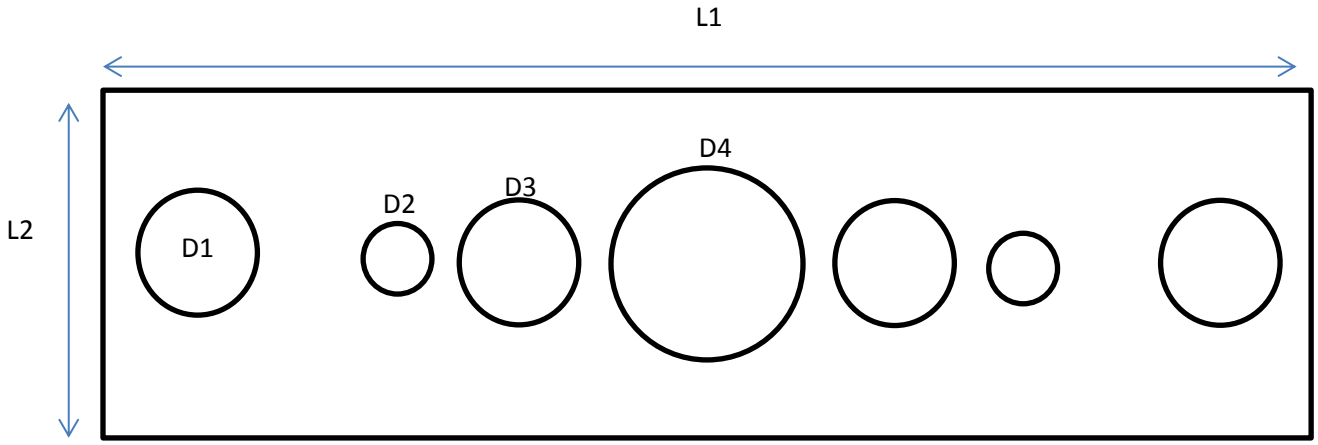
Dwg 4



TOL: x.xx +/- 0.10

Activity Three:

The goal of this activity is to measure the diameters, thickness and lengths of a thin plate, labelled 'Plate One' in the toolkit. Using a micrometer and calipers, measure the plate and fill in the template below with the proper dimensions. Include units.



- D1: _____
- D2: _____
- D3: _____
- D4: _____
- L1: _____
- L2: _____
- Thickness of plate: _____

Once you've completed all of your tasks, please sign the bottom of this paper and leave it in the designated bin at the front of the lab. Please put all tools back inside their proper cases and lock them in the proper locker.

You are to complete one short quiz. The link for which can be found in the final slide of the PowerPoint for this module and on the website

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I have completed the tasks and module to the best of my ability on my own:

_____ Signature

_____ Date