INT112 Job Sheet 2.2: Sawing, Drilling and Tapping

Objective/Outcomes:
Upon completion of this lab procedure, the student should be able to perform the following tasks in the NSCC Machine Shop:

1. Cut/saw an aluminum block to a specific size for the NIMS workpiece
2. Remove sharp edges and burrs on the workpieces through sanding or filing
3. Layout the marks for drilling on the workpiece
4. Center punch the marks to assure aligned drilling
5. Drill the three holes on the NIMS project workpiece
6. Deburr the holes using a countersink bit on a hand drill
7. Insert a bushing into a specific hole using a hammer and vice
8. Thread two holes on the workpiece using a hand tap

***Important**: This project is the first performance assessment of the NIMS Job Planning Benchwork Layout certification. The other performance assessment for this certification will be the NIMS Layout, which is found in the next job sheet.*

The Finished Project
Figure 1 shows the finished project for the NIMS Benchwork performance certification. Notice that the hole on the lower left, has a bushing inserted into it. The hole on the upper right has been tapped, and the hole in the middle has been tapped and has an allen cap screw threaded into it. (The original print shows a hex head machine screw threaded into the center hole)

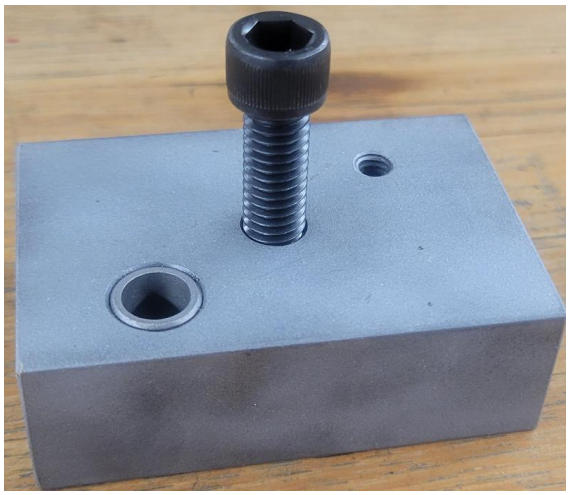

Figure 1. The NIMS Benchwork finished project.

Procedure:

1. **The mechanical blueprint**: Figure 2 shows the mechanical print for the NIMS benchwork part.
2. Review the print to determine the size of the block, the size of the holes required, and what thread sizes that will be tapped.

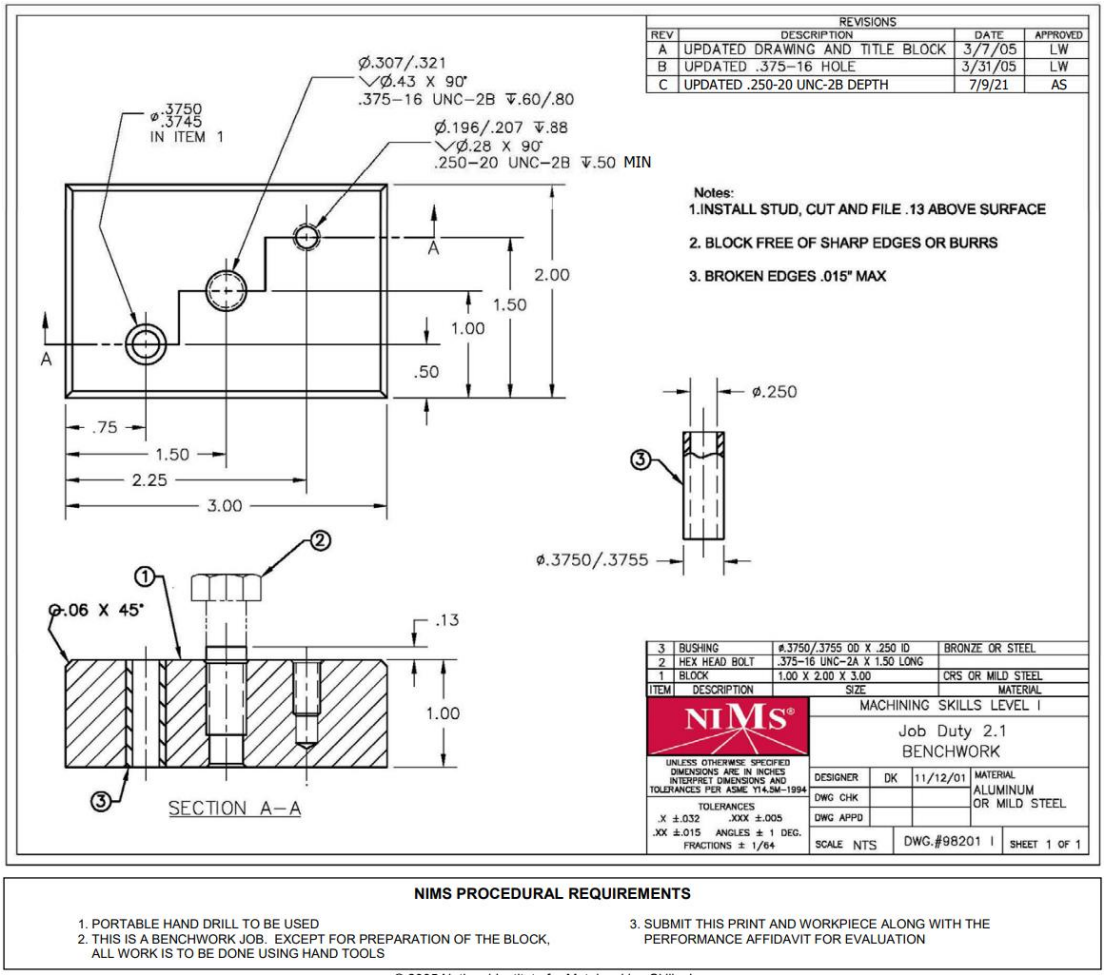

Figure 2. The mechanical print for the Benchwork workpiece.

3. **Size of the workpiece**: Based on the print in Figure 2, what should be the length, width and thickness of the NIMS workpiece?

   What is the length of the workpiece? _____

   What is the width of the workpiece? _____

   What is the thickness of the workpiece? _____

4. **Saw/cut a block for the project piece**: Utilize the horizontal band saw to cut a block for the NIMS benchwork workpiece, as shown in Figure 3.

   The block was properly measured and scribed for sawing: _____

   The student cut the block with the horizontal band saw: _____

Figure 3. Sawing the block from a piece of stock.

5. **Measure the cut workpiece**: Utilize the square to measure the workpiece to verify that it is the same size as referenced from the print, as shown in Figure 4.

   What is the length of the workpiece? _____

   What is the width of the workpiece? _____

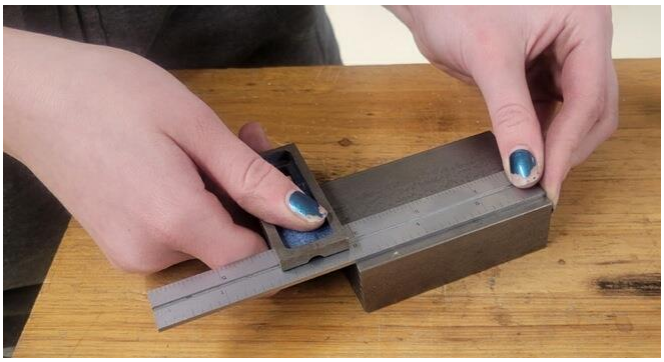

Figure 4. Measuring the NIMS block.

6. **File the workpiece**: Using a file, deburr the edges of the workpiece as shown in Figure 6.

Figure 5. Removing sharp edges and burrs using a file.

_____ The student removed all sharp edges and burrs on the workpiece.

7. **Layout the location of the holes on the workpiece**: The student will clean one side of the workpiece, apply the blue die, then measure and scribe the location of the holes on the workpiece as shown in Figure 7..

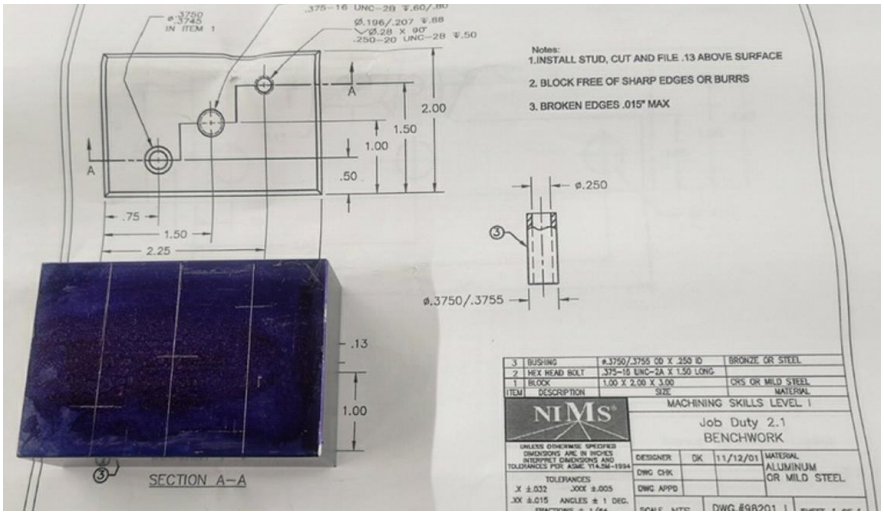

Figure 7. Laying out the hole center points on the workpiece.

_____ The student correctly did the layout of the holes for the workpiece.

8. **Punch a small hole at the center marks**: A center punch should be used to punch a small indentation in the aluminum at the center of the planned hole, so when the drill bit is used, it will keep the drill in the same location. How to use a center punch is shown in Figure 8.

Figure 8. Center punch the scribe marks.

_____ The student center punched the marks with accuracy.

9. **Drill the three holes on the workpiece**: Using a hand drill, the student should choose the correct drill size for the hole size, then insert the drill into the chuck, then drill the three holes, changing out the drill bits for the appropriate hole size. This drilling process is shown in Figure 9.

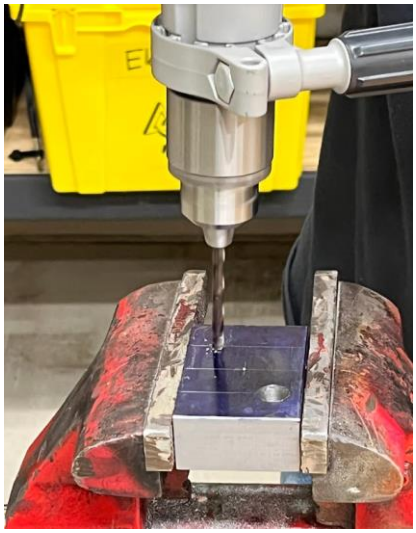

Figure 9. Drilling the holes in the workpiece.

_____ The student drilled all of the holes on the workpiece with accuracy.

10. **Inserting the bushing into the hole of the workpiece**: Put the workpiece into a bench vice, then tap the bushing into the appropriate hole with a light hammer. This is shown in Figure 10.

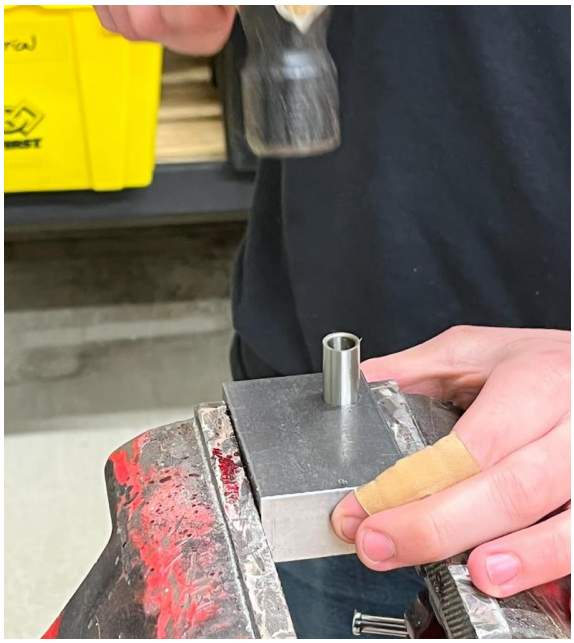

Figure 10. Inserting the bushing into one of the holes on the workpiece.

_____ The student inserted the bushing into the hole on the workpiece.

11. **Thread two holes using a hand tap**: Use multiple size hand taps to tap the two holes on the workpiece. The student will have to change taps since the two threaded holes will be different sizes. This is shown in Figure 11.

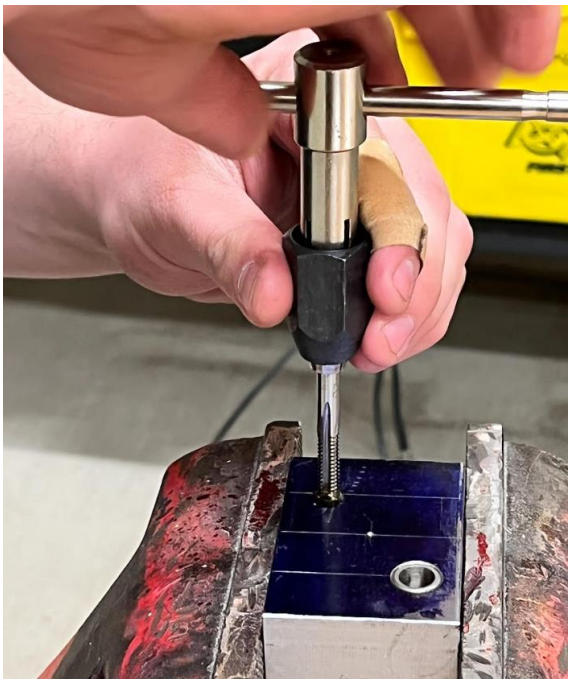

Figure 11. Hand tapping a thread on the NIMS workpiece.

_____ The student successfully tapped the two holes on the workpiece.

12. **The Performance Standard**: Figure 12 shows the performance assessment that was created by the NIMS organization. This chart will show you the tolerances allowed in this project. The student must pass all of the criteria to get a 100% on the HOA. Realize that the student must also pass the Layout Performance Assessment, then take the online certification test to receive the NIMS Job Planning Benchwork Layout certification.

Performance Project – Benchwork **Evaluation Criteria**		**Pass**	**Fail**
1. Tap .250 thread .5 min depth (hole 3)	Pass = tapped to the minimum depth Fail = not tapped to minimum depth	❒	❒
2. Stud within .13 surface (hole 2) ± .015	Pass = within tolerance Fail = out of tolerance	❒	❒
3. Press fit bushing check.	Pass = pressed correctly – tight, cannot push out with finger pressure; flush ± .03 Fail = not flush or loose	❒	❒
4. Bench chamfer .06 x 45° on top four edges	Pass = within tolerance .06 ± .015 45° ± 1° Fail = out of tolerance	❒	❒
5. Overall finish and quality	Pass = edges were broken .015" max. Burrs removed. Threads clean Fail = burrs, excessive edge break > .015, congested threads	❒	❒
END OF BENCHWORK EVALUATION			

It is important to note that the part must be 100% within the tolerances listed on the print. The criteria listed here are a guide for instructors and supervisors. Not every dimension is included in this guide. Nonetheless, the completed part must be 100% within the specifications of the print. The print takes precedence over this guide when the parts are inspected by the MET-TEC committee. *The candidate must also complete the performance in layout to be eligible for the related theory exam for the NIMS Credential in Job Planning, Benchwork, and Layout. When both performances have been successfully met, the sponsor should complete and send to NIMS only the completed signed Performance Affidavit*

Figure 12. Performance Standard for Benchwork Project.

Important: The outcomes of this exercise (listed on page 1) specifies the skills that the Student must demonstrate to the Instructor. Once the Instructor is satisfied with the demonstration of Knowledge & Skills by the individual student, they will sign this document (for the student), then enter a 100% into the Hands-On Assessment grade in Sakai.

I verify that this student has completed all of the requirements of this Hands-On Assessment:

Student Name: _____

Faculty Signature: _____ Date: _____

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