

INT113 LAB 1.1: TURNING

Student Name: _____

Student ID: _____

LAB OUTCOMES:

Upon completion of this lab procedure, the student should be able to:

1. Interpret a plan for a lathe-machined part
2. Use a center drill to prepare a workpiece for turning between centers
3. Perform facing, turning, and grooving operations on a lathe
4. Machine a part to the specified diameters using a lathe

LAB PROCESS:

Before entering the machine shop, ensure that you have observed all required safety procedures:

- Safety glasses on
- Closed-toed shoes
- No rings or other jewelry
- No loose-fitting clothing
- Long hair pulled back
- Not under the influence of any substance that dulls reaction time or judgement

Part 1:

1. Review the print on the last page of this lab. You will be starting with your 5.25" steel round stock from the Sawing Lab 112-2.2. In this lab, you will be machining the outside diameters of the part.

What size of center drill will you need?

Measure the length of your workpiece. How much material will need to be removed by facing?

Measure the diameter of your workpiece. How much material will need to be removed for each diameter of the finished part?

2. Locate the center on both ends of the stock and center punch.
3. Check the alignment of the lathe centers by bringing the headstock and tailstock together, and using the witness lines on the tailstock. Does the lathe need realignment?
4. Mount a Jacobs chuck and center drill in the spindle of the lathe. Support your workpiece with your left hand and the tailstock. Use your right hand to turn the tailstock handwheel and carefully push the workpiece into the center drill.
5. Repeat the center drill for the other end of the workpiece.
6. Remove the Jacobs chuck and center drill.
7. Attach a live center to the headstock.
8. Attach the lathe dog to your workpiece and set it up to be machined between centers.

Part 2:

1. Select your cutting tool for your initial facing operation. What is this?
2. Calculate the RPM using the standard formula. The table in the text gives the recommended cutting speed for mild steel as 130 fpm for roughing cuts.

3. Consult with the instructor and set the appropriate spindle speed on the lathe. What speed is set? How does this compare to your calculated RPM?
4. Set the compound rest to 30°
5. Face the end of the workpiece supported by the tailstock. Remove half of the required length, as the of the end will need to be faced as well. Be careful not to run the cutting tool into the center!
6. Remove and flip the workpiece. Remount the workpiece between centers. Face the other end of the workpiece.
7. Measure the length of your workpiece. Are you within the acceptable tolerance for the part?

If you are still too long, remove more material until you are within the acceptable tolerance.

Part 3:

1. Select your cutting tool for your turning operation. What is this?
2. Ensure your workpiece is securely mounted between centers.
3. Consider the print. Are you going to begin turning the left side of the print or the right?

How much material will you need to remove for the first diameter you cut? How deep will your roughing cut(s) be?

4. Set up the cutting tool and compound rest for turning.

5. Rough turn the tailstock half of the workpiece to the appropriate diameters. Stop and measure each.
6. Remove and flip the workpiece. Remount the workpiece between centers. Rough turn the other half of the workpiece.

Part 4:

1. Measure the rough turned diameters of your workpiece. How much material will need to be removed for your finishing cuts? How deep will your finishing cuts be?
2. Calculate the RPM using the standard formula. The table in the text gives the recommended cutting speed for mild steel as 160 fpm for finishing cuts.
3. Consult with the instructor and set the appropriate spindle speed on the lathe. What speed is set? How does this compare to your calculated RPM?
4. Ensure your workpiece is securely mounted between centers.
5. Set up the cutting tool and compound rest for turning.
6. Finish turning the workpiece to the final dimensions and quality. Measure each diameter. Are these within the accepted tolerance?

Part 5:

1. Locate where a groove needs to be cut on your workpiece. Measure the current diameter. How much material needs to be removed? How deep will your cut be?

2. Select your cutting tool for your grooving operation. What is this?
3. Consult with the instructor and set the appropriate spindle speed. What speed is set? How does this compare to your roughing and finishing speeds?
4. Ensure your workpiece is securely mounted between centers.
5. Set up the cutting tool and compound rest for cutting a groove.
6. Cut the groove.
7. Measure the length and diameter. Is this within the acceptable tolerance?

Questions:

1. Are all diameters and lengths within the acceptable tolerance?
2. Is the finish of the workpiece acceptable, based on the print? What are some common causes of poor finish quality?

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 Lab grade in Sakai.

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

Student Name: _____

Faculty Signature: _____ Date: _____

DOL DISCLAIMER:

This product was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The product was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership.



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Performance Standards

Turning Between Centers

Material

Mild steel or low carbon steel $\varnothing 1.00 \times 5.15$ " – saw enough material to face both ends and center drill.

Duty

Setup and carry out between centers turning operations for straight turning.

Performance Standard

Given raw material, process plan, part print, hand, precision, and cutting tools, as well as access to an appropriate turning machine and its accessories, produce a part matching the process plan and the part print specifications using appropriate trade techniques and speeds and feeds. The part specified should have at least three diameters within $\pm .002$, one UNC external thread, one UNF external thread, and require part be turned end for end to complete.

Other Evaluation Criteria

1. Finishes are at least 125 Ra microinches.
2. No sharp edges.

Accuracy Level: $\pm .015$ on all fractions, $\pm .005$ on all decimals unless otherwise specified on the part print.
Diameters to be coaxial within .002 total run out.

Assessment Equipment and Material

Workstation: A common workbench, an engine lathe of 14"X 30" minimum capacity, a three-jaw universal scroll chuck, or a four-jaw independent chuck. The lathe must have a quick change gear box with the threads pitch called for on the blueprint available from the gear box.

Material: A part matching the material requirements of the turning print, material: Mild steel.

Tooling: Tool post, right and left hand turning tools capable of turning to a square shoulder, an external threading tool matched to the profile of the thread called out on the turning blueprint, a drill chuck, combination drill and countersink, drive dog, grooving/ parts tools, 45° chamfer tools, live center, dead center fitted to the spindle taper, magnetic base for a dial indicator, files, wrenches as necessary.

Measuring Instruments: Required micrometers, combination set, thread pitch gages, center gage, thread ring gages, dial indicator, 6" rule, 6" vernier, dial, or electronic caliper, surface finish comparison plates.

Reference: Machinery's Handbook

Performance Assessment Worksheet

Turning Between Centers

INSTRUCTIONS: Rate the candidate's performance for the Turning Between Centers job according to the twelve (12) criteria below. The checklist below represents only a listing of criteria to be evaluated. It is ***not*** a sequence of process steps or a process plan for making the part. For each item, check the box under Pass or Fail accordingly.

Remember, NIMS requires that **all** specifications must be met within the allowable tolerance limits. If the part does not meet all specifications, the candidate must correct or redo the project.

Candidate Name _____

Evaluation Date _____

Performance Project – Turning Between Centers			
Evaluation Criteria		Pass	Fail
1. $\varnothing .500 \pm .002$ $\varnothing .625 \pm .002$ $\varnothing .750 \pm .002$	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
2. Diameters of grooves adjacent to the knurl: $.600 \pm .015$ (2 places)	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
3. Total runout on specified diameters within .001 TIR as specified to combined datums A - B Diameters circled 1, 2, 3. TIR of coaxial dia's .010	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
4. $5.12 \pm .015$ Overall Length	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
5. $3.25 \pm .015$ Length $4.37 \pm .015$ Length	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
6. $2.50 \pm .015$ Length $1.0 \pm .032$	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
7. .500 – 13 UNC – 2A Pitch diameter tolerance .4435/.4485	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
8. 750 – 16 UNF – 2A Pitch diameter tolerance: .7029/.7079	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
9. Groove width: $.12 \pm .015$ (3 places) Groove diameter: $\varnothing .37 \pm .015$	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>

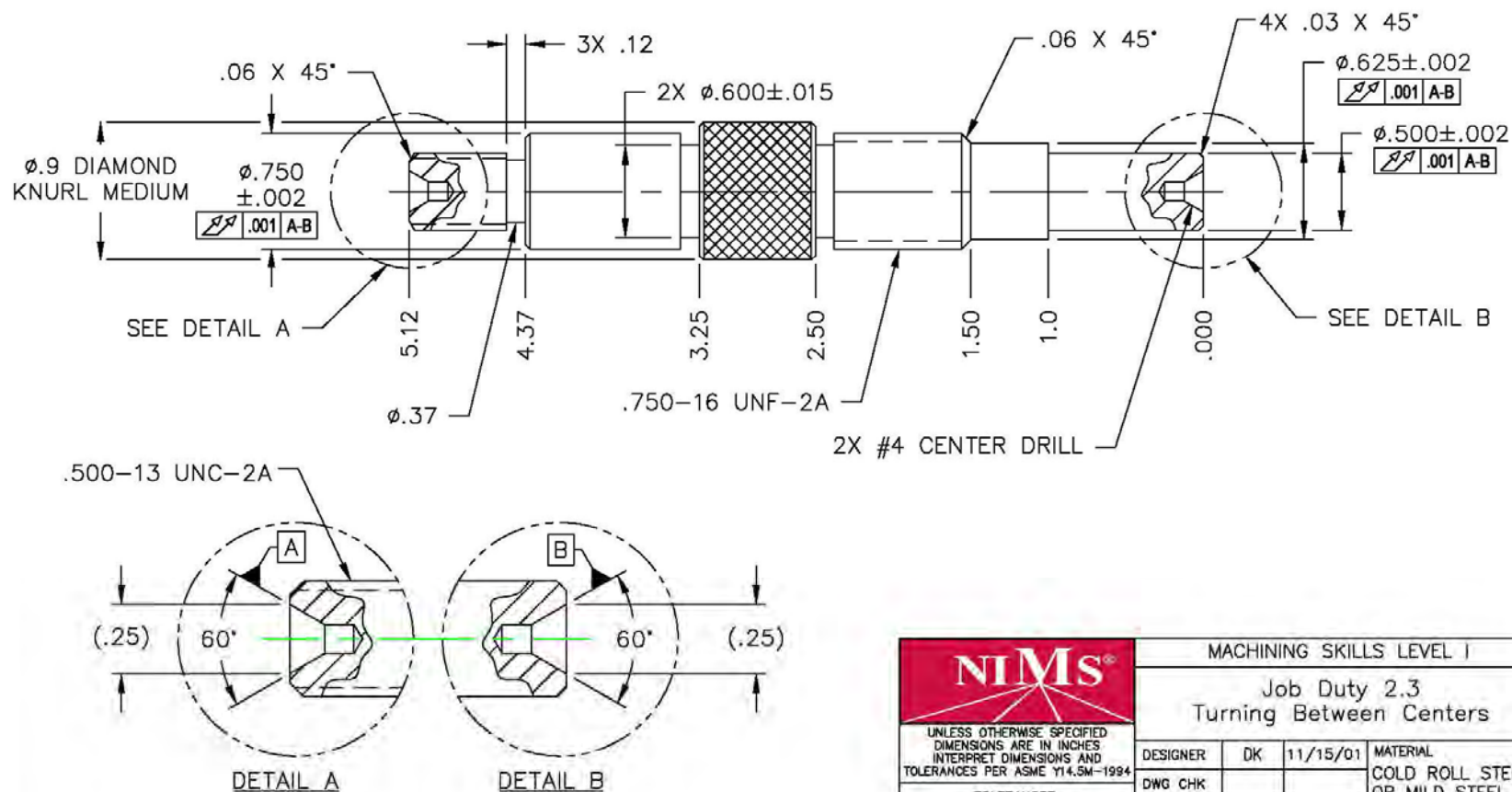
Performance Project – Turning Between Centers			
Evaluation Criteria		Pass	Fail
10. Diamond knurl- no flakes $\varnothing.9 \pm .032$	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
11. Surface finish	Pass = 125 Ra microinches or better Fail = over 125 Ra microinches	<input type="checkbox"/>	<input type="checkbox"/>
12. Sharp edges: .015 max.	Pass = radii less than .015 Fail = sharp edges, radii greater than .015	<input type="checkbox"/>	<input type="checkbox"/>
END OF TURNING BETWEEN CENTERS 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 part print and the Performance Affidavit should be sent along with the part to the MET-TEC for evaluation. Send to NIMS only the completed Performance Affidavit, signed by the MET-TEC members. A copy of the Performance Affidavit should be retained in the candidate's file documenting completed performance for this credential.

NOTES:

1. FINISH ALL OVER TO $\sqrt{125}$
2. BREAK ALL SHARP EDGES .015 MAX
3. UNLESS OTHERWISE SPECIFIED,
ALL COAXIAL DIAMETERS $\sqrt{.010}$ A-B

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	UPDATED DRAWING AND TITLE BLOCK	3/7/05	LW



DO NOT SCALE DRAWING

<p>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994</p> <p>TOLERANCES .X $\pm .032$.XXX $\pm .005$.XX $\pm .015$ ANGLES ± 1 DEG. FRACTIONS $\pm 1/64$</p>		MACHINING SKILLS LEVEL 1	
		Job Duty 2.3 Turning Between Centers	
DESIGNER	DK	11/15/01	MATERIAL
DWG CHK			COLD ROLL STEEL OR MILD STEEL
DWG APPD			
SCALE FULL		DWG.#98601 I	SHEET 1 OF 1

NIMS PROCEDURAL REQUIREMENTS

1. SUBMIT THIS PRINT AND WORKPIECE ALONG WITH THE PERFORMANCE AFFIDAVIT FOR EVALUATION