

Performance Standards Benchwork

Materials

A block of cold rolled mild steel – 1.00 x 2.00 x 3.00 milled or filed to length (see *Duties and Standards for Machining Skills – Level I*, September 2001) or as specified on the print for this project. The block may be prepared for the candidate or you may choose to have the candidate cut or mill the block to length. Use a 3/8" – 16 UNC bolt for stud installation (unplated and low tensile).

Duty

Using mildsteel, hand held drill and hand tap holes. Use hand drills, hand taps, tap wrench, files, scrapers, and coated abrasives to deburr parts. Use arbor presses to perform press fits. Use bench vises and hand tools appropriately.

Performance Standard

Given a process plan, blueprint, access to hand tools, produce a part with two holes prepared for hand tapping, a hole prepared (reamed) for the press fit of a bushing, and a stud for one of the tapped holes. Deburr the part, hand drill and hand tap the holes, press in the bushing, and install the stud. File chamfer

Other Evaluation Criteria

1. Free of sharp edges or burrs.
2. Go/NoGo gage for the threads.
3. Length of stud within .03 of basic dimension and square to surface.

Accuracy Level: +/- .015 unless otherwise specified on the blueprint.

Assessment Equipment and Material

Workstation: Common workbench with at least a four-inch bench vise, an arbor press.

Material: A part machined to the benchwork blueprint, A stud matching the requirements of the blueprint, and a selection of sleeve bushings for the desired fit, cutting oil, and appropriate lubricants.

Tooling: Taps, tap wrenches, assorted files with handles, assorted scrapers, reamer, hacksaw frame with an assortment of blades.

Measuring Instruments: Combination set, height gage or depth micrometer, a 1/4-20 plug gage, and .244-.246 pin gauges.

Reference: Machinery's Handbook.

Performance Assessment Worksheet Benchwork

INSTRUCTIONS: Rate the candidate's performance for the Benchwork job according to the 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.

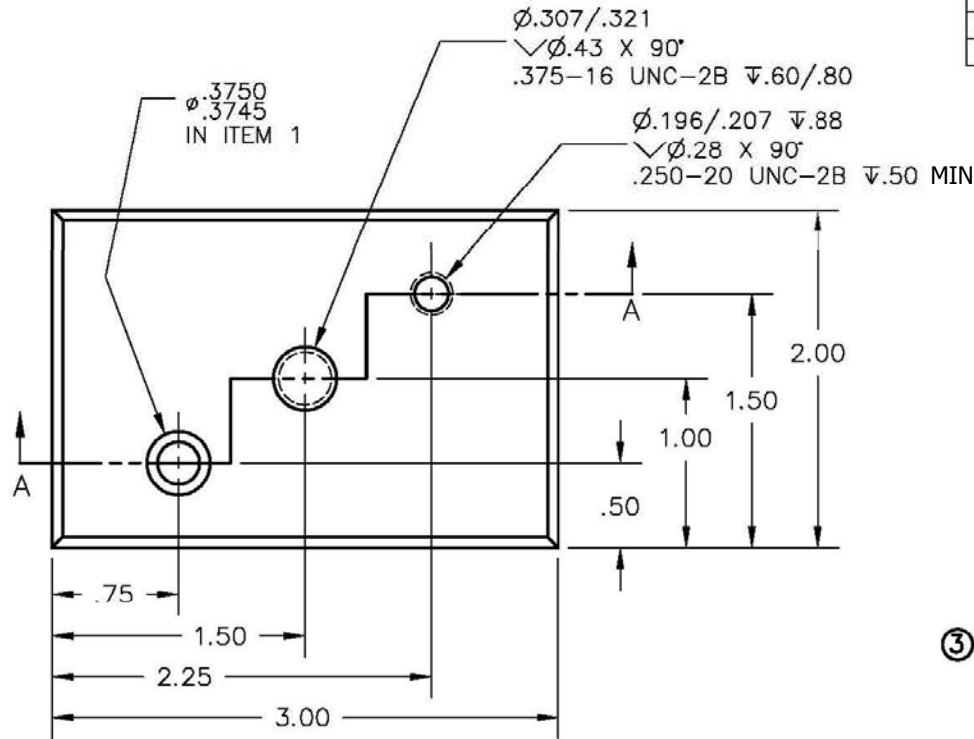
Candidate Name

Evaluation Date

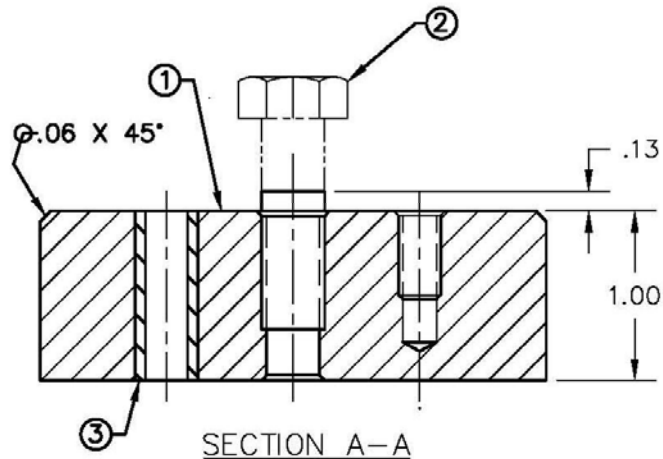
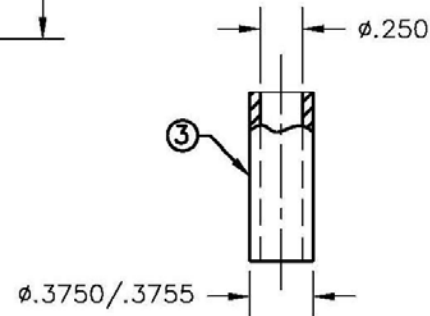
Performance Project – Benchwork		Pass	Fail
Evaluation Criteria			
1. Tap .250 thread .5 min depth (hole 3)	Pass = tapped to the minimum depth Fail = not tapped to minimum depth	<input type="checkbox"/>	<input type="checkbox"/>
2. Stud within .13 surface (hole 2) \pm .015	Pass = within tolerance Fail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

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	UPDATED DRAWING AND TITLE BLOCK	3/7/05	LW
B	UPDATED .375-16 HOLE	3/31/05	LW
C	UPDATED .250-20 UNC-2B DEPTH	7/9/21	AS



- Notes:
1. INSTALL STUD, CUT AND FILE .13 ABOVE SURFACE
 2. BLOCK FREE OF SHARP EDGES OR BURRS
 3. BROKEN EDGES .015" MAX



3	BUSHING	$\phi .3750 / .3755$ OD X .250 ID	BRONZE OR STEEL
2	HEX HEAD BOLT	.375-16 UNC-2A X 1.50 LONG	
1	BLOCK	1.00 X 2.00 X 3.00	CRS OR MILD STEEL
ITEM	DESCRIPTION	SIZE	MATERIAL
NIMS MACHINING SKILLS LEVEL I			
Job Duty 2.1 BENCHWORK			
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994		DESIGNER	DK 11/12/01
TOLERANCES .X $\pm .032$.XXX $\pm .005$.XX $\pm .015$ ANGLES ± 1 DEG. FRACTIONS $\pm 1/64$		DWG CHK	MATERIAL ALUMINUM OR MILD STEEL
		DWG APPD	
		SCALE NTS	DWG.#98201 SHEET 1 OF 1

NIMS PROCEDURAL REQUIREMENTS

1. PORTABLE HAND DRILL TO BE USED
2. THIS IS A BENCHWORK JOB. EXCEPT FOR PREPARATION OF THE BLOCK, ALL WORK IS TO BE DONE USING HAND TOOLS

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

Performance Standards Layout

Material

Cold rolled steel or low carbon steel .25" x 2" x 6.125" with add stock on left end.

Duty

Layout the location of hole centers and surfaces within an accuracy of +/- .015.

Performance Standard

Given a surface plate, surface gage, layout height gage, combination set, scribe, layout ink, prick punch, ball peen hammer, process plan, and part print, layout hole locations, radii, and surfaces matching the specifications.

Other Evaluation Criteria

1. Layout ink is applied to the surface appropriately.
2. Lines are struck once.
3. Intersections are clean and clear.
4. Punch marks are centered on intersections.

Accuracy Level: +/- .015 unless otherwise specified on the blueprint.

Assessment Equipment and Material

Workstation: Common workbench, a layout surface plate at least 12" X 18"

Material: A part matching the layout print, material: Cold rolled mild steel.

Tooling: A scribe, layout ink or a Magic Marker, prick punch, ball peen hammer, angle plate, C-clamps, parallel-closing clamps, magnifying glass.

Measuring Instruments: Combination set, radius gages, 6" dividers, surface gage, or layout height gage.

Reference: Machinery's Handbook.

Performance Assessment Worksheet Layout

INSTRUCTIONS: Rate the candidate's performance for the Layout job according to the nineteen (19) criteria below. The checklist below only represents 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/student must correct or redo the project.

Candidate Name _____

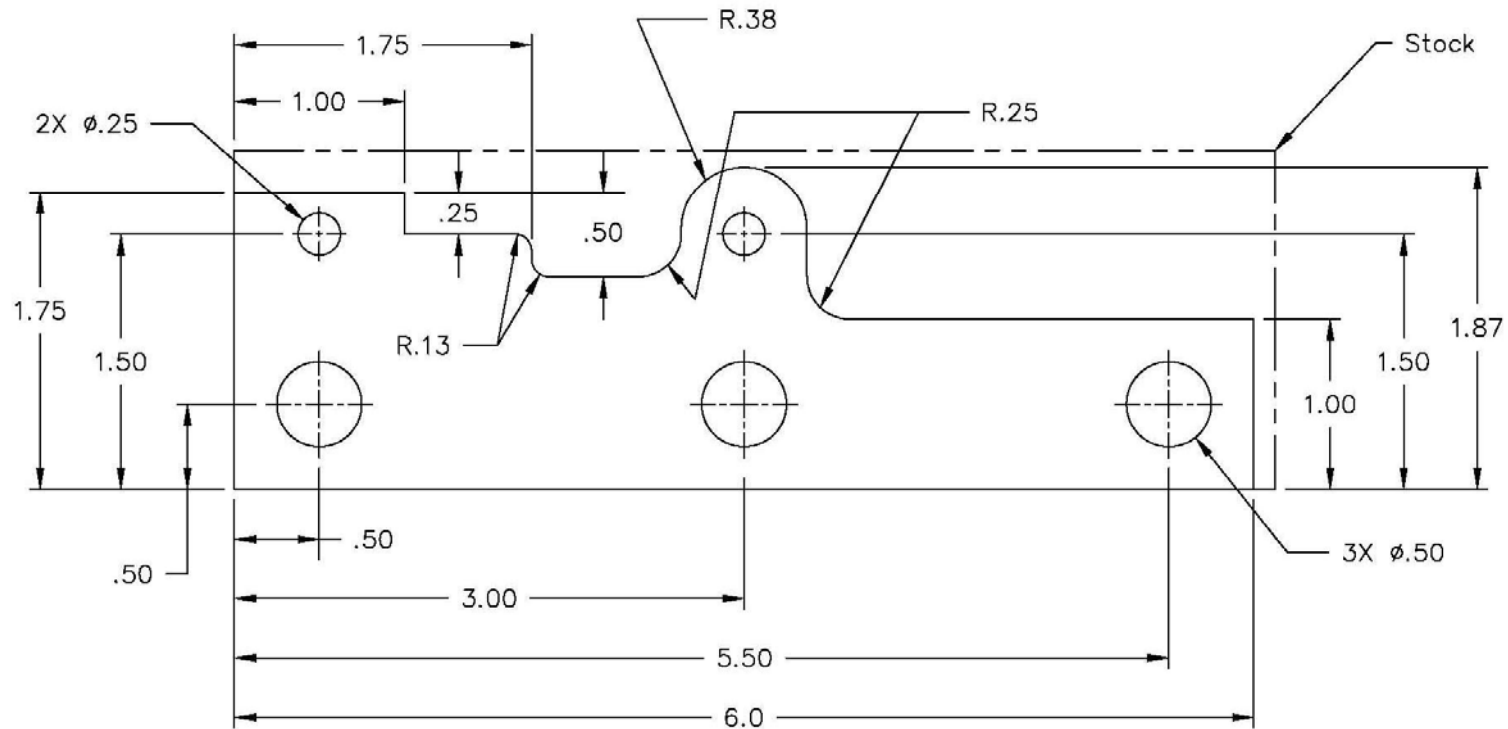
Evaluation Date _____

Performance Project – Layout		Pass	Fail
Evaluation Criteria			
1. Length: 6.032/5.968	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
2. Height: 1.765/1.735	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
3. Height: 1.885/1.855	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
4. Height 1.015/. 985	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
5. Radius: .38 ± .015	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
6. Radius: .25 ± .015	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
7. Location of hole #2: 3.015/2.985-x .515/. 485	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
8. Location of hole #5: 3.015/2.985 x 1.515/1.485	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
9. Location of hole #1: .515/.485 x .515/.485	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>


Performance Project – Layout		Pass	Fail
Evaluation Criteria			
10. Location at hole #3: .515/.485 x 1.515/1.485	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
11. Location at hole #4: 5.515/5.485 x .515/.485	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
12 Length to step: 1.75 1.765/1.735	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
13. Length to step: 1.00 1.765/1.735 5	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
14. Step height .25 .265/.235 .50 .515/.485	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
15. Radius: .125 ± .015	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
16. Location of hole #2: 3.015/2.985-x .515/.485	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
17. Location of hole #5: 3.015/2.985 x 1.515/1.485	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
18. Intersections are struck once	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>
19. Location of hole #1: .515/.485 x .515/.485	Pass = within tolerance Fail = out of tolerance	<input type="checkbox"/>	<input type="checkbox"/>

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

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



Notes:
BREAK ALL SHARP EDGES

 <p>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994</p> <p>TOLERANCES .X ± .032 .XXX ± .005 .XX ± .015 ANGLES ± 1 DEG. FRACTIONS ± 1/64</p>	MACHINING SKILLS LEVEL I			
	Job Duty 2.2 Manual Operation, Layout			
	DESIGNER	DK	11/01/01	MATERIAL
	DWG CHK			COLD ROLL STEEL OR MILD STEEL
DWG APPD				
SCALE FULL	DWG.#98202 I	SHEET 1 OF 1		

DO NOT SCALE DRAWING

NIMS PROCEDURAL REQUIREMENTS

1. THIS IS A LAYOUT ONLY, DO NOT CUT PART PROFILE
2. CONSTRUCTION LINES FOR LAYOUT ARE PERMISSIBLE
3. LINES ARE STRUCK ONCE

4. INTERSECTIONS ARE CLEAN AND CLEAR
5. PUNCH MARKS ARE CENTERED ON INTERSECTIONS: ± .015
6. SUBMIT THIS PRINT AND WORKPIECE ALONG WITH THE PERFORMANCE AFFIDAVIT FOR EVALUATION