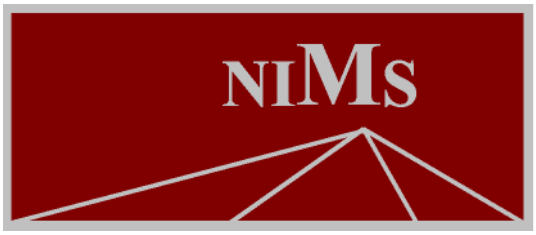


The National Institute for Metalworking Skills, Inc.

Performance Guide

NIMS Credentialing Program

Machining Level I

10565 Fairfax Boulevard, Suite 203
Fairfax, VA 22030
Tel: (703) 352-4971 | FAX (703) 352-4991
www.nims-skills.org

Issued: August 2005

Machining Level I Table of Contents

General Instructions – Please Review Carefully

1. This section presents the specific requirements and evaluation criteria a candidate must satisfy to qualify for a NIMS skill credential. You as the candidate's sponsor or trainer have the responsibility to review the candidate's work, assessing it against the requirements as detailed for the specific credentials in this section prior to MET-TEC submission. The instructions and worksheets in this section should be followed closely in fulfilling your training and evaluative role. **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.**

2. Each skill credential offered by NIMS is based on a set of duties, which collectively approximate a complete role or job. The separate duties for Machining – Level I can be found in the ***Duties and Standards for Machining Skills – Level I.*** The complete standards chart is available to download at

   http://www.nims-skills.org/downloads/downloads.htm.

3. There is only one project for the candidate to complete for each skill area designated in this Evaluators Guide. Some skill areas encompass two or more performance requirements.

4. Upon completion of a part by a candidate, measure and check the part against all specifications, using the corresponding Performance Assessment Worksheet included for the part in the section. If all specifications have been met within the allowable tolerances, then complete the Sponsor/Trainer portion of the Performance Affidavit and arrange for the part to be validated by a MET-TEC. If all of the specifications have not been met, then the candidate must make appropriate corrections or repeat the job.

NIMS standards require 100% conformance to all specifications.

5. The credentialing candidate's sponsor should ensure that each candidate has a copy of the part print he or she is following to meet a NIMS performance requirement.

Machining Performance Affidavit

NIMS Credentialing Program

National Institute for Metalworking Skills, Inc.

Applicant

Name _____ Email _____

Address of Applicant _____ City _____ State _____ Zip _____

Machining Level I: (Check Only One **)

- ☐ Benchwork * and Layout *
- ☐ Turning – Chucking
- ☐ Turning – Between Centers
- ☐ CNC Milling – Setup/Prog.
- ☐ CNC Turning – Setup/Prog
- ☐ Drill Press
- ☐ Grinding
- ☐ Milling

Machining Level II: (Check Only One **)

- ☐ Manual Milling
- ☐ Manual Turning – Chucking
- ☐ Manual Turning – Between Centers
- ☐ Manual Drill Press
- ☐ CNC Milling
- ☐ CNC Turning
- ☐ Cylindrical Grinding
- ☐ Surface Grinding
- ☐ EDM – Plunge EDM
- ☐ EDM – 2-Axis Wire EDM

* Does not require MET-TEC review – Sponsor should review the project and complete the Affidavit of Sponsor only.
** Separate Performance Affidavits are required for each credential

Sponsor

Affidavit of Sponsor. Sponsor: Complete this portion and send to the MET-TEC along with the part and part print.

I hereby attest that the above named applicant did perform the requirements being evaluated, that my inspection leads to the conclusion that the applicant's project meets the published NIMS specifications and requirements for the indicated activity, and that the applicant understood and practiced appropriate safety procedures in the conduct of his//her performance.

For Machining Level II Parts: Credentialing applicant must complete part in the allotted time.

Time to complete part: _____ ❒ Pass ❒ Fail

_____

Sponsor's Signature | Sponsor's Company / Organization | Evaluation Date

MET-TEC

Affidavit of Local Metalworking Technical Evaluation Committee

We hereby attest that we have individually inspected the part presented by the above named candidate and record the following evaluation. The evaluation will be measured with a pass or fail grade where "Pass" means that all specifications have been met and are within allowable tolerances and "Fail" means that one or more specification have not been met or are outside of allowable tolerances. Candidate must receive a passing score from at least two inspectors for submission.

Name _____ Company _____ Pass ❒ Fail ❒

Signature _____ Date _____

Name _____ Company _____ Pass ❒ Fail ❒

Signature _____ Date _____

Name _____ Company _____ Pass ❒ Fail ❒

Signature _____ Date _____

MET-TEC – Return the original Performance Affidavit, part, part print, and Evaluation Sheet to the sponsor of this applicant. Stamp passing parts with a letter stamp on critical surface to prevent re-submission. Retain a copy of the Performance Affidavit for your records.

Sponsor send or fax Performance Affidavit to:

National Institute for Metalworking Skills
10565 Fairfax Blvd., Suite 203
Fairfax, VA 22030
Fax: (703) 352-4991

Machining Performance Affidavit

NIMS Credentialing Program

National Institute for Metalworking Skills, Inc.

1. **Applicant Information.** The individual whose work is being evaluated should be identified by name, address, email address, and birth date.

2. **Performance Evaluation.** Check the appropriate box for the performance activity being evaluated. Please note that this affidavit can apply to **only one** performance activity.

3. **Affidavit of Sponsor.** The Sponsor of the applicant should complete the appropriate section, sign, and date the affidavit. The affidavit, part, and part print should be sent to the MET-TEC for review.

4. **Affidavit of MET-TEC.** The MET-TEC must attest to its findings by inspecting the part presented by the applicant. The original affidavit should be sent to the **sponsor** along with the part and part print. MET-TECs should keep a copy of the affidavit for their file

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 ¼-20 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.

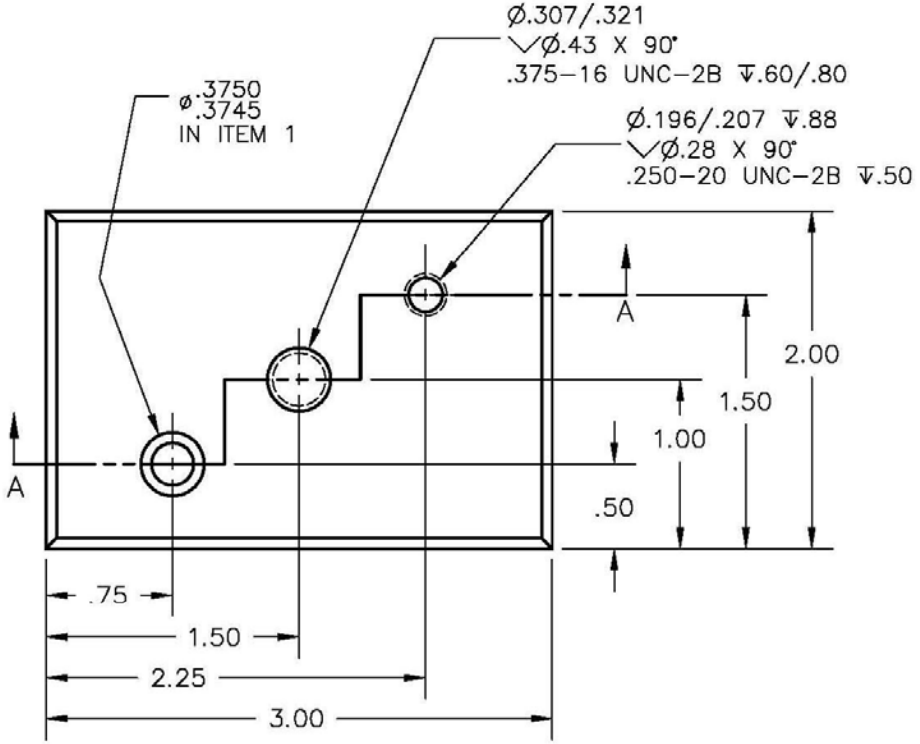
Remember, NIMS requires that all specifications must be met within the allowable tolerance limits. If the part does not meet all specifications, the candidate must correct or redo the project.

Candidate Name Evaluation Date

Performance Project – Benchwork **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			

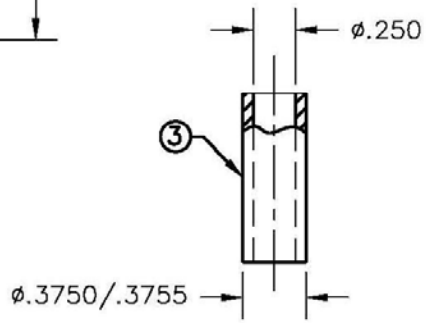
It is important to note that the part must be 100% within the tolerances listed on the print. The criteria listed here are a guide for instructors and supervisors. Not every dimension is included in this guide. Nonetheless, the completed part must be 100% within the specifications of the print. The print 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*

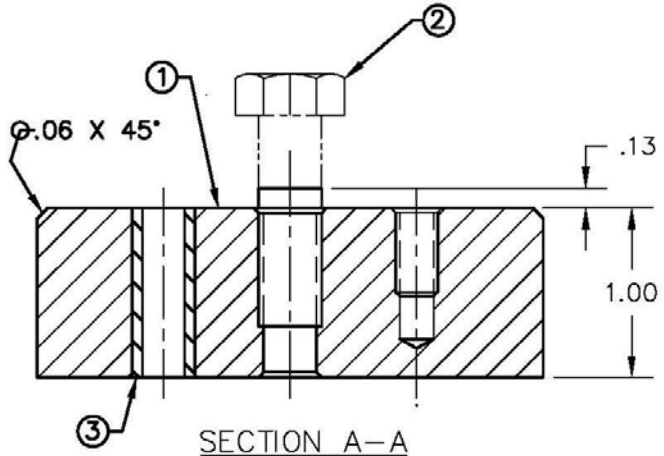
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	UPDATED DRAWING AND TITLE BLOCK	3/7/05	LW
B	UPDATED .375–16 HOLE	3/31/05	LW



Notes:

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





ITEM	DESCRIPTION	SIZE	MATERIAL
3	BUSHING	ø.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

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

TOLERANCES
.X ±.032 .XXX ±.005
.XX ±.015 ANGLES ± 1 DEG.
FRACTIONS ± 1/64

DESIGNER	DK	11/12/01	MATERIAL: ALUMINUM OR MILD STEEL
DWG CHK			
DWG APPD			
SCALE NTS	DWG.#98201 I	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, scriber, 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 scriber, 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

Evaluation Criteria

		Pass	Fail
1. Length: 6.032/5.968	Pass = within tolerance Fail = out of tolerance	❒	❒
2. Height: 1.765/1.735	Pass = within tolerance Fail = out of tolerance	❒	❒
3. Height: 1.885/1.855	Pass = within tolerance Fail = out of tolerance	❒	❒
4. Height 1.015/. 985	Pass = within tolerance Fail = out of tolerance	❒	❒
5. Radius: .38 ± .015	Pass = within tolerance Fail = out of tolerance	❒	❒
6. Radius: .25 ± .015	Pass = within tolerance Fail = out of tolerance	❒	❒
7. Location of hole #2: 3.015/2.985-x .515/. 485	Pass = within tolerance Fail = out of tolerance	❒	❒
8. Location of hole #5: 3.015/2.985 x 1.515/1.485	Pass = within tolerance Fail = out of tolerance	❒	❒
9. Location of hole #1: .515/.485 x .515/.485	Pass = within tolerance Fail = out of tolerance	❒	❒

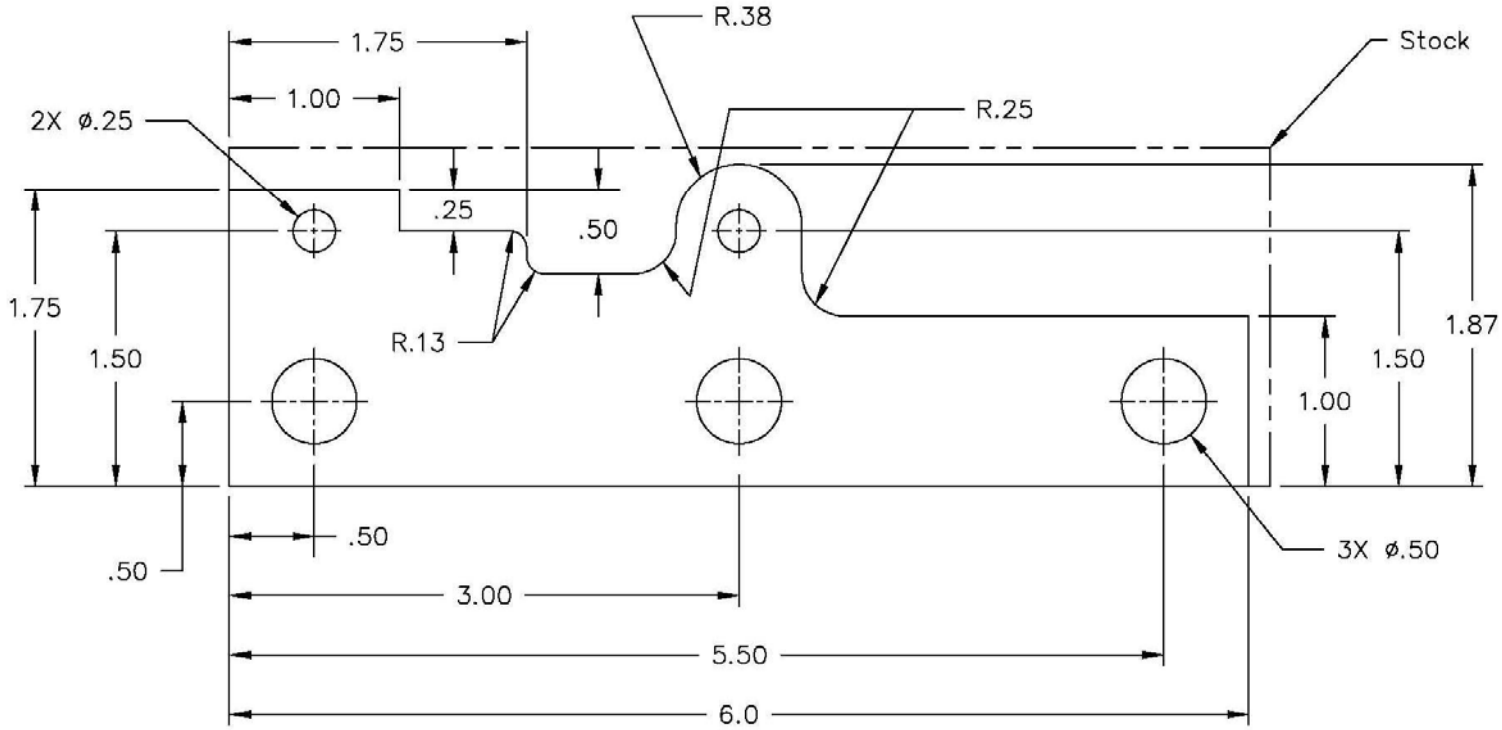
Performance Project – Layout

Evaluation Criteria

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

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

DO NOT SCALE DRAWING

NIMS®

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994

TOLERANCES
.X ±.032 .XXX ±.005
.XX ±.015 ANGLES ± 1 DEG.
FRACTIONS ± 1/64

MACHINING SKILLS LEVEL I

Job Duty 2.2
Manual Operation, Layout

DESIGNER	DK	11/01/01	MATERIAL: COLD ROLL STEEL OR MILD STEEL
DWG CHK			
DWG APPD			
SCALE FULL	DWG.#98202 I		SHEET 1 OF 1

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

Performance Standards
Vertical Milling Level I

Material

Mild steel or low carbon steel 1.5" x 2" x 2.6"

Duty

Setup and operate vertical milling machines. Perform routine milling, and location of hole centers within +/-.005".

Performance Standard

Given raw material, print, hand, precision, and cutting tools, as well as access to an appropriate vertical milling machine and its accessories, produce a part matching the blueprint specifications using appropriate trade techniques and speeds and feeds. The part specified should require squaring up from the raw state, have at least one milled slot, require the location of at least two drilled and reamed holes within positional tolerance of .014" and have three steps controlled by tolerances of +/-.005".

Other Evaluation Criteria

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

Accuracy Level: +/- .015 on all fractions, +/-.005 on all decimals unless otherwise specified on the blueprint. Finishes Surfaces to be square within .005 over 4". Finished surfaces are to be 125 Ra microinches unless otherwise specified.

Assessment Equipment and Material

Workstation: A common workbench, a vertical mill. Table capacity of approximately 12"X36".

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

Tooling: A 6" milling vise or greater, screws, studs, nuts, washers, and clamps sufficient to secure the vise, or the part to the table. Assorted parallels, ball peen, and soft-faced hammers, assorted cutters and cutter adapters fitted to the machine spindle, files, magnetic base for indicators, soft jaws for the vise, drill chuck, drills, reamers, combination drill and countersink or spotting drill, countersink, and edge finder. Coolants and cutting oil.

Measuring Instruments: 0-3 Micrometers, combination set, dial indicator, 6" rule, a 6" vernier, dial, or electronic caliper, adjustable parallels, and depth micrometer, and surface finish comparison plates.
Pingages. .123", .124", .125", .126", .127"
Solid square
¼ - 20 UNC 2B plug gage
Telescopic gage .750
Small hole gage

Reference: Machinery's Handbook.

Performance Assessment Worksheet
Vertical Milling Level I

INSTRUCTIONS: Rate the candidate's performance for the Milling project according to the sixteen (16) criteria below. The checklist below represents a listing of the only 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/trainee must correct or redo the project.

Candidate Name Evaluation Date

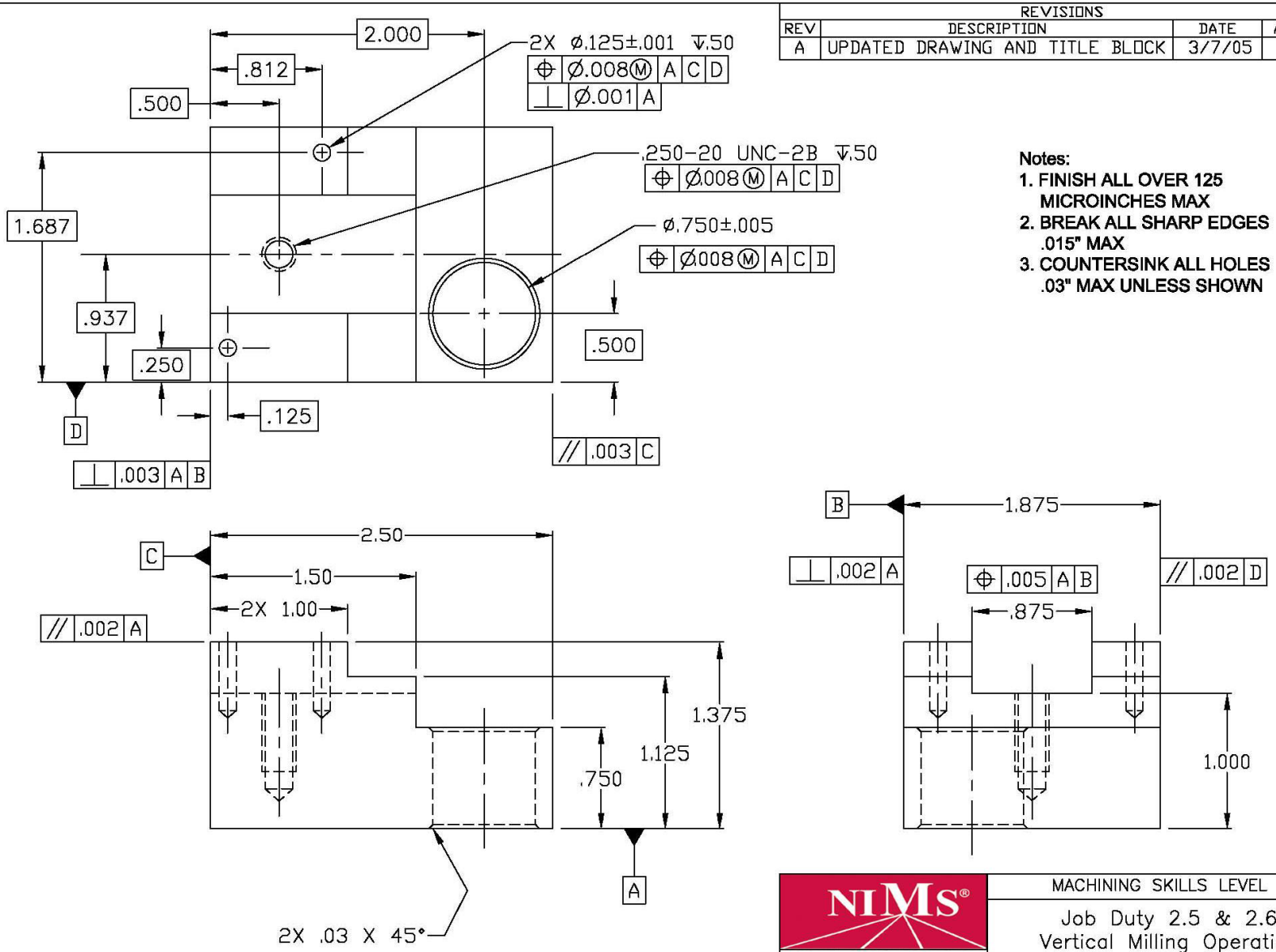
Performance Project – Milling **Evaluation Criteria**		**Pass**	**Fail**
1. Lengths 2.50 ± .015, 1.50 ± .015, 1.00 ± .015	Pass = within tolerance Fail = out of tolerance	❒	❒
2. Heights 1.375 ± .005, 1.125 ± .005, .750 ± .005, 1.000 ± .005	Pass = within tolerance Fail = out of tolerance	❒	❒
3. Width 1.875 ± .005	Pass = within tolerance Fail = out of tolerance	❒	❒
4. All surfaces are □ or // within specified tolerance zones in the feature control symbols to their respective datums	Pass = within tolerance zones Fail = exceeds tolerance zones	❒	❒
5. ∅.750 ± .005 bore	Pass = within tolerance Fail = out of tolerance	❒	❒
6. True position of ∅.750 bore .014 tolerance zone to datums A, C and D	Pass = within tolerance Fail = out of tolerance	❒	❒
7. ∅.25 - 20 UNC-2B Thread True position tolerance zone of .014 to datums A, C and D (base true position from tap drill diameter.	Pass = within tolerance Fail = out of tolerance	❒	❒

Performance Project – Milling

Evaluation Criteria		Pass	Fail
8 .875 ± .005 position to datum B with a .005 tolerance zone.	Pass = within tolerance Fail = out of tolerance	❒	❒
9. 2 x .125" holes positioned within .812 ± .005 datums A, C, & D	Pass = within tolerance Fail = out of tolerance	❒	❒
10. .125 hole diameter ± .001 (both holes)	Pass = within tolerance Fail = out of tolerance	❒	❒
11. Tap for .25 – 20 x .50 deep min. (No break out at the bottom of the hole)	Pass = within tolerance zones Fail = exceeds tolerance zones	❒	❒
12. .031 deep × 45° chamfers	Pass = within tolerance Fail = out of tolerance	❒	❒
13. Surface finish, no ground surfaces	Pass = 125 Ra microinches or better Fail = over 125 Ra microinches	❒	❒
14. Sharp edges .015 max. and holes countersunk .031 max.	Pass = no sharp edges, within maximum allowance Fail = sharp edges	❒	❒

END OF MILLING 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.*



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

Notes:

1. FINISH ALL OVER 125 MICROINCHES MAX
2. BREAK ALL SHARP EDGES .015" MAX
3. COUNTERSINK ALL HOLES .03" MAX UNLESS SHOWN

NIMS®

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994

TOLERANCES
.X ±.032 .XXX ±.005
.XX ±.015 ANGLES ± 1 DEG.
FRACTIONS ± 1/64

MACHINING SKILLS LEVEL I

Job Duty 2.5 & 2.6
Vertical Milling Operation

DESIGNER	DK	8/1/01	MATERIAL: COLD ROLL STEEL OR MILD STEEL
DWG CHK			
DWG APPD			
SCALE FULL	DWG.#98301 I	SHEET 1 OF 1	

NIMS PROCEDURAL REQUIREMENTS

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

Performance Standards
Drill Press

Material

Mild steel or low carbon steel 1.00" x 2.00" x 3.00"

Duty

Setup and operate drill presses. Perform routine drill press operations.

Performance Standard

Given a part print, hand precision, and cutting tools, as well as access to a drill press and its accessories, produce a part matching the process plan and the blueprint specifications. Each hole must have at least two secondary operations. The secondary operations will consist of reaming, spot facing, countersinking, counterboring, and counterdrilling. At least one hole must be a blind hole and one a through hole. At least one hole will may be power tapped.

Other Evaluation Criteria

1. Finishes are at least 250 Ra microinches.
2. No sharp edges.
3. The mouths of all holes are lightly countersunk.

Accuracy Level: +/- 1/64 on all fractions, holes square within .005 per inch, drilled diameters, +.006, -.000. Reamed diameters +.001, -.000, +/-.005 on all decimals unless otherwise specified on the blueprint.

Assessment Equipment and Material

Workstation: A common workbench, a drill press. Morse taper #3 spindle capacity or greater preferred. The drill press must have a tapping capability or a tapping head accessory.
Material: A part matching the material requirements of the drill press blueprint, material: mild steel, cutting fluids.

Tooling: A 6" drill vise or greater, screws, studs, nuts, washers, and clamps sufficient to secure the vise, or the part. Assorted parallels, a composition hammer, assorted Morse taper sleeves fitted to the machine spindle, drill chucks, drills, reamers, countersinks, spot facers, counterbores, centerdrills, and various taps. A scriber, layout ink, prick punch, ball peen hammer, angle plate, 6" dividers, surface gage.

Measuring Instruments: Required micrometers, combination set, 6" rule, a 6" vernier, dial, or electronic caliper, go/nogo gage for threads, plug gages, telescoping gages, layout height gage, and surface finish comparison plates.

Reference: Machinery's Handbook.

Performance Assessment Worksheet
Drill Press

INSTRUCTIONS: Rate the candidate's performance for the Drill Press 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.

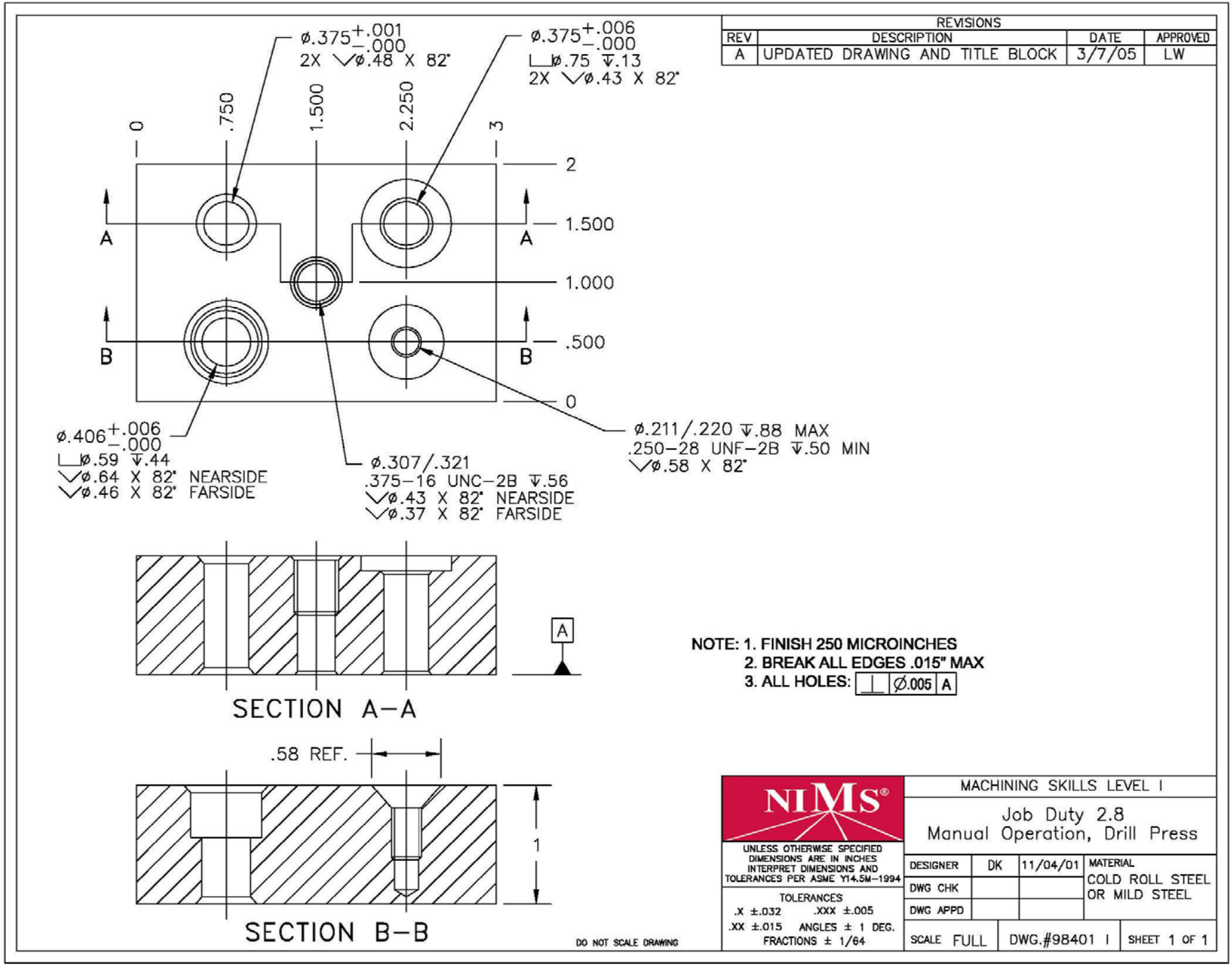
Remember, NIMS requires that all specifications must be met within the allowable tolerance limits. If the part does not meet all specifications, the candidate/trainee must correct or redo the project.

Candidate Name Evaluation Date

Performance Project – Drill Press **Evaluation Criteria**		**Pass**	**Fail**
1. ∅.375 + .001/-.000 reamed hole (hole 1)	Pass = within tolerance Fail = out of tolerance	❒	❒
2. Location of .375-16 tapped hole 1.500 ± .005 1.00 ± .005	Pass = within tolerance Fail = out of tolerance	❒	❒
3. ∅.375 drilled hole +.006/-.000 ∅ .75 spotface × .13 deep ± .015" (hole 2)	Pass = within tolerance Fail = out of tolerance	❒	❒
4. ∅ .406 +.006/– .000 ∅ .59 c'bore × .44 deep ± .015"	Pass = within tolerance Fail = out of tolerance	❒	❒
5. .250 - 28 UNF 2B .5 deep min. full thread #3 drill (∅.213) .878 deep max.	Pass = within tolerance Fail = out of tolerance	❒	❒
6. .375 UNC 2B, .5 deep min., full thread .75 max. .31 drill hole +.006/-.000	Pass = within tolerance Fail = out of tolerance	❒	❒
7. Holes ⊥ to datum A within .005	Pass = within tolerance Fail = out of tolerance	❒	❒

Performance Project – Drill Press **Evaluation Criteria**		**Pass**	**Fail**
8. Surface finish	Pass = 125 Ra microinches or better Fail = Over 125 Ra microinches	❒	❒
9. Sharp edges broken .015 max.	Pass = no sharp edges Fail = sharp edges	❒	❒
10. Holes: countersunks are within tolerance.	Pass = countersunk within tolerance Fail = holes not countersunk	❒	❒
END OF DRILL PRESS 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.*



NIMS PROCEDURAL REQUIREMENTS

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

Performance Standards
Surface Grinding

Material

Common mild steel or low carbon steel 1.0 x 1.5 x 2.0 (rough milled)

Duty

Setup and operate manual surface grinders with a 8" and smaller diameter wheel. Perform routine surface grinding, location of surfaces, and squaring of surfaces. Perform wheel dressing.

Performance Standard

Given a block squared up on a mill, part print, hand and precision tools, and choice of a grinding wheels, as well as access to a surface grinder and its accessories, dress the wheel, produce a part matching the print specifications using appropriate trade techniques. The part specified will be in the semi-finished state having been squared up and milled. Finishing the part will require the precision finishing of the six faces of the block to tolerances common to precision grinding for squareness, size, and surface finish characteristics.

Other Evaluation Criteria

1. Finishes are at least 32 Ra microinches or better.
2. Free of sharp edges.

Accuracy Level: +/- .001 on all decimals unless otherwise specified on the print. Square within .001 over 4".

Assessment Equipment and Material

Workstation: A common workbench with a precision surface plate, a surface grinder with a suitable magnetic chuck..

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

Tooling: A magnetic chuck, assorted parallels, a suitable angle plate or precision grinding vise, and assorted clamps, composition hammer, assorted grinding wheels suitable for mounting to the spindle, files, magnetic base for indicators, surface gage of sufficient size, and diamond dresser.

Measuring Instruments: Required micrometers, combination set, dial test indicator, 6" rule, a 6" vernier, dial, or electronic caliper, adjustable parallels, depth micrometer set, master square or magnetic square, surface finish comparison gages.

Reference: Machinery's Handbook

Gage blocks
V block
Sine chuck
Sine plate

Performance Assessment Worksheet
Surface Grinding

INSTRUCTIONS: Rate the candidate's performance for the Surface Grinding job according to the eleven (11) 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 must correct or redo the project.

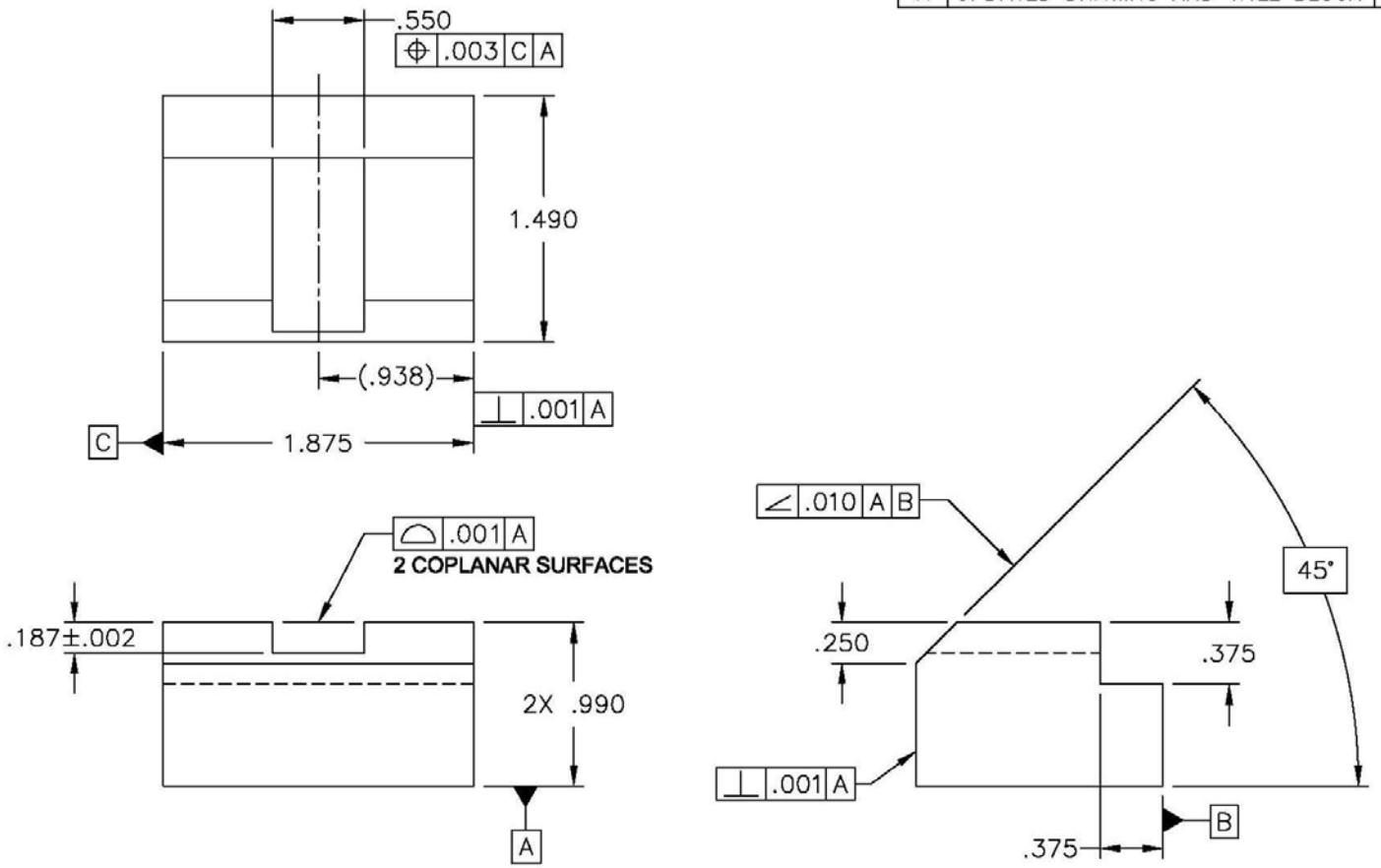
Candidate Name Evaluation Date

Performance Project -Surface Grinding **Evaluation Criteria**		**Pass**	**Fail**
1. .990 ± .001	Pass = within tolerance Fail = out of tolerance	❒	❒
2. 1.490 ± .001	Pass = within tolerance Fail = out of tolerance	❒	❒
3. 1.875 ± .001	Pass = within tolerance Fail = out of tolerance	❒	❒
4. .187 ± .002 slot depth	Pass = within tolerance Fail = out of tolerance	❒	❒
5. Perpendicularity & profile per GD&T call outs within specified tolerance zones	Pass = within specifications Fail = out of specifications	❒	❒
6. .550 ± .001 Position tolerance .003 to datum C & A	Pass = within tolerance Fail = out of tolerance	❒	❒
7. .375 ± .001 Width .375 ± .001 Depth	Pass = within tolerance Fail = out of tolerance	❒	❒

Performance Project -Surface Grinding **Evaluation Criteria**		**Pass**	**Fail**
8. Angularity of 45° within .010 .250 ± .001 depth of 45°angle	Pass = within tolerance Fail = out of tolerance	❒	❒
9. Surface finish	Pass = 32 Ra microinches or better Fail = over 32 Ra microinches	❒	❒
10.Fillet radii .015 max.	Pass = less than .015 Fail = greater than .015	❒	❒
11. Sharp edges broken .015 max.	Pass = below max. Fail = above max.	❒	❒
END OF SURFACE GRINDING 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.*

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



Notes:
1. GRIND ALL OVER 32 MICROINCH
2. BREAK ALL SHARP EDGES .015 MAX
3. FILLET AND RADII .015 MAX

DO NOT SCALE DRAWING

NIMS®

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994

TOLERANCES
.X ±.032 .XXX ±.001
.XX ±.015 ANGLES ± 1 DEG.
FRACTIONS ± 1/64

MACHINING SKILLS LEVEL I

Job Duty 2.7b
Surface Grinding Operation

DESIGNER	DK	11/11/01	MATERIAL: COLD ROLL STEEL OR MILD STEEL
DWG CHK			
DWG APPD			
SCALE FULL	DWG.#98501 I	SHEET 1 OF 1	

NIMS PROCEDURAL REQUIREMENTS

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

Performance Standards
Turning Between Centers

Material

Mild steel or low carbon steel ∅1.00 x 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 +/-.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: +/- .015 on all fractions, +/-.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 part does not meet all specifications, the candidate must correct or redo the project.

Candidate Name Evaluation Date

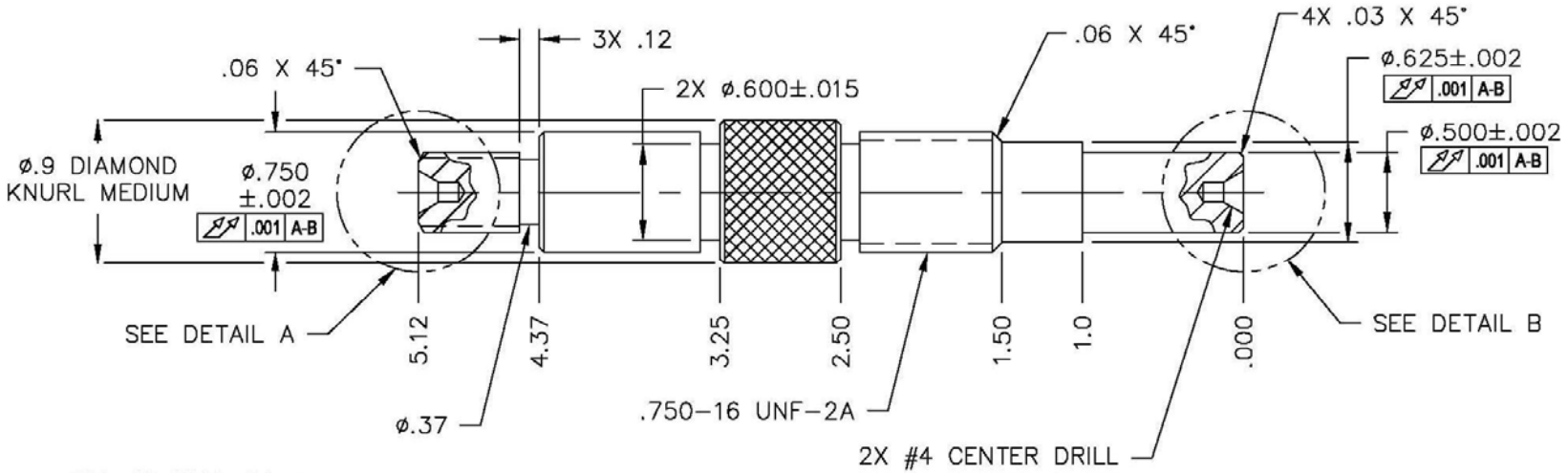
Performance Project – Turning Between Centers **Evaluation Criteria**		**Pass**	**Fail**
1. ∅.500 ± .002 ∅.625 ± .002 ∅.750 ± .002	Pass = within tolerance Fail = out of tolerance	❒	❒
2. Diameters of grooves adjacent to the knurl: .600 ± .015 (2 places)	Pass = within tolerance Fail = out of tolerance	❒	❒
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	❒	❒
4. 5.12 ± .015 Overall Length	Pass = within tolerance Fail = out of tolerance	❒	❒
5. 3.25 ± .015 Length 4.37 ± .015 Length	Pass = within tolerance Fail = out of tolerance	❒	❒
6. 2.50 ± .015 Length 1.0 ± .032	Pass = within tolerance Fail = out of tolerance	❒	❒
7. .500 – 13 UNC – 2A Pitch diameter tolerance .4435/.4485	Pass = within tolerance Fail = out of tolerance	❒	❒
8. 750 – 16 UNF – 2A Pitch diameter tolerance: .7029/.7079	Pass = within tolerance Fail = out of tolerance	❒	❒
9. Groove width: .12 ± .015 (3 places) Groove diameter: ∅.37 ± .015	Pass = within tolerance Fail = out of tolerance	❒	❒

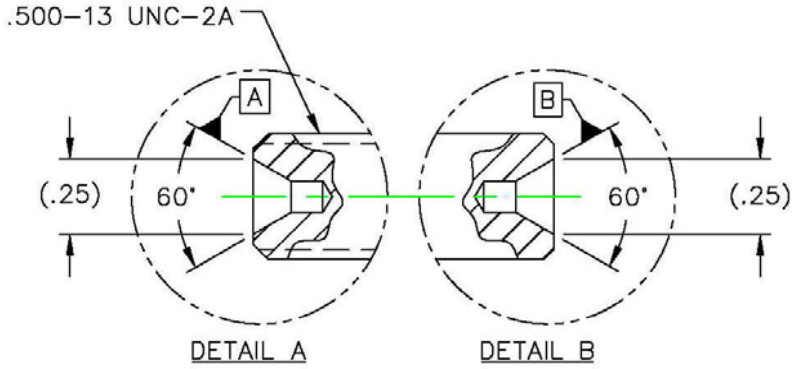
Performance Project – Turning Between Centers **Evaluation Criteria**		**Pass**	**Fail**
10. Diamond knurl- no flakes ∅.9 ± .032	Pass = within tolerance Fail = out of tolerance	❒	❒
11. Surface finish	Pass = 125 Ra microinches or better Fail = over 125 Ra microinches	❒	❒
12. Sharp edges: .015 max.	Pass = radii less than .015 Fail = sharp edges, radii greater than .015	❒	❒
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 125
2. BREAK ALL SHARP EDGES .015 MAX
3. UNLESS OTHERWISE SPECIFIED,
   ALL COAXIAL DIAMETERS ⌖ .010 A-B

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





DO NOT SCALE DRAWING

NIMS®

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994

TOLERANCES
.X ±.032 .XXX ±.005
.XX ±.015 ANGLES ± 1 DEG.
FRACTIONS ± 1/64

MACHINING SKILLS LEVEL I

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

Performance Standards
Turning-Chucking

Material

Cold rolled steel or low carbon steel, ∅2" x 4.5"

Duty

Setup and carry out chucking operations for turning.

Performance Standard

Given raw material, part print, hand, precision, and cutting tools, as well as access to an appropriate turning machine and its accessories, produce a part matching the print specifications using appropriate trade techniques and speeds and feeds. The part specified should have at least three diameters within +/-.005", two bores within +/-.005", one UNC external thread, and require at least two chuckings or other workholding setup.

Other Evaluation Criteria

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

Accuracy Level: +/- .015 on all fractions, +/-.005 on all decimals unless otherwise specified on the blueprint. 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, and a four jaw independent chuck. The lathe must have a quick change gear box with the threads called for on the print available from the gear box.

Material: A part matching the material requirements of the turning blueprint, 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 print, a boring bar and boring tool capable of boring to a square shoulder, a drill chuck, centerdrill, and assorted drills necessary to rough out the bore, magnetic base for a dial indicator, thread wires for chucks, files, wrenches as necessary.

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

Reference: Machinery's Handbook

Performance Assessment Worksheet
Turning-Chucking

INSTRUCTIONS: Rate the candidate's performance for the Turning- Chucking 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.

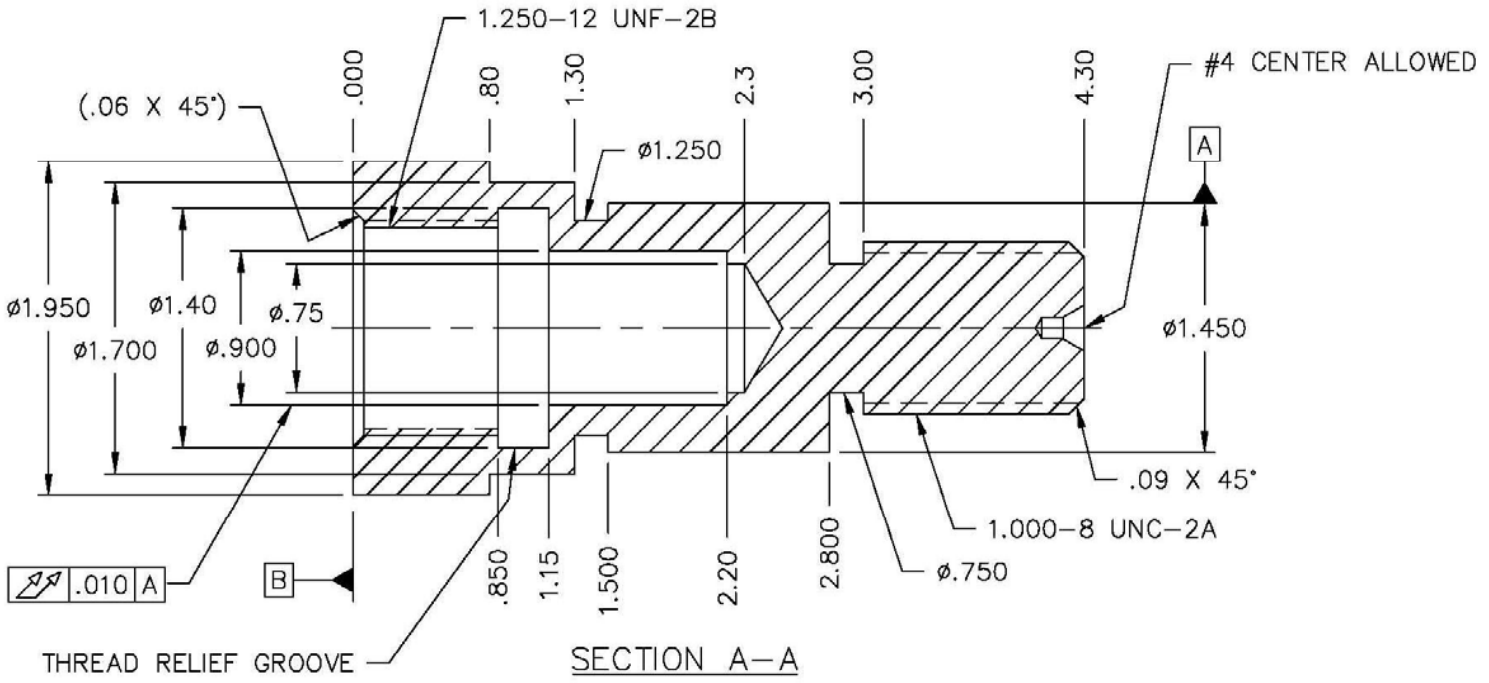
Candidate Name Evaluation Date

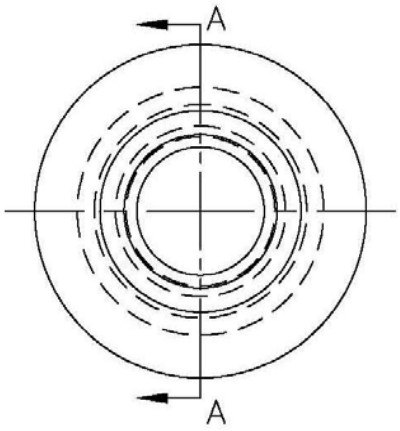
Performance Project – Turning-Chucking **Evaluation Criteria**		**Pass**	**Fail**
1. Length dimensions .80 ± .015 1.30 ± .015 2.800 ± .005 4.30 ± .015	Pass = all dimensions within tolerance Fail = one or more dimensions not within tolerance	❒	❒
2. Outside diameters ∅1.950 ± .005 ∅ 1.700 ± .005 ∅1.450 ± .005	Pass = all dimensions within tolerance Fail = one or more not within tolerance	❒	❒
3. Groove dimensions ∅.750 ± .005 ∅1.250 ± .005	Pass = both grooves within tolerances Fail = one or both grooves not within tolerance	❒	❒
4. External thread 1-000-8 UNC 2A thread Pitch diameter: 0.9100 / 0.9168	Pass = Gage "go" compliance or within pitch diameter tolerance Fail = Accepts "no-go" gage or out of pitch diameter tolerance	❒	❒
5. Internal thread 1 .25 -12 UNF - 2B thread	Pass = meets "Go" condition on gage Fail = Accepts "No-go" gage	❒	❒
6. Drill and bore hole 2.20 ± .015 bore depth 2.3 ± .032 drill depth ∅.75 ± .015 drill hole	Pass = all dimensions within tolerance Fail = one or more dimensions out of tolerance	❒	❒

Performance Project – Turning-Chucking **Evaluation Criteria**		**Pass**	**Fail**
7. ∅.900 bore concentric to datum A .010 TIR	Pass = TIR of .005 or less Fail = TIR exceeds .005	❒	❒
8. Coaxial on all non-threaded diameters .010 TIR on all diameters	Pass = all diameters within TIR callout Fail = one or more diameters exceed TIR callout	❒	❒
9. Bore diameter .900 ± .005	Pass = within tolerance Fail = out of tolerance	❒	❒
10. External surfaces ⊥ surfaces to datum B .005	Pass = all surfaces perpendicular within .005 (Reference surface is datum B) Fail = one or more surfaces exceeds .005	❒	❒
11. Surface finish	Pass = 125 Ra microinches or better Fail = over 125 Ra microinches	❒	❒
12. Sharp edges not to exceed .015	Pass = no sharp edges Fail = sharp edges or edge break exceed .015	❒	❒
END OF TURNING-CHUCKING 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.*

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





DO NOT SCALE DRAWING

NOTES:
1. FINISH ALL OVER 125 MICROINCHES MAX
2. BREAK ALL SHARP EDGES .015" MAX.
3. EXTERNAL SURFACES: ⊥ Ø.005 B
4. ALL EXTERNAL NON-THREADED DIAMETERS: ⌭ .010 B A

NIMS®

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994

TOLERANCES
.X ±.032 .XXX ±.005
.XX ±.015 ANGLES ± 1 DEG.
FRACTIONS ± 1/64

MACHINING SKILLS LEVEL I

Job Duty 2.4
Turning Operation, Chucking

DESIGNER	DK	11/8/01	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

Performance Standards
CNC Milling

Material

Aluminum or mild steel.

Duty

- Set up, program, and operate a CNC mill or machining center and manufacture a part within tolerance
- Work from a process sheet and part print.
- Understand the x, y, z Cartesian coordinate system.
- Create a tool set up sheet.
- Understand fundamental machine processing, feeds and speed, and select simple part.

Performance Standard

Write a program at the machine or off line. Setup the machining operation and perform standards given on mill operations (2.10) to develop a simple part (with linear and circular interpolations).

*Accuracy Level**:*** Match the requirements of the part print. 63 Ra microinch finish

Assessment Equipment and Material:

Workstation: A standard workbench, a CNC mill with continuous path capability on 2½ axes.

Material: A part matching the material requirements of the part print, material: cold rolled steel.

Tooling: A 6" milling vise or greater, screws, studs, nuts, washers, and clamps sufficient to secure the vise, or the part to the table. Assorted parallels, ball peen, and composition hammers, assorted cutters and cutter adapters fitted to the machine spindle, files, magnetic base for indicators, soft jaws for the vise and assorted cutters.

Measuring Inst: Required micrometers, combination set, dial indicator, 6" rule, a 6" vernier, dial, or electronic caliper, adjustable parallels, edge finder, appropriate tools for determining squareness, and surface finish comparison standards.

Reference: Machinery's Handbook, operator's manual of the machine tool.

Performance Assessment Worksheet
CNC Milling

INSTRUCTIONS: Rate the candidate's performance for the CNC Milling 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.

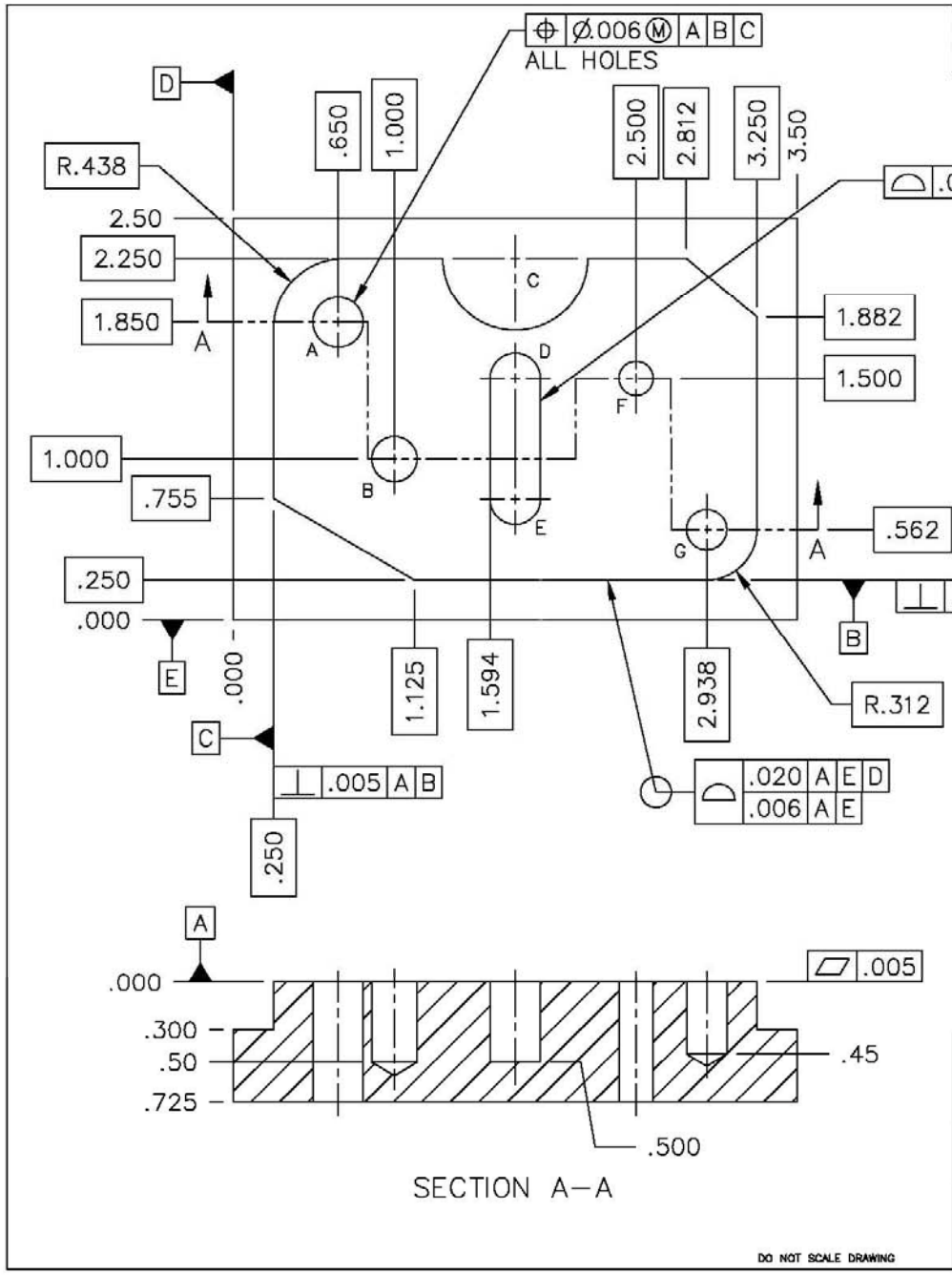
Remember, NIMS requires that all specifications must be met within the allowable tolerance limits. If the part does not meet all specifications, the candidate/trainee must correct or redo the project.

Candidate Name Evaluation Date

Performance Project – CNC Milling **Evaluation Criteria**		**Pass**	**Fail**
1. Overall Dimensions Length 3.50 ± .010 Width 2.50 ± .010 Thickness .725 ± .003	Pass = within tolerance Fail = out of tolerance	❒ ❒ ❒	❒ ❒ ❒
2. Profile tolerance within limits Position ± .006 Depth .300 ± .003	Pass = within tolerance Fail = out of tolerance	❒ ❒	❒ ❒
3. Hole A Position ± .006 Diameter ± .002	Pass = within tolerance Fail = out of tolerance	❒ ❒	❒ ❒
4. Hole B Position ± .006 Diameter .281 ± .005 Depth .500 ± .010	Pass = within tolerance Fail = out of tolerance	❒ ❒ ❒	❒ ❒ ❒
5. Hole F Position ± .006 Diameter ± .002	Pass = within tolerance Fail = out of tolerance	❒ ❒	❒ ❒
6. Hole G Position ± .006 Diameter ± .005 Depth .45 ± .010	Pass = within tolerance Fail = out of tolerance	❒ ❒ ❒	❒ ❒ ❒
7. Slot D-E Position ± .006 Width .312 ± .002 Depth .500 ± .003	Pass = within tolerance Fail = out of tolerance	❒ ❒ ❒	❒ ❒ ❒

Performance Project – CNC Milling **Evaluation Criteria**		**Pass**	**Fail**
8. Break all sharp edges .015 max.	Pass = within tolerance Fail = out of tolerance	❒	❒
9. Surface finish 63 Ra microinches min.	Pass = within tolerance Fail = out of tolerance	❒	❒
END OF CNC MILLING 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.*



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

NOTES:

1. HOLE LETTER / DIAMETER / X / Y

HOLE LETTER	DIAMETER	X	Y
A	.312 ±.002		
B	.281 ±.005		
C	R.450 ±.002	1.750	2.250
D	.312 ±.002	1.750	1.500
E	.312 ±.002	1.750	.750
F	.213 ±.002		
G	.250 ±.005		

2. BREAK ALL SHARP EDGES: .015 INCHES MAXIMUM
3. SURFACE FINISH TO BE 63 MICROINCHES MINIMUM

NIMS®

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994

TOLERANCES
.X ±.020 .XXX ±.003
.XX ±.010 ANGLES ± 1 DEG.
FRACTIONS ± 1/64

MACHINING SKILLS LEVEL I

Job Duty 2.10
CNC: Milling

DESIGNER	CLC	02/21/02	MATERIAL: ALUMINUM OR MILD STEEL
DWG CHK			
DWG APPD			
SCALE FULL	DWG.#98431 I	SHEET 1 OF 1	

NIMS PROCEDURAL REQUIREMENTS

1. PROGRAM MUST BE WRITTEN IN LONG HAND – NO CAM
2. COORDINATE CALCULATIONS CAN BE FOUND WITH GEOMETRY OR TRIG
3. SUBMIT THE CALCULATIONS WITH THE PROGRAM
4. SUBMIT THIS PRINT, COPY OF PROGRAM CODE (LONGHAND), AND WORKPIECE ALONG WITH THE PERFORMANCE AFFIDAVIT FOR EVALUATION

Performance Standards
CNC Turning

Material

Aluminum or mild steel.

Duty

- Set up, program and operate a CNC lathe or turning center and manufacture a part within tolerance.
- Work from a process sheet.
- Understand the x, z Cartesian coordinate system.
- Create a tool set up sheet.
- Understand fundamental machine processing, feeds and speed, and select simple part.

Performance Standard

Write a program at the machine or off line. Setup the machining operation and perform all standards given on lathe operations (2.9) to develop a simple part (with linear and circular interpolations).

Accuracy Level: Match the requirements of the part print.

Assessment Equipment and Material:

Workstation: A standard workbench, a CNC mill with continuous path capability on 2½ axes.

Tooling: CNC lathe or turning center and computer workstation
Material as per print
Tooling as appropriate
Measuring instruments as needed
Reference: Operation process sheet

Measuring Inst: Required micrometers, combination set, dial indicator, 6" rule, a 6" vernier, dial, or electronic caliper, adjustable parallels, edge finder, appropriate tools for determining squareness, and surface finish comparison standards.

Reference: Machinery's Handbook, operator's manual of the machine tool.

Performance Assessment Worksheet
CNC Turning

INSTRUCTIONS: Rate the candidate's performance for the CNC Turning 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/trainee must correct or redo the project.

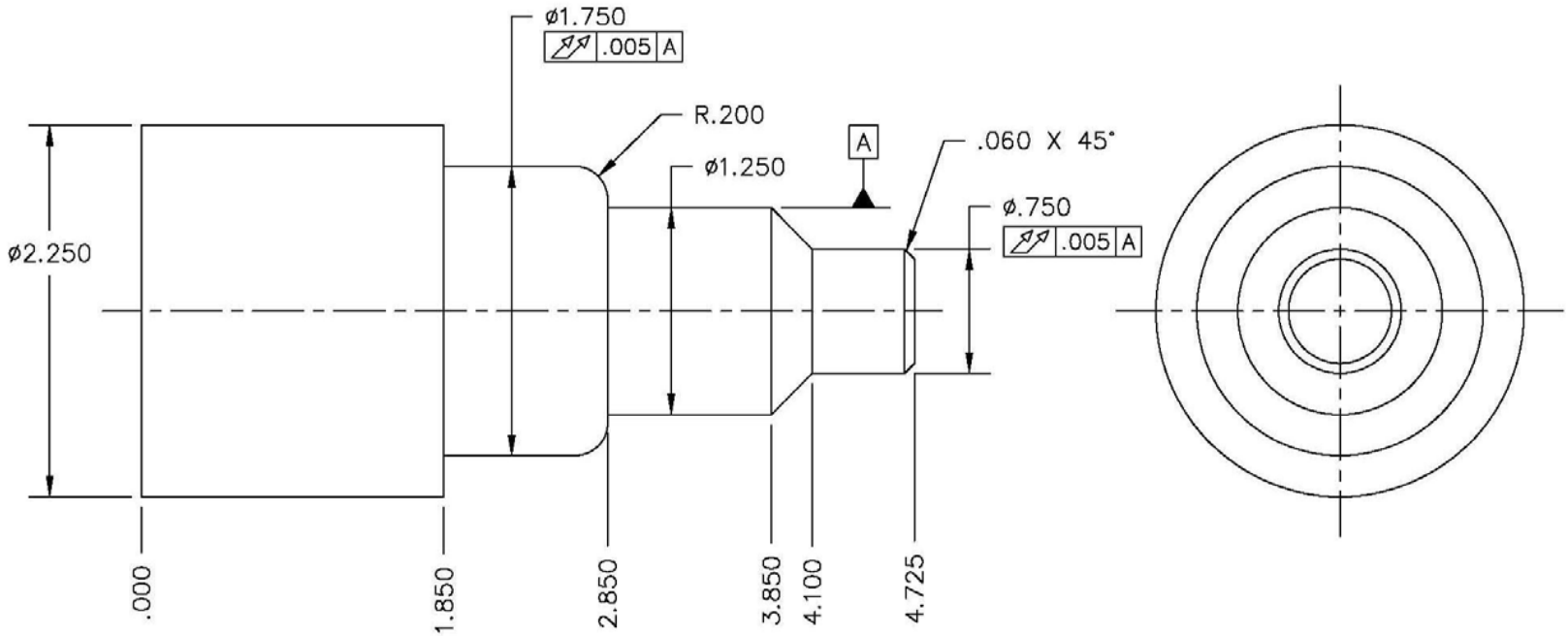
Candidate Name Evaluation Date

Performance Project – CNC Turning **Evaluation Criteria**		**Pass**	**Fail**
1. 1.850 Length	Pass = within tolerance Fail = out of tolerance	❒	❒
2. 2.850 Length	Pass = within tolerance Fail = out of tolerance	❒	❒
3. 3.850 Length	Pass = within tolerance Fail = out of tolerance	❒	❒
4. 4.100 Length	Pass = within tolerance Fail = out of tolerance	❒	❒
5. 4.725 Length	Pass = within tolerance Fail = out of tolerance	❒	❒
6. ∅.750	Pass = within tolerance Fail = out of tolerance	❒	❒
7. ∅ 1.250	Pass = within tolerance Fail = out of tolerance	❒	❒

Performance Project – CNC Turning **Evaluation Criteria**		**Pass**	**Fail**
8. ∅ 1.750	Pass = within tolerance Fail = out of tolerance	❒	❒
9. ∅ 2.250	Pass = within tolerance Fail = out of tolerance	❒	❒
10. Runnouts .005	Pass = within tolerance Fail = out of tolerance	❒	❒
11. Surface finish 63 Ra microinches min.	Pass = within tolerance Fail = out of tolerance	❒	❒
12. Unless otherwise specified, all coaxial diameters .010	Pass = within tolerance Fail = out of tolerance	❒	❒
13. Radius .200	Pass = within tolerance Fail = out of tolerance	❒	❒
14. Chamfer .06 X 45°	Pass = within tolerance Fail = out of tolerance	❒	❒
END OF CNC TURNING 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.*

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



NOTES:
1. CENTER PERMISSIBLE (Ø.750 END)
2. ALL FILLETS AND RADII .015 INCHES MAXIMUM
3. SURFACE FINISH ALL OVER 63 MICROINCHES MAXIMUM
4. UNLESS OTHERWISE SPECIFIED, ALL COAXIAL DIAMETERS .010 A

DO NOT SCALE DRAWING

NIMS®

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994

TOLERANCES
.X ±.020 .XXX ±.003
.XX ±.010 ANGLES ± 1 DEG.
FRACTIONS ± 1/64

MACHINING SKILLS LEVEL I

Job Duty 2.11
CNC: Turning

DESIGNER	CLC	02/23/02	MATERIAL: ALUMINUM OR MILD STEEL
DWG CHK			
DWG APPD			
SCALE FULL	DWG.#98441 I	SHEET 1 OF 1	

NIMS PROCEDURAL REQUIREMENTS

1. PROGRAM MUST BE WRITTEN IN LONG HAND – NO CAM
2. COORDINATE CALCULATIONS CAN BE FOUND WITH GEOMETRY OR TRIG
3. SUBMIT THE CALCULATIONS WITH THE PROGRAM
4. SUBMIT THIS PRINT, COPY OF PROGRAM CODE (LONGHAND), AND WORKPIECE ALONG WITH THE PERFORMANCE AFFIDAVIT FOR EVALUATION