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

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.

<table>
<thead>
<tr>
<th>Performance Project – Milling</th>
<th>Pass</th>
<th>Fail</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Evaluation Criteria</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 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

<table>
<thead>
<tr>
<th>Test Description</th>
<th>Pass</th>
<th>Fail</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.875 ± .005 position to datum B with a .005 tolerance zone.</td>
<td>Pass = within tolerance</td>
<td>Fail = out of tolerance</td>
</tr>
<tr>
<td>9. 2 x .125” holes positioned within .812 ± .005 datums A, C, &amp; D</td>
<td>Pass = within tolerance</td>
<td>Fail = out of tolerance</td>
</tr>
<tr>
<td>10. .125 hole diameter ± .001 (both holes)</td>
<td>Pass = within tolerance</td>
<td>Fail = out of tolerance</td>
</tr>
<tr>
<td>11. Tap for .25 – 20 x .50 deep min. (No break out at the bottom of the hole)</td>
<td>Pass = within tolerance zones</td>
<td>Fail = exceeds tolerance zones</td>
</tr>
<tr>
<td>12. .031 deep × 45° chamfers</td>
<td>Pass = within tolerance</td>
<td>Fail = out of tolerance</td>
</tr>
<tr>
<td>13. Surface finish, no ground surfaces</td>
<td>Pass = 125 Ra microinches or better</td>
<td>Fail = over 125 Ra microinches</td>
</tr>
<tr>
<td>14. Sharp edges .015 max. and holes countersunk .031 max.</td>
<td>Pass = no sharp edges, within maximum allowance</td>
<td>Fail = sharp edges</td>
</tr>
</tbody>
</table>

**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.*
NIMS PROCEDURAL REQUIREMENTS

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

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