

Machine Tool Technology (58.0501)

Cross-reference to Show-Me standards (main report)

Measurable Learner Objective and Task Statement	Knowledge (Content)	Performance (Goals)	National Standards (NTMA)
A. Appreciate and apply all personal and work place safety procedures	CA 3, HP 6, HP 7, SC 8	1.10, 1.4, 3.1, 4.7	
1. Demonstrate appropriate work place safety practices (e.g., hand tools, power tools, fluid power, electrical, and environmental hazards).			I 5.1, I 6.1
2. Adhere to state and federal environmental/regulatory requirements/codes (e.g., OSHA and EPA).			I 5.1, I 6.1
3. Recognize when first aid is needed for occupational injuries and follow proper procedures.			KSAO I-3.1
4. Identify types, purposes, and the operation of fire extinguishers and suppression resources.			KSAO I-6.1
5. List machine shop safety rules and regulations.			I 6.1
B. Perform machine tool related mathematical calculations	MA 1, MA 2, MA 5	3.2, 3.5	
1. Convert common fraction to decimal fraction and vice versa.			I 2.1
2. Calculate measurement of right triangles.			KSAO I-2.2
3. Determine tap drill size with formula and charts.			I 2.8
4. Convert customary measurements to metric and vice versa.			KSAO I-6.4
5. Use calculator to perform mathematical operations.			KSAO I-2.1
6. Verify the accuracy of calculations derived with a calculator.			KSAO I-2.1
7. Calculate amount of stock required.			KSAO I-2.3
8. Calculate part and feature dimensions and locations.			I 2.2, I 2.6
9. Convert revolutions per minute (rpm) to surface feet per minute (sfpm).			KSAO I-2.3
10. Calculate feeds and speeds.			I 1.1, I 2.6
11. Determine tapers for machine set-up per formulas and charts.			II 2.4
12. Determine sine bar set-up with formulas and charts.			
13. Perform angular and simple indexing calculations.			

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C. Measure machined parts using industry recognized instruments	MA 1, MA2	1.4, 1.10	
1. Measure using direct-reading instruments (e.g., scales, protractors, and precision levels).			KSAO I-6.1, I 3.1
2. Measure using transfer instruments (e.g., plain inside and outside calipers, telescoping gages, adjustable hole gages, and adjustable parallels).			KSAO I-6.1, I 3.1
3. Measure using precision measuring instruments (e.g., micrometers, gage blocks, verniers, dial indicators, and digital calipers).			KSAO I-6.2, I 3.1
4. Measure using surface plate instruments (e.g., height gages, angle plates, and sine bars and plates).			KSAO I- 6.3, I 3.1
5. Measure using comparison instruments (e.g., radius gages, squares, cutter tooth gages and center gages).			KSAO I-6.2, I 3.1
6. Measure using other instruments (e.g., optical comparators).			KSAO I-6.2, I 3.1
7. Measure pitch diameters using thread wires.			I 3.1
8. Measure using unconventional methods (e.g., digital readouts on milling machines).			I 3.1
D. Interpret designs, drawings, and specifications	CA 3, MA 1, MA 2	1.5, 1.8, 3.5	
1. Interpret blueprints including common drafting symbols.			I 5.1, I 5.2
2. Make a sketch from a finished workpiece.			KSAO II-3.1
3. Calculate tolerances and allowances.			KSAO I-2.3
4. Calculate missing dimensions.			KSAO I-2.3
5. Use geometric dimensioning and tolerancing.			I 5.2
E. Plan work consistent with industry standards	CA 1, CA 3, MA 1	1.8, 1.10, 3.5, 3.7	
1. Use Machinery's Handbook to plan work.			I 2.1 thru I 2.9
2. Plan sequence of part layout based on blueprint information.			I 1.1, II 1.1
3. Identify cutting tool types (e.g., steel and carbide) and their applications (e.g., mills and lathes).			KSAO I-7.2, 7.4

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4. Plan sequence of machining operations.			I 2.3 thru I 2.9, II 1.1
5. Plan tooling sequences for machining operations.			KSAO I-7.2, 7.4
6. Calculate machining operation, setup, and tear down times.			
F. Inspect machined parts using industry standard tools/equipment	MA 1, MA 2	1.4, 1.7, 4.7	
1. Inspect part using appropriate measuring instruments (e.g., scales, micrometers, verniers, and protractors).			I 3.1
2. Inspect part using surface plate instruments (e.g., indicators, height gages, angle plates, height-transfer gages, and sine bars and plates).			I 3.1
3. Inspect part using optical comparator.			II 3.1
4. Inspect part using CMM (coordinate measuring machine).			II 3.2
G. Collect and analyze quality control data	CA 1, CA 4, CA 6, SC 7	1.1, 1.8, 3.5	
1. Follow a quality plan.			I 3.2
2. Participate in capability study.			II 4.1
3. Analyze the performance of a single-part production process.			I 4.1
4. Analyze the performance of a production process.			I 4.2
H. Layout and fabricate bench work consistent with industry and safety standards	MA 1, MA 2, SC 1, SC 2	3.1, 3.2	
1. Cut materials with hand hack saw.			I 2.1
2. Mark locations with prick and center punches.			I 2.1, II 2.1
3. Locate holes with transfer screws and transfer punches.			I 2.1, II 2.1
4. Bench file/deburr workpiece.			I 2.1
5. Cut threads with die.			I 2.1

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6. Cut threads with hand tap.			I 2.1
7. Ream holes with hand reamer.			I 2.1
8. True and dress grinding wheels on pedestal/bench grinder.			I 2.7a
9. Grind and shape tools on pedestal/bench grinder.			
10. Use abrasives/whetting/polishing/lapping.			III 2.1
11. Grind using appropriate hand grinder.			
12. Remove damaged screws.			
13. Remove broken drills and taps.			I 5.3
14. Remove and install dowel pins.			
15. Install a thread insert.			
16. Straighten workpiece on arbor press.			I 2.1
17. Assemble and disassemble workpiece with arbor press.			I 2.1
18. Broach workpiece with broaching tool.			
19. Assemble and disassemble precision parts.			
I. Describe and conduct material sciences procedures	CA 1, CA 3, MA 1, MA 2, SC 1, SC 2	1.8, 3.1, 3.2, 4.1	
1. Identify types of metals and related materials.			KSAO I-7.3, II-6.1
2. List properties that affect machinability.			KSAO I-7.3, II-6.1
3. Correlate types of materials to their properties.			KSAO I-7.3, II-6.1
4. List major cutting tool variables.			KSAO I-7.3, II-6.1
5. Perform heat treatment process.			

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6. Test workpiece for hardness with and without hardness tester.			
7. Interpret time-temperature-transformation diagrams.			
8. Identify the effect of heat treatment on materials.			KSAO I-7.3
J. Operate power saws consistent with industry and safety standards	MA 1, MA 2, SC 1, SC 2	1.10, 3.2, 3.3, 4.7	
1. Perform power saw care and maintenance.			I 5.1, 5.2 II 5.1, 5.2
2. Select blade type for sawing operations and materials.			II 2.2
3. Cut and weld band saw blades.			II 2.2
4. Select and set speeds and feeds on power saw.			
5. Cut material to length with power saw.			II 2.2
6. Select and apply cutting fluids.			KSAO I 7.5, II-5.4
7. Contour saw to scribed line.			II 2.2
8. Saw internal contours with band saw.			II2.2
K. Operate drill presses consistent with industry and safety standards	CA 3, MA 1, SC 1, SC 2	1.10, 3.2, 3.3, 4.7	
1. Perform drill press care and maintenance.			I 5.1, I 5.2, I 5.3 II 5.1, 5.2
2. Set up and clamp workpiece to drill press table.			I 2.8
3. Select drill type based on job requirements.			I 2.8
4. Determine cutting tool variables prior to use.			KSAO I-7.2
5. Set up drill press according to calculated feeds and speeds.			I 2.8
6. Select and apply cutting fluids.			KSAO I 7.5, II-5.4

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7. Drill holes to specification using manual and automatic feed.			I 2.8
8. Countersink hole to specifications.			I 2.8
9. Counterbore hole to specifications.			I 2.8
10. Spotface to specific dimensions.			I 2.8
11. Mount workpiece on V-blocks.			I 2.8
12. Power ream hole to size.			I 2.8
13. Use drill jigs and bushings.			I 2.8
14. Hand tap hole using drill press.			I 2.1
15. Tap hole with tapping attachments.			I 2.1
16. Perform taper reaming and subsequent pipe tapping.			
17. Sharpen drills at a pedestal grinder or with grinding attachments and specialized grinders.			
18. Set up radial drill press.			I 2.8
L. Operate lathes consistent with industry and safety standards	CA 3, MA 1, SC 1, SC 2	2.5, 3.2, 3.3, 4.7	
1. Perform lathe care and maintenance.			I 5.1, I 5.2, I 5.3
2. Align lathe centers using test bar and dial indicators.			I 2.3, II 2.3
3. Select cutting tool based on job requirements.			I 1.1, II 1.1
4. Calculate feeds and speeds for lathe set-up.			I 1.1, II 1.1
5. Free-hand grind turning and facing tools.			I 5.3
6. Select and apply cutting fluids.			KSAO I 7.5, II-5.4
7. Operate lathe controls.			I 2.3, I 2.4, II 2.3, II 2.4, II 2.5

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8. Face workpiece and center drill.			II 2.4
9. Set up tooling.			I 2.3, 2.4, II 2.3, 2.4, 2.5, III 2.3, 2.4, 2.5, 2.6
10. Turn workpiece between centers.			I 2.3, II 2.3
11. Indicate workpiece in four-jaw chuck.			I 2.4
12. Drill, ream, bore, and countersink holes.			II 2.5
13. Counterbore holes.			
14. Knurl parts.			
15. Free-hand grind 60-degree threading tool.			
16. Chase external/internal threads.			
17. Chase metric threads.			
18. Cut multiple lead threads.			
19. Cut Acme threads.			
20. Use compound rest to cut short external/internal tapered surfaces.			III 2.3
21. Cut tapers by offset tailstock.			II 2.3
22. Cut external tapered surface with taper attachment.			II 2.5
23. Cut internal tapered surface with taper attachment.			II 2.5
24. Align workpiece on faceplate.			
25. Perform lathe filing.			
26. Polish workpiece.			

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27. Turn or thread long workpieces using follower and steady rest.			III 2.4
28. Use form tooling.			III 2.3
29. Use mandrel.			
M. Operate milling machines consistent with industry and safety standards	CA 3, MA 1, SC 1, SC 2	3.2, 3.3, 4.7	
1. Perform care and maintenance of milling machine.			I 5.1, I 5.2, I 5.3
2. Tram (align) mill head.			
3. Select milling machine attachments according to job requirements.			I 2.3, 2.4, 2.5, II 2.10, 2.11
4. Align workpiece mounted on machine table.			
5. Calculate feeds and speeds and set up mill accordingly.			I 1.1, II 1.1
6. Select and apply cutting fluids.			KSAO I 7.5, II-5.4
7. Select cutting tool based on job requirements.			I 1.1, II 1.1
8. Square up workpiece in milling vise using face mill.			II 2.6
9. Mill workpiece with end mill.			I 2.6, II 2.6
10. Locate work with edge finder.			
11. Drill holes with milling machine.			II 2.7
12. Ream holes.			
13. Bore holes with milling machine.			II 2.7, 2.12
14. Use form cutter to mill workpiece.			
15. Machine workpiece mounted on V-blocks.			
16. Machine external straight keyway.			II 2.8

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17. Machine woodruff keyway.			II 2.8
18. Mill simple and compound angles.			III 2.7
19. Mill an external radius with rotary table.			II 2.10
20. Mill an internal radius with rotary table.			II 2.10
21. Mill workpiece using simple indexing operation.			II 2.11
22. Use digital readout.			
23. Machine workpiece by straddle milling.			
24. Perform gang milling.			
N. Operate grinders consistent with industry and safety standards	CA 3, MA 1, SC 1, SC 2	3.2, 3.3, 4.7	
1. Perform grinder care and maintenance.			I 5.2
2. Select and apply cutting fluids.			KSAO I 7.5, II-5.4
3. Inspect and ring-test grinding wheel.			I 2.7a
4. Balance grinding wheel.			II 2.7, III 2.10
5. Select and mount grinding wheel.			I 2.7a
6. True and dress machine tool grinding wheel.			I 2.7a
7. Grind workpiece on magnetic chuck using power feed.			I 2.7b, II 2.15
8. Square up workpiece on surface grinder.			II 2.15
9. Indicate workpiece to be ground.			I 2.7b
10. Dress form on grinding wheel.			I 2.7b
11. Grind angular surfaces.			II 2.14

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12. Grind straight and tapered surfaces between centers using cylindrical grinding.			II 2.18, III 2.11
O. Fabricate and resurface cutting tools consistent with industry and safety standards	CA 3, SC 1	3.2, 3.3, 4.7	
1. Perform care and maintenance of tool-and-cutter grinder.			I 5.3
2. Inspect and ring-test grinding wheels.			I 2.7a
3. Select and mount grinding wheel.			II 2.5
4. True and dress grinding wheel.			I 2.7a
5. Set up machine.			I 2.7b
6. Sharpen cutters on tool-and-cutter grinders.			I 5.3
P. Operate and maintain computerized numerical control (CNC) machines consistent with industry and safety standards	CA 3, MA 1, MA 2	1.8, 3.2, 3.5, 4.7	
1. Perform machine care and maintenance.			I 5.1, I 5.2, I 5.3
2. Calculate coordinates and dimensions needed for CNC program.			I 2.9
3. Write program for CNC machine.			II 2.21, III 2.16
4. Set up a CNC machine.			III 2.18, 2.19
5. Machine workpiece with CNC machine.			II 2.22, 2.23, III 2.18, 2.19
Q. Operate electric discharge machines (EDM) consistent with industry and safety standards	CA 1, CA 3	1.10, 3.2, 4.7	
1. Describe the electric discharge machine theory.			
2. Operate a wire electric discharge machine.			
3. Operate a plunge electric discharge machine.			II 2.17
4. Operate a two-axis electric discharge machine.			II 2.18

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R. Demonstrate leadership skills in the classroom, industry, and society	CA 1, CA 4, CA 6, SS 6, HP 2	2.1, 2.3, 2.6, 4.3, 4.4, 4.6, 4.8	
1. Demonstrate an understanding of SkillsUSA, its structure, and activities.			
2. Demonstrate an understanding of one's personal values.			KSAO I-4.1, 4.2
3. Perform tasks related to effective personal management skills.			KSAO I-4.1, 4.2
4. Demonstrate interpersonal skills.			I 7.3
5. Demonstrate etiquette and courtesy.			KSAO I-4.1, 4.2
6. Demonstrate effectiveness in oral and written communication.			KSAO I-1.2, 1.3, 1.4
7. Develop and maintain a code of professional ethics.			KSAO I-4.1, 4.2
8. Maintain an appropriate professional appearance.			KSAO I-4.1, 4.2
9. Perform basic tasks related to securing and terminating employment.			I 7.1, I 7.2, II 7.1
10. Perform basic parliamentary procedures in a group meeting.			I 7.4,
S. Explain and demonstrate skills in a specialization area identified by the instructor			

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