

## TOOL & DIE MAKER

### APPENDIX A

O\*NET CODE 51-4111.00

This training outline is a minimum standard for Work Processes and Related Instruction. Changes in technology and regulations may result in the need for additional on-the-job or classroom training.

### WORK PROCESSES

	<b>Approximate Hours</b>
<b>A. Power Hack Saw and Manual/Power Bandsaw</b>	<b>200</b>
1. Selecting cutting blade, proper speed, clamping, measuring, safety.	
<b>B. Lathe</b>	<b>800</b>
1. Centering, facing, straight turning, shoulder turning, taper turning, threading, knurling, check work (drilling, boring, reaming, finishing, chuck and face plate turning), steady rest and follow rest, offset tailstock and compound, necking, recessing, filing, lapping, polishing, form turning, tapping, tools and centers, speeds and feeds, lubricants, safety.	
<b>C. Milling Machine – Vertical and Horizontal</b>	<b>800</b>
1. Selection of cutter, methods of holding work (vise, clamps, dividing head, circular table), rough milling, plain milling, surface milling, milling to accurate depth, accurate depth and various width cuts, angle cuts with plain cutter, taper and face milling, T slot milling, milling to irregular laid out line, internal milling, making jigs and fixtures, sawing, boring, flycutter milling, keyway cutting, form milling, spline milling, removing stock, lubricants, safety.	
<b>D. Grinders</b>	<b>1,500</b>
1. Surface Grinders (500 hrs.)	
a. Selecting grinding wheel, mounting wheel, surface grinding, angle grinding, squaring, method of holding work, form and dovetail grinding, magnetic chuck (dressing), dressing wheels, safety.	
2. Cylindrical Grinder (400 hrs.)	

<ul style="list-style-type: none"> <li>a. Selecting and mounting grinding wheel, straight and taper cylinder grinding, cutter, face and form grinding.</li> </ul>	
3. Internal Grinder (300 hrs.)	
<ul style="list-style-type: none"> <li>a. Selecting and mounting grinding wheel, dressing wheel, mounting work in chuck, mounting work in faceplate, rough and finish cuts.</li> </ul>	
4. Universal Grinder_(300 hrs.)	
<ul style="list-style-type: none"> <li>a. Selecting and mounting wheels, dressing wheels; straight, taper, angle, face, form, ID grinding, safety.</li> </ul>	
<b>E. Drill Press</b>	<b>300</b>
1. Tapping, drilling, reaming, counterboring, honing, lapping, grinding drills, speeds and feeds, safety.	
<b>F. Die and Fixture</b>	<b>1,000</b>
1. Filing, assembling, layout of holes, lapping, measuring with height gauge, hacksawing, layout and make simple dies and fixtures.	
<b>G. Bench, Layout and Assembly</b>	<b>1,000</b>
1. Filing, assembling, layout of holes, lapping, measuring with height gauge, hack-sawing, indicating use of gauge blocks, deburring, assembly and fitting, safety.	
<b>H. Welding</b>	<b>250</b>
1. Clamping, weld preparation, selection of rod, stick welding, arc welding, MIG and TIG welding, brazing, soldering, safety.	
<b>I. Shaper</b>	<b>500</b>
1. Using vise and clamps, surface planning, angle planning, shaping to irregular laid out line, internal shaping such as blanking dies, keyway cutting, squaring, speeds and feeds, tools, safety.	
<b>J. Heat Treating (optional)</b>	<b>200</b>
1. How to harden steel, how to cure hardened steel, how to draw steel, colors of various heats, different kinds of steel – S.A.E. classification, testing hardness of steel, annealing, safety.	
<b>K. EDM</b>	<b>450</b>
1. Ram-type Electric Discharge Machining. Selecting electrode materials, setting up and operating. Taper cutting of punches and dies.	

<b>L. Jig Bores</b>	<b>500</b>
<ul style="list-style-type: none"> <li>1. Indicating and set up of work; selecting of holding methods; selecting and using proper boring bars, cutters, etc.; operation of jig bores, using spindle and scope precision boring, compound and hole set up, using sine plate and rotary table, theory and use of tooling balls, inspection, safety.</li> </ul>	
<b>M. Tool and Cutter Grinding</b>	<b>300</b>
<ul style="list-style-type: none"> <li>1. Mounting wheels, grinding drills, end mills, reamers, form cutters, setting up for clearance angles and relief, safety.</li> </ul>	
<b>N. Machine Repair (optional)</b>	<b>200</b>
<ul style="list-style-type: none"> <li>1. Removing and replacing broken and worn parts of machine tools, bearing replacement, inspection, safety.</li> </ul>	

**Approximate Total Hours      8,000\***

\*If one or more optional items is not selected, the additional hours should be devoted to other work processes.

*Apprenticeship work processes are applicable only to training curricula for apprentices in approved programs. Apprenticeship work processes have no impact on classification determinations under Article 8 or 9 of the Labor Law. For guidance regarding classification for purposes of Article 8 or 9 of the Labor Law, please refer to <https://dol.ny.gov/public-work-and-prevailing-wage>*

**TOOL & DIE MAKER**  
**APPENDIX B**  
**RELATED INSTRUCTION**

**Safety**

1. Fundamentals (4 hours first year)
2. Trade Safety (12 hours second year)
3. First Aid (minimum 6.5 hours every 3 years)
4. Sexual Harassment Prevention Training – MUST comply with section 201-g of the Labor Law

**Blueprint Reading, Sketching and Drawing**

1. Elementary Blueprint Reading and Shop Drawing
2. Advanced Blueprint Reading and Shop Drawing
3. Specialized Drawing
4. Fundamentals of CAD (optional)

**Mathematics**

1. Fundamentals (algebra, geometry, trigonometry)
2. Application to the Trade
3. Precision Measurement
4. Estimating

**Industrial and Labor Relations (20 hours)**

1. History and Background (6 hours first year)
2. Current Laws and Practices (14 hours second year)

**Trade Theory and Science**

1. Tools and Equipment
2. Materials
3. Metallurgy
4. Terminology
5. Machines
6. Layout and Production Methods
7. Tool & Die Design
8. Fundamentals of Mechanics (including stresses and loads)

9. Heat Treatment (optional)

10. Welding

A minimum of 144 hours of Related Instruction are required for each apprentice for each year.

Appendix B topics are approved by New York State Education Department