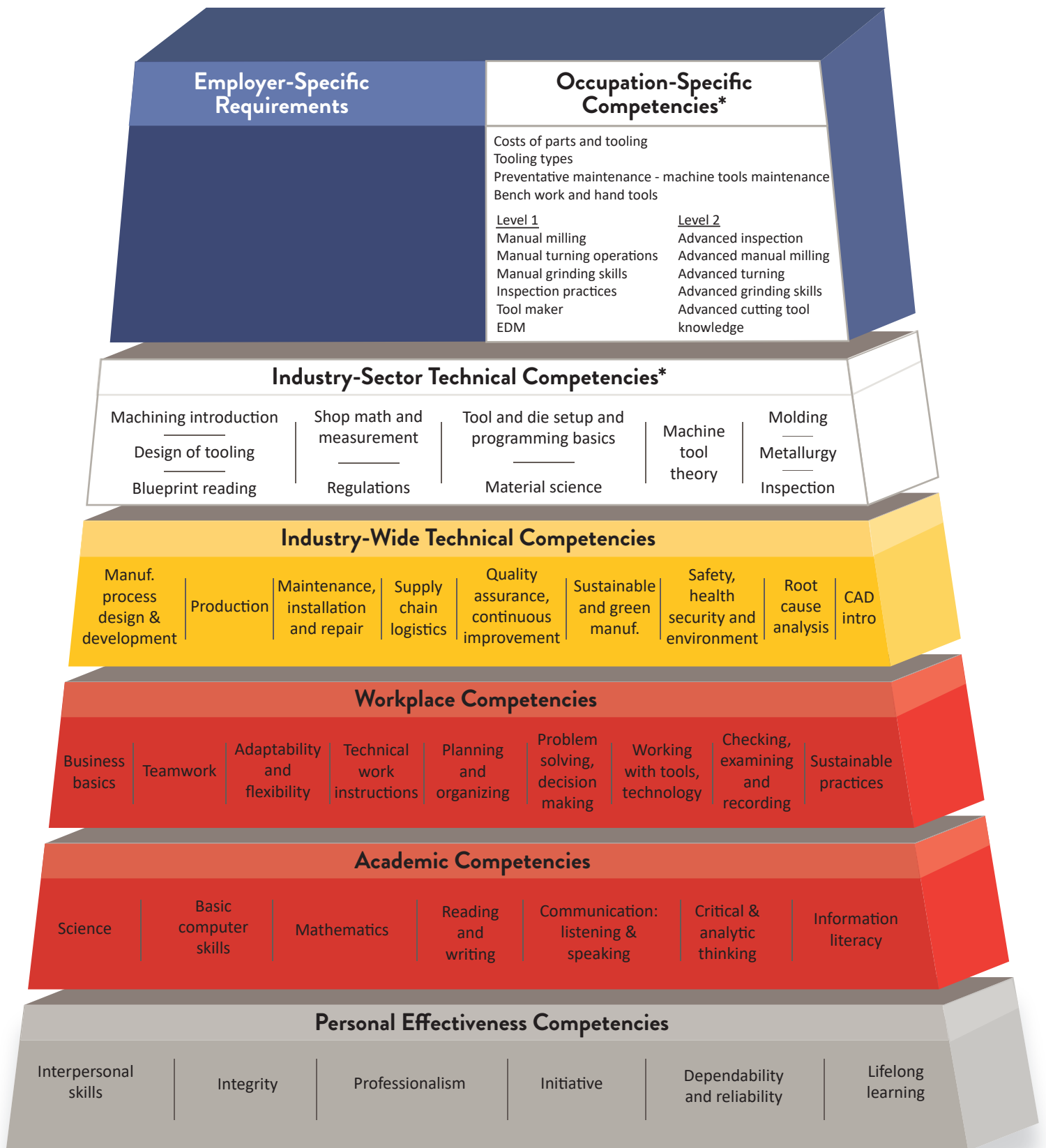


Minnesota Dual-Training Pipeline

Competency Model for Advanced Manufacturing

Occupation: Machinist/Tool and Die Maker



Based on: Advanced Manufacturing Competency Model Employment and Training Administration, U.S. Dept. of Labor, April 2010.

* Minnesota Dual-Training Pipeline recommends the Industry-Sector Technical Competencies as formal training opportunities (provided through related instruction) and the Occupation-Specific Competencies as on-the-job training opportunities.

Competency Model for Advanced Manufacturing

Machinist/Tool and Die Maker

A machinist/tool and die maker is a skilled craftsperson who makes, repairs and modifies custom made, prototype or special tools, dies, jigs, fixtures and gauges to very specific and precise dimensions. The work involves the operation of lathes, grinders, milling and boring machines. They must read and interpret blueprints, manuals and other work instructions of tools, dies, prototypes or models. They compute and verify dimensions, sizes, shapes and tolerances of workpieces. Machinists operate a variety of computer-controlled and mechanically controlled machine tools. They must plan the sequence of operations from set-up to finished product making sure that machined parts conform to specifications by using precision measuring instruments. They must work safely to prevent on-the-job injuries, which includes wearing personal protective equipment. These professionals identify any flaws in the finish or operation of machined parts and take corrective action while working independently or as a member of a team on a variety of different projects and tasks.

Possible Certifications

- National Institute for Metalworking Skills (NIMS) Certified Machinist
- North American Die Casting Association (NADCA) Certification
- Tool and Die Moldmaking Diploma
- Associates in Applied Science – Tool and Die Moldmaking

Industry-Sector Technical Competencies

- Machining Introduction – Learn basic machining operations including safety, MSDS, measuring tools and use of drill presses and band saws.
- Blueprint Reading – Knowledge in reading and understanding industrial prints such as GD&T.
- Shop Math and Measurement – Training in basic math including linear measurement, metrics and beginning algebra, as well as SPC (statistics) used for data collection.
- Tool and Die Setup and Programming Basics – Exposure to manual programming of tools. Learn types of tool and die controls, machinery, programming formats and basic terminology.
- Design of Tooling –
 - Determining the time it will take for a job to run
 - How to develop a part blank allowance for drawing and bending
- Regulations – Understanding of industry regulations (such as ISA, GMP and AS) and how to interpret work instructions, standard operating procedures and work instructions based on regulations.

- Machine Tool Theory – Learn to complete the processes required for manufacturing a precision part, use standard shop safety practices, set-up and operate standard manufacturing machines, complete accurate lay-outs, explain applications of hand tools and use correctly and use basic measuring tools.
- Material Science – Basic understanding of material science or plastics and/or metallurgy.
- Molding – Demonstrated knowledge of the process used in manufacturing to shape materials
- Metallurgy – Understanding of the physical and chemical behavior of metallic elements, their inter-metallic compounds, and their mixtures (alloys). Includes:
 - Materials stamped
 - Selection of tool steels for tooling
- Inspection – Know the proper methods and instruments used to effectively inspect parts in the shop, including using instruments such as the caliper, micrometer, and CMM.

Occupation-Specific Competencies

- Costs of parts and tooling – demonstrate the ability to obtain or provide quotes of costs for parts and tooling
- Tooling Types – demonstrate knowledge of the different types of tooling, including draw dies, coining, blanking, progressive
- Preventative Maintenance - Machine Tools Maintenance – Practice industry approved procedures for preventative maintenance on machines and tools.
- Bench work and Hand Tools – Knowledge of the various tools, methods, and procedures for common machine shop bench work and hand tool work.

Level 1

- Manual Milling – Display basic operation of the vertical and horizontal milling machines and the ability to use cutting tools and holders, setups, spindles and arbors, work holding methods.
- Manual Turning Operations – Demonstrate lathe applications such as understanding turning safety, calculating speeds and feeds, using various tools and tool holders, identifying basic tool geometry, and the use of common lathe spindle tooling.
- Manual Grinding Skills – Use surface grinders with proper set up techniques and grinding processes.
- Inspection Practices – Demonstrate the proper methods and instruments used to effectively inspect parts in the shop, including using instruments such as the caliper, micrometer, and CMM.

- Tool Maker – Demonstrated ability to perform advanced turning and advanced manual milling.
- EDM (Wire/Plunge) – Demonstrate basic understanding of Electrical Discharge Machining.

Level 2

- Advanced Inspection – Able to use measuring instruments relating to state-of-the-art manufacturing environments, such as coordinate measuring machine and calibration. Understanding of Quality Control, TQM, and SPC processes as they relate to manufacturing environments.
- Advanced Manual Milling – Use mill for advanced techniques such as squaring a block, perform angle layouts with various methods including a sign bar. Perform simple key seat and slotting operations.
- Advanced Turning – Ability to operate lathe for advanced processes such as form radius, single-point isometric threads, turn spherical radius, use a radius gauge, as well as advanced taper techniques and work support devices.
- Advanced Grinding Skills – Demonstrate advanced techniques of grinding including use of sine bars and chucks, sine bars, gage blocks, wheel balancers, various grinding wheels and diamond dressers
- Advanced Cutting Tool Knowledge – Demonstrated ability to perform advanced operations of a drill press, vertical milling machine, engine lathe, surface grinder and saws.

Machinist/Tool and Die Maker Occupational Training Plan

	List Course/Training Name and Title	Description of Courses and/or Training Program	List Responsible Provider: Company, College, Trainer, or other	Anticipated Completion Date
<i>Related Instruction Competencies</i>				
Machining Introduction				
Blueprint Reading				
Shop Math and Measurement				
CNC Turning				
CNC Milling				
CNC Setup and Programming Basics				
Machine Tool Theory				

Material Science				
Inspection				
<i>On-The-Job Training Competencies</i>				
Preventative Maintenance – Machine Tools Maintenance				
Bench work and Hand Tools				
Tooling types				
Costs of parts and tooling				
Manual Milling				
Manual Turning Operations				
Manual Grinding Skills				
Inspection practices				
Tool maker				
EDM (Wire Plunge)				
Advanced Inspection				
Advanced Manual Milling				
Advanced Turning				
Advanced Cutting Tool Knowledge				
Advanced Grinding Skills				