



Focus Area Level Report

Including Knowledge and Skills, and Performance Indicators



 Career Area: Industrial and Engineering Systems

 Cluster: Manufacturing

 Focus Area: **Machining & Metalforming**

Industry-based knowledge and skill

Skill Type

MNMF01 Perform skills necessary to operate metalforming equipment.

Performance Indicators

Delivery Level

MNMF01.01.01	Inspect and assess the general condition of an assigned metalforming machine tool.
MNMF01.01.02	Make routine adjustments on metalforming machine tools.
MNMF01.01.03	Fill and refill lubrication and coolant reservoirs with appropriate lubricants and fluids.
MNMF01.01.04	Identify and explain the usage of machine guarding and safety equipment such as light curtains, etc.
MNMF01.01.05	Know lock-out and tag-out procedures.
MNMF01.01.06	Identify the common component of metalforming machinery and auxiliary equipment.
MNMF01.01.07	Explain the role of each element of the machine and auxiliary equipment in the metalforming process.

Industry-based knowledge and skill

Skill Type

MNMF02 Handle materials used in metalforming operations.

Performance Indicators

Delivery Level

MNMF02.01.01	Recognize and apply basic measuring instruments such as rules, protractors, go-no-go gages, gage blocks, and checking fixtures.
MNMF02.01.02	Recognize and apply precision measuring instruments such as micrometers, vernier, dial, and electronic calipers, dial indicators, telescoping gages, gage blocks, adjustable parallels and optical comparators.
MNMF02.01.03	Understand the prime characteristics of common materials used in metalforming operations.
MNMF02.01.04	Recognize, select, and understand the application of appropriate lubricants, cutting fluids and coolants, whether synthetic or organic.
MNMF02.01.05	Recognize and understand the application of different types of tooling for forming and blanking metal.

Industry-based knowledge and skill

Skill Type

MNMF03 Perform skills necessary in planning and controlling metalforming operations.

Performance Indicators

Delivery Level

MNMF03.01.01	Read and understand a process plan for a formed metal part.
MNMF03.01.02	Monitor the metalforming process both visually and audibly and respond to problems as they arise.
MNMF03.01.03	Inspect sample parts using precision tools and techniques.
MNMF03.01.04	Follow a sampling plan.
MNMF03.01.05	Inspect samples for required data.
MNMF03.01.06	Enter inspection data on appropriate charts.
MNMF03.01.07	Respond to warning conditions indicated by process charts.
MNMF03.01.08	Interpret standard part drawings.

Industry-based knowledge and skill

Skill Type

MNMF04 Perform bench operations related to machining.

Performance Indicators


Delivery Level


MNMF04.01.01	Hand tap holes.
MNMF04.01.02	Deburr parts.
MNMF04.01.03	Use arbor presses to perform press fits.

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Delivery Level

MNMF04.01.04	Layout the location of hole centers and surfaces within an accuracy of +/- .015.
MNMF04.01.05	Interpret orthographic blueprints.
MNMF04.01.06	Interpret GDT orthographic prints.
MNMF04.01.07	Identify the common symbols, the use of datum references and tolerances used in GD&T.
MNMF04.01.08	Write a detailed process plan that includes a quality plan for a part requiring milling, drilling, turning, or grinding.
MNMF04.01.09	Produce and operation sheet detailing the process plan; identify all critical dimensions and required speeds and feeds.
MNMF04.01.10	Set up and lay out bolt circles, locations of surfaces related to non-right angles, locations of points of tangency between arcs and lines, and profiles of a line which is non-arc based.
MNMF04.01.11	Apply trigonometry to the solution of geometric position problems for CNC toolpaths.
MNMF04.01.12	Read and interpret GDT drawings with multiple datums.
MNMF04.01.13	Read and interpret engineering drawings having multiple auxiliary views.
MNMF04.01.14	Write simple RS274-D programs using M and G codes from the Machinery's Handbook.

Industry-based knowledge and skill

Skill Type

MNMF05 Perform metal cutting operations on a lathe.

Performance Indicators

Delivery Level

MNMF05.01.01	Setup and carry out between centers turning operations for straight turning.
MNMF05.01.02	Setup and carry out chucking operations for turning.
MNMF05.01.03	Set up and perform between centers turning for straight and tapered turning by offsetting the tailstock.
MNMF05.01.04	Set up and perform tapered boring and turning using a taper attachment.
MNMF05.01.05	Set up and perform boring for location, size, and finish.
MNMF05.01.06	Set up and perform taper reaming and subsequent pipe tapping.
MNMF05.01.07	Operate a CNC lathe.

Industry-based knowledge and skill

Skill Type

MNMF06 Perform metal cutting operations on a mill.

Performance Indicators


Delivery Level


MNMF06.01.01	Set up and perform squaring up the six surfaces of a block.
MNMF06.01.02	Set up and operate vertical milling machines.
MNMF06.01.03	Perform routine milling and location of hole centers.
MNMF06.01.04	Using the principles of cartesian coordinates, develop a program for the manufacturing of a simple part on a CNC milling machine.
MNMF06.01.05	Inspect, assess the condition of, and refurbish tooling where appropriate.
MNMF06.01.06	Recognize and understand the use of a wide variety of cutting tools, tool holding devices, and work holding devices.
MNMF06.01.07	Develop a knowledge of basic word address programming codes.
MNMF06.01.08	Produce a simple part drawing chart with the X and Y coordinates necessary to drive a tool around the periphery of the part.
MNMF06.01.09	Set up and perform milling keyseats on a shaft.

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Delivery Level

MNMF06.01.10	Set up and perform the cutting of a deep slot using a staggetooth cutter.
MNMF06.01.11	Set up and perform the development of surfaces at a specified non-right angle using a rotary table.
MNMF06.01.12	Set up and establish hole locations in various relationships to one another using a rotary table.
MNMF06.01.13	Set up and perform operations requiring a dividing head.
MNMF06.01.14	Set up and establish hole locations in various relationships to one another using a dividing head.
MNMF06.01.15	Set up and perform boring for location, size, and finish and mill a slot for location and size.
MNMF06.01.16	Operate a CNC milling machine.

Industry-based knowledge and skill

Skill Type

MNMF07 Perform metal cutting operations using contour sawing and electric discharge.

Performance Indicators

Delivery Level

MNMF07.01.01	Set up and perform contour sawing to a layout, choose and mount appropriate blades, and weld blades as necessary.
MNMF07.01.02	Produce an electrode and operate a plunge electric discharge machine.
MNMF07.01.03	Operate a 2 axis wire electric discharge machine.

Industry-based knowledge and skill

Skill Type

MNMF08 Perform metal cutting operations using a drill press.

Performance Indicators

Delivery Level

MNMF08.01.01	Setup and operate drill presses.
MNMF08.01.02	Perform routine drill press operations.
MNMF08.01.03	Set up and perform drilling operations using a radial drill.

Industry-based knowledge and skill

Skill Type

MNMF09 Perform metal cutting operations using grinding equipment.

Performance Indicators

Delivery Level

MNMF09.01.01	Ring test, perform visual safety inspection of, mount, and dress a grinding wheel in preparation for surface grinding.
MNMF09.01.02	Setup and operate manual surface grinders.
MNMF09.01.03	Perform routine surface grinding, location of surfaces, and squaring of surfaces.
MNMF09.01.04	Perform wheel dressing on surface grinders.
MNMF09.01.05	Grind a block's six faces to finished dimensions having tolerances of +/- .0005 and squareness of .0005 over 4 inches with 32 microinch surface finishing.
MNMF09.01.06	Set up and perform the finish surface grinding of flat surfaces as simple angles with respect to one another.
MNMF09.01.07	Set up and perform the preparation and balancing of a grinding wheel 14" diameter or greater.
MNMF09.01.08	Set up and perform between centers grinding for straight diameters.

Industry-based knowledge and skill


Skill Type


MNMF10 Perform inspection and quality assurance procedures in machining.

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Performance Indicators

Delivery Level

MNMF10.01.01	Recognize and apply appropriate precision tools and instruments for surface plate work such as precision angle plates and tool blocks, precision transfer gages, and precision height gages.
MNMF10.01.02	Set up and perform the inspection of profiles in shadow and in reflection.
MNMF10.01.03	Set up and perform the inspection of parts.
MNMF10.01.04	Apply the capacities of Coordinate Measuring Machines to inspection.
MNMF10.01.05	Understand and explain the ideas of heat, shock, friction, zone of distortion, cutting interface, machinability, cutter presentation, cutter geometry, and chip-holding capacity as they relate to machining applications.
MNMF10.01.06	Recognize common materials and their principal properties relevant to machining tasks.

Industry-based knowledge and skill

Skill Type

MNMF11 Understand properties of materials and their relationship to machining processes.

Performance Indicators

Delivery Level

MNMF11.01.01	Recognize differences between ferrous and non-ferrous, magnetic, and ductile materials.
MNMF11.01.02	Understand the changes which heat-treat impart to materials.
MNMF11.01.03	Recognize, select, and apply appropriate coolants and coolant delivery systems.
MNMF11.01.04	Identify the critical design and material characteristics of an electrode with respect to various materials to be machined.
MNMF11.01.05	Identify and apply the properties of coolants and/or cutting fluids with respect to the tooling, materials, material condition, and the machine tool and its delivery system.
MNMF11.01.06	Determine appropriate cutting technique based partially upon metallurgical properties of a class of materials.
MNMF11.01.07	Determine appropriate cutting techniques based partially upon cutting properties of a material.
MNMF11.01.08	Use and apply the concepts of tooling with properties customized to the CNC environments of mills and lathes.