



CORPORATE | EDUCATORS | INDIVIDUALS

CERTIFICATION

Certified Manufacturing Technologist (CMfgT)
and Certified Manufacturing Engineer (CMfgE)

Competency Model

Competency Model

SME analyzed the roles of both a Certified Manufacturing Technologist (CMfgT) and Certified Manufacturing Engineer (CMfgE). This competency model will help identify the knowledge, skills, and abilities one should have to achieve these certifications. This is a helpful tool to gain an understanding of each certification and determine if it is a good fit for you.

To create this model a committee of content experts in engineering and manufacturing roles, who also carry CMfgT and CMfgE credentials, used the Body of Knowledge to identify specific roles for each certification.

1. Mathematics, Applied and Engineering Sciences, and Materials
2. Product/Process Design and Development
3. Manufacturing Process Applications and Operation
4. Production System and Equipment Design/Development
5. Automated Systems and Control
6. Quality and Continuous Improvement
7. Manufacturing Management
8. Personal Effectiveness

TECHNOLOGIST**ENGINEER**

Technologist 1.1 — Mathematics	Engineer 1.1 — Mathematics
Apply pre-calculus based equations (rates of change, two equations, two variables, area under curve) to the solution of technical problems	Apply calculus and advanced mathematics to the solution of engineering design and analysis problems

Technologist 1.1.1 — Algebra	Engineer 1.1.1 — Algebra
Derive variable expressions	Derive variable expressions
Apply order of operations	Apply order of operations properly to the solution of equations
Derive equations	Derive linear equations
Derive inequalities	Derive inequalities
Derive linear equations in one variable	Derive linear equations in one variable
Solve systems of linear equations	Derive systems of linear equations
Solve quadratic equations	Solve quadratic equations
Apply exponents and logarithms	Apply exponents and logarithms
Understand unsolvable, undetermined, and over-undetermined systems	Understand unsolvable, undetermined, and over-undetermined systems

Technologist 1.1.2 — Trigonometry	Engineer 1.1.2 — Trigonometry
Derive ratios and proportions	Derive ratios and proportions
Solve triangle relationships/similarity of figures	Solve triangle relationships/similarity of figures
Solve right triangles	Solve right triangles
Apply laws of sines and cosines	Apply laws of sines and cosines
Solve circle problems (area and circumference)	Solve circle problems (area and circumference)
Solve for areas of various figures	Solve for areas of various figures
Solve for angles and arcs	Solve for angles and arcs
Apply graphical methods to create plots of trigonometric functions	Apply graphical methods to create plots of trigonometric functions

Technologist 1.1.3 — Analytical Geometry	Engineer 1.1.3 — Analytical Geometry
Topic covered in algebra and trigonometry	Topic covered in algebra and trigonometry

Technologist 1.1.4 — Calculus	Engineer 1.1.4 — Calculus
Not applicable	Apply differential calculus methods to polynomials and trig functions
	Apply integral calculus methods to polynomials and trig functions
	Apply numerical integration techniques
	Solve multivariate calculus problems (partial derivatives, vector calculus)
	Apply series methods

TECHNOLOGIST**ENGINEER**

Technologist 1.1.5 — Statistics	Engineer 1.1.5 — Statistics
Apply descriptive statistics to numerical data (mean, mode, median, standard deviation/variance)	Apply descriptive statistics to numerical data (mean, mode, median, standard deviation/variance)
	Apply linear regression techniques to numerical data
	Apply hypothesis testing methods to numerical data (chi-square, F-test)

Technologist 1.2.1 — Metrication/SI System	Engineer 1.2.1 — Metrication/SI System
Apply metric system properly, including units, and prefixes	Apply metric system properly, including units, and prefixes

Technologist 1.2.2 — Physics	Engineer 1.2.2 — Physics
Classical physics, non-calculus based	Classical physics, calculus based
Solve equations to fundamental problems of wavelengths and calculations	Apply principles of kinematics and mechanics of a particle to determine work, energy and momentum
Solve equations to calculate sound levels	Apply associated conservation laws for rotation, torque and angular momentum of particles
Solve equations of particle kinematics and mechanics to find work and energy	Apply principles of oscillations and wave motions for particles
Solve equations for conservation of momentum	Solve equations in electrostatics, electrical current, and circuit
Solve equations to determine rotation and torque	Solve equations in magnetism, electromagnetic induction, and waves
Solve equations in electric current, and circuits	Solve equations in geometrical optics

Technologist 1.2.3 — Chemistry	Engineer 1.2.3 — Chemistry
Understand basic knowledge of periodic table and bonding	Apply basic knowledge of periodic table and bonding
Understand acids/bases, pH level	Understand acids/bases, pH level
Write a balance chemical reaction	Solve a balance chemical reaction equation
Understand valence and crystal structure	Understand valence and crystal structure
Understand effect of parameters on reaction rates	Understand effect of parameters on reaction rates
	Understand quantum mechanical structure of atoms
	Understand models of chemical bonding
	Understand models of chemical equilibrium
	Understand thermo chemistry

Technologist 1.2.4 — Statics	Engineer 1.2.4 — Statics
Understand free-body diagrams for the solution of engineering mechanics problems	Derive free-body diagrams for the solution of engineering mechanics problems
Solve for reaction forces to determine stability and equilibrium of rigid bodies	Solve for reaction forces to determine stability and equilibrium of rigid bodies
Solve for shear and moment distributions in beams	Solve for internal forces, moments in trusses, and beams
	Solve equations to determine distributed loads and properties of areas in rigid bodies
	Solve for shear and moment distributions in beams

TECHNOLOGIST**ENGINEER**

Technologist 1.2.5 — Dynamics	Engineer 1.2.5 — Dynamics
Solution of dynamical problems related to the motion of particles and rigid bodies.	Application of dynamics principles to particles, systems of particles, and planar rigid bodies
Solve kinematic equations to determine position, velocity and acceleration in single-degree-of-freedom and vector coordinate systems	Apply kinematic principles to determine position, velocity and acceleration in single-degree-of-freedom and vector coordinate systems
Solve kinetic equations to determine work (power) and energy	Apply kinetic principles to determine work (power) and energy
	Apply principles of rotating coordinate systems
	Apply principles of linear and angular moment and impulses, including conservation
	Solve for mass moments of inertia

Technologist 1.2.6 — Fluid Mechanics	Engineer 1.2.6 — Fluid Mechanics
Understand fluid properties and how they affect fluid systems design and operation	Solve problems in fluid kinematics
Understand fundamental laws of fluid mechanics and energy relationships for incompressible fluids	Solve for mass, momentum, energy of fluids using control volume methods
Solve for pressure loss	Solve dimensional analysis and dynamic similarity problems
Understand flow measurement	Solve for lift and drag
Solve equations related to pipe sizing and pump selection	Understand turbulence
Solve problems related to open channel flow analysis	Not applicable

Technologist 1.2.7 — Thermodynamics/Heat Transfer	Engineer 1.2.7 — Thermodynamics/Heat Transfer
Solution of problems related to the application of principles of thermodynamics in the analysis of vapor and gas power cycles	Apply First Law of Thermodynamics to determine work, heat, properties of substances, and state equations
Solve problems in refrigeration and heat pump machinery	Apply Second Law of Thermodynamics to solve problems of steady state conduction, elementary boundary layer analysis for laminar and turbulent convection, and radiation
Understand properties of moist air (psychometrics)	Not applicable
Solve problems in air distribution systems	Not applicable
Solve basic application problems of conduction, convection, and radiation	Not applicable

Technologist 1.2.8 — Electrical Circuits/Electronics	Engineer 1.2.8 — Electrical Circuits/Electronics
Solve series/parallel circuits using basic electrical principles	Apply basic circuit analysis methods to solve electrical design problems
Understand basic circuit elements (source, ground, resistor, capacitor)	Understand basic circuit elements (source, ground, resistor, capacitor)

Technologist 1.3.1 — Metals (Properties and Applications)	Engineer 1.3.1 — Metals (Properties and Applications)
Understand elastic and plastic deformation	Apply principles of elastic and plastic deformation in selection and design
Solve for metal tensile strength from plots or data	Apply principles of tensile strength in selection and design
Understand Young's modulus (modulus of elasticity) in selection and design	Apply principles of Young's modulus (modulus of elasticity) in selection and design
Understand load/deformation and stress/strain; true stress/true strain in selection and design	Apply principles of resistivity in selection and design
Understand principles of friction in selection and design	Apply principles of density in selection and design
	Apply principles of crystal structure (microstructure) in selection and design

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	Apply principles of heat capacity in selection and design
	Apply principles of friction in selection and design
	Apply principles of toughness in selection and design
	Apply principles of load/deformation and stress/strain; true stress/true strain in selection and design
	Apply principles of phase diagrams (liquid/solid phases, eutectic, eutectoid) in selection and design

Technologist 1.3.2 — Plastics/Polymers (Properties and Applications)	Engineer 1.3.2 — Plastics/Polymers (Properties and Applications)
Understand types of polymers in selection and design	Understand types of polymers in selection and design
Apply general mechanical properties in selection and design	Understand principle of degree of polymerization in selection and design
Understand general electrical properties in selection and design	Understand crystallinity in selection and design
Understand general thermal properties in selection and design	Understand glass-transition temperature in selection and design
	Apply general mechanical properties in selection and design
	Understand general electrical properties in selection and design
	Understand general thermal properties in selection and design
	Understand elastic and plastic deformation in selection and design

Technologist 1.3.3 — Composites (Properties and Applications)	Engineer 1.3.3 — Composites (Properties and Applications)
Types of composites	Apply proper selection criteria for composites selection
Reinforced polymers	Apply proper selection criteria for reinforced polymers selection
Metal-matrix composites	Apply proper selection criteria for metal-matrix composites
Ceramic-matrix composites	Apply proper selection criteria for ceramic-matrix composites
General mechanical properties	Understand general mechanical properties
General electrical properties	Understand general electrical properties
General thermal properties	Understand general thermal properties

Technologist 1.3.4 — Ceramics (Properties and Applications)	Engineer 1.3.4 — Ceramics (Properties and Applications)
Understand selection criteria for ceramics	Apply proper selection criteria for types of ceramics
Understand general mechanical properties	Understand structure of ceramics
Understand general electrical properties	Understand general mechanical properties
Understand general thermal properties	Understand general electrical properties
	Understand general thermal properties

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Technologist 1.3.5 — Fluids (Properties and Applications)	Engineer 1.3.5 — Fluids (Properties and Applications)
Understand fluid properties and how they affect fluid systems design and operation	Solve problems in fluid kinematics
Understand fundamental laws of fluid mechanics and energy relationships for incompressible fluids	Solve for mass, momentum, energy of fluids using control volume methods
Solve for pressure loss	Solve dimensional analysis and dynamic similarity problems
Understand flow measurement	Solve for lift and drag
Solve equations related to pipe sizing and pump selection	Understand turbulence
Solve problems related to open channel flow analysis	Not applicable

Technologist 2 — Product/Process Design & Development	Engineer 2 — Product/Process Design & Development
Become familiar with product and review form, fit and function	Work with designer on what problem the product is solving
Begin brainstorming processing of product	Analyze product, does it solve the problem? Does the solution create a new problem?
Begin brainstorming how the product flows through facility	Provide form, fit, and function suggestions
Review processes	Begin assessing part(s) flow and handling for processing.
Make suggestions for processes improvements	Analyze brainstorming results
	Provide a high level site capability study
	Provide high level estimates on capacity requirements

Technologist 2.1 — Product Design and Development	Engineer 2.1 — Product Design and Development
Not Applicable	Provide input for material selections
	Provide drawing input and reviews
	Develop manufacturing bill of material based on engineering bill of materials
	Work with vendors, based on early concepts
	Provide rough order of magnitude costs/lead times
	Provide Raw Material Lead Times
	Develop a drawing release schedule with design
	Plan for final delivery and workout foreseeable challenges
	Develop project management schedules
	Plan and develop concept tooling and estimated costs
Technologist 2.1.1 — Product R & D	Engineer 2.1.1 — Product R & D
Conduct product testing	Design and development product concepts based on R&D
Provide test results	Provide test results to marketing and designers
Provide fixturing concepts	Analyze the data
Develop fixturing	Develop reports
Provide feedback to the Engineer	Listen to marketing team
Provide input during brainstorming sessions	Work with marketing team
	Analyze competitor's product
	Analyze brainstorming results
	Conduct R&D project meetings

TECHNOLOGIST

ENGINEER

	Develop a workable schedule
	Manage budgets
	Provide budget to management and marketing

Technologist 2.1.2 — Market/Sales/Life Cycle Analysis	Engineer 2.1.2 — Market/Sales/Life Cycle Analysis
Provide data on what the life cycle will be based on testing results	Provide life cycle analysis (how long the product will function, how long will it last, good warranty, disposal, from beginning to end, and maintenance)
Providing processing times, routings, and costs of processing	Provide a description of product for marketing
	Provide information on cost of materials to management and sales team
	Develop and write the business case

Technologist 2.1.3 — Intellectual Property Protection (e.g. patents, trademarks, copyrights, etc.)	Engineer 2.1.3 — Intellectual Property Protection (e.g. patents, trademarks, copyrights, etc.)
Provide testing/proving out new idea	Work with patent attorneys
Provide report results of testing to engineer	Analyze new ideas
	Research existing patents and pending patents
	Conduct patent meetings
	Respond to office actions to United States Patent and Trademark Office (USPTO)

Technologist 2.1.4 — Design Management	Engineer 2.1.4 — Design Management
Provide estimates of time to build the product	Provide input on tooling, machine, and capacity (size of part) to the management team
Provide input on manufacturing and assembly methods and tooling requirements	Manage drawing release schedule
Provide input on machines utilizations	Develop the bill of material
Provide input during brainstorming sessions	Provide standard materials options

Technologist 2.1.5 — Simulation/Engineering Design Analysis	Engineer 2.1.5 — Simulation/Engineering Design Analysis
Understand results of analysis	Understand results of analysis
Conducting simulation studies for processes	Conduct Finite Element Analysis (software)
Provide rough time estimates based on hands on expertise	Provide layout and flow analysis
Provide feedback to the engineer	Provide time studies
	Provide flow diagrams
	Develop reports
	Provide manpower estimates
	Provide resource planning
	Conduct failure mode and effects analysis (FMEA)
	Conduct and analyze brainstorming sessions
	Attend design and engineering meetings
	Develop schedule
	Provide budgetary evaluations
	Provide budget to management and marketing

TECHNOLOGIST

ENGINEER

Technologist 2.1.6 — Concurrent Engineering	Engineer 2.1.6 — Concurrent Engineering
Provide feedback to engineer/designer	Work with design
Provide input for brainstorming	Conduct and analyze brainstorming sessions
	Conduct preliminary drawing reviews
	Provide materials options
	Provide producibility reports
	Provide budgetary evaluations
	Understand and conceptualize vague plans

Technologist 2.1.7 — Design for X (Manufacturing, Assembly, Maintenance, etc.)	Engineer 2.1.7 — Design for X (Manufacturing, Assembly, Maintenance, etc.)
DFM:	DFM:
Analyze part function (can part be simplified, eliminated, combined?)	Work with design, perform part function analysis (can part be simplified, eliminated, combined?)
Provide standard component suggestions (OEM)	Provide standard component analysis (cost, inventory, overhead cost reductions)
Develop questions	Review tolerance requirements.
	Review threaded features for manufacturability
	Review material selections
	Eliminate small machined features where possible
DFA:	DFA:
Research whether part features can be eliminated?	Work with design to eliminate part features that are not CTF
Research for items like fixture locating features	Analyze fixture locating features on parts/assemblies and build process to accommodate
Research part movement, lift points	Analyze part intent, structural compatibility through manufacturing processes (distortion control, material handling, etc.)
	Analyze orientation features to aid in assembly
DFMaintenance:	DFMaintenance:
Research ease of: accessibility, interchangeability, serviceability	Research expected service life, failure consequences, service kits

Technologist 2.1.8 — Drafting/Drawing/Engineering Graphics/Modeling	Engineer 2.1.8 — Drafting/Drawing/Engineering Graphics/Modeling
Understand drawings	Develop preliminary processing
Provide feedback on drawings	Understand drawings and blueprint standards
	Review and interpret drawings
	Analyze and do basic through complex drafting
	Understand and do basic modeling
	Provide graphics for processing
	Provide feedback and communicate with design
	Conduct model manipulation
	Provide strong computer skills

Technologist 2.1.9 — CAD/CAM/CAE Applications	Engineer 2.1.9 — CAD/CAM/CAE Applications
Understand programming language	Understand programming knowledge
Provide tooling recommendations	Understand drawings and blueprint standards
Provide sound fixturing solutions	Review and interpret drawings

TECHNOLOGIST

ENGINEER

	Understand and do basic drafting
	Understand and do basic modeling
	Provide tooling/fixtures drawings for fabrication
	Provide feedback and communicate with design
	Understand and do model manipulation
	Understand and have strong computer skills

Technologist 2.1.10 — Tolerance Analysis/GD&T	Engineer 2.1.10 — Tolerance Analysis/GD&T
Understand and do what drawing requires	Understand realistic tolerances
Review and interpret what is critical/non-critical	Provide realistic GD&T requirements
Understand temperature, climate, and environment importance on tolerance	Provide an in-depth understanding of what the drawing is communicating
Provide accurate measurements	Understand and eliminate unrealistic GD&T requirements
Understand and use of gage blocks	Understand temperature, climate, and environment importance on tolerance
Understand basic GD&T and research GD&T for more in-depth interpretations	Provide tolerance stack-up analysis
	Provide feedback and communicate with design

Technologist 2.1.11 — Product Liability	Engineer 2.1.11 — Product Liability
Understand and recognize consumer hazards/risks	Research existing laws, be awareness, develop legal resources
	Understand risks and provide proactive risk assessments
	Understand warning label requirements
	Understand where to research OSHA safety regulations
	Review marketing materials to help avoid unintentional marketing fraud
	Research Code of Federal Regulations (CFR) as needed

Technologist 2.2 — Process Design & Development	Engineer 2.2 — Process Design & Development
Provide feedback on processes, designs, and preliminary developments	Review and understand contract requirements
Provide input during brainstorming sessions	Analyze floor and audience reading processes and skill levels
Provide process format suggestions	Develop and maintain process
Provide tooling suggestions	Develop file naming conventions and storage methods
Provide feedback on preferred assembly views, wording	Develop strong verbal and written communication skills

Technologist 2.2.1 — Process R&D	Engineer 2.2.1 — Process R&D
Provide feedback	Conduct meetings with technologist, floor, shop leads, customer, management, etc.
Provide input during brainstorming sessions	Conduct model manipulations for processes
Provide process format suggestions	Create presentations for progress updates
Provide tooling suggestions	Provide suggestions and processing updates
Provide feedback on preferred assembly views, wording	Understand and meet requirements of drawings/specifications
Review rigging requirements (material handling)	Manage safety and assembly size/weight restrictions
	Develop workable material handling strategy

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ENGINEER

Technologist 2.2.2 — Simulation/Process Analysis	Engineer 2.2.2 — Simulation/Process Analysis
Provide feedback	Conduct meetings with technologist, floor, shop leads, customer, management, etc.
Provide input during brainstorming sessions	Provide ergonomic analysis
	Provide lighting suggestions
	Provide workstation analysis (reach, etc.)
	Develop time standards/critical path
	Develop flow analysis
	Develop and understand takt times
	Develop scheduling
	Develop equipment (resource) cycle times

Technologist 2.2.3 — Product Prototype Build and Test	Engineer 2.2.3 — Product Prototype Build and Test
Develop a working, scaled model	Analyze the build and observe the methods
Analyze the working, scaled model	Develop documented feedback
Provide feedback concerning the prototype build and test	Manage brainstorm session(s)
Provide input during brainstorming sessions for improvements	Provide equipment research for safe testing
Re develop, working model using alternate methods	Analyze design for manufacturing (DFM)
Conduct testing	Plan 6S, lean principal incorporation
	Provide documented build methods
	Analyze times to perform various operations
	Review time standards to actual build times
	Review and adjust time standards as necessary for planning
	Provide design improvement suggestions

Technologist 2.2.4 — Process Development and Test	Engineer 2.2.4 — Process Development and Test
Provide processing feedback	Review prototype build results, incorporate improvements and suggestions
Provide suggestions for improved processing	Provide rewritten processes
Review concept prove outs	Manage and conduct meetings to discuss and incorporate improvements
	Develop and provide refined processes for review
	Provide times for MRP/routings

Technologist 2.2.5 — Print Reading	Engineer 2.2.5 — Print Reading
Understand how to read prints	Understand drawing/print reading
Understand the different use of line types	Understand the different use of line types
Understand the different symbols and uses	Understand the different symbols and uses
Provide drawing tolerance data for actual parts	Provide drawing tolerance data for actual parts
Understand drawing notes and uses	Understand drawing notes and uses
Review and verify title block to configuration requirements	Review and verify title block to configuration requirements
Provide feedback to manufacturing and design group	Provide feedback to technologist and design group
	Analyze pertinent information and apply to processing
	Review drawings and make suggestions for improvement
	Provide documentation and deliver to drawing requirements.

TECHNOLOGIST

ENGINEER

Technologist 2.2.6 — Rapid Prototyping (RP)	Engineer 2.2.6 — Rapid Prototyping (RP)
Review RP model for brainstorming/improvements	Understand or research RP techniques available and the applications of each
Provide feedback to manufacturing and design group	Provide feedback to technologist and design group
Understand machine setup	Understand CAD software and machine parameters
Provide input on material selections	Provide input on material selections

Technologist 3 — Manufacturing Process Applications & Operation	Engineer 3 — Manufacturing Process Applications & Operation
Understand existing applications and uses	Research existing applications and be able to derive benefits, costs, and drawbacks of the ones in question
Understand how to use existing manufacturing applications efficiently	Provide suggestions based on investigative research
Understand where to look for new technology relating to new process applications and operation	Provide training for operators/technologist on new technology and how to use it

Technologist 3.1 — Manufacturing Process Applications and Operation	Engineer 3.1 — Manufacturing Process Applications and Operation
Understand existing applications and uses	Research existing applications and be able to derive benefits, costs, and drawbacks of the ones in question
Understand how to use existing manufacturing applications efficiently	Provide suggestions based on investigative research
Understand where to look for new technology relating to new process applications and operation	Provide training for operators/technologist on new technology and how to use it

Technologist 3.1.1 — Material Removal Processes	Engineer 3.1.1 — Material Removal Processes
Understand speeds and feeds	Develop machine programs
Analyze programming code	Create process
Review and follow process	Understanding of tooling and fixturing
Understand how to troubleshoot machinery	Analyze and hold an in depth knowledge of tooling available
Understanding of tooling and fixturing	Understand advanced math, trigonometry, and algebra
Understand tooling selection	Analyze and anticipate tooling reactions
Understand how to apply various measurement devices, gages	Understand modeling (VERICUT) to prove out tool paths
Understand basic math and trigonometry	

Technologist 3.1.2 — Fabrication Process	Engineer 3.1.2 — Fabrication Process
Analyze equipment needs	Provide process selection based on geometry and material
Provide materials (e.g. raw stock/consumables)	Develop Routings
Provide data to support process selection	Review alternate processes based on geometry
Provide a record of Recorded process parameters (e.g. voltage/current)	Provide pre and post material treatment suggestions
Provide feedback/input on procedure requirements	Develop inspection plan
Manage the adherence to drawing standards	Analyze customer requirements (work with customer to define requirements)
Develop coordinated activities through scheduling	Develop fabrication methods to meet mechanical property requirements
Understand safety and regulatory compliance	Provide suggestions for "make/buy" decisions
Review, verify, complete, and sign paperwork/contract documents	Review supplier capabilities

TECHNOLOGIST

ENGINEER

Provide explanations for variances to engineer/manager	Provide input for welder requirements, tests, and inspector requirements, tests
Review and ensure correct processes are used	Develop weld procedures and select process standard
Understand and track schedules	Communicate requirements
Analyze to ensure correct resources are assigned to the job	Manage adherence to quality standard
Provide part and process updates as it progresses through various departments	Develop manufacturing process
	Create routing
	Develop estimates and time standards
	Develop supplier list, set up vendors, and sub-contractors
	Review in-house qualifications and certifications
	Manage and recognize incorrect operations
	Review progression through operations
	Conduct meetings/answer for variances
	Conduct meetings to track budget and schedule
	Conduct meetings to help ensure quality conformance

Technologist 3.1.3 — Hot and Cold Forming Processes	Engineer 3.1.3 — Hot and Cold Forming Processes
Review, verify, complete, and sign paperwork/contract documents	Develop manufacturing process
Provide explanations for variances to engineer/manager	Create routing
Review and ensure correct processes are used	Develop estimates and time standards
Understand and track schedules	Develop supplier list, set up vendors, and sub-contractors
Analyze to ensure correct resources are assigned to the job	Review in-house qualifications/certifications
Provide part and process updates as it progresses through various departments	Manage and recognize incorrect operations
	Review progression through operations
	Conduct meetings/answer for variances
	Conduct meetings to track budget and schedule
	Conduct meetings to help ensure quality conformance

Technologist 3.1.4 — Casting and Molding Processes	Engineer 3.1.4 — Casting and Molding Processes
Review, verify, complete, and sign paperwork/contract documents	Develop manufacturing process
Provide explanations for variances to engineer/manager	Create routing
Review and ensure correct processes are used	Develop estimates and time standards
Understand and track schedules	Develop supplier list, set up vendors, and sub-contractors
Analyze to ensure correct resources are assigned to the job	Review in-house qualifications/certifications
Provide part and process updates as it progresses through various departments	Manage and recognize incorrect operations
	Review progression through operations
	Conduct meetings/answer for variances
	Conduct meetings to track budget and schedule
	Conduct meetings to help ensure quality conformance

TECHNOLOGIST

ENGINEER

Technologist 3.1.5 — Electrical/Electronics Mfg. Processes	Engineer 3.1.5 — Electrical/Electronics Mfg. Processes
Provide input during brainstorming sessions	Develop manufacturing process
Provide feedback	Create routing
Review and track updates	Develop estimates and time standards
Provide tooling requirements and availability recommendations	Develop supplier list, set up vendors, sub-contractors
	Review in-house qualifications/certifications
	Manage and recognize incorrect operations
	Review progression through operations
	Conduct meetings/answer for variances
	Conduct meetings to track budget and schedule
	Conduct meetings to help ensure quality conformance
	Provide process updates
	Provide orders for necessary tools/tooling

Technologist 3.1.6 — Heat Treatment Processes	Engineer 3.1.6 — Heat Treatment Processes
Review and understand oven capabilities	Develop process
Review, analyze, plan for oven calibration/certifications	Review and establish heat treat requirements
Understand how to program the equipment	Review and understand specifications/limitations
Provide process verification	Provide input for setting up vendors, sub-contractors
Provide input for training operators	Review in-house qualifications/certifications
Work with safety to assure proper personal protective equipment (PPE)	Provide reports/process verifications per requirements
Plan for proper material handling	Develop lead times for in-house/vendor
	Provide input for materials and requirements per specifications
	Analyze tooling/fixtures requirements
	Analyze and develop a quality conformance program
	Provide process updates
	Research and order necessary tools/tooling

Technologist 3.1.7 — Joining, Welding, and Assembly Processes	Engineer 3.1.7 — Joining, Welding, and Assembly Processes
Review and provide feedback for machine availability	Develop process
Review and provide feedback for machine capability	Conduct tests, create Performance Qualification Records and Weld Procedure Specifications
Review and suggest tooling and fixturing requirements	Review personnel qualification requirements
Review tooling and fixturing designs	Review and understand specifications/customer requirements
Work with safety to assure proper personal protective equipment (PPE)	Understand torque requirements/equipment
Plan for proper material handling	Provide layouts, flow analysis
	Create set locations/modular work-station designs
	Analyze and setup shop supplies/deliveries (Kanban)
	Research and provide for any tooling/fixtures requirements
	Review to ensure quality conformance
	Provide process updates
	Research and order necessary tools/tooling

TECHNOLOGIST

ENGINEER

Technologist 3.1.8 — Finishing Processes	Engineer 3.1.8 — Finishing Processes
Understand existing applications and uses	Analyze existing finishing processes and be able to derive benefits, costs, drawbacks of ones in question
Provide finishing suggestions across various situations.	Provide suggestions based on investigative research
Understand the tools used or available for various finishing processes	Train operators/technologist on new technology and how to use it
Understand and enforce quality requirements to ensure product meets contract requirements	Review controlling documents and be able to recognize and communicate controlling features
Provide guidance in order to meet requirements	Manage work being done to ensure quality requirements are met
Provide tool/equipment selection feedback	Research new tooling equipment to meet any new or existing requirements
Review and enforce safety requirements	Work with technologist to select best tools for shop floor
	Review safety procedures and enforce safe practices

Technologist 3.1.9 — Bulk and Continuous Flow Processes	Engineer 3.1.9 — Bulk and Continuous Flow Processes
Understand and follow processes	Develop processes
Provide feedback on how to develop or improve processes	Review processes for improvement
Review processes, ensure they are being followed, report shortcomings, and things that work well	Create layouts that support flow analysis and processes
Review processing methods and encourage flexibility	Analyze and take calculated risks
	Review and make corrections

Technologist 3.1.10 — Material Handling/Packaging	Engineer 3.1.10 — Material Handling/Packaging
Review practices to make sure processes are followed	Research handling equipment needs
Plan in order to keep supplies on hand	Review OSHA safety regulations relating to handling and packaging.
Provide feedback to engineer on what works and where improvements are necessary	Review regulations relating to packaging of liquids, hazmat, and size limits
Provide recommendations for material handling needs	Provide packaging/material handling suggestions/solutions
	Create processes for various handling requirements
	Create processes for packaging requirements
	Review company policies and make sure they are understood and complied with

Technologist 3.1.11 — Hand Tool Use/Machine Operating	Engineer 3.1.11 — Hand Tool Use/Machine Operating
Understand hand tool use and be able to train others	Research and make recommendations for hand tools and machines
Understand how to use machines and be able to train others	Research and make recommendations for improvements
Analyze tooling needs, make suggestions	Create processes and safety procedures
Analyze and make suggestions for shop supplies relating to hand tool use and machine operations	Review personal protective equipment (PPE) requirements and help operators understand how to use it

Technologist 4 — Production System and Equipment Design/Development	Engineer 4 — Production System and Equipment Design/Development
Production System (Delmia, etc.):	Production System (Delmia, etc.):
Provide floor flow reviews/feedback	Provide time and flow analysis based on estimates
Provide suggestions on equipment placement within software	Develop shop layout, flows, virtual flow animations
Review actual versus estimated production times, feedback	Manage brainstorming sessions
Equipment Design:	Equipment Design:
Provide feedback and suggestions relating to equipment design	Provide feedback and suggestions

TECHNOLOGIST

ENGINEER

Provide sound guidelines based on real life situations in order to specify requirements	Develop lists of specific equipment requirements
Review drawings to make sure equipment is buildable	Review drawings
	Provide input for material selections
Development:	Development:
Review plans and provide feedback	Provide suggestions and feedback

Technologist 4.1 — Production System Design and Development	Engineer 4.1 — Production System Design and Development
Production System (Delmia, etc.):	Production System (Delmia, etc.):
Provide floor flow reviews/feedback	Provide time and flow analysis based on estimates
Provide suggestions on equipment placement within software	Develop shop layout, flows, virtual flow animations
Review actual versus estimated production times, feedback	Manage brainstorming sessions
Equipment Design:	Equipment Design:
Provide feedback and suggestions relating to equipment design	Provide feedback and suggestions
Provide sound guidelines based on real life situations in order to specify requirements	Develop lists of specific equipment requirements
Review drawings to make sure equipment is buildable	Review drawings
	Provide input for material selections
Development:	Development:
Review plans and provide feedback	Provide suggestions and Feedback

Technologist 4.1.1 — Infrastructure/Plant Location Analysis	Engineer 4.1.1 — Infrastructure/Plant Location Analysis
Infrastructure:	Infrastructure:
Provide input on facility requirements (power, water, climate, ventilation, etc.)	Provide input on facility requirements (power, water, climate, ventilation etc.)
	Analyze needs and work with contractors to develop rough estimates to setup facility based on layouts/analysis
	Work with management on budgetary feedback
	Manage contractors to set up facility per requirements
	Manage timelines, budgets, and contractors compliance with requirements
Plant Location Analysis:	Plant Location Analysis:
	Analyze raw material and finished goods shipping and receiving paths.
	Analyze costs associated with location relating to tooling/fixturing (distance from customer may require multiple shipping fixtures, etc.)

Technologist 4.1.2 — Facility Planning/Plant Layout	Engineer 4.1.2 — Facility Planning/Plant Layout
Provide feedback during brainstorming sessions	Create layouts and simulation models
Provide input on facility Requirements (power, water, climate, ventilation, etc.)	Manage facility requirements (power, water, climate, ventilation, etc.)
	Develop the receiving, product flows, and shipping plans
	Analyze crane and rigging requirements
	Review floor layouts, flows and part movements
	Review time studies/standards
	Identify and address bottlenecks
	Identify office requirements
	Identify gate/facility security reviews

TECHNOLOGIST

ENGINEER

	Manage brainstorming sessions
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Technologist 4.1.3 — Process Planning & Development	Engineer 4.1.3 — Process Planning & Development
Provide feedback during brainstorming sessions	Create detailed assembly plans
Identify equipment needs and availability	Create detailed assembly sequencing
	Identify tooling/fixtures/equipment needs
	Create the written assembly/process plan
	Manage meetings

Technologist 4.1.4 — Capacity Planning	Engineer 4.1.4 — Capacity Planning
Identify needed resources needs and provide feedback	Develop part flow mapping
Review and communicate space requirements	Analyze current capacities versus future production needs
Review flow options and provide feedback	Create resource plans
Provide feedback to engineering plans	Analyze costs
	Analyze return on investment (ROI)

Technologist 4.1.5 — Production/Manufacturing System Design and Organization	Engineer 4.1.5 — Production/Manufacturing System Design and Organization
Provide input and feedback	Provide input and feedback
	Research best production practices and manufacturing system designs
	Analyze in-house manufacturing systems versus external methods

Technologist 4.1.6 — Process Documentation/Work Instructions	Engineer 4.1.6 — Process Documentation/Work Instructions
Provide input for sequencing/responsibilities	Create work instructions or review and understand existing work instructions
Provide feedback during brainstorming sessions	Identify and address specification requirements from drawings
Understand actual build/inspection/specification requirements	Identify and address inspection requirements in process
	Create process documents
	Review process documentation against actual build methods
	Crates processes that closely resemble actual build methods
	Analyze and capture key sequencing requirements

Technologist 4.1.7 — Tool and Equipment Selection	Engineer 4.1.7 — Tool and Equipment Selection
Understand tool and equipment capabilities/limitations	Research tool and equipment capabilities/limitations
Identify production needs and wants	Understand and communicate company policy and guidelines on tool and equipment selection
Identify features of importance	Identify productions needs from wants
	Analyze features of importance and be able to present them
	Analyze advantages and disadvantages between value versus cost
	Provide input on space requirements/ergonomic concerns (counter weights, etc.)
	Analyze equipment cycle times costs value and bottom line impacts

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Technologist 4.1.8 — Production System Build/Test	Engineer 4.1.8 — Production System Build/Test
Provide training, monitor progress, and deliver feedback to engineer	Manage compliance to cost, quality, and schedule
Communicate the work space setup requirements and enforce flows	Manage to ensure process is followed; correct or corrected
Communicate to ensure safest known practices are exercised	Work with workers to make sure they have what they need to be successful
Communicate the importance of following processes	Listen to workers feedback and implement it in a timely manner
Provide feedback to engineer	Respond to actuals and update manufacturing resource plans (MRP)
Provide insight to unanticipated variances	Review variances, track and report them to management
	Manage product compliance, identify non-conformances, design improvements, and properly log them
	Review design updates, corrections, and improvement plans

Technologist 4.1.9 — Human Factors, Ergonomics and Safety	Engineer 4.1.9 — Human Factors, Ergonomics and Safety
Define problems and situations, concerns, and violations	Understand range user calculations, limits, size, and parameters
Understand the sources that create the actual injury	Analyze and incorporate the human modeling methods
Understand OSHA and other safety regulations and comply	Conduct safety walks and audits
Awareness of Ergonomic Safety Data Sheets (ESDS)	Understand the sources that create the actual injury
Become familiar with locations for MSDS sheets and how to use them	Develop the safety standards
Become aware of the MSDS systems in place	Determine tooling/assistant requirements
Create an environment of compliance relating to personal protective equipment (PPE)	Understand OSHA and other safety regulations and comply
Observe and monitor to identify opportunities to improve ergonomics and human factors — ensure compliance with proper processes	Understand non-hazardous materials
Identify problems, situations, concerns, and violations	Awareness of Ergonomic Safety Data Sheets (ESDS)
Implement safety resolutions and ergonomics	Define personal protective equipment (PPE) requirements
Communicate any requirements needing to be addressed in safety standards	Observe and monitor practices and implement improvements
	Development production processes to minimize injury
	Develop work place design and plant layout
	Identify hazardous materials and log them into the MSDS database
	Review and improve work bench design and plant layout
	Observe and monitor to identify opportunities to improve ergonomics and human factors — ensure compliance with proper processes
	Develop production processes to minimize injury

Technologist 4.1.10 — Maintenance Systems	Engineer 4.1.10 — Maintenance Systems
Review maintenance cards to ensure properly filled out and up to date	Work with maintenance group to establish maintenance guidelines/frequency of maintenance and tracking programs
Create maintenance work-orders	

Technologist 4.1.11 — Environmental Protection/Waste Management	Engineer 4.1.11 — Environmental Protection/Waste Management
Ensure chemicals are properly labeled/handled on the floor	Review drawings to ensure compliance with company policy relating to environmental impacts

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ENGINEER

Communicate safety practices relating to handling of waste, and in case of emergency	Review and encourage the wise use of resources to minimize waste
Review company policy relating to environmental practices and chemicals allowed or not allowed.	Develop proper waste disposal methods
	Work with environmental department to make sure new chemicals are logged into company system, all necessary data is attached, and proper labeling is available and affixed

Technologist 4.2 — Equipment/Tool Design and Development	Engineer 4.2 — Equipment/Tool Design and Development
Provide feedback on requirements and what works/does not work	Understand and be proficient with various CAD software programs
Provide solutions relating to equipment and an ability to figure out new equipment	Understand tooling/equipment functions
Implement a safety conscious environment	Understand and analyze tolerance requirements
Create solutions and an ability to get things done with tools at hand along with a willingness to speak up when additional requirements are necessary	Research and understand the uses of motion controls
Analyze drawings/concepts and have a good mental ability to understand and think through conceptual and final designs	Review design to ensure safety and ergonomics are addressed
Communicate clearly and be able to work with peers, subordinates, and managers	Review for proper lighting requirements
	Analyze and troubleshoot designs
	Understand the need in order to sell and persuade if needed
	Listen to end users and work with vendors and management
	Manage meetings/develop presentation skills
	Provide materials selection knowledge
	Provide producibility suggestions
	Manage project (quality, schedule, cost, etc.)

Technologist 4.2.1 — Cutting Tool Design	Engineer 4.2.1 — Cutting Tool Design
Provide input to what works on various materials	Research various design requirements and what works on what and why various designs are necessary
Provide resourceful ideas and solutions	Analyze and quantify various design requirements
Understanding of various cutting tool designs and why various designs are necessary	Analyze and create new, well thought out concepts based on research and feedback from users
Communicate various tool design requirements to a broad audience from subordinates through management	Understand how to use CAD software
	Provide resourceful ideas and solutions
	Communicate well in order to sell new concepts/designs
	Analyze costs on various designs and requirements

Technologist 4.2.2 — Work holding Tool Design	Engineer 4.2.2 — Work holding Tool Design
Understanding of machine rigidity requirements based on tolerance requirements	Understanding of machine rigidity requirements based on tolerance requirements
Understand datum targets and how the finished product will be inspected	Understand datum targets and how the finished product will be inspected
Understand work holding requirements for various machines	Understand work holding requirements for various machines
Understand safety concerns	Understand safety concerns
	Understand how to use CAD software
	Identify material requirements
	Research and quantify various concepts
	Create schedules of need dates for various designs

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	Communicate concepts for production use
	Understand material strengths

Technologist 4.2.3 — Die/Mold Design	Engineer 4.2.3 — Die/Mold Design
Understanding of machine rigidity requirements based on tolerance requirements	Understanding of machine rigidity requirements based on tolerance requirements
Understand datum targets and how the finished product will be inspected	Understand datum targets and how the finished product will be inspected
Analyze and visualize work holding requirements for various machines	Analyze and visualize work holding requirements for various machines
Understand safety concerns	Understand safety concerns
Understand how die/mold will be used in production	Understand how die/mold will be used in production
	Understand how to use CAD software
	Identify material requirements
	Research and quantify various concepts
	Create schedules of need dates for various designs
	Communicate concepts for production use
	Understand material strengths

Technologist 4.2.4 — Gage Design	Engineer 4.2.4 — Gage Design
Understanding tolerance requirements	Understanding of tolerance requirements
Understand datum targets and how the finished product will be inspected	Understand datum targets and how the finished product will be inspected
Understanding of inspection techniques	Understanding of inspection techniques
	Understand how to use CAD software
	Research and quantify various concepts
	Create schedules of need dates for various designs
	Communicate concepts for production use
	Understand material strengths

Technologist 4.2.5–4.2.6–4.2.7 — Machine Design	Engineer 4.2.5–4.2.6–4.2.7 — Machine Design
Create and initiate part orders	Review machine functional requirements
Create machine drawings	Provide safety assessment
Understand and derive component selection (to create workable design)	Create operator manual
Analyze and troubleshoot, design, installation, etc.	Develop business case/funding requirements
Provide feedback for functional requirements	Understand how to use CAD software
Conduct tests for machine once it's built	Research make/buy options
Conduct training	Conduct tests for machine once it's built
Review design	Conduct training for the machine
	Develop the parameters and power system control systems
	Review system and machine design
	Review tolerances fits
	Provide input for components, build process/assembly process
	Develop maintenance schedule drawing/spare parts, lead time

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ENGINEER

Technologist 4.2.8 — Nanotechnology, Packaging & Systems	Engineer 4.2.8 — Nanotechnology, Packaging & Systems
Nanotechnology	Nanotechnology
Crystal growing	Crystal growing effect of dopants on conductivity purpose of a single crystal
Silicon wafer manufacturing	Silicon wafer manufacturing wafer slicing edge grinding lapping laser marking effect of flatness variations
Clean rooms	Clean rooms protocol definition
Film deposition	Film deposition PVD CVD sputtering typical thicknesses
Oxidation	Oxidation purpose
Lithography	Lithography methods resolutions equipment
Etching	Etching reactive ion etching acid etching
Diffusion	Diffusion diffusion equations
Metallization	Metallization
Wire bonding	Wire bonding
Packaging	Packaging
Printed circuit boards	Printed circuit boards
MEMS	MEMS
	Apply hypothesis testing methods to numerical data (chi-square, F-test)

Technologist 5.1.1 — Automated Systems (Hard/Flexible)	Engineer 5.1.1 — Automated Systems (Hard/Flexible)
Understand automated material handling principles (conveyance, robotics)	Understand goals of implementing automation
Understand purpose of and describe hard automation	Apply classification/description schemes for manufacturing systems (job shop, work cell, flexible lines, transfer lines, etc.)
Understand purpose of and describe flexible automation	Apply design principles for automated material handling systems (conveyance, transfer, robotics)
Understand purpose of and describe soft automation	Understand purpose of and describe hard automation
	Understand purpose of and describe flexible automation
	Understand purpose of and describe soft automation

Technologist 5.1.2 — CNC/PLC/Computer Control	Engineer 5.1.2 — CNC/PLC/Computer Control
Understand flowcharts	Understand pseudo-code and flowcharts
Apply basic G-code programming for CNC	Apply basic G-code programming methods for CNC
Apply basic ladder-logic for PLC programming	Understand impact of interpolated versus point-to-point control

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	Understand basic ladder-logic programming for PLC
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Technologist 5.1.3 — Computer Systems and Networks	Engineer 5.1.3 — Computer Systems and Networks
Understand purpose of computer networks in manufacturing and manufacturing engineering	Understand purpose of computer networks in manufacturing and manufacturing engineering
	Understand various network types (LAN, WAN) and advantages/disadvantages
	Understand various LAN configurations (star, rung, bus) and advantages/disadvantages
	Understand basic system manufacturing information system design/requirements

Technologist 5.1.4 — Information Technology/Database	Engineer 5.1.4 — Information Technology/Database
Understand purpose and capability of database technology	Understand purpose and capability of database technology
Understand types of data stored in databases	Understand types of data stored in databases

Technologist 5.1.5 — Enterprise-wide Systems Integration (MES, ERP, etc.)	Engineer 5.1.5 — Enterprise-wide Systems Integration (MES, ERP, etc.)
Understand data requirements	Understand and communicate basics of functional requirements
Understand system verification methods	Understand system elements and reporting requirements as relates to manufacturing engineering applications for design and benefit justification
Understand DOE (main effects analysis)	Apply methods to create and interpret DOE (main effects analysis)
Understand DOE (interaction analysis)	Apply methods to create and interpret DOE (interaction analysis)
Understand linear regression analysis	Understand ANOVA analysis
	Understand dimension reduction methods (PCA, etc.) as used in factor analysis
	Apply methods to create and interpret linear regressions
	Understand correlation matrix/coefficient

Technologist 6. 1.1 — Customer Focus (Research/Test/ Satisfaction)	Engineer 6. 1.1 — Customer Focus (Research/Test/ Satisfaction)
Know who customer is (internal and external)	Determine value from customer perspective
Execute tests, gathered data report	Develop test methods
Communicate customer requirements to operators/shop floor.	Provide impact analysis of requested customer requirements
Understand familiarity of f(x) of end product (what it's supposed to do)	Manage versions of each customer requirement
	Communicate requirements and changes to process
	Understand familiarity of f(x) of end product (what it's supposed to do)
	Customer relations

Technologist 6.1.2 — Quality System and Standards (e.g. QS/ISO/CE/Mark/etc.)	Engineer 6.1.2 — Quality System and Standards (e.g. QS/ISO/CE/Mark/etc.)
Familiar with the standards and if need help for interpretation go to the engineer	Know the standards/industry standards. Customer standards. Internal standards
Seek clarification on standards	Own and manager documents
Implement new processes	Assess standards, changes, impact and set new processes
Provide input on changes required	Support CA or deficiencies
Assist with audits	Initiate non-conformities

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ENGINEER

	Understand quality reg of system/supply chain and enforce compliance
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Technologist 6.1.3 — Probability & Statistics	Engineer 6.1.3 — Probability & Statistics
See section 1.1.5 for statistics	See section 1.1.5 for statistics
Event probability	Basic counting methods (permutations, combinations)
	Event probability
	Standard normal probability
	Central limit theorem

Technologist 6.1.4 — Statistical Control Methods	Engineer 6.1.4 — Statistical Control Methods
X-bar and R charts	X-bar and R charts
	Charts for individual measurements
	P-charts (fraction defective)
	Moving average charts

Technologist 6.1.5 — Problem Analysis & Solving (Fishbone/Pareto/FMEA/etc.)	Engineer 6.1.5 — Problem Analysis & Solving (Fishbone/Pareto/FMEA/etc.)
Comparative data analysis	Comparative data analysis

Technologist 6.1.6 — Factor Analysis (DOE/Correlation/etc.)	Engineer 6.1.6 — Factor Analysis (DOE/Correlation/etc.)
Understand DOE (main effects analysis)	Understand DOE (main effects analysis)
DOE (interaction analysis)	DOE (interaction analysis)
Linear regression	Understand ANOVA analysis
	Understand dimension reduction methods (PCA, etc.) as used in factor analysis
	Linear regression
	Correlation matrix/coefficient

Technologist 6.1.7 — Capability Analysis (Process/Equipment/etc.)	Engineer 6.1.7 — Capability Analysis (Process/Equipment/etc.)
Understand concept of process capability vs. product specification	Understand concept of process capability vs. product specification
Understand Cp	Solve for Cp
Understand Cpk	Solve for Cpk
Understand Gage R&R analysis	Understand gage R&R analyses

Technologist 6.1.8 — Inspection/Test/Validation	Engineer 6.1.8 — Inspection/Test/Validation
Understand differences between inspection and process monitoring	Understand differences between inspection and process monitoring
Understand destructive test and inspection methods (tensile, loading, fatigue)	Apply principles to design destructive test and inspection procedures (tensile, loading, fatigue)
Understand non-destructive test and inspection methods (ultrasonic, acoustic, x-ray, thermographic)	Apply principles to design non-destructive test and inspection procedures (ultrasonic, acoustic, x-ray, thermographic)
Understanding system/product level test and validation	Understanding system/product level test and validation
Understanding component level test and validation	Understanding component level test and validation
Understand advantages/disadvantages of various methods and procedures	Understand advantages/disadvantages of various methods and procedures

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Technologist 6.1.9 — Metrology	Engineer 6.1.9 — Metrology
Understand principle of accuracy	Understand principle of accuracy
Understand principle of resolution	Understand principle of resolution
Understand principle of repeatability/precision	Understand principle of repeatability/precision
Understand principle of contact versus non-contact methods	Understand principle of contact versus non-contact methods
Understand principle of absolute measurement	Understand principle of absolute measurement
Understand principle of relative measurement	Understand principle of relative measurement
Understand operation of various instruments (micrometer, scale, caliper, CMM)	Understand operation of various instruments (micrometer, scale, caliper, CMM)
Understand principle of operation for light-based instruments (vision, laser)	Understand principle of operation for light-based instruments (vision, laser)
Understand advantages/disadvantages of various methods and procedures	Understand advantages/disadvantages of various methods and procedures

Technologist 6.1.10 — Reliability Analysis	Engineer 6.1.10 — Reliability Analysis
Understand concept of reliability	Understand concept of reliability
Understand component and system reliability	Apply component reliability principles in design and manufacturing
	Apply system reliability principles in design and manufacturing
	Apply series reliability principles in design and manufacturing
	Apply parallel reliability principles in design and manufacturing

Technologist 6.1.11 — Continuous Improvement/Lean	Engineer 6.1.11 — Continuous Improvement/Lean
Understand Deming's 14 Points for management	Apply Deming's 14 Points for management
Understand Kaizen (Shewhart Cycle, Deming Cycle)	Understand Kaizen (Shewhart Cycle, Deming Cycle)

Technologist 6.1.12 — Customer and Field Service	Engineer 6.1.12 — Customer and Field Service
Understand accessibility, interchangeability, and serviceability	Review tolerance requirements
Understand drawing and blueprint standards	Review material selections
Review and interpret drawings	Analyze failures
Understand and communicate company policy/guidelines on warranty and/or service issues	Understand expected service life
Understand OSHA safety requirements and comply	Understand accessibility, interchangeability, and serviceability
Manage meetings	Understand drawing and blueprint standards
Guide customers in the area of maintenance schedule/needs for products sold	Review and interpret drawings
Conduct training in the proper use of equipment and/or components sold to customers	Understand and communicate company policy/guidelines on warranty and /or service issues
Understand customer needs and communicate to others within the company	Understand OSHA safety requirements and comply
Review, understand, and convey customer standards and designs to others within the company	Analyze and troubleshoot designs
Follow up with customers to ensure issues are resolved to customer's satisfaction	Manage meetings
Read and interpret technical manuals and specifications	Guide customers in the area of maintenance schedule/needs for products sold
Maintain confidentiality of customer information	Conduct training in the proper use of equipment and/or components sold to customers
Strive to provide quality and customer satisfaction in dealings with customers	Understand customer needs and communicate to others within the company
Technologist 6.1.12 — Customer and Field Service	Engineer 6.1.12 — Customer and Field Service
Do not accept bribes or kickbacks from customers	Review, understand, and convey customer standards and designs to others within the company
Listen respectfully to input from customers and keep an open mind	Follow up with customers to ensure issues are resolved to customer's satisfaction
Act in a professional manner when dealing with customers	Read and interpret technical manuals and specifications

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Solve problems by using critical-thinking skills	Maintain confidentiality of customer information
Communicate with customers in a clear and well organized manner	Strive to provide quality and customer satisfaction in dealings with customers
Provide clean and factual trip reports on matters relating to field service	Do not accept bribes or kickbacks from customers
Prepare technical reports	Listen respectfully to input from customers and keep an open mind
	Act in a professional manner when dealing with customers
	Solve problems by using critical-thinking skills
	Communicate with customers in a clear and well organized manner
	Provide clean and factual trip reports on matters relating to field service
	Prepare technical reports

Technologist 7.1.1 — Strategic Planning/Global Competitiveness	Engineer 7.1.1 — Strategic Planning/Global Competitiveness
Be aware of company's strategic plan	Be aware of company's strategic plan
Participate in benchmarking to understand where gaps are and where improvement efforts should be focused	Participate in benchmarking to understand where gaps are and where improvement efforts should be focused
	Participate in strengths, weaknesses, opportunities, threats (SWOT) analysis as required

Technologist 7.1.2 — Organizational Design and Management	Engineer 7.1.2 — Organizational Design and Management
Utilize computer software to manage and share large amounts of information	Utilize computer software to manage and share large amounts of information
	Understand the Theory of Constraints
	Be familiar with various organizational structures (line and staff, matrix, product)

Technologist 7.1.3 — Project Management	Engineer 7.1.3 — Project Management
Report task status for which you have responsibility	Knowledge of project management tools and software
Provide time estimates for tasks	Obtain, justify, track and manage resources (personnel)
Prioritize work duties and specific project tasks	Set milestones
Participate in change management process	Train project team members (terminology, templates, expectations)
	Communicate project status of the overall project to sponsor and plan approvers
	Determine project requirements
	Assign action items
	Create and manage project plan
	Track and manage project expenditures
	Perform risk assessment of project
	Prioritize work duties and specific project tasks
	Manage changes in a project, ensure proper approval of changes, and keep team members apprised of approved changes
	Implement corrective actions when projects veer off course
	Anticipate obstacles to the successful completion of your project and develop a contingency plan(s) to overcome these obstacles
	Follow up with customers, vendors, and colleagues during projects and after project completion

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ENGINEER

	Address customer concerns, comments, or objections in a timely manner
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Technologist 7.1.4 — Personnel Management Methods	Engineer 7.1.4 — Personnel Management Methods
Not Applicable	Maintain required documentation for direct reports
	Understand and administer policies and government regulations related to your work.

Technologist 7.1.5 — Human Behavior/Motivation/Leadership	Engineer 7.1.5 — Human Behavior/Motivation/Leadership
Understand diversity (through classes, textbooks, direct contact with other cultures)	Understand diversity (through classes, textbooks, direct contact with other cultures)
Seek challenging work assignments to position oneself for growth	Seek challenging work assignments to position oneself for growth
Take responsibility for your actions and decisions	Take responsibility for your actions and decisions
Complete work assigned/required through perseverance	Complete work assigned/required through perseverance
Influence and motivate others (through your actions) to work toward company objectives	Influence and motivate others (through your actions) to work toward company objectives
Change plans, actions, and/or priorities to deal with changing company objectives	Change plans, actions, and/or priorities to deal with changing company objectives
	Be familiar with Deming's 14 Points for management
	Understand various theories of motivation (Maslow, McClelland, Herzberg, Equity, Expectancy)

Technologist 7.1.6 — Labor Relations	Engineer 7.1.6 — Labor Relations
Not Applicable	Contribute to contract negotiation points
	Recognize contributions and performance of union labor and develop performance incentives, if required.

Technologist 7.1.7 — Education/Training	Engineer 7.1.7 — Education/Training
Learn/absorb	Assess knowledge, skills, and abilities (KSAs)
Setup simulations	Recommend and/or develop courses
Freely share knowledge and expertise with others	Pursue lifelong education
Participate in application and skills training	Mentor others
Evaluate and validate training	Deliver training
Pursue lifelong education	Read and interpret technical manuals, technical specifications, and appropriation requests
Read and interpret technical manuals, technical specifications, and appropriation requests	Determine knowledge gaps in direct reports and take action to remedy

Technologist 7.1.8 — Operations Research, Analysis, & Forecasting	Engineer 7.1.8 — Operations Research, Analysis, & Forecasting
Utilize computer software to manage and share large amounts of information	Utilize computer software to manage and share large amounts of information
Understand and apply statistics and probabilities (mean, median, standard deviation)	Understand and apply statistics and probabilities (mean, median, standard deviation)
Identify internal and external customers and understand their needs.	Identify internal and external customers and understand their needs.

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Technologist 7.1.9 — Supply Chain & Logistics	Engineer 7.1.9 — Supply Chain & Logistics
Contribute to make versus buy decisions	Understand Theory of Constraints
Understand the principles of just-in-time	Lead make versus buy decisions
Understand and apply statistics and probabilities (mean, median, standard deviation)	Understand and apply statistics and probabilities (mean, median, standard deviation)
Understand the principles of lean manufacturing	Understand and plan movement and storage of products - taking into consideration the needs of suppliers and customers
	Understand the principles of just-in-time
	Understand the principles of lean manufacturing
	Determine plant capacity in terms of workflow
	Work with others to improve logistics (transportation) for company product
	Adhere to standards (legal) for customs and exporting of product

Technologist 7.1.10 — Accounting/Finance/Economics (including Engineering Economics/Cost Justification/Value Analysis/Project Justification)	Engineer 7.1.10 — Accounting/Finance/Economics (including Engineering Economics/Cost Justification/Value Analysis/Project Justification)
Gather production data (rates, per piece cost, tooling costs) to aid in justifying machine replacement or rebuild	Gather production data (rates, per piece cost, tooling costs) to aid in justifying machine replacement or rebuild
Interpret equipment specifications	Interpret equipment specifications
Be familiar with various methods for depreciating equipment	Understand Theory of Constraints
Utilize computer software to manage and share large amounts of information	Utilize computer software to manage and share large amounts of information
Use estimation techniques for time, costs, materials, resources, etc. required for projects	Use estimation techniques for time, costs, materials, resources, etc. required for projects
Understand and apply statistics and probabilities (mean, median, standard deviation)	Understand and apply statistics and probabilities (mean, median, standard deviation)
Have knowledge of basic business principles including supply/demand, market characteristics, profit and loss, make versus buy, ROI, etc.	Have knowledge of basic business principles including supply/demand, market characteristics, profit and loss, make versus buy, ROI, etc.
	Be familiar with various methods for depreciating equipment

Technologist 7.1.11 — Business/Engineering Ethics and Social Responsibility	Engineer 7.1.11 — Business/Engineering Ethics and Social Responsibility
Comply with ethics policies/standards of your employer and/or professional organization	Comply with ethics policies/standards of your employer and/or professional organization
Maintain confidentiality of company information and customer information	Maintain confidentiality of company information and customer information
As an individual, act in the best interest of your employee, your community, and the environment	As an individual, act in the best interest of your employee, your community, and the environment
Use company property in a proper manner in order to minimize loss, waste, or theft	Use company property in a proper manner in order to minimize loss, waste, or theft
Do not accept bribes or kickbacks from customers or colleagues	Do not accept bribes or kickbacks from customers or colleagues
Strive to provide quality and customer satisfaction to your customer base	Strive to provide quality and customer satisfaction to your customer base
Strive to minimize waste when developing processes — develop with the intent to conserve energy and reduce carbon footprint	Strive to minimize waste when developing processes — develop with the intent to conserve energy and reduce carbon footprint

Technologist 7.1.12 — Standards, Laws, and Regulations	Engineer 7.1.12 — Standards, Laws, and Regulations
Keep abreast of current laws, standards, and regulations	Keep abreast of current laws, standards, and regulations
Comply with regulations, including but not limited to, industry, local, federal, safety, and environmental.	Comply with regulations, including but not limited to, industry, local, federal, safety, and environmental.

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Technologist 8.1.1 — Interpersonal Skills	Engineer 8.1.1 — Interpersonal Skills
Show respect for co-workers	Show respect for co-workers
Listen respectfully to opinions of others from various backgrounds and cultures	Listen respectfully to opinions of others from various backgrounds and cultures
Keep an open mind when dealing with people from backgrounds/cultures different from your own	Keep an open mind when dealing with people from backgrounds/cultures different from your own
Strive to be an effective team member in order to achieve goals of the company	Strive to be an effective team member in order to achieve goals of the company
Maintain honest and open working relationships with supervisors and co-workers	Maintain honest and open working relationships with supervisors and co-workers
Influence and motivate others (through your actions) to work toward company objectives	Influence and motivate others (through your actions) to work toward company objectives
Be open to considering new ways to accomplish company goals	Be open to considering new ways to accomplish company goals
Act in a courteous and professional manner when dealing with customers or colleagues	Act in a courteous and professional manner when dealing with customers or colleagues
Solve problems by using critical-thinking skills	Solve problems by using critical-thinking skills

Technologist 8.1.2 — Negotiating & Conflict Management	Engineer 8.1.2 — Negotiating & Conflict Management
Strive for "win-win" in negotiation process	Strive for "win-win" in negotiation process
Treat others fairly and with respect	Treat others fairly and with respect
Act in a professional manner at all times	Act in a professional manner at all times
Be open to considering new ways to accomplish company goals	Be open to considering new ways to accomplish company goals
Be objective and do not take things personal	Be objective and do not take things personal
Focus on the problem and work toward consensus	Focus on the problem and work toward consensus
Be open to considering new ways to accomplish company goals	Be open to considering new ways to accomplish company goals
Face conflicts directly and have both parties work through the disagreement	Face conflicts directly and have both parties work through the disagreement
Compromise during conflict management process, if necessary, so that both parties feel like they have gained in the process	Compromise during conflict meeting so that both parties feel like they have gained in the process
Deal calmly and professionally with conflict	Deal calmly and professionally with conflict

Technologist 8.1.3 — Presentation Skills & Oral Communication	Engineer 8.1.3 — Presentation Skills & Oral Communication
Evaluate audience and tailor specific communication to audience	Evaluate audience and tailor specific communication to audience
Use available software to convey clear messages	Use available software to convey clear messages
Utilize clear and unambiguous language for communicating with others	Utilize clear and unambiguous language for communicating with others
Plan oral presentations to ensure successful delivery of message	Plan oral presentations to ensure successful delivery of message
Make use of graphs, bar charts, pie charts, etc. to clarify message	Make use of graphs, bar charts, pie charts, etc. to clarify message
Strive to be an active and effective listener	Strive to be an active and effective listener
Focus on messages from others instead of formulating a response	Focus on messages from others instead of formulating a response
Remain unbiased when communicating with people of different cultures or backgrounds	Remain unbiased when communicating with people of different cultures or backgrounds
Communicate clearly all thoughts, ideas, and suggestions in a well-organized (logical, coherent) persuasive manner (correct spelling, punctuation, and appropriate grammar is expected)	Communicate clearly all thoughts, ideas, and suggestions in a well-organized (logical, coherent) persuasive manner (correct spelling, punctuation, and appropriate grammar is expected)

TECHNOLOGIST

ENGINEER

Technologist 8.1.4 — Written Communication Skills	Engineer 8.1.4 — Written Communication Skills
Evaluate audience and tailor specific communication to audience	Evaluate audience and tailor specific communication to audience
Use available software to convey clear messages	Use available software to convey clear messages
Utilize clear and unambiguous language for communicating with others	Utilize clear and unambiguous language for communicating with others
Make use of graphs, bar charts, pie charts, etc. to clarify message	Make use of graphs, bar charts, pie charts, etc. to clarify message
Create documents including letters, manuals, flow charts, reports, graphs, and work instructions.	Create documents including letters, manuals, flow charts, reports, graphs, and work instructions.
Use brief but succinct written communication to provide details concerning work-related matters	Use brief but succinct written communication to provide details concerning work-related matters
Communicate results through formal reports (as required)	Communicate results through formal reports (as required)
Write coherently so as to avoid confusion — proofread	Write coherently so as to avoid confusion — proofread
Prepare technical reports	Prepare technical reports

Technologist 8.1.5 — Innovation & Creativity	Engineer 8.1.5 — Innovation & Creativity
Show innovation and creativity when helping others solve problems	Show innovation and creativity when helping others solve problems
Be inquisitive and ask why	Be inquisitive and ask why
Follow industry and market changes to help with creation of new ideas	Follow industry and market changes to help with creation of new ideas
Be open-minded, look for the unexpected, and be willing to take risks	Be open-minded, look for the unexpected, and be willing to take risks
Identify and share sources of information relevant to new methodologies, technologies, tools, machine tools, materials, etc.	Identify and share sources of information relevant to new methodologies, technologies, tools, machine tools, materials, etc.
Comply with intellectual property laws (trademarks, patents, copyrights)	Comply with intellectual property laws (trademarks, patents, copyrights)
Draw conclusions from relevant data supplied (information may be lacking) by using logic and reasoning	Draw conclusions from relevant data supplied (information may be lacking) by using logic and reasoning
Use various sources (including the internet) to locate information needed — evaluate information for relevance and completeness before sharing with colleagues	Use various sources (including the internet) to locate information needed — evaluate information for relevance and completeness before sharing with colleagues
Protect trade secrets	Protect trade secrets

Technologist 8.1.6 — Learning & Knowledge	Engineer 8.1.6 — Learning & Knowledge
Keep abreast of new technology	Keep abreast of new technology
Hold an active membership in professional organization(s)	Hold an active membership in professional organization(s)
Attend relevant training/seminars sponsored by vendors or customers	Attend relevant training/seminars sponsored by vendors or customers
Partake in lifelong learning to benefit yourself and your employer	Partake in lifelong learning to benefit yourself and your employer
Take advantage (full participation) of company sponsored training	Take advantage (full participation) of company sponsored training
Maintain certifications, as required, through testing, or acquiring needed PDUs, CEUs, etc.	Maintain certifications, as required, through testing, or acquiring needed PDUs, CEUs, etc.
Seek learning and knowledge by setting challenging goals in your field of expertise	Seek learning and knowledge by setting challenging goals in your field of expertise