



October 19, 2018

Dear Educator Colleagues,

The Vermont Talent Pipeline Management (VTPM) program is a statewide initiative developed by the US Chamber of Commerce Foundation to fill the skills gap, by implementing lessons from supply-chain management, in which we serve employers as “end-customers”. In this model, we share employer demand data with education providers, with the goal of aligning training for the most critical jobs. To that end, we invite you to share the attached information with any additional educational partners delivering training for the Manufacturing careers identified.

The enclosed two-year forecast for the most critical jobs in **Advanced Manufacturing** careers was developed by the VTPM’s Manufacturing Employer Collaborative. This vital information is provided to inform educational program development and alignment with the time-sensitive needs of the state’s manufacturing industry. It is intended to complement the work of the Vermont Agency of Education and is not meant as a complete representation of manufacturing jobs in Vermont.

The VTPM model relies on the education community to support the needs of industry with training. If your organization can provide programs to fulfill the attached requirements for: Production Assembler/Operator; CNC Machinist; Equipment Maintenance Technician; Team Leader, or Engineer, then we want to hear from you. Please respond in writing by November 15, 2018 with a **letter of intent** to provide an aligned training proposal with the job requirements attached. Thank you for your time and consideration for this important work.

Respectfully Submitted,

A handwritten signature in blue ink that reads "Mary Anne Sheahan". The signature is written in a cursive, flowing style.

Mary Anne Sheahan
Executive Director, Vermont Talent Pipeline
Vermont Business Roundtable

Attachments:

- I. Survey Methodology and Highlights
- II. Job Category Summary
- III. VTPM Adv Manufacturing Needs Assessment Survey Data

Survey Methodology

The Vermont Talent Pipeline invited Advanced Manufacturing industry employers to participate in a collective impact model for talent development. Thirty-four employers voluntarily agreed to participate in the demand planning process, involving consensus on the most critical jobs, and a needs assessment forecast and requirements survey. The survey ran from August 1 through August 21, 2018 and enjoyed a 100% participation rate among employers, who are located throughout all parts of the state. Manufacturing employers were asked to provide details on projections for new and replacement jobs, which they identified as critical to their operating ability and growth potential. Respondents were also asked to rate the importance of specific Competencies, Employability skills, Education, and Industry Credentials for each of the five most critical jobs, identified as:

1. Production Assembler/Operator
2. CNC Machinist
3. Equipment Maintenance Technician
4. Team Leader
5. Engineer (Design/Manufacturing)

Assumptions for the survey were defined by employers as: The job forecast is for the period of July 2018 – July 2020. The **New** Jobs Forecast represents planned or anticipated industry growth. The **Replacement** Jobs Forecast represents attrition/turnover and retirements.

Survey Highlights

- **1381 jobs** are forecast in the next two years among 34 employers.
- 448 (or 33%) of these jobs represent **new hires** due to industry growth potential.
- 933 (or 67%) of jobs represent **replacement hires**, due to attrition and retirements.

Advanced Manufacturing Employers explained the hiring need with the following foundational comments:

1. There is a general lack of industry and career knowledge of high-paying, high-quality manufacturing jobs among the labor market.
2. Every critical job has an entry gate of employability skill, the threshold for hiring.
3. A lack of locally available workforce and training has led employers to create non-standard, in-house programs to upskill employees who demonstrate employability skills and other technical abilities.
4. The shortage of available workers results in lack of both entry-level and trained supervisor-level staff members.
5. An aging workforce with a high number of retirements, results in a large number of replacement jobs at all levels.

Job Category Summary

1. Production Assembler/Operator

The largest need in the industry is for entry level workers in Production. Two types of Production jobs are described by employers - Assemblers and Operators. This is the entry point for new employees who bring employability skills as their primary talent and skill set. Onboarding an employee with employability skills can range from 30 days to 12+ months (for more advanced production like electro-mechanical assemblers), to reach full productivity. Onboarding a production operator can be longer, depending on the production technology involved.

For the more advanced manufacturing operation, skill and/or experience in electro-mechanical operations is helpful, like those of the Certified Production Technician (CPT). Employers also value the skilled assembler/operator who displays an understanding of Lean principles. Lean practices help to reduce waste, improve efficiency, and measure quality. Additionally, some employers provide training as Certified Production Technicians (CPT) as a means of development and professional growth within an organization.

2. CNC Machinists

The number of CNC machinists forecast is described by employers as “artificially low”, primarily because most companies are currently training/developing CNC Machinists in-house. Some employers are up-skilling as many as 30 production workers to CNC Machinists in-house in a year. Employers typically promote production workers and train them as CNC Machinists, if they show strong employability, problem-solving and aptitude for mechanical skill.

CNC Machinist training is commonly developed and performed in-house by a technically strong existing machinist. In fact, employers estimated that 2 out of 3 CNC Machinist are homegrown. This indicates that the number of CNC Machinists could be **3 times the forecast** (or about 175) number. A self-identified shortcoming of in-house training is the teaching skill of the trainer, who may be a technically strong Machinist. The quality of in-house training is not consistent or standard between companies or trainers. The in-house onboarding process for a CNC Machinist is about 3-9 months depending on experience.

There’s a significant opportunity for well-paying jobs, including expanded opportunities for **women** in this field.

The Competencies described by the **Certified Production Technician (CPT)** credential closely mirror the skills needed for a CNC Operator. Specific in-house machine and technology training

will supplement a CPT credential. Also described as a potential value for further research and evaluation by employers is the **NIMS Industrial Maintenance Certification - Machining Level 1** competencies, and how they differ from those of the CPT program. Programs like these are anticipated to come from Career and Technical Education Centers and Technical College programs as a credential of value, and with potential for college credits. A 4-year college degree is not a requirement.

3. Equipment Maintenance Technicians

Much like the CNC Operators, Maintenance Technicians are typically promoted from the incumbent Production workforce and trained in-house to work on specific machines. Maintenance Techs need to understand (or learn) mechanical and electrical systems. This job requires shift work to keep machines running in production. Maintenance Techs routinely perform preventive maintenance and troubleshooting. Shift pay differentials have not kept pace with need, resulting in a high turnover rate among the incumbent workforce (about 2/3 of Maintenance Techs turn over in 2 years). People who have worked with machines and heavy equipment are well suited for this role, particularly if they have strong communication, critical thinking, and problem-solving skills.

With a lack of Maintenance Technicians in the workforce, in-house training has been conducted by most employers, which can run about 10-12 weeks in a formal training environment – more, in an informal training environment. Employers look to training programs at Career and Technical Education Centers and Technical College programs for the **Certified Production Technician** and **Industrial Maintenance Certification** in potential employees.

4. Team Leader

Team leaders are also usually promoted from incumbent workers in production employment. It is unusual for a company to hire a team leader from outside the company because many production staff members have more technical experience. However, hiring this role from outside is not unheard of when the employee has prior demonstrated experience.

Employers would embrace leadership training for critical thinking; trouble shooting; providing feedback; motivating teams; etc. - AND would look for ways to implement performance of this learning on the job. Additional technical competencies are highly valued in Lean manufacturing, Quality, and Inspection. Typically, training for this role has not occurred formally, but in some situations, has been provided by outside leadership development programs. While these leadership trainings are valuable in content, they frequently lack practical application on the job internally. Internal or external, leadership training requires a committed upper leadership and curriculum to ensure practical application and success on the job.

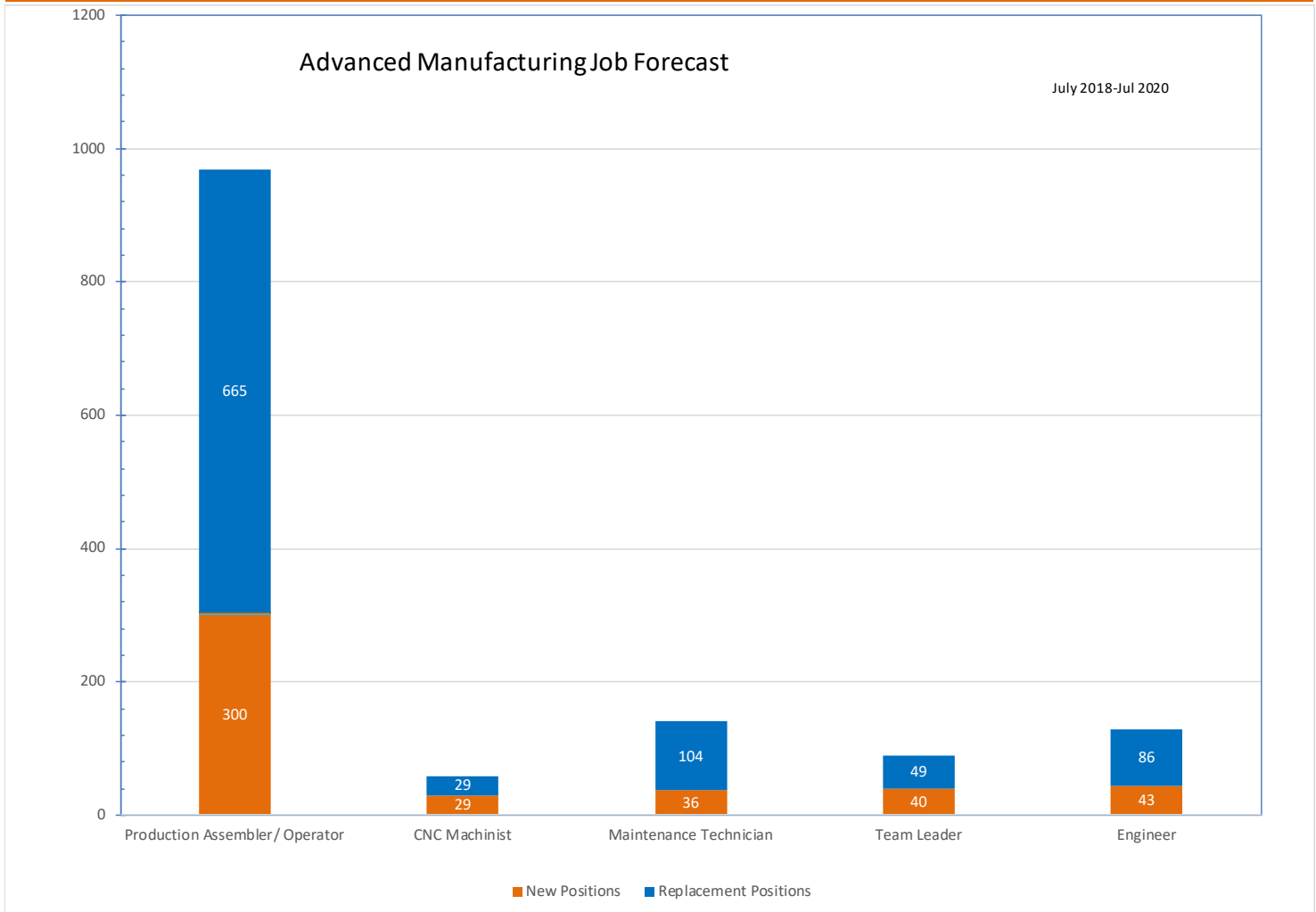
5. Engineers

Engineers are among the most critical jobs - and are already in short supply. Employers estimate the demand for engineers growing by 10-50% per year. Some engineering positions are posted and vacant for 2 years or more. The highest demand falls into two major categories: Design Engineers and Manufacturing Engineers. Design Engineers include mechanical, electrical and software engineers - with technical skills in CAD software; Solidworks; Mat Lab; Altium; and/or Circuit design. Manufacturing (or Process) Engineers support production using continuous improvement; safety; quality; time studies; and other operational efficiencies and functionality.

These skills are expected to be learned in bachelor's degree programs WITH some job experience (or internships), prior to hiring. Engineering degree candidates may also be identified from an incumbent workforce, and begin as apprentices, or with stackable credentials. Currently, practical experience for Engineering graduates is not developed enough for employers. However, most employers shared a willingness to train and pay interns, to gain field experience and demonstrate competencies and results in a work environment.

Some employers have hired engineers from other countries, using an H1B visa. While employers must show proof of inability to hire for certain skills to sponsor a foreign engineering employee, the financial cost/risks of sponsorship are high. The current political administration limits the number of foreign workers – and uses a lottery system. Employers who work on Federal or defense contracts are unable to hire engineers who are not US citizens.

Vermont Talent Pipeline Manufacturing Employer Collaborative



Position	New Positions	% New Positions	Replacement Positions	% Replacement Positions	Total Positions	% Total	# Employers
Production Assembler/ Operator	300	67%	665	71%	965	70%	34
CNC Machinist	29	6%	29	3%	58	4%	34
Maintenance Technician	36	8%	104	11%	140	10%	34
Team Leader	40	9%	49	5%	89	6%	34
Engineer	43	10%	86	9%	129	9%	34
	448		933		1381		

Production Assembler/Operator Job Requirements

Competencies	Value to Employer				
Follows detailed assembly procedures with accuracy	92%				
Possesses Manual dexterity to handle and move products	88%				
Exhibits Knowledge of Quality Control processes	80%				
Detects and troubleshoots non-conformities	76%				
Performs in-process inspections	76%				
Uses hand, power and bench tools properly	75%				
Analyzes information to solve problems	68%				
Displays Mechanical Knowledge of Machines and Tools	67%				
Possesses Knowledge of production process using raw materials	65%				
Inspects equipment, structures and materials	64%				
Controls machine precision	63%				
Understands basics of Lean Manufacturing	62%				
Exhibits skills in Mathematics, including Algebra and Geometry	58%				
Displays basic computer system skills, including Office software and email	58%				
Performs acceptance test procedures	58%				
Employability Skills	Value to Employer				
Positive attitude and behavior	96%				
Accountable for work products	94%				
Detail oriented and accurate	93%				
Respectful and patient	90%				
Collaborative and flexible	90%				
Use appropriate strategies for dealing with conflict	87%				
Use appropriate strategies and solutions for dealing with conflicts	82%				
Problem Solver	78%				
Knowledgeable	75%				
Lifelong learner	72%				
Education	Preferred	Required	Neither		
High School General Education	42%	52%	6%		
High School Technical Education	79%	6%	15%		
Post-secondary Technical Education	42%	0%	58%		
Associates Degree	21%	0%	79%		
Bachelor's Degree	6%	0%	94%		
Credentials	Preferred	Required	Neither		
Certified Production Technician	48%	0%	52%		
Lean Certification (Bronze)	39%	0%	61%		
Lean Six Sigma (Yellow Belt)	27%	0%	73%		
Geometric Dimensioning and Tolerance Professional	21%	0%	79%		
J Standard Soldering	12%	3%	85%		
NIMS core	9%	0%	91%		
Work Experience	No Requirement	< 1 Year	2-3 Years	4-5 Years	>5 Years
Entry Level - Required Experience	76%	18%	6%	0%	0%
Entry Level - Preferred Experience	27%	24%	48%	0%	0%
Mid Level - Required Experience	21%	12%	55%	12%	0%
Mid Level - Preferred Experience	12%	0%	55%	27%	6%
Senior Level- Required Experience	12%	0%	18%	45%	24%
Senior Level - Preferred Experience	9%	0%	6%	24%	61%

CNC Machinist Job Requirements

Competencies	Value to Employer				
Provides safe machine operations and environment	93%				
Measures dimensions and conformance to specifications	88%				
Controls machines and processes	86%				
Develops constructive and cooperative working relationships	84%				
Handles, moves and manipulates objects	83%				
Inspects equipment, structures and materials	81%				
Analyzes quality control and make adjustments	81%				
Obtains information from relevant sources	79%				
Identifies, selects and uses appropriate tools and technological solutions	78%				
Demonstrates math abilities in algebra, geometry and higher levels	76%				
Utilizes manufacturers technical data references	73%				
Use Computer Technologies - CAD, CAM, Solidworks	66%				
Employability Skills	Value to Employer				
Attention to detail	97%				
Demonstrate respect for people, property and time	96%				
Interacts positively with peers and supervisors	95%				
Accountable for product outcomes	95%				
Dependable and ethical	94%				
Communication skills with co-workers and supervisors	92%				
Cooperation	90%				
Comprehension of relevant materials and policies	86%				
Uses appropriate strategies for dealing with conflict	86%				
Uses appropriate strategies and solutions for dealing with conflict	85%				
Patience and self-control	84%				
Conflict resolution	83%				
Education	Preferred	Required	Neither		
High School General Education	43%	43%	13%		
High School Technical Education	74%	22%	4%		
Post-secondary Technical Education	70%	4%	26%		
Associates	17%	0%	83%		
Bachelors	4%	0%	96%		
Credentials	Preferred	Required	Neither		
Certified Production Technician	65%	4%	30%		
Lean Certification (Bronze)	48%	4%	48%		
NIMS Machining Level 2	43%	0%	57%		
Certified Control Systems Technician	39%	4%	57%		
NIMS Machining Level 1	39%	9%	52%		
Certified Automation Professional	35%	4%	61%		
Lean Certification (Silver)	26%	0%	74%		
Control Systems Engineer License	17%	0%	83%		
Lean Six Sigma (Green Belt)	13%	4%	83%		
Work Experience	No Requirement	< 1 Year	2-3 Years	4-5 Years	>5 Years
Entry Level - Required Experience	30%	48%	22%	0%	0%
Entry Level - Preferred Experience	26%	13%	43%	17%	0%
Mid Level - Required Experience	17%	9%	43%	30%	0%
Mid Level - Preferred Experience	13%	0%	39%	30%	17%
Senior Level- Required Experience	17%	0%	9%	30%	43%
Senior Level - Preferred Experience	9%	0%	4%	9%	78%

Equipment Maintenance Technician Job Requirements						
Competencies		Value to Employer				
Performs preventive maintenance activities		95%				
Exhibits mechanical abilities, based on experience		94%				
Maintains high quality standards for production equipment		93%				
Identifies and defines problems		91%				
Generates and evaluates possible solutions		90%				
Runs tests to diagnose problems and develop potential solutions		83%				
Runs physical inspections and calibrations on a documented schedule		82%				
Utilizes Total Productive Maintenance methods		78%				
Applies scientific principles to solve problems and complete tasks		76%				
Measures performance and conversions to generate threshold tolerance		69%				
Reads blueprints and plans		69%				
Employability Skills		Value to Employer				
Attention to detail		96%				
Communicate problems to appropriate personnel		96%				
Interact professionally and respectfully with others		95%				
Accountable for work products and outcomes		93%				
Proactive		89%				
Establish trust among others		89%				
Use appropriate strategies and solutions for dealing with conflicts and differences to maintain a smooth workflow.		86%				
Uses appropriate strategies for dealing with conflict		86%				
Active listening and consideration of other viewpoints		83%				
Read and comprehend documents ranging from simple and straightforward, to more complex and detailed		83%				
Critical review, analysis, comparison and interpretation of information		82%				
Speak clearly, in precise language and in a logical manner		81%				
Add, subtract, multiply and divide whole numbers, fractions, decimals and percents		80%				
Use scientific method to identify problems, collect information, form opinions and draw conclusions		79%				
Computer, software and technology skills		77%				
Recognize and interpret verbal and non-verbal cues		72%				
Education		Preferred	Required	Neither		
High School General Education		38%	52%	10%		
High School Technical Education		79%	21%	0%		
Post-secondary Technical Education		59%	17%	24%		
Associates		31%	7%	62%		
Bachelors		7%	7%	86%		
Masters		0%	3%	97%		
Credentials		Preferred	Required	Neither		
Certified Production Technician		69%	3%	28%		
NIMS Industrial Maintenance Certification		52%	0%	48%		
Total Productive Maintenance Certification		38%	10%	52%		
Certified Control Systems Technician		34%	3%	62%		
Lean Six Sigma (Green Belt)		34%	0%	66%		
Certified Calibration Technician		31%	7%	62%		
Certified Automation Professional		31%	0%	69%		
Quality Technician Certification (ASQ)		28%	0%	72%		
Certified Manufacturing Technologist		24%	3%	72%		
Lean Certification (Silver)		24%	0%	76%		
Lean Certification (Gold)		21%	0%	79%		
Certified Manufacturing Engineer		14%	0%	86%		
Control Systems Engineer License		14%	0%	86%		
Work Experience		No Requirement	< 1 Year	2-3 Years	4-5 Years	>5 Years
Entry Level - Required Experience		28%	21%	48%	3%	0%
Entry Level - Preferred Experience		10%	7%	69%	10%	3%
Mid Level - Required Experience		3%	0%	55%	41%	0%
Mid Level - Preferred Experience		3%	0%	17%	69%	10%
Senior Level- Required Experience		3%	0%	10%	21%	66%
Senior Level - Preferred Experience		3%	0%	7%	3%	86%

Team Leader Job Requirements

Competencies	Value to Employer				
Enforces safety in production	96%				
Communicates with all levels of workers (top to bottom)	93%				
Coordinates activities of production and operations	91%				
Develops and trains staff members	87%				
Ensures sanitation/Clean in Place of workspaces	84%				
Monitors processes, materials and surroundings	83%				
Plans work schedules and assignments to meet production goals	82%				
Plans production sequences to meet production goals	79%				
Inspects materials and products to detect defects	79%				
Documents processes	76%				
Exhibits Lean Manufacturing expertise	75%				
Manages data and reporting	75%				
Coordinates activities between departments	74%				
Inspects equipment for proper use and maintenance	70%				
Enforces Total Productive Maintenance methods	70%				
Employability Skills	Value to Employer				
Accountable for work product outcomes	94%				
Active listening	94%				
Understanding the organization and culture	90%				
Oral expression	89%				
Use of appropriate strategies for dealing with conflict	89%				
Demonstrated leadership qualities	88%				
Critical thinking and problem solving	86%				
Problem sensitivity	85%				
Coordination of logistics and activities	84%				
Human resource management of personnel	76%				
Speaks well in a group setting	74%				
Education	Preferred	Required	Neither		
High School General Education	39%	57%	4%		
High School Technical Education	68%	11%	21%		
Post-secondary Technical Education	57%	11%	32%		
Associates	46%	7%	46%		
Bachelors	29%	4%	68%		
Masters	4%	0%	96%		
Doctorate	0%	0%	100%		
Credentials	Preferred	Required	Neither		
Lean Certification (Silver)	54%	0%	46%		
Certified Quality Inspector (ASQ)	46%	0%	54%		
Total Productive Maintenance Certification	39%	0%	61%		
Lean Certification (Gold)	36%	4%	61%		
Lean Six Sigma (Green Belt)	36%	4%	61%		
CIP - Clean in Place	25%	4%	71%		
Lean Six Sigma (Black Belt)	25%	4%	71%		
Geometric Dimensioning and Tolerance Professional	18%	4%	79%		
Work Experience	No Requirement	< 1 Year	2-3 Years	4-5 Years	>5 Years
Entry Level - Required Experience	14%	25%	61%	0%	0%
Entry Level - Preferred Experience	7%	4%	79%	7%	4%
Mid Level - Required Experience	7%	4%	46%	43%	0%
Mid Level - Preferred Experience	7%	4%	14%	68%	7%
Senior Level- Required Experience	7%	4%	7%	36%	46%
Senior Level - Preferred Experience	7%	0%	7%	11%	75%

Engineer Job Requirements						
Competencies		Value to Employer				
Designs and develops products to specifications		91%				
Applies structured problem-solving and decision-making tools and methods		89%				
Interfaces with collaborating groups to prototype designs		86%				
Produces assembly design and layout from concept through completion		85%				
Applies math skill to analyze performance data		85%				
Measures and improves the quality of products and systems		85%				
Develops and verifies compliance test plans and procedures		81%				
Documents process through fabrication		81%				
Reads and applies complex technical regulatory design and performance requirements		81%				
Knowledge and use of Lean Fundamentals		78%				
Trains production staff to build new products and use new processes		77%				
Interfaces with suppliers on component specification an		73%				
Analyzes financial information to develop and support conclusions		71%				
Creates 3D CAD models, bills of material and engineering drawings		70%				
Creates 2D process and instrumentation drawings		60%				
Employability Skills		Value to Employer				
Positive attitude		94%				
Dilligent, thorough and goal-oriented		94%				
Prioritizes multiple tasks and projects		93%				
Self motivated		91%				
Proficient in computer technologies, including office software		88%				
Interpersonal skills		88%				
Written and verbal skills		88%				
Team contributor		87%				
Cost conscious, weighing quality, value and risk		86%				
Writing ability for reports, correspondence and procedures		83%				
Mechanical abilities		81%				
Proficient in Computer Aided Design Technologies		76%				
Proficient in programming and development technologies		74%				
Presentation skills		71%				
Proficient in Enterprise Resource Planning (ERP) software		69%				
Education		Preferred	Required	Neither		
High School General Education		10%	81%	10%		
High School Technical Education		35%	19%	45%		
Post-secondary Technical Education		32%	26%	42%		
Associates		29%	35%	35%		
Bachelors		32%	65%	3%		
Masters		45%	3%	52%		
Doctorate		6%	0%	94%		
Credentials		Preferred	Required	Neither		
Geometric Dimensioning and Tolerance Professional (ASME)		52%	10%	39%		
Statistical Process Control		52%	3%	45%		
AutoCAD Certified		52%	10%	39%		
SME Certified Manufacturing Engineer		48%	10%	42%		
Lean Six Sigma (Green Belt)		48%	10%	42%		
Lean Certification (Silver)		45%	3%	52%		
Solidworks Professional		42%	19%	39%		
Lean Six Sigma (Black Belt)		39%	0%	61%		
Lean Certification (Gold)		29%	10%	61%		
Navisworks Certified		19%	0%	81%		
Mechanical Electrical Plumbing (MEP) Engineer		10%	3%	87%		
Work Experience		No Requirement	< 1 Year	2-3 Years	4-5 Years	>5 Years
Entry Level - Required Experience		26%	39%	35%	0%	0%
Entry Level - Preferred Experience		3%	19%	71%	3%	3%
Mid Level - Required Experience		6%	0%	35%	52%	6%
Mid Level - Preferred Experience		3%	0%	19%	58%	19%
Senior Level- Required Experience		6%	0%	3%	13%	77%
Senior Level - Preferred Experience		3%	0%	3%	3%	90%