



Manufacturing Core Competencies Guide

September 13, 2013

Employer			Eligibility	Suitability	Training Plan				
Job Forecasting	Job Posting	Other			Career Plan	Expanded Bridge	Optional Training	Technical Training	Job Openings & Placements
x	x	X				X	X	X	X

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What are the Manufacturing Core Competencies?

The Illinois Manufacturing Learning Exchange and the Illinois Network for Advanced Manufacturing (INAM) have adopted the National Association of Manufacturing (NAM) endorsed national skills certification framework for all major manufacturing career pathways including those for production and maintenance-related occupations. The INAM has developed a set of “terminal objectives” to be used in manufacturing education and training programs based on the standards and certifications included in the NAM-endorsed system including:

- Manufacturing Skill Standards Council (MSSC)
- National Institute for Metalworking Skills (NIMS)
- American Welding Society (AWS)

For purposes of this initiative, “core competencies” is an equivalent term to the INAM “Terminal Objectives”. The core of the initiative is the initial and ongoing engagement with employers to determine and clarify occupational competencies using the INAM Terminal Objectives. Nearly half of the state’s community colleges (21) are engaged in INAM and have access to staff that are familiar with the Terminal Objectives.

There are five sets of INAM Terminal Objectives which cover a majority of the jobs that employers might have available. These represent standards-based core competencies that cover the most common competencies across employers. Some employers may require all or just some of these and may have additional competency requirements that can be added, but

should be described in similar language and format to ensure consistency within and across regions. Below are the five occupational categories this project is to focus on:

Occupational Categories Crosswalk	
INAM Categories	ATIM Categories
1. Certified Production Technician	Machine Operator
2. Industrial Maintenance	Mechatronics
3. Mechatronics	Mechatronics
4. Welding (Metalwork)	Welding
5. Precision Machining Computer Numerical Control (CNC)	Machine Operator
	Logistics/Inventory

How Should Core Competencies Be Used in ATIM?

- Determine employer competency requirements for targeted occupations.
- Develop Personalized Employment and Training Plans for addressing the competency requirements.
- Deliver customized training based on these plans.
- Use regional “employer- validated “core competencies for all the Personalized Training and Employment Plans (PTEP)and training programs.

Core Competencies and the Employer

Follow the steps outlined below for all occupational categories.

Core Competencies and the Employer Steps	Related ATIM Tools	Related Worksheet¹
1. Begin with your targeted employers.		
2. Meet with each employer to determine current and projected openings in targeted occupations. This information needs to be entered into the ATIM/Illinois workNet system.	<ul style="list-style-type: none"> • Job Forecasting • Job Openings 	<ul style="list-style-type: none"> • Job Forecasting and Openings Checklist
3. Review the core competencies for these occupations with each employer. Begin with the core competencies to ensure a		<ul style="list-style-type: none"> • Employer Occupational Title and Competency Crosswalk Worksheet • Employer Occupational

¹ All worksheets are available only to ATIM partners through the ATIM Guide on the website.

Core Competencies and the Employer Steps	Related ATIM Tools	Related Worksheet¹
common framework and language.		Title and Competency Crosswalk Worksheet
4. Add additional competencies to the competency lists based on the employer's input using similar writing style as the core competencies.		<ul style="list-style-type: none"> • Employer Occupational Title and Competency Crosswalk Worksheet
5. Enter the employer competencies into ATIM.	<ul style="list-style-type: none"> • Competency Lists 	<ul style="list-style-type: none"> • Employer Occupational Title and Competency Crosswalk Worksheet
6. Use the competency data from all targeted employers to determine what competencies are most common for each occupation and could be shared across all training plans and which ones are unique to different employers and require customization.	<ul style="list-style-type: none"> • Competency Lists • Reports 	<ul style="list-style-type: none"> • Employer Occupational Title and Competency Crosswalk Worksheet
7. Use the job forecasting/opening tools and competency crosswalk report for working with employers and for tracking and categorizing the occupations and core competencies.	<ul style="list-style-type: none"> • Job Forecasting • Job Openings • Competency Lists • Reports 	
8. Work with employers to update and align occupations with the core competencies identified by the targeted employers. (Ongoing Process)	<ul style="list-style-type: none"> • Competency Lists 	<ul style="list-style-type: none"> • Manufacturing Core Competencies ATIM Initiative Guide • Employer Occupational Title and Competency Crosswalk Worksheet

Core Competencies and the Personalized Training Plan

The core competencies validated through your employers need to be included in the PTEP based on the individual's occupational interests and skills AND most importantly – the employer's core competencies for that particular occupation described above.

Core Competencies/Personalized Training Plan Steps	Related ATIM Tools	Related Worksheet
1. Identify the appropriate competencies that have been identified by your employers; if occupational objectives are not in core competencies– write the competencies in the style of the outlines; they need to be: <ul style="list-style-type: none"> • documentable, • demonstrable, and • measurable. 	<ul style="list-style-type: none"> • Personal Training Plan • Competency Lists 	<ul style="list-style-type: none"> • Employer Occupational Title and Competency Crosswalk Worksheet
2. Remember that the competencies will carry through and align across the various training options.	<ul style="list-style-type: none"> • Personal Training Plan • Competency Lists • Reports 	<ul style="list-style-type: none"> • Employer Occupational Title and Competency Crosswalk Worksheet
3. Competencies can be revised if the needs of the employer change, but then needs to be followed through all of the training steps to ensure alignment.	<ul style="list-style-type: none"> • Personal Training Plan • Competency Lists 	<ul style="list-style-type: none"> • Employer Occupational Title and Competency Crosswalk Worksheet
4. Document competencies student indicates they have already met.	<ul style="list-style-type: none"> • Personal Training Plan • Competency Lists 	
5. Use the core competencies to develop personalized competency checklists.	<ul style="list-style-type: none"> • Personal Training Plan • Competency Lists 	

Core Competencies and Training

The following are various combinations of training –all of which have two things in common – (1) they all have the PTEP as a foundation and (2) they should all lead to employment:

- Classroom only
- On-the-Job Training (OJT) only
- Work Experience (WE) only
- Classroom with some combination of OJT and Work Experience
- Classroom with OJT only
- Classroom with Work Experience only
- Classroom to employment
- Directly to employment

You will use the ATIM personalized training plan to identify all of the potential training experiences using all of the above options.

Classroom Training

It is important to ensure that the core competencies are embedded in the curriculum and clearly articulated by indicating in writing where there is alignment between the curriculum and the competencies. **There needs to be formalized coordination/ongoing dialogue between the training providers, the program manager, and the employers to ensure the competencies are utilized across the entire life of the training leading to employment.**

Classroom Training Steps	Related ATIM Tools	Related Worksheet
1. Create a crosswalk showing the direct links between course content and competencies. <ul style="list-style-type: none"> ○ The majority of the time there will be competencies from more occupational area core competencies in a single course and/or across courses. 		
2. The training provider must align the course with the employer’s core competencies – not the other way around.		
3. The training provider should clarify: <ul style="list-style-type: none"> ○ How these course objectives align with the competencies; this is where acceleration comes into play and should lead to training customization. ○ How it will determine which competencies to use to determine success and the ability to move into OJT, WE, Internship, and/ or employment -MUST BE BASED ON EMPLOYER NEED AND REQUEST. ○ Show how the competencies will be met if the course is compressed and/or open entry-open exit. ○ How the competencies will be 	<ul style="list-style-type: none"> • Personal Training Plan/ Classroom Training Section 	<ul style="list-style-type: none"> • ATIM Team Guide for Creating and Using Personalized Training and Employment Plans

Classroom Training Steps	Related ATIM Tools	Related Worksheet
used in various classroom training options; online in-class, etc.; how the training will be adapted to the competencies curriculum for either credit or non-credit.		

On-the-Job Training

Definition – Training by the employer that is provided to a paid participant while engaged in productive work in a job that:

- *Provides knowledge or skills essential to the full and adequate performance of the job;*
- *Reimbursement to the employer of up to 90% of the wage rate of the participant, for the extraordinary costs of providing the training and additional supervision related to the training;*
- *And is limited in duration as appropriate to the occupation for which the participant is being trained, taking into account the content of the training, prior work experience of the participant, and the service strategy of the participant, as appropriate; and*
- *Uses the competencies checklists that follow the student throughout the life of the training to determine the student's suitability for the OJT.*

OJT Steps	Related ATIM Tools	Related Worksheet
1. In consultation with the employer, determine the required core competencies.	<ul style="list-style-type: none"> • Competency Lists 	<ul style="list-style-type: none"> • Employer Occupational Title and Competency Crosswalk Worksheet
2. Add other competencies if needed by the employer, but ensure that they will be included in the OJT by the trainer and that they are documentable, demonstrable, and measurable and that it is stated in the OJT contract. Link back to classroom training providers to ensure that revised competencies are reflected in curriculum.	<ul style="list-style-type: none"> • Competency Lists 	Employer Occupational Title and Competency Crosswalk Worksheet

OJT Steps	Related ATIM Tools	Related Worksheet
3. Use one or a variation of one of the attached OJT contract templates.		<ul style="list-style-type: none"> OJT Contract Templates
4. Indicate with the employer any competencies that can be documentable, demonstrable, and measurable based on classroom training or validation from the Individual Training Plan (ITP).	<ul style="list-style-type: none"> Personal Training Plan/ Placement Section 	<ul style="list-style-type: none"> ATIM Team Guide for Creating and Using Personalized Training and Employment Plans Employer Occupational Title and Competency Crosswalk Worksheet

Work Experience

Definition – A planned, structured learning experience that takes place in a workplace for a limited amount of work. Work experience may be paid or unpaid as appropriate. A work experience workplace may be in the private for-profit sector, the nonprofit sector or the public sector. It provides a person with the opportunity to gain the skills and knowledge necessary to perform a job, including work habits and behaviors, and which may be combined with classroom or other training.

Similar to OJT above. The goal is employment or the ability to move up to an OJT.

Work Experience Steps	Related ATIM Tools	Related Worksheet
1. Still requires in-depth discussion with employers.	<ul style="list-style-type: none"> Competency Lists 	<ul style="list-style-type: none"> Employer Occupational Title and Competency Crosswalk Worksheet
2. A great starting point for someone with basic manufacturing competencies – the student could participate in a work experience component while in classroom training.	<ul style="list-style-type: none"> Personal Training Plan/ Placement Section 	<ul style="list-style-type: none"> Employer Occupational Title and Competency Crosswalk Worksheet

Internship

Definition – Normally offered as part of an academic sequence; can be offered through an OJT or a Work Experience and be paid or unpaid. Certain internships may provide college credit.

Internship Steps	Related ATIM Tools	Related Worksheet
Still requires in-depth discussion with employers/training.	<ul style="list-style-type: none"> • Personal Training Plan/ Placement Section 	<ul style="list-style-type: none"> • ATIM Team Guide for Creating and Using Personalized Training and Employment Plans • Employer Occupational Title and Competency Crosswalk Worksheet

Competency Lists

Logistics/Inventory Core Competencies

Standard Occupational Classification Code (SOC Code)

43-5032	Dispatchers
11-3071	Transportation, Storage and Distribution Managers
43-1011	1st-Line Supervisors/Managers, Office and Administration Support Workers (Shipping & Receiving Manager, Supply Chain Manager, Import Coordinator)
13-1081	Logisticians (Logistics Coordinator, Logistics Planner, Logistics Analyst)
43-5071	Shipping, Receiving and Traffic Clerks (Shipping and Receiving Manager)
43-5061	Production, Planning, & Expediting Clerks (Production Planner, Production Scheduler)
11-3071	Transportation, Storage and Distribution Managers

NOTE: The competency list for Logistics/Inventory is not yet available. Once the list is created, this document will be updated. Check the ATIM Guide for updates.

Machine Operator Core Competencies

Standard Occupational Classification Code (SOC Code)

51-4011	Computer-controlled Mach Tool Operators
51-4012	Numerical Tool/process control Programmers
51-4041	Machinists

Precision Machining Computer Numerical Control (CNC)

1. Demonstrate knowledge of basic OSHA requirements, general shop safety, and machine tool safety procedures.
2. Interpret basic part prints and/or technical drawing including Geometric Dimensioning and Tolerancing (GD & T) and apply the information as it relates to gauging, dimensioning, and tolerancing.
3. Apply a working knowledge of basic measuring and inspection tools and use appropriate measuring devices to confirm a part's compliance to required specifications including GD&T symbols.
4. Perform conversion, computations, and calculations that result in parts production to specific industry standards and specifications.
5. Demonstrate entry-level skills to setup and operate machine tools.
6. Interpret CNC G & M code programs and apply editing procedures as needed.
7. Use basic communication skills (reading, writing, speaking, and listening) to understand technical manuals and written work instructions while interacting well in a team/group environment.
8. Demonstrate use of basic math skills to facilitate technical metal cutting competences.
9. Set for the relevant National Institute for Metalworking Skills (NIMS) credentialing exams.

Production, Other Core Competencies

Standard Occupational Classification Code (SOC Code)

51-2092	Team Assemblers
51-4021	Extruding/Drawing Mach Setters/Operators
51-4022	Forging Mach Setters/Operators/Tenders
51-4023	Rolling Mach Setters/Operators/Tenders
51-4031	Cutting/Punching Mach Setters/Operators

Certified Production Technician

1. Utilize effective, safety-enhancing workplace practices in multiple industries.
2. Demonstrate an understanding of quality practices and measurement.

3. Identify basic fundamental of blueprint reading.
4. Determine resources and workflow required of the production process.
5. Document product and process compliance with customer requirements.
6. Recognize potential maintenance problems, issues or concerns with basic production systems.
7. Recognize preventative maintenance indicators to ensure correct operations.
8. Identify different types of basic production and related mechanical principles, mechanical linkages, and production materials.
9. Demonstrate use of basic math skills to facilitate technical competences.
10. Sit for the national Certified Production Technician (MSSC-CPT) exam.

Mechatronics (Equipment Service and Repair) Core Competencies

Standard Occupational Classification Code (SOC Code)

49-2094	Electrical and Electronics Repairers-Commercial/Industrial
49-9043	Maintenance Workers, Machinery
49-9041	Industrial Machinery Mechanics
49-9071	Maintenance Repair Workers, General

Mechatronics (Industrial Maintenance):

1. Identify different careers available in the Industrial Maintenance field.
2. Describe physical properties of a variety of equipment used in the workplace including: force, torque, simple machine, and mechanical drives.
3. Utilize effective, safety-enhancing workplace practices in multiple sites.
4. Demonstrate an understanding of safe and proper use of tools/supplies required to diagnose/repair a malfunction in the workplace.
5. Employ a systematic approach to troubleshooting a scenario based upon an industrial equipment system failure/problem/complaint and prepare an effective repair solution.
6. Interpret basic fundamental of blueprints mechanical drawings, designs, sketches, layout drawings, plans, specifications, shop drawings, service and repair manuals, and schematics used in industrial maintenance.
7. Demonstrate the fundamentals of industrial fluid power which includes pneumatics and hydraulics, and electrical theory.
8. Identify and demonstrate proper use of different types of basic electrical testing equipment.
9. Understand how electricity is produced and the physics behind it such as voltage, amperage, resistance, and power.

Welding Core Competencies

Standard Occupational Classification Code (SOC Code)

51-4121 Welders, Cutters, Solderers and Brazers
51-4122 Welding/Soldering Machine Setters/Operators

Welding (Metalworking)

1. Identify safe welding practices and procedures conforming to American Welding Society (AWS) Z 49 standards.
2. Demonstrate practical knowledge of making welds with all types of mild steel electrodes, arc air gouging and the welding of mild steel in all positions in a safe manner.
3. Exhibit a basic understanding of metallurgy required of a competent welder.
4. Interpret both basic and advanced welding fabrications blueprints including: welding symbols, weld testing symbols, structural steel shapes, and welding specifications.
5. Document advanced knowledge and techniques for the safe and successful operation of gas tungsten welding, shielded metal arc welding, gas metal arc welding, and oxy fuel gas welding.
6. Demonstrate knowledge of code practices and procedures in American Welding Society (AWS) D1.1.
7. Perform an American Welding Society (AWS) 1G with a backing strip test or 3G with an open root.

Projected Job Openings and Wages

Logistics/Inventory

Standard Occupational Classification (SOC) Code	Title	Base Year	Projected Year	Employment Change		Average Annual Job Openings due to			Entry Wage		Median Wage	
		Emp. 2010	Emp. 2020	Number	Percent	Growth	Replacements	Total	Hourly	Annual	Hourly	Annual
00-0000	Total, All Occupations	5,992,362	6,509,464	517,102	8.63	55,932	141,351	197,283				
<u>Logistics/Inventory</u>												
11-3071	Trans., Storage & Distribution Managers	4,905	5,019	114	2.32	11	118	129	\$23.70	\$49,290	\$35.25	\$73,320
43-1011	1st-Line Supvrs/Mgrs, Office & Adm. Support Workers (Shipping & Receiving Manager, Supply Chain Manager, Import Coordinator)	47,740	51,980	4,240	8.88	424	1,277	1,701	\$15.74	\$32,750	\$23.89	\$49,690
43-5032	Dispatchers	7,588	8,203	615	8.10	62	144	206	\$13.17	\$27,390	\$18.36	\$38,200
13-1081	Logisticians (Logistics Coordinator, Logistics Planner, Logistics Analyst)	3,811	4,442	631	16.56	63	73	136	\$20.92	\$43,500	\$31.09	\$64,660
43-5071	Shipping, Receiving, & Traffic Clerks (Shipping & Receiving Manager)	30,267	28,374	-1,893	-6.25	0	772	772	\$10.21	\$21,240	\$14.02	\$29,150
43-5061	Production, Planning, & Expediting Clerks (Production Planner, Production Scheduler)	9,487	9,609	122	1.29	12	248	260	\$13.69	\$28,470	\$20.93	\$43,540

Machine Operator

Standard Occupational Classification (SOC) Code Title		Base Year Emp. 2010	Projected Year Emp. 2020	Employment Change		Average Annual Job Openings			Entry Wage		Median Wage	
				2010-2020		due to			Hourly	Annual	Hourly	Annual
				Number	Percent	Growth	Replacements	Total				
00-0000 Total, All Occupations		5,992,362	6,509,464	517,102	8.63	55,932	141,351	197,283				
<u>Machine Operator</u>												
51-4041	Machinists Computer-Controlled Mach Tool	25,009	25,141	132	0.53	13	459	472	\$12.74	\$26,500	\$18.82	\$39,150
51-4011	Operators Numerical Tool/Process Control	7,829	8,957	1,128	14.41	113	149	262	\$12.09	\$25,140	\$17.30	\$35,980
51-4012	Programmers	996	1,036	40	4.02	4	19	23	\$13.95	\$29,010	\$18.93	\$39,380
<u>Other Production</u>												
51-2092	Team Assemblers	62,415	63,876	1,461	2.34	146	1,237	1,383	\$9.20	\$19,150	\$12.65	\$26,320
51-2099	Assemblers & Fabricators, All Other Extruding/Drawing Mach	10,322	10,806	484	4.69	48	204	252	\$9.62	\$20,010	\$12.25	\$25,480
51-4021	Setters/Operators Forging Mach Setters/Operators/	2,962	3,060	98	3.31	10	56	66	\$10.10	\$21,010	\$15.34	\$31,900
51-4022	Tenders Rolling Mach Setters/Operators/	1,249	1,261	12	0.96	1	24	25	\$14.29	\$29,720	\$17.96	\$37,350
51-4023	Tenders Cutting/Punching Mach Setters/	2,139	2,144	5	0.23	0	41	41	\$13.57	\$28,220	\$17.60	\$36,610
51-4031	Operators	12,383	11,909	-474	-3.83	0	92	92	\$10.02	\$20,830	\$14.00	\$29,110

Mechatronics

Standard Occupational Classification (SOC) Code	Title	Base Year	Projected Year	Employment Change		Average Annual Job Openings			Entry Wage		Median Wage	
		Emp. 2010	Emp. 2020	2010-2020		due to			Hourly	Annual	Hourly	Annual
00-0000 Total, All Occupations		5,992,362	6,509,464	517,102	8.63	55,932	141,351	197,283				

Mechatronics

49-2094	Elec. Repairers-Commercial/Industrial	1,659	1,602	-57	-3.44	0	41	41	\$16.40	\$34,100	\$24.10	\$50,130
49-9041	Industrial Machinery Mechanics	11,368	13,134	1,766	15.53	177	218	395	\$17.11	\$35,590	\$23.74	\$49,390
49-9043	Maintenance Workers, Machinery	5,257	5,261	4	0.08	0	97	97	\$17.55	\$36,490	\$24.53	\$51,020
49-9071	Maintenance & Repair Workers, General	51,359	54,237	2,878	5.60	288	944	1,232	\$11.68	\$24,290	\$18.33	\$38,130

Welding

Standard Occupational Classification (SOC) Code	Title	Base Year	Projected Year	Employment Change		Average Annual Job Openings			Entry Wage		Median Wage	
		Emp. 2010	Emp. 2020	2010-2020		due to			Hourly	Annual	Hourly	Annual
00-0000 Total, All Occupations		5,992,362	6,509,464	517,102	8.63	55,932	141,351	197,283				

Welding

51-4121	Welders, Cutters, Solderers & Brazers Welding/Soldering Mach	14,154	15,021	867	6.13	87	378	465	\$12.70	\$26,410	\$17.07	\$35,500
51-4122	Setters/Operators	2,262	2,377	115	5.08	12	60	72	\$11.62	\$24,160	\$17.09	\$35,550

Glossary

Core Competencies - a defined level of expertise that is essential or fundamental to a particular job; the primary area of expertise; specialty; the expertise that allows an organization or individual to beat its competitors.

Standards Based – refers to using learning standards as the basis for instructional design and delivery.

Standard Occupational Classification Code - a system used by all United States Federal Statistical Agencies to classify workers into occupational categories for the purpose of collecting, calculating, or disseminating data.

References/Links

[Illinois Manufacturing Learning Exchange](#)

Illinois Network for Advanced Manufacturing (INAM)

[National Association of Manufacturing \(NAM\)](#)

[National Institute for Metalworking Skills \(NIMS\)](#)

[Standard Occupational Classification Code \(SOC Code\)](#)