Wisconsin Youth Apprenticeship

Manufacturing

PROGRAM GUIDE

Investing in
Wisconsin's Future

Department of Workforce Development

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MANUFACTURING
YOUTH APPRENTICESHIP
PROGRAM GUIDE

Description

Manufacturing is the engine that drives American prosperity. It is central to our economic and national security. However, often the perception is that the heyday of U.S. manufacturing is in the past. Nothing could be further from the truth. In many regions of the U.S. there is great demand for highly skilled technicians. Trends indicate while low skill jobs continue to outsource to low wage countries, high skill jobs in manufacturing will grow with the use of computers and robotics, and need for green energy components.[1]

Furthermore, manufacturing is the backbone of the Midwest economy. The national average for Manufacturing employment is 9%, but is close to 12% in the Midwest, with both Indiana and Wisconsin employing 16% of the labor force in Manufacturing. While companies recover from the recent recession, output will continue to grow.[2]

This Youth Apprenticeship occupational area focuses on four of the six pathways within the Manufacturing industry. The Logistics and Inventory Control pathway is covered in the Transportation, Distribution and Logistics YA program. In the Production pathway, skills are required to work with machines to make or assemble parts or products. Processes from both the Manufacturing Production Process Development pathway and the Quality Assurance pathway are incorporated into Production Operations Management which covers monitoring and ensuring processes and products meet specifications. Preventive maintenance, troubleshooting and repair of tools and equipment are learned in the Maintenance, Installation, and Repair pathway.

The Youth Apprenticeship Program was approved by the Wisconsin State legislature in 1991 to provide a direct link between business, schools, and youth to meet the workforce demands of technology, teamwork, communication, and leadership.

Wisconsin Youth Apprenticeship (YA) is a rigorous program that combines academic and related technical classroom instruction with mentored on the job learning for high school students. By training youth apprentices, employers play an active role in shaping the quality of their future workforce, improving the skill level of potential workers, and enhancing their competitive positioning in the marketplace. Employers, school districts, local consortiums, parents, and potential YA students are referred to the Youth Apprenticeship Program Operations Manual for general YA Program requirements.

Objective

[1] Manufacturing Career Cluster brochure, NCTEF, 2010.
[2] Georgetown University CEW, The Midwest Challenge, http://cew.georgetown.edu/regions/, Septemeber 2011.

The Wisconsin Manufacturing YA Program is designed to provide students with a working understanding of core manufacturing industry skills and occupationally specific technical skills in four of the six pathways within the Manufacturing industry. This program provides the framework for educators and industry to work together to produce work-ready, entry-level employees that will compete favorably in a global market, as well as, provide for post-secondary educational advancement while integrating work-based learning in the school and worksite.

The following features distinguish a YA Program from other similar youth school to work programs.

Level Two Youth Apprenticeship is a two-year program for high school juniors and seniors with an interest in a particular field; i.e., manufacturing. One-year Youth Apprenticeship Programs are also available to pursue.

Youth apprentices, parents, employers, YA program coordinators, and school districts enter into a written agreement approved by the Department of Workforce Development.

Statewide skills are established by the industry, making the youth apprentice skill set more relevant to the state's employers.

Youth apprentices are trained at the worksite by skilled mentors and are paid minimum wage or better for their work. Students average 10-15 hours per week.

Youth apprentices receive a high school diploma and a Certificate of Occupational Proficiency from the Wisconsin Department of Workforce Development (DWD) at graduation.

Youth apprentices may receive advanced standing credit and/or transcripted credit for the YA Program at a Wisconsin Technical College and/or at some four year colleges. See **Appendix F** for current details.

Statewide skill standards focus on skills and knowledge needed by employers for entry level employment in the Manufacturing industry.

Students apply and are interviewed by Manufacturing employers for positions in the Manufacturing YA Program. The state approved skill standards and program guide for the Manufacturing YA Program are used in both the classroom instruction and worksite learning. If the local school district is unable to provide the related technical classroom instruction courses, they may contract with their local technical college or employer practitioners to do so.

The skill standards are competency based. Competencies are performance-based outcome statements of occupational related skills defined by representatives of Manufacturing worksites throughout Wisconsin and aligned with national skill standards. The competencies are aligned with the National Association of State Directors of Career Technical Education Consortium (NASDCTEc) Career Cluster Skill Standards in Manufacturing, http://www.careertech.org/ for four of the Manufacturing pathways: Production, Quality Assurance, Manufacturing Production Process Development, and Maintenance, Installation, and Repair. Competencies for Logistics and Inventory Control can be found in the Transportation, Distribution and Logistics YA program.

The competencies will be taught at the worksite in combination with supportive, related technical classroom instruction. While the skill competencies are established statewide, program implementation and oversight occurs through local consortium committees to assure local needs are met.

Target Population

This Youth Apprenticeship occupational area focuses on Manufacturing pathway YA students acquiring basic skills pertinent to understanding and working in careers to plan, manage, and perform processing of materials into products. The Production units (Assembly and Packaging, Manufacturing Processes, Machining, Welding) allow students to work with a variety of equipment and processes to transform materials into parts or products. The Production Operations Management unit gives students a chance to plan and manage processes that monitor and ensure that materials and products are produced according to specification in an efficient manner. The Maintenance, Installation, and Repair units (Basic and Advanced Industrial Equipment) allow students to monitor, troubleshoot, and repair the equipment necessary for production operations.

All students successfully meeting current high school graduation requirements and with a good attendance record for that year are encouraged to apply for the Manufacturing Youth Apprenticeship (YA) Program. The student must apply to the program in the year previous to program entry and be on track toward fulfilling high school graduation requirements in their school district. SEE **Appendix G** for students entering or continuing the Manufacturing YA Program in 2012.

All Youth Apprentices must complete the industry-wide foundational skill competencies consisting of competencies in core employability skills, safety, and manufacturing fundamentals. The Required Skill competencies may be completed concurrently with the specific technical skills.

Potential Manufacturing youth apprentices will be required to complete a ***minimum*** of 450 work hours with 180 hours (2 semesters) of related technical classroom instruction for a Level One (1-year) Manufacturing YA Program or a ***minimum*** of 900 work hours with 360 hours (4 semesters) of related technical classroom instruction for a Level Two (2-year) Manufacturing YA program.

The industry- specific technical skill competencies can be chosen based on interest and job placement. Worksites can be chosen from any number of the manufacturing SUB-INDUSTRIES:

- Chemical
- Computers and Electronic
- Electrical Equipment and Appliances
- Food and Beverage
- Furniture
- Machine
- Non-Metallic Minerals
- Plastic and Rubber Production
- Primary and Fabricated Metals
- Textiles
- Wood

PROCESSING any variety of manufacturing MATERIALS:

- Metals (Ferrous, Non-Ferrous, Powdered)
- Polymers (Wood, Textiles, Leather, Plastic, Elastomer)
- Composites

Chemicals
Finishes (Wood Finishes, Metal Finishes)
Food and Beverage

PROVIDED THAT the competencies related to that SUB-INDUSTRY, MATERIAL, and EQUIPMENT USED are allowable by DWD Child Labor Laws. See Appendix A for more detail or contact the Department of Workforce Development's Equal Rights Division/Labor Standards Bureau at 608-266-6860 for questions regarding child labor laws.

Manufacturing Units

Production Pathway-

Assembly and Packaging Unit
Manufacturing Processes Unit
Machining Unit
Welding Unit

Production Operations Management Pathway-

Production Operations Management Unit

Maintenance, Installation, and Repair Pathway-

Basic Industrial Equipment Unit
Advanced Industrial Equipment Unit

Manufacturing YA Program Responsibilities

The following responsibilities are outlined for individuals involved in the Manufacturing YA Program.

Students-

1. Maintain academic skills and attendance at the high school to remain on track for high school graduation.
2. Participate in progress reviews as scheduled.
3. Exhibit maturity and responsibility to meet requirements of employment as designated by the employer.

Parents or Guardians-

4. Ensure that adequate transportation is available to and from the worksite.
5. Participate in student progress reviews as scheduled.

School District-

6. Recruit students and coordinate student enrollment in the program with the consortiums and/or employers.
7. Integrate the YA Program related technical classroom instruction and worksite training into the student's overall education program with high school graduation credit issued for each semester successfully completed.

8. Participate in student progress reviews as scheduled.

YA Program Coordinators-

9. Apply and maintain approval from the DWD to operate a YA Program.
10. Ensure a minimum of 450 hours of worksite instruction/experience plus a minimum of 180 hours of related technical classroom instruction for each one year YA program.
11. Establish and meet regularly with an advisory committee that will identify when and where tasks will be taught during the Manufacturing YA Program.
12. Develop and maintain a yearly commitment with participating high schools, technical colleges, and local businesses to accommodate the number of students involved in the Manufacturing YA Program.
13. Establish and maintain a YA student grievance procedure.
14. Provide employer mentor training.

Related Technical Classroom Instruction Faculty-

15. Qualify in the specialty areas being taught in the YA Program.

Employers and Worksite Mentors-

16. SEE **Appendix B -** Manufacturing YA Implementation Guide for Employers.
17. Participate in a mentor training session and provide on the job training of the Youth Apprentices.

Department of Workforce Development-

18. Monitor national and state regulatory agencies, such as OSHA, for changes and impact on the Manufacturing Youth Apprenticeship Program.

Program Guide Organization

The competencies included in the program guide are aligned with the skills required under the National Association of State Directors of Career Technical Education Consortium (NASDCTEc) Career Cluster Skill Standards in Manufacturing, http://www.careertech.org/, for four of the six Manufacturing pathways: Production, Quality Assurance, Manufacturing Production Process Development, and Maintenance, Installation, and Repair.

The Manufacturing YA Program also requires that Related Technical Classroom Instruction is provided to support attainment of the knowledge necessary to master the competencies. While recommendations for specific Related Technical Classroom Instruction are detailed separately in **Appendix C**, instructional requirements will vary depending on local consortium and advisory group decisions. It is strongly advised that local consortiums work with their advisory groups to determine appropriate Related Technical Classroom Instruction based on their local needs and resources.

The Youth Apprenticeship Program Guide is written and organized according to the Worldwide Instructional Design System (WIDS) format and includes the Manufacturing YA Skill Standards Checklist, Program Appendices and Unit Appendices, and Course Outcome Summary (COS)

for the program. Overall progress is documented on the Skill Standards Checklist, which lists skill level achievement for each competency achieved. The Unit Appendices outline each skill competency with corresponding performance standards and learning objectives. The Performance Standards describe the tasks and behaviors, as applicable, that employers should look for in order to evaluate the competency. The Learning Objectives outline the recommended content to be covered in the related technical classroom instruction. SEE **Appendix D** - Wisconsin Instructional Design System (WIDS) Format and Youth Apprenticeship Program Guide Terms and **Appendix E** - Use and Distribution of the Curriculum for further details.

Evaluation

The student must successfully complete the related technical classroom instruction and demonstrate the minimum skill level required on the Manufacturing YA Skill Standards Checklist for each competency according to the applicable curriculum. Worksite mentors and/or instructors use this checklist to evaluate the learner on each of the required skills. It is the responsibility of the mentor(s) to rate the students skill level on all tasks performed at the worksite.

Manufacturing YA Program Completion

Upon successful completion of high school and the Level Two (2 year) Manufacturing YA Program requirements, the youth apprentice will receive a high school diploma and the applicable Certification of Occupational Proficiency from the Department of Workforce Development indicating “Manufacturing Youth Apprenticeship". Youth Apprentices who successfully complete a Level One (1 year) Manufacturing YA Program and who are on track for graduation will be eligible for a Level One Certificate from the Department of Workforce Development. Furthermore, the YA students may;

1. Continue to work in the manufacturing industry.
2. Apply to a registered apprenticeship.
3. Pursue a degree or diploma from a Wisconsin Technical College with advanced standing and/or transcripted credit.
4. Apply for admission to a four-year University of Wisconsin school with high school academic elective credit for admission.
5. Go into military service.

SEE **Appendix F** for current agreements for post-secondary credit at Wisconsin Technical Colleges and University of Wisconsin colleges.

This curriculum was developed through a grant from the Wisconsin Department of Workforce Development to Wisconsin's Cooperative Educational Services Agency 6 (CESA6)

Appendices

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Appendix A

WORK CONTRACTS, CHILD LABOR LAWS, LIABILITY & INSURANCE

WORK CONTRACTS

Education Training Agreement -

Students and employers participating in an approved youth apprenticeship program must have a **signed Education/Training Agreement (ETA) on file with both the school and the employer**. Employers without a valid ETA may be assessed (a) double compensation in the event of injury on the job, and/or (b) fines ranging from $25 to $1,000 for every day without a permit for a first offense to $250 to $5,000 for every day without a permit for a second offense within a five year period. The Local Youth Apprenticeship Coordinator will provide the employer with a copy of the ETA. This form is also available from the Department of Workforce Development at http://dwd.wisconsin.gov/youthapprenticeship/forms_pubs.htm

Work Permits -

Students and employers participating in an approved youth apprenticeship program do not need to obtain a separate work permit for the work to be performed as a part of the youth apprenticeship program, **although it is highly recommended**. If employers hire the youth apprentices to perform other work duties outside of their youth apprenticeship duties, a work permit will be required. Employers without a valid work permit (if applicable) may be assessed (a) double compensation in the event of injury on the job, and/or (b) fines ranging from $25 to $1,000 for every day without a permit for a first offense to $250 to $5,000 for every day without a permit for a second offense within a five year period.

CHILD LABOR LAWS

Youth apprentices enrolled in approved youth apprenticeship programs and their employers are subject to all state and federal child labor laws regarding the employment of minors. The Department of Workforce Development (DWD) will review all statewide youth apprenticeship curriculum for compliance with the child labor laws and will clarify the laws whenever necessary to allow for program implementation. Youth apprentices **are allowed** to work in **some prohibited** occupations because they meet the criteria of **"student learner" AND** the work performed is **incidental** to their training **and** is for **intermittent and for short periods of time** (Wis. Admin. Code DWD 270.14(3)(c)1 at http://docs.legis.wisconsin.gov/code/admin_code/dwd/270.pdf). However, they are **not exempt** from the child labor laws by virtue of being enrolled in a youth apprenticeship program. Students and employers must comply with child labor laws with regard to daily/weekly hours, time of day, employment restrictions, etc.

While DWD can interpret the law, DWD cannot exonerate employers from liability should an accident occur on the job which results in injury to an employee and a subsequent lawsuit. Determining liability for an accident can only be settled in a court of law. DWD can assure employers that they will not be cited (by DWD) for employing a minor in a prohibited occupation as long as the students are enrolled in a DWD approved youth apprenticeship program and a signed Education/Training Agreement is on file with both the student's high school and the employer. This means that employers will not be assessed treble fines should an injury occur which results in the employer being cited.

Readers should refer to DWD 270.12 and 270.14 Child Labor Laws (http://dwd.wisconsin.gov/er/labor_standards_bureau/child_labor_laws.htm) for descriptions and definitions of the occupations or activities which are normally prohibited to minors.

Manufacturing -

Youth apprentices who are 16-17 years old can perform the following tasks, *only after appropriate operation/safety training* AND *only as indicated below*. The ***student learner exception*** limits the minor to **using *hazardous* equipment** on an **incidental** basis [less than 5% of their work time] and only **occasionally** [can't be a regular part of their job]. For example, the student learner exception may apply in a situation, such as carpentry, where most of the work is acceptable but once in a while you might need the minor to use a portable saw to cut a piece to fit. Further interpretation or clarification of Child Labor Laws should be directed to the Department of Workforce Development (DWD) Labor Standards Bureau Director at 608-266-6860.

Forklift Operation-

- **Prohibited** to students

Hoists and Hoisting Apparatus (270.12(12))-

- **Prohibited** to students:
  - operating an elevator, crane, derrick, hoist or high-lift truck (including hoists commonly used on tow trucks and other hoists);
  - perform work that involves riding on a man lift or on a freight elevator, **except** a freight elevator operated by an assigned operator;
  - assist in the operation of a crane, derrick or hoist performed by crane hookers, crane chasers, hookers-on, riggers, rigger helpers and like occupations.
- Students may operate an unattended automatic operation passenger elevator OR an electric or air-operated hoist not exceeding one-ton capacity

Metal Forming, Punching, and Shearing Power-Driven Machines (270.12(19))-

- Students may operate pressing and punching machines equipped with automatic feed and ejection, with a fixed barrier to prevent hands or fingers from entering the area between the dies, power presses, and plate punches.

- Students are **prohibited** from operating rolling machines, bending machines, hammering machines, and shearing machines.
- Students may set up, adjust, repair, oil, and clean machines provided the tasks are completed electronically OR in a manner so that the student is not accessing sharp or moveable parts.

Power-Driven Machinery (light) (270.13(15))-

- Students may operate drill presses, grinder wheels, lathes, and portable power-driven machinery such as drills, sanders, floor polishers, and floor scrubbers.

Saws and guillotine shears (270.12(25))-

- Students may operate or assist on these types of machines **only if** they are equipped with full automatic feed and ejection and fixed guards.
- Setting up, adjusting, repairing & cleaning is allowable provided the tasks are completed electronically OR in a manner so that the youth is not accessing sharp or moveable parts.

Welding (270.13(15))-

- Students may do light or spot welding.

Woodworking (270.12(27))-

- Students are **prohibited** to operate power-driven woodworking machines such as those that cut, shape, form, nail, stitch, and fasten.

Student Learner Criteria -

In order to be considered a student learner, youth apprentices must meet the following criteria:

1. They are enrolled in a youth apprenticeship program approved by DWD;
2. They are enrolled in school and receiving school credit for program participation;
3. They receive appropriate safety instruction at the school and at the workplace;
4. The work performed is under direct and close supervision of a qualified and experienced person;
5. The work performed in any occupation declared hazardous is incidental to their training and is for intermittent and short periods of time (refer to DWD 270.14(3)(c)1; and
6. There is a schedule of organized and progressive work processes to be performed on the job (i.e. the worksite is following the state curriculum);

Hours of Work -

The hours an apprentice spends working in the program *during* the hours school is in session during the day **DO NOT COUNT** towards the limitation on total hours a minor may work. See the **DWD Child Labor web site** for applicable hours and times of the

day that minors may work in Wisconsin.
(http://dwd.wisconsin.gov/er/labor_standards_bureau/child_labor_laws.htm)

LIABILITY AND INSURANCE

As employees of the company, youth apprentices are covered by worker's compensation in the event of injury on the job. Employers should review their specific liability coverage to ensure there are no restrictions on employing minors and/or on coverage of minors operating particular machinery. Schools are not allowed to cover youth apprentices through their own workers' compensation policy while the youth apprentice is an employee of the local business.

As stated previously, DWD and/or local schools cannot exonerate employers from liability if a youth apprentice is injured on the job and a subsequent lawsuit is filed against the employer. Determining liability for an accident can only be settled in a court of law and will be based on the specific circumstances for each case. It is important that a signed ETA be kept on file by both the school and the employer to ensure that employers will not be cited for illegally employing a minor in a prohibited occupation.

General Liability –

An employer is liable for the service provided at their facility. In general an employer has adequate general liability and workers compensation coverage, no additional liability is required as a result of the Youth Apprenticeship program. However, before participating in the program, an employer may wish to consult with their insurance carrier.

Transportation –

In general, the party responsible for transportation is liable in case of an accident. Youth apprentices responsible for their own transportation to and from the worksite are responsible for their own insurance. In instances where the school provides transportation for the youth apprentices, the school is responsible for insurance coverage. Only if the facility provides transportation to and from work for the youth apprentice is the facility responsible for this insurance coverage.

Workers Compensation –

Once a youth apprentice becomes a paid employee they must be covered by the employer's workers compensation insurance.

Unemployment Compensation –

If a youth apprentice is enrolled full-time in a public educational institution and receives school credit for their participation in the YA program, then they are NOT eligible to file

for unemployment compensation from the employer. Youth apprentices who do NOT meet this criterion may be eligible for unemployment compensation benefits.

Worker Displacement –

No employer may hire a youth apprentice who will displace any currently employed worker, including a partial displacement, such as reduction in the hours of non-overtime work, wages, or employment benefits.

Layoffs/Strikes –

A youth apprentice cannot be hired when any other individual is on temporary layoff, with the clear possibility of recall, from the same or equivalent job OR if the employer has terminated the employment of any regular employee, or otherwise reduced the workforce, with the intention of filling the vacancy created with a youth apprentice. Local bargaining units should determine the status of youth apprentices already working in the facility in the event of a layoff. Youth apprentices may be laid off or transferred to work areas to take the place of laid off workers. Child labor laws prohibit youth apprentices from working in a company where a strike or lockout is in active progress.

Collective Bargaining Agreements –

The youth apprenticeship program should not impair existing contracts for services or collective bargaining agreements. Any youth apprenticeship program that would be inconsistent with the terms of a collective bargaining agreement shall be approved only with the written concurrence of the labor organization and employer involved.

Appendix B

Wisconsin Manufacturing Youth Apprenticeship
Implementation Guide for Employers

BENEFITS TO THE EMPLOYER

Manufacturing is the engine that drives American prosperity. It is central to our economic and national security. However, often the perception is that the heyday of U.S. manufacturing is in the past. Nothing could be further from the truth. In many regions of the U.S. there is great demand for highly skilled technicians. Trends indicate while low skill jobs continue to outsource to low wage countries, high skill jobs in manufacturing will grow with the use of computers and robotics, and need for green energy components.[1]

Furthermore, manufacturing is the backbone of the Midwest economy. The national average for Manufacturing employment is 9%, but is close to 12% in the Midwest, with both Indiana and Wisconsin employing 16% of the labor force in Manufacturing. While companies recover from the recent recession, output will continue to grow.[2]

This Youth Apprenticeship (YA) occupational area focuses on four of the six pathways within the Manufacturing industry: Production; Quality Assurance; Production Process Development; and Maintenance, Installation, and Repair. The Logistics and Inventory Control pathway is covered in the Transportation, Distribution and Logistics YA program.

A unique opportunity and added incentive for participation in the Manufacturing Youth Apprenticeship Program for both the employer and the student is that the competencies are aligned with the curriculum objectives of the national occupational skill standards recognized by the National Association of State Directors of Career Technical Education Consortium (NASDCTEc) Career Cluster Skill Standards in Manufacturing, http://www.careertech.org/, and the Secretary's Commission on Achieving Necessary Skills (SCANS).

Employers also play an active role in improving the quality of the future workforce by helping develop skill standards geared to employer needs, reducing employee turnover by hiring program graduates, supporting program graduates as they continue their education in post-secondary settings, raising the interest of other employees in education and training, and increasing the potential for teamwork and flexibility in work sharing. One employer noted, “This program is the single most effective use of taxpayer dollars to link our business community to the workforce and training needs of

[1] Manufacturing Career Cluster brochure, NCTEF, 2010.
[2] Georgetown University CEW, The Midwest Challenge, http://cew.georgetown.edu/regions/, Septemeber 2011.

the community. We must expand, celebrate, promote and encourage participation in this endeavor. I have personally gained staff, changed some lives, and enjoyed the successes of the participants. It has enriched our staff in learning to operate as mentors, and enhanced our perception in the community as involved participants.[3]"

ROLE OF THE EMPLOYER

The work-based learning component of the Youth Apprenticeship Program is the **primary** method for teaching the required competencies. The local business becomes an extension of the classroom for the youth apprentice. The related classroom instruction is intended to *support* the work-based learning experience by providing theoretical knowledge and, when needed, providing appropriate skill development. The work-based learning component is designed to provide an on-the-job learning environment for students by being "apprenticed" to an experienced mentor.

As an employer of a youth apprentice, you will be responsible for the following:

Student Selection

Review employment applications, interview candidates, and select the student(s) they want to hire. New Employee Orientation is provided by you according to your facility's Human Resources policies.

Wages

Youth apprentices must receive minimum wage or higher. A pay schedule is agreed upon with the employer, local YA coordinator and the student. Most employers grant periodic raises dependent upon performance or length of employment.

Workers Compensation

Once a youth apprentice becomes a paid employee they must be covered by the employer's workers compensation coverage. Other benefits may be provided at the discretion of the employer.

Education/Training Agreement (ETA)

Employers must sign and comply with the requirements in the ETA, and have a copy on file.

See *Appendix A* "*Work Contracts, Child Labor Laws, Liability & Insurance"* for more detail.

Work Permits

See *Appendix A* "*Work Contracts, Child Labor Laws, Liability & Insurance"* for more detail.

[3] Kent Olson, YA Employer, Wausau, WI

Child Labor Laws
Employers must ensure that the work of any student at their worksite is allowed by Child Labor Laws and is under the direct and close supervision of a qualified and experienced person. Students must be provided with adequate safety training both in the school and at the worksite. All Manufacturing Youth Apprenticeship skill standards **competencies** have been reviewed by the Wisconsin Department of Workforce Developments Labor Standards Bureau and are in compliance with the child labor rules.

See *Appendix A* "*Work Contracts, Child Labor Laws, Liability & Insurance"* for more detail.

Unemployment Compensation
YA students are typically not eligible for unemployment compensation from the employer.
See *Appendix A* "*Work Contracts, Child Labor Laws, Liability & Insurance"* for more detail.

Job Performance
Employers review, evaluate, and report on the youth apprentice's job performance approximately every nine weeks to ensure they are learning the required competencies. Mentors are expected to participate in progress reviews with the apprentice, school staff and/or Youth Apprenticeship instructors, and parent(s)/guardian(s).

Worksite Hours
Employers must provide for the youth apprentice to meet the following work requirements:

> Youth Apprentices in a Level Two (2-year) program must complete a *minimum* of **900 hours** of work-based learning while they are enrolled in the program. At least 500 hours of the required minimum work-based learning hours must take place when related classes are being held, so that classroom instruction can be integrated with worksite learning.
>
> Youth apprentices in a Level One (1 year) program must complete a *minimum* of **450 hours** of work based learning while they are enrolled in the program. At least 250 hours of the required minimum work-based learning hours must take place when related classes are being held, so that classroom instruction can be integrated with worksite learning.
>
> Youth apprentices may work *more* than the required minimum hours throughout the program.

Training to Competencies
The employer is responsible for providing the worksite training required to meet the skills standard competencies specified in the applicable Manufacturing area. This requirement means that while the youth apprentice may be hired under one particular

job function, he/she must be allowed to rotate and perform other functions in other departments to meet competencies if some of them are not normally a part of that job function.

Mentors
Employers assign worksite mentors to supervise and train youth apprentices. They also allow the mentors to attend special training classes provided by the local YA consortium to become successful mentors of high school apprentices.

See "Role of Mentors" below for more detail.

Organized Labor
Usually the Manufacturing Youth Apprenticeship is considered an educational activity rather than a job classification/position status. However, the youth apprenticeship program should not impair existing contracts for services or collective bargaining agreements. Any youth apprenticeship program that would be inconsistent with the terms of a collective bargaining agreement shall be approved only with the written concurrence of the labor organization and employer involved. If youth apprentices will be working in areas covered by labor agreements, organized labor must be involved to approve the program at the worksite.

See *Appendix A* "*Work Contracts, Child Labor Laws, Liability & Insurance"* for more detail.

ROLE OF THE MENTOR

Workplace mentors are one of the most critical elements which often determine the success of a youth apprenticeship. One mentor may work with more than one youth apprentice at a worksite, and the mentor may assign multiple "trainers" to instruct the youth apprentice while they rotate among various departments.

Effective Mentor Qualifications

- Experience working with adolescents either on the job, through family, or through outside activities
- Effective teaching/training skills with adults and/or youth
- Highly skilled in the area in which the youth apprentices will be trained
- Good communication skills in the workplace
- Knowledge of and commitment to the Manufacturing Youth Apprenticeship program

Mentor Responsibilities

- Develop a cooperative training schedule for the youth apprentice to ensure performance of the required work-based skills

- Work with instructors to coordinate the application of classroom learning objectives to the worksite
- Communicate regularly with the school, YA coordinator, and the instructor to ensure work-based learning objectives are being met
- Demonstrate tasks to youth apprentices and explain their importance
- Identify other trainers appropriate to train youth in the required competencies
- Evaluate the youth apprentice's progress on a regular basis and document achievements and skills
- Meet with the student, the student's parent(s)/guardian(s), and school staff and/or YA instructor at least once each grading period to review and update them on the student's progress
- Provide encouragement, support, and direction about the work site culture and skills
- Help the youth apprentice build self-confidence and self-esteem
- Be alert to personal problems that may affect the apprentice's work performance and guide them to seek help from appropriate sources
- Attend mentor training workshops and mentor meetings

Obtain additional resources for mentoring guidance from your local YA coordinator.

CHECKLIST FOR PROGRAM PARTICIPATION

The following checklist will help you to participate in a Youth Apprenticeship (YA) Program:

- Discuss the Manufacturing YA program with the local partnership that offers Youth Apprenticeship Programs
- Consult with the management team of your organization and union officials, if applicable
- Obtain approval from appropriate organization officials to hire youth apprentices
- Identify mentors and arrange for mentor training through your local YA Coordinator
- Interview Manufacturing YA candidates for the program
- Select youth apprentice(s)
- Sign Education/Training Agreement (ETA)
- Secure a Work Permit form
- Orient your new youth apprentice to the workplace according to your organization's Human Resources policies

Youth Apprenticeship coordinators are available to meet at your location to facilitate any phase of the YA program.

CHECKLIST FOR PROGRAM OPERATION

The following checklist will help ensure continued operation of the Manufacturing Youth Apprenticeship (YA) Program:

- Provide worksite training according to the Manufacturing Youth Apprenticeship Area curriculum
- Participate in progress reviews with youth apprentices, school staff and/or YA instructors, and parents/guardians
- Meet regularly with the youth apprentices to discuss their performance and any other issues
- Employ youth apprentices during school breaks, either part-time or full-time
- Participate in recognition events organized by the school for youth apprenticeship graduates

FREQUENTLY ASKED QUESTIONS

For questions not addressed here, do not hesitate to call your local youth apprenticeship coordinator or visit the Department of Workforce Development Youth Apprenticeship website (http://dwd.wisconsin.gov/youthapprenticeship/)

How does this program differ from other work-based programs like coop education?
Skilled Certified Coop Education and Youth Apprenticeship are similar in that they are both components of Wisconsin's overall school to work transition programs. An important difference, however, is that Youth Apprenticeship students are exposed to an occupational cluster versus a specific job. Additionally, the skills the student learns are developed in association with Wisconsin Manufacturing personnel, Wisconsin technical college faculty, YA consortium coordinators, and school district coordinators/instructors. The curriculum is standardized throughout the state.

Will the mentor have to spend his/her entire time at work teaching the student?
No. Apprentices need to be supervised, but you are not required to "shadow" them at all times. However, someone should be available for guidance as necessary. One mentor may work with more than one youth apprentice at a worksite, and the mentor may assign multiple "trainers" to instruct the youth apprentice while they rotate among various departments.

Will the student do productive work?
Yes. After appropriate training, youth apprentices can become productive employees of the facility. However, since they are often rotated through different departments they will require more training time than employees who stay in the same department. It is important to remember that this is a training program. Upon completion of the probationary period, students are expected to meet the requirements of the position.

Will there be a lot of paperwork for me to complete?
Prior to the program, employers are required to sign the Education Training Agreement and maintain it. During the program, employers are expected to verify the youth apprentice's skills on the job and provide input during grading periods. Mentors must complete/maintain a simple "Skill Standards Checklist" as the student completes their competencies.

What happens if I cannot provide all of the required competencies at my facility?
In order to successfully complete the program and receive a Certificate of Occupational Proficiency, the youth apprentice must demonstrate proficiency in all areas required on the Skill Standards Checklist. If your facility does not provide the full range of services needed for competency mastery, the local youth apprenticeship coordinator may be able to arrange for the missing skills to be provided by another company. This arrangement should be discussed with the coordinator before you hire the youth apprentice.

What costs will my business incur and will I be reimbursed?
Primary costs to the employers are the wages paid to the youth apprentice and mentor during the training period.

Will I have to treat the youth apprentice differently than my other employees?
It is important to remember youth apprentices are placed in your facility to learn. Patience and guidance are required while they learn responsible work habits as well as the required skills. However, they are expected to follow your facility's work rules, e.g., dress code, behavior, discipline, etc., and to become a productive member of the Manufacturing team.

What is the typical time frame for activities over the course of a youth apprentice's stay with a facility?
Most program activities follow a one-year or two-year cycle depending on the offerings within your company. There may be variance in the timing of learning activities to accommodate local and seasonal needs including trainer availability.

Appendix C

RECOMMENDATIONS FOR RELATED TECHNICAL CLASSROOM INSTRUCTION FOR MANUFACTURING YA

These recommendations are intended to be used by the Local YA Consortium when determining appropriate related technical instruction for Manufacturing YA. It is not all inclusive but should be used to assist the partnership with identification and/or development of course work that supports the work-based competencies as identified in the Skill Standards Checklist. As with all YA programs the consortium must ensure that the related instruction meets with the approval of their administration and school board.

OPERATIONAL NOTES

Related Technical Classroom Instruction maybe offered by the employer, within the school district, at another school district, at a Wisconsin Technical College, and/or at a Community College or University by instructors qualified according to the Youth Apprenticeship Program Operations Manual.

Learning Objectives are the foundation of related technical classroom instruction. Consortiums may teach using locally developed coursework; however, it is recommended that agreements with the local technical college be pursued to obtain post-secondary credit for YA worksite and classroom experiences.

A minimum of 180 hours (2 semesters) of related technical instruction is required for each one year YA program with 250 of the **work** hours coinciding with the instruction. The student must also receive high school credit towards graduation for this instruction, no matter the provider.

It is suggested that the following courses or learning experiences be provided as a pre-requisite OR concurrently for students interested in this youth apprenticeship:

- Metals/Machining
- Manufacturing/Industrial Arts
- Welding
- Computer Aided Drafting (CAD)/Technical Drawing
- Electronics/Electricity
- Additionally, students should complete a job shadow prior to enrollment in the Manufacturing YA program.

Commercial programs or Employer provided classroom certification programs are also appropriate provided that the student receives high school credit towards graduation for the class work. Possible classroom programs include training and certification by Manufacturing Skill Standards Council (MSSC) (http://www.msscusa.org/), American Welding Society (ASW) (http://www.aws.org/w/a/), National Institute for Metalworking Skills, Inc. (NIMS) (https://www.nims-skills.org/web/nims/home), and National Center for Manufacturing Sciences (NCMS) (http://www.ncms.org/).

Manufacturing Youth Apprenticeship (YA) Plan of Study

NAME: _____ **DATE:** _____

The Related Technical Instruction course selection and delivery are entirely within local consortium control. The recommendations listed below are only a suggested path of YA career planning and should be individualized to meet each learner's educational and career goals. All plans should meet high school graduation requirements, as well as, college entrance requirements as applicable.

HIGHLY Recommended for **ALL Manufacturing** YA students

Educational Level	Grade	**English/ Language Arts** 4 required	**Social Studies Social Sciences** 3 Required	**Math** 2 Required	**Science** 2 Required	**Career Pathway Courses** **(Electives)**	**Recommended Enhancement Electives or Activities**
Secondary	**9**	Oral Communication (Speech)		Technical Math and Measuring	Physical Science	Manufacturing/Industrial Arts Metals/Machining	Skills USA
	10				Chemistry	Manufacturing/Industrial Arts Metals/Machining Electricity/Electronics Computer Applications	Skills USA
	11				Physics (Engineering)	**Manufacturing Youth Apprenticeship - Level One –** Computer Aided Drafting (CAD)/Technical Drawings Industrial Arts/Equipment Operation Welding Safety in the Workplace Employability Skills	
	12			Calculus (Engineering)		**Manufacturing Youth Apprenticeship - Level One or Two –** Advanced Manufacturing Welding	

Post-Secondary Occupational Opportunities

The chart below shows examples of career ladders organized by manufacturing career pathway.
For additional career cluster information, visit www.careerclusters.org
For additional career information on a specific occupation, visit http://wiscareers.wisc.edu/ or http://worknet.wisconsin.gov/worknet/default.aspx

		High School Diploma, On-the-Job Training, Apprenticeships	Certificate / License (1 year or less college)	Associate's Degree (2 year college)	Bachelor's/Master's Degree (4 year college)
Manufacturing Pathways	**Production Process & Development**		Power Plant Operators Industrial Engineering Technicians: Lab Technicians / Process Control Technicians / Process Improvement Technicians / Quality Control Technicians First-Line Supervisors/Managers of Production and Operating Workers	Industrial Engineering Technicians: Manufacturing Technicians Electro-Mechanical Technicians Engineering Technicians, Except Drafters Mechanical Engineering Technicians Civil Engineering Technicians	Industrial Engineers: Manufacturing Engineers Civil Engineers: Design Engineers Mechanical Engineers: Design Engineers Electronics Engineers, Except Computer Electrical Engineers
	Quality	QC Lab Tech Instrumentation Technician	Calibration and Instrumentation Technicians Industrial Engineering Technicians: Lab Technicians / Process Control Technicians / Quality Control Technicians	Industrial Engineering Technicians: Lab Technicians / Process Control Technicians / Quality Control Technicians	Industrial Engineers: Quality Engineers Logisticians: Statistical Process Control (SPC) Coordinators
	Health, Safety, & Environmental Awareness		Compliance Officers Except Agriculture, Construction, Health and Safety, Transportation: Environmental Compliance Inspectors	Environmental Science and Protection Technicians, Including Health Environmental Engineering Technicians	Environmental Engineers Health and Safety Engineers, Except Mining Safety Engineers and Inspectors

		High School Diploma, On-the-Job Training, Apprenticeships	Certificate / License (1 year or less college)	Associate's Degree (2 year college)	Bachelor's/Master's Degree (4 year college)
Manufacturing Pathways	**Production**	Carpenters Engraver Production and Planning Clerk Production Assembler Metalworkers Foundry Mold/Core makers Tool & Die Makers Grinders Welders, Cutters, Solders, Brazers	Computer-Controlled Machine Tool Operators: Automated Manufacturing Technician Electrical and Electronics Repairers, Commercial and Industrial Equipment Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic Hoist and Winch Operators Machinists: Instrument Makers / Machine Operators Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic Sheet Metal Workers Tool and Die Makers Welders, Cutters, Solderers, and Brazers	Industrial Engineering Technicians	Industrial Production Managers Technical Education Teacher
Manufacturing Pathways	**Maintenance**	Control/Valve Repair Electric Tool Repair	Medical Equipment Repairers: Biomedical Equipment Repairers Communications / Telecommunications Equipment Installers and Repairers Except Line Installers Electrical and Electronics Repairers, Commercial and Industrial Equipment: Electrical Equipment Installers/Repairers Industrial Machinery Mechanics: Maintenance Repairers Maintenance and Repair Workers, General Electricians: Job/Fixture Designers / Facility Electricians Control and Valve Installers and Repairers, Except Mechanical Door: Meter Installers/Repairers Electric Motor, Power Tool, and Related Repairers: Major Appliance Repairer	Computer, Automated Teller, and Office Machine Repairers: Computer Installers/Repairers / Computer Maintenance Technicians Electrical and Electronics Repairers, Commercial and Industrial Equipment Industrial Engineering Technicians	

SOURCES: The States' Career Clusters Initiative, 2007, www.careerclusters.org; The Oklahoma Department of Career & Technology Education, 2007; Waukesha County Technical College (WCTC), Susan Maresh, Waukesha County School-to-Work, 2007; Wisconsin's Worknet 2007, http://worknet.wisconsin.gov.

Appendix D

WISCONSIN INSTRUCTIONAL DESIGN SYSTEM (WIDS)
FORMAT AND YOUTH APPRENTICESHIP PROGRAM GUIDE TERMS

WIDS/YA Program DOCUMENTS:

Course Outcome Summary (COS)

The overview summary of the Manufacturing YA program listing the program units and their corresponding *competencies.*

Manufacturing YA Program Guide

Description of the Manufacturing YA Program. The *appendices* contain program information; and *competencies* with their corresponding *performance standards* and *learning objectives* by unit. In WIDS, this information is located in the Program Outcome Summary (POS)

Skill Standards Checklist

Listing of ALL the competencies in ALL of the industry-wide and industry-specific skill areas. The checklist provides the overall documentation for DWD of the skill achievement levels for the competencies in the Specialty Areas

WIDS TERMS:

Competency

The major skill or outcome stated in observable, measurable terms telling learners what they must be **able to do** AFTER a learning experience.

Performance Standards

Specifications by which performance of a competency will be evaluated (criteria) and the circumstances/situation (condition) in which the competency will be evaluated. This is what the employer should look for when assessing the student's skills, as applicable to that worksite.

Core Skills

Competencies that address the abilities, values, and attitudes required for productive and successful employment.

Learning Objectives

The background knowledge that is recommended in order for the student to master the competency. These objectives can direct learning in the related technical classroom instruction information that can be taught on-the-job, in a class, online, or through supplemental reading.

Appendix E

USE AND DISTRIBUTION OF THE CURRICULUM

New and current employers should be given at least one set of the complete curriculum package. The curriculum package includes a copy of the **Program Guide**, **Skill Standards Checklist**, **Unit Appendices,** and **the Course Outcome Summary (COS).** In particular, the performance standards for each competency should be highlighted with the employer mentor(s) so that they know HOW to assess the learner for competency evaluation.

All related technical classroom **instructors** will need to be provided with the **Unit Appendices** in order to see the Learning Objectives for each competency for the related technical classroom instruction. The local Manufacturing Youth Apprenticeship advisory group should determine the requirements and delivery of the required related technical classroom instruction ***prior to*** offering this YA program in the local consortium area. It is recommended that the advisory group ensure that the learning objectives are being taught either at the employer facility, school, and/or technical college.

At the beginning of the Manufacturing YA program, **student learners** should receive a copy of the **Skill Standards Checklist** and the applicable pages from the **Unit Appendices** to review with their instructor(s) **and** worksite mentor(s). This is the opportunity for instructors and mentors to highlight the worksite experiences, related technical classroom instruction, and assessments that will occur. In a performance-based curriculum successful learning is enhanced when the learners have the opportunity to review what will be expected of them in advance of the lessons.

It is recommended that a portfolio be prepared for EACH learner. The learner should be given the responsibility for maintaining this documentation and making it available to the instructor and/or worksite mentor for recording performance assessments.

When the performance criteria are completed successfully, the learner achievement level information must be recorded on the **Skill Standards Checklist**. A copy of the completed Skill Standards Checklist is the piece of documentation required by DWD in order to issue the Certification of Occupational Proficiency.

Appendix F

POST SECONDARY CREDITS

Wisconsin Technical College System –

Graduates of one-year or two-year Manufacturing Youth Apprenticeship programs may be awarded credits in Wisconsin Technical College programs. Each Technical College may grant credit through specific local articulation agreements. Contact the local technical college to determine the number and type of articulated credits available for Manufacturing YA. The credits may be taken as technical college courses within Youth Apprenticeship programs or may be granted through advanced standing agreements when students enroll in the technical college.

In addition, YA students should request a credit evaluation of their YA classroom and work experiences upon admission to the local technical college under the Wisconsin Technical College System "Credit for Prior Learning Policy" #323 and through the WTCS-YA Credit Articulation Guidance Document.
(http://dwd.wisconsin.gov/youthapprenticeship/pdf/wtcs_ya_articulation_guidance_10_2010.pdf)

UW Institutions Credits for *Admission* –

Admission Credits for the Manufacturing Youth Apprenticeship Program are yet TO BE DETERMINED.

Appendix G

GRANDFATHER CLAUSE – PROGRAM TRANSITION GUIDELINES

For NEW and CONTINUING Manufacturing YA Students

If the student begins Manufacturing YA using the JUL 2009 checklist in Manufacturing, then the student must complete the YA program using the OLD checklist. The appropriate Level One or Level Two Certificate of Occupational Proficiency from the Wisconsin Department of Workforce Development (DWD) will be awarded.

Senior graduating in 2013 **Level One** YA: The youth apprentice may complete either the JUL 2009 checklist in Manufacturing OR use the revised 2012 YA checklist. The appropriate Level One Certificate of Occupational Proficiency from the Wisconsin Department of Workforce Development (DWD) will be awarded.

Senior graduating in 2013 **Level Two** YA: The youth apprentice completes the JUL 2009 checklist for the year 2 curriculum for Manufacturing YA. An appropriate Level Two Certificate of Occupational Proficiency from the Wisconsin Department of Workforce Development (DWD) will be awarded.

Junior in 2012-2013, **Level One** YA: The youth apprentice may complete either the JUL 2009 checklist in Manufacturing OR use the revised 2012 Manufacturing YA checklist. The appropriate Level One Certificate of Occupational Proficiency from the Wisconsin Department of Workforce Development (DWD) will be awarded for the Junior year participation in the YA program.

Junior in 2012-2013, **Level Two** YA: The youth apprentice starts either the JUL 2009 checklist in Manufacturing OR uses the revised 2012 Manufacturing checklist, however, the youth apprentice must complete the YA program using the same checklist the 2nd year, their Senior year. The appropriate Level Two Certificate of Occupational Proficiency from the Wisconsin Department of Workforce Development (DWD) will be awarded.

Sophomores applying for the Manufacturing YA Program for 2013-2014: New youth apprentices must use the revised 2012 Manufacturing YA checklists **by the 2013-14** school year. A Certificate of Occupational Proficiency will not be issued to students who submit the old checklist.

NOTE: Additionally, Youth Apprenticeship students must maintain good academic standing and be on track for graduation to be eligible for a Certificate of Occupational Proficiency from the Department of Workforce Development.

Appendix H

MANUFACTURING
YOUTH APPRENTICESHIP

SKILL STANDARDS CHECKLIST

DOWNLOAD MOST CURRENT:
http://dwd.wisconsin.gov/dwd/forms/dws/detw_16165_e.htm

SKILL STANDARDS CHECKLISTS (all programs):
http://dwd.wisconsin.gov/youthapprenticeship/skills_checklists.htm

Appendix I

MANUFACTURING
YOUTH APPRENTICESHIP

COURSE OUTCOME SUMMARY:
OVERVIEW AND TABLE OF CONTENTS

Manufacturing Youth Apprenticeship
Course Outcome Summary

Course Information

Organization	Cooperative Educational Services Agency 6 (CESA6)
Developers	Robin Kroyer-Kubicek
Development Date	August 2012

Description
This curriculum describes the performance-based worksite Competencies, Performance Standards, and Learning Objectives for the Wisconsin Youth Apprenticeship (YA) Program in Manufacturing. The Wisconsin Manufacturing YA Program is designed to provide students with a working understanding of core manufacturing industry skills and occupationally specific skills that serve as the standard for occupations in the Manufacturing industry. This program provides the framework for educators and industry to work together to produce work-ready, entry-level employees that will compete favorably in a global market, as well as, provide for post-secondary educational advancement while integrating work-based learning in the school and worksite.

The Manufacturing YA program competencies are aligned with the National Association of State Directors of Career Technical Education Consortium (NASDCTEc) Career Cluster Skill Standards in Manufacturing, http://www.careertech.org/. Manufacturing YA students are required to perform all of the Core and Safety skills, as well as, the Manufacturing Fundamentals skills for EACH pathway they enroll in. **Level One (one year)** YA students are to choose additional competencies from a MINIMUM of ONE Manufacturing Unit in a specific pathway. **Level Two (two year)** YA students are to complete all of the Level One requirements plus an additional unit within their chose pathway.

Pathway choices:

Production Pathway
Production Operations Management Pathway
Maintenance, Installation, & Repair Pathway

EACH competency (worksite skill) is listed with its corresponding Performance Standards and Learning Objectives. The Performance Standards describe the behaviors, ***as applicable***, that employers should look for in order to evaluate the competency. The Learning Objectives suggest classroom learning content recommended for the required related technical instruction.

Curriculum Sources

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This curriculum was developed through a grant from the Wisconsin Department of Workforce Development to Wisconsin's Cooperative Educational Services Agency 6 (CESA6)

Manufacturing Youth Apprenticeship

Table of Contents

REQUIRED SKILLS
APPENDIX J:

Unit 1: Core Skills

1. Apply academic knowledge
2. Apply career knowledge
3. Apply manufacturing knowledge
4. Communicate effectively
5. Act professionally
6. Cooperate with others in a team setting
7. Think critically
8. Exhibit regulatory and ethical responsibilities
9. Use resources wisely
10. Use basic technology

Unit 2: Safety

1. Follow personal safety requirements
2. Maintain a safe work environment
3. Demonstrate professional role in an emergency

Unit 3: Manufacturing Fundamentals

1. Focus on customer needs
2. Measure using various instruments
3. Operate tools and equipment safely
4. Practice quality assurance principles

APPENDIX K:

Unit 4: Production Pathway: Assembly & Packaging

1. Read technical drawings & work orders
2. Interpret assembly & packaging symbols & procedures
3. Identify set up for assembly
4. Select tools and materials
5. Perform safety checks
6. Perform assembly set up
7. Verify assembly set up
8. Perform assembly
9. Perform quality checks
10. Build packaging
11. Package product
12. Process packaging documents
13. Clean up
14. Monitor equipment for correct operation
15. Document equipment use &/or operational problems

APPENDIX L:

Unit 5: Production Pathway: Manufacturing Processes

1. Read technical drawings & work orders
2. Interpret symbols & procedures
3. Identify set up
4. Select tools & materials
5. Perform safety checks
6. Assist to perform set up
7. Verify set up
8. Perform start up
9. Operate equipment
10. Monitor product & process specifications
11. Process production documents
12. Shutdown process
13. Clean up
14. Monitor equipment for correct operation
15. Document equipment use &/or operational problems

APPENDIX M:

Unit 6: Production Pathway: Machining

1. Read machining technical drawings & work orders
2. Interpret machining symbols & procedures
3. Identify set up
4. Select tools and materials
5. Perform safety checks
6. Assist to perform set up
7. Verify set up
8. Perform start up
9. Operate machining equipment
10. Monitor machining product and process specifications
11. Process production documents
12. Shutdown machining process
13. Clean up
14. Use hand tools
15. Use CNC equipment (W/S)
16. Monitor equipment for correct operation
17. Document equipment use &/or operational problems

APPENDIX N:

Unit 7: Production Pathway: Welding

1. Read welding technical drawings & work orders
2. Interpret welding symbols & procedures
3. Layout & plan work
4. Perform safety checks
5. Prepare base metal
6. Set up to fabricate base metal
7. Fabricate base metal
8. Thermally/chemically cut metal
9. Tack work pieces
10. Weld metal
11. Monitor product & process
12. Assist to inspect, measure, &/or test completed metal pieces
13. Process production documents
14. Clean up
15. Monitor equipment for correct operation
16. Perform routine preventive maintenance (PM)
17. Document equipment use, PM, &/or operational problems

APPENDIX O:

Unit 8: Production Operations Management Pathway: Production Operations Management

Inventory

1. Assist to purchase materials & supplies
2. Receive inventory
3. Manage inventory levels
4. Distribute materials & products
5. Assist to develop inventory forecasts (W/S)
6. Maintain inventory records

Resources

7. Assist to develop a production plan for customer order (W/S)
8. Assist to record & summarize financial data
9. Assist to coordinate work schedules & duty assignments

Quality Management

10. Use quality tools
11. Calibrate tools & equipment (W/S)
12. Assist to analyze production process for productivity (W/S)
13. Monitor operations for product & process quality
14. Assist to investigate root causes of product &/or process failure
15. Take corrective action to restore or maintain quality
16. Participate in quality improvement processes

APPENDIX P:

Units 9-10: Maintenance, Installation, & Repair Pathway: Industrial Equipment

Basic Industrial Equipment Unit

1. Read technical drawings & work orders
2. Interpret equipment symbols & procedures
3. Maintain schedules, communication, & documentation
4. Monitor equipment for correct operation
5. Identify maintenance requirements
6. Layout & plan work
7. Perform safety checks
8. Use hand tools
9. Perform preventive maintenance (PM)
10. Perform lubrication procedures
11. Assist with basic equipment problem identification & diagnosis
12. Assist with basic equipment repair
13. Assist to re-qualify equipment

Advanced Industrial Equipment Unit

1. Calibrate tools and instruments (W/S)
2. Set up & fabricate metal
3. Mount a bearing
4. Install mechanical fasteners
5. Assist with electrical circuit problem identification & diagnosis
6. Assist with motor control problem identification & diagnosis
7. Assist with hydraulic &/or pneumatic problem identification & diagnosis
8. Maintain and repair mechanical drive system components
9. Maintain and repair electrical control system components
10. Maintain and repair hydraulic &/or pneumatic system components
11. Assist to install & qualify equipment

Appendix J

MANUFACTURING
YOUTH APPRENTICESHIP

REQUIRED SKILLS CURRICULUM
UNITS 1-3

Unit 1: Required Skills
Core Skills

Competency
1. Apply academic knowledge

Performance Standard Condition
Competence will be demonstrated
at the worksite and classroom

Performance Standard Criteria
Performance will be successful when learners:
Read and comprehend work related materials
Apply mathematical operations involving whole numbers, fractions, decimals, percentages, formulas and methods of measurement accurately when necessary
Interpret charts, tables, and graphs

Learning Objectives
MATH
Add, subtract, multiply, and divide whole numbers, fractions, decimals and percents
Calculate averages, ratios, proportions, and rates
Convert decimals to fractions, fractions to percents and vice versa
Measure and accurately report measurements of time, temperature, length, width, height, width, perimeter, area, volume, and weight
Use appropriate formulas
Convert measurements correctly (e.g., English (standard) to metric)
Interpret meaning from data
ENGLISH
Use standard English to compile information and prepare written reports
Apply English language correctly (spelling, grammar, structure)
Derive meaning from text through summarizing
Discern meaning from written word
Use acceptable language
Write legibly
SCIENCE
Explain the key elements of the scientific process
Define the differences in qualitative and quantitative measurements
Compare and contrast subjective and objective information
Discriminate between fact and opinion

Comments:

Unit 1: Required Skills
Core Skills

Competency
2. Apply career knowledge

Performance Standard Condition

Competence will be demonstrated

at the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

Demonstrate understanding of career development in the Manufacturing industry
Obtain necessary skills and knowledge to meet position requirements

Learning Objectives

Explain the process for seeking employment
Describe the major functions and duties of the career pathways within the Manufacturing career cluster
Discuss educational, training, and credentialing requirements for a selected job
Research job requirements and characteristics of a selected job
Contrast "positive" and “less positive” aspects of a selected job
Describe opportunities for advanced training in Manufacturing careers

Comments:

Unit 1: Required Skills
Core Skills

Competency

3. Apply manufacturing industry knowledge

Performance Standard Condition

Competence will be demonstrated

at the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

Demonstrate Manufacturing industry systems understanding based on ***current knowledge and training***

Learning Objectives

Define common equipment and purposes used in the following manufacturing processes:

- Machining
- Cutting, drilling, bonding
- Joining and welding
- Finishing and assembly

Explain the function of the following pieces of manufacturing equipment:

- CNC
- Lathe
- Milling Center
- Machine Center
- Router
- Grinder
- Welding equipment
- Jigs and fixtures

Mechanical Systems

- Describe simple machines
- Identify the characteristics of simple machines
- Explain the function of pulleys, gears, and belts
- Explain fluid power
- Illustrate how pressure distributes itself in a closed system

Electrical Systems

- Determine the basic requirements for an electrical circuit to function
- Determine the basic requirements of a series circuit
- Examine the differences and similarities of series and parallel circuits
- Describe the relationship between voltage, current and resistance
- Explore the relationship between electricity and magnetism
- Identify common components used in electronics

HISTORY AND TRENDS

Describe a brief history of modern manufacturing

Examine the current state and future forecast of the manufacturing industry

Describe the impact of technology in the manufacturing industry

Explain how manufacturing affects our standard of living

List the sub-industries within manufacturing
Describe how the global economy is impacting manufacturing

Comments:

Unit 1: Required Skills
Core Skills

Competency

4. Communicate effectively

Performance Standard Condition

Competence will be demonstrated

at the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

Use effective oral communication skills
Communicate in bias-free manner
Listen actively to others
Does not overreact in response to anger
Record information in a timely manner
Record written information legibly and accurately
Use email, the Internet, printer, copier, scanner, and fax machine equipment appropriately as applicable
Is sensitive to special, multicultural, and/or multilingual needs

Learning Objectives

GENERAL
- Compare verbal and nonverbal behaviors

LISTEN
- Discuss effective and active listening skills

WRITTEN
- Discern meaning from written instructions
- Write clearly to communicate written ideas
- Discuss common recording errors and how to avoid them

CUSTOMER
- Identify internal and external customers at your facility
- Discuss steps to assess customer understanding
- Describe the steps to follow when dealing with complaints

TOOLS
- Describe technology used in communicating such as, telephone, texting, instant messaging (IM), computers, fax, intercom, beepers, etc.
- Explain the proper use and etiquette required for these forms of communication technology
- Review the policies and procedures for using written communication tools in your company such as email, Internet, printer, copier, scanner, and/or fax

Comments:

Unit 1: Required Skills
Core Skills

Competency
5. Act professionally

Performance Standard Condition

Competence will be demonstrated

at the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

Follow oral and written instructions
Is pleasant, courteous, and professional with coworkers and internal and external customers
Appearance and dress are appropriate according to the requirements of the employer
Takes personal responsibility for attendance
Is punctual
Begin work promptly
Organize and prioritizes tasks efficiently
Exhibit positive attitude and commitment to task at hand
Complete assigned tasks accurately and in a timely manner
Take responsibility for actions and decisions
Recognize lack of knowledge and seeks help from information sources
Evaluate work goals periodically with worksite professional
Accept constructive criticism and applies suggestions
Communicate safety, training, and job-specific needs
Adhere to safety rules and regulations

Learning Objectives

Locate and explain written organizational policies, rules and procedures to help employees perform their jobs
Locate and explain your company's employee manual for policies on Appearance, Breaks, Time Off, Cell Phone Use, Weather, Personal Issues, etc.
List qualities of successful Manufacturing employees
Describe how you can demonstrate enthusiasm and commitment at the worksite
Define initiative
Explain ways that you can show initiative at a worksite
Explain methods to evaluate work assignments and prioritize them
Describe how to effectively receive feedback

Comments:

Unit 1: Required Skills
Core Skills

Competency

6. Cooperate with others in a team setting

Performance Standard Condition

Competence will be demonstrated

at the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

Demonstrate respect relating to people
Contribute to a group with ideas, suggestions, and effort
Listen and respond appropriately to team member contributions
Work collaboratively with people from other backgrounds/cultures
Resolve differences for the benefit of the team
Complete their share of tasks necessary to complete a project

Learning Objectives

Explain the functions of each department or unit within the larger organization
Identify roles found in teams such as leader, facilitator, recorder, etc.
List effective meeting management skills
Demonstrate techniques which show respect for others
Describe how to effectively give and receive feedback
Describe conflict resolution methods
Discuss ways to participate within a team setting
Explain how to interact appropriately with diverse ethnic, age, cultural, religious, and economic groups in different situations
Describe how work teams coordinate work flow and help manage resources

Comments:

Unit 1: Required Skills
Core Skills

Competency
7. Think critically

Performance Standard Condition
Competence will be demonstrated
at the worksite and classroom

Performance Standard Criteria
Performance will be successful when learners:
Recognize the existence of a problem
Apply problem-solving steps
Differentiate between fact and opinion
Consider other viewpoints and perspectives
Apply the principles and strategies of organized thinking
Evaluate information, ideas, and problems
Collect information through probing questions and research
Define the problem
Use techniques such as brainstorming to acquire alternative solutions
Demonstrate comparison skills
Make decisions based on analysis
Present ideas for critical evaluation
Support viewpoints with evidence

Learning Objectives
Describe how to break a problem down in order to brainstorm, evaluate, and analyze possible solutions
Discuss data collection techniques for the problem solving process
Describe how to present a solution with evidence
Explain ways to reach a decision by consensus
Discuss methods to evaluate a solution that has been implemented

Comments:

Unit 1: Required Skills
Core Skills

Competency

8. Exhibit regulatory and ethical responsibilities

Performance Standard Condition

Competence will be demonstrated

at the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

Follow all safety and worksite standards and regulations
Perform legally and ethically by all local, state, and national standards
Use email, the Internet, printer, copier, scanner, and fax machine equipment appropriately and correctly as applicable
Operate within scope of authority adhering to company rules, regulations, and policies as established in employee handbook/procedures
Comply with legal requirements for documentation
Document work processes as required
Record and file appropriate documents in timely manner
Maintain confidentiality of company, customer, and co-worker information
Document reportable incidents to worksite professional immediately, if applicable
Receive, handle, package, and ship materials and product according to shipping laws and regulations if applicable

Learning Objectives

GENERAL

Explain the role of the government in regulating and managing the manufacturing industry
Compare national, state and local regulators that oversee the manufacturing industry: Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), the Federal Trade Commission (FTC), etc. as applicable
Identify major manufacturing industry associations: National Association of Manufacturers (NAM), National Council for Advanced Manufacturing, National Center for Manufacturing Sciences (NCMS), National Institute for Metalworking Skills (NIMS), American Welding Society (AWS), Manufacturing Skill Standards Council (MSSC), etc.
Identify the management structure and employees' roles within your organization
Compare copyright, patent, and trademark laws

ETHICAL

Explain the difference between an ethical practice and a legal responsibility
Identify current ethical issues common to the Manufacturing field
Describe ethical work values such as confidentiality, productivity during the day, following safety standards

SAFETY

Define legal and ethical responsibilities for safety procedures
Describe the certification/license requirements to operate specific equipment or perform specific functions

RECORDS

Identify the main functions of documents and documentation

Identify the guidelines for retaining common documents

Comments:

Unit 1: Required Skills
Core Skills

Competency
9. Use resources wisely

Performance Standard Condition
Competence will be demonstrated
at the worksite and classroom

Performance Standard Criteria
Performance will be successful when learners:
Follow the facility pollution/waste prevention plan
Recycle whenever possible
Dispose of materials appropriately
Dispose of hazards legally and with regard to environmental impact

Learning Objectives
Identify current environmental issues affecting the Manufacturing industry
Define what is meant by making “green” choices
Compare renewable and nonrenewable natural resources
Explain the meaning of sustainable resources use
Identify practices that contribute to sustainability
Describe why wise use of resources at the worksite is important
Give examples of wasteful uses of resources (unnecessary waste and duplication) at the worksite
List materials that can be recycled
Describe materials that require special disposal
Explain purpose of pollution control systems
Relate power generation to energy sources
Compare environmental impact of energy sources (e.g., fuel cells, chemical, wind, hydro, nuclear, electric, mechanical, solar, biological)

Comments:

Unit 1: Required Skills
Core Skills

Competency
10. Use basic technology

Performance Standard Condition

Competence will be demonstrated

at the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

Use communication technology (such as pagers, radios, phone, fax, email, Internet) to access and distribute data and other information within the scope of the job

Follow rules for proper computer and communication technology usage

Use calculating tools such as a computer, calculator, and adding machine correctly

Enter, edit, and store data on computerized equipment according to worksite guidelines

Verify data entry prior to data storage or equipment operation

Learning Objectives

Identify the parts and functions of a computer system using correct terminology including the keyboard, monitor, mouse, printer

Point out the storage device locations on the computer such as the Hard drive, Floppy drive, CD-ROM drive, and Portable File Storage drive, etc

Show the appropriate connections and positioning of peripheral devices such as a mouse, keyboard, monitor, portable devices, and printer

Discuss the importance of backing up computerized files

Compare different forms of communications technology including email, texting, word processing, spreadsheets, database, presentation software, and use of the internet to communicate, search and display information

Describe how to evaluate internet web sites and information for validity and reliability

Explain appropriate and inappropriate uses of email and internet while at work

Comments:

Unit 2: Required Skills
Safety

Competency

1. Follow personal safety requirements

Performance Standard Condition

Competence will be demonstrated

at the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

Participate in all required safety training
Follow all worksite guidelines for personal safety
Apply principles of proper body mechanics when necessary
Report any exposures, injuries, or accidents, personal or to others, immediately, if applicable
Locate and can find key information on Material Safety Data Sheets (MSDS)
Handle and dispose of any hazardous materials appropriately, if applicable
Operate only equipment that he/she is trained on
Adhere to equipment safety standards
Visually inspect equipment to ensure safety compliance and function before operation
Wear the required Personal Protective Equipment (PPE) at all times as required by the worksite for specific tasks

Learning Objectives

Discuss the regulatory purpose and responsibility of the Occupational Safety and Health Administration (OSHA)
List your rights as a worker according to OSHA
Explain the procedure to follow in case of an exposure, injury, or accident to self or to another
Explain ways your company prevents accidents
List engineering controls that are taken to protect workers from accidents
Describe safe and unsafe work habits and their implications
List safety hazards at your facility
Explain potential hazards associated with blood borne pathogens
Explain the ergonomic impact of work techniques
Describe proper techniques for lifting loads
Describe the Material Safety Data Sheet (MSDS) and its purpose
Discuss the procedures of handling and disposing of hazardous material
List mechanical, chemical, electrical, compressed air, and equipment safety hazards at your facility
Explain how Lock Out/Tag Out procedures prevent accidents
Define the Personal Protective Equipment (PPE) required for specific tasks in your facility
Explain the use of safety equipment such as eyeball washers and chemical safety showers and when you would use them
Describe ways to prevent burns

Comments:

Unit 2: Required Skills
Safety

Competency

2. Maintain a safe work environment

Performance Standard Condition

Competence will be demonstrated

at the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

Comply with posted safety warnings and symbols
Identify unsafe conditions and/or work habits and reports them to the worksite professional immediately, if applicable
Help maintain a clean and safe working environment free of debris and obstacles
Clean, organize, put away items in the work area
Safely identify, handle, store, and use hazardous materials according to company procedure, if applicable
Report any indications of insects or pests

Learning Objectives

List the major components of a facility safety program
List the different state and federal agencies that provide regulatory oversight at your facility for personal safety, environmental safety, and equipment safety
List accident and fire prevention techniques
Describe posted safety warnings and symbols and what they mean
Describe safe and unsafe work habits and their implications
Discuss the importance of keeping the work area and tools/equipment clean
List mechanical, electrical, and equipment safety hazards at your facility
Discuss how to identify and report unsafe conditions in your facility
Discuss safety procedures to prevent accidents
Describe the requirements at your facility for safety training and auditing
Assess need for good housekeeping practices
List accident and fire prevention techniques
List hazards that contribute to injury due to slips, trips, or falls
Outline compliance requirements of sanitation and health inspections

Comments:

Unit 2: Required Skills
Safety

Competency

3. Demonstrate professional role to be used in an emergency

Performance Standard Condition

Competence will be demonstrated

at the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

Participate in emergency safety simulations and drills
Outline the company's policy and procedure for worksite incidents, accidents, electrical, fire, tornado, bomb threats, robbery, hostage situations, and other emergency situations
Identify the closest fire alarms and emergency exits in the assigned worksite area
Identify the fire extinguishers in the assigned worksite area
Identify appropriate alarms and procedures for using alarms
Contact emergency personnel according to company requirements in the event of an emergency
Document any emergency incidents according to company requirements

Learning Objectives

Describe the procedures in your company to report an emergency
Review your company procedures for responding to exposures, injuries, accidents, spills, fire, tornado, bomb threat, robbery, hostage situations, etc.
Demonstrate how to use the fire blanket and/or fire extinguisher
Explain the evacuation plan for the worksite
Indicate the demeanor necessary during an emergency
Identify methods to cope with emergency situations
Name the resources for assistance in crimes or accidents
Locate and explain use of first aid emergency care kits
Detail steps to use in medical emergencies requiring First Aid, CPR, and/or Heimlich maneuver
Locate and explain use of spill kits, if applicable to worksite
Explain who in your facility can give first aid care in the event of an emergency
Explain the local protocols in place with local law enforcement
Explain the role of the Hazardous Materials (HAZMAT) team
Detail how to access help in a robbery or terrorist situation
Explain the use of safety equipment such as eyeball washers and chemical safety showers and when you would use them

Comments:

Unit 3: Required Skills
Manufacturing Fundamentals

Competency

1. Focus on customer needs

Performance Standard Condition

Competence will be demonstrated

at the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

Identify internal and external customers impacted by the production process
Satisfy internal and external customer's expectations
Collaborate with team to provide responses and solutions to meet the requirements, requests, and concerns of internal and external customers
Assist worksite professional to keep internal and external customers informed of project progress and decisions that may affect them

Learning Objectives

Identify the internal and external customers in your facility
Describe the role of sales and marketing operations in your facility
Describe how production requirements are determined from the product specifications
Explain the importance of continual customer contact about product specifications
Describe facility issues that may impact customer needs being met
Explore why a consumer buys a product
Evaluate how customer service affects purchases
Explain why manufacturers need to be able to customize products

Comments:

Unit 3: Required Skills
Manufacturing Fundamentals

Competency

2. Measure using various instruments

Performance Standard Condition

Competence will be demonstrated

at the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

Consider the degree of precision required by the part feature
Choose correct measuring instrument for task
Verify equipment is available for use and in working order
Verify equipment is current for preventative maintenance and/or calibration
Inspect tools and work area for safety considerations
Clean and adjust measuring instrument prior to use
Measure correctly and accurately
- With gages, calipers, and micrometer instruments
- With semi-precision and precision layout tools
- With digital gages

Confirm measurement to given specification
Record measurement correctly including unit of measurement
Calibrate, clean, and store measuring instruments properly as required

Learning Objectives

Add, subtract, multiply, and divide whole numbers, fractions, decimals and percents
Calculate averages, ratios, proportions, and rates
Convert decimals to fractions, fractions to percents and vice versa
Compare accuracy and precision when using measuring equipment
Identify various calipers, micrometer instruments, and layout tools and their applications
Identify digital measuring gages and instruments and their applications
Describe how to read and interpret gages
Measure and accurately report measurements of time, temperature, distance, length, width, height, width, perimeter, area, volume, weight, velocity and speed
Use appropriate formulas
Convert measurements correctly (e.g., English (US standard) to metric)

Comments:

Unit 3: Required Skills
Manufacturing Fundamentals

Competency

3. Operate tools and equipment safely

Performance Standard Condition

Competence will be demonstrated

at the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

Operate only equipment that he/she is trained on
Choose correct tool or equipment for the task
Follow and complete any tool check list
Verify tool/equipment is available for use and in working order
Verify tool/equipment is current for preventative maintenance and/or calibration
Verify safety equipment and any Personal Protective Equipment (PPE) needed for tool/equipment use
Inspect tool/equipment and work area for safety considerations
Set up and prepare tool/equipment for safe operation:

- Lubrication and fluid level checks
- Air and pressure supplies
- Power supply

Wear the required Personal Protective Equipment (PPE) at all times as required for the operation of the tool/equipment
Operates tool/equipment safely with guarding devices in the manner required for the job task
Checks accuracy of tool/equipment operation with first run
Monitor tool/equipment for safe operation while operating
Compare tool/equipment performance regularly to optimal equipment operations
Follow facility procedures for clean up and shut down after use
Perform any required preventative maintenance procedures
Investigate and promptly reports abnormal tool/equipment conditions
Properly shuts down and labels any tool/equipment that is not operating as expected
Follow Lock Out/Tag Out procedures as applicable
Document use and maintenance as required

Learning Objectives

Distinguish between common hand tools including hammers, wrenches, pliers, punches, taps, and dies
List the various tools and equipment used at your worksite such as cutting and non-cutting hand tools, sawing machines, pedestal (bench) grinders, drill presses, vertical milling machines, CNC equipment, lathes, molding equipment, etc.
Give examples of manufacturing processes that use fixtures
Define jig or fixture
Describe the classes of jigs or fixtures
Compare open and closed jigs

Outline applications of each tool and equipment
Describe and demonstrate the safety requirements for each tool and equipment
Discuss start up and shut down procedures for each tool/equipment you will operate
Explain the purpose of preventative maintenance
Describe emergency shutdown procedures for the tool/equipment you will operate
Explain how to recognize and address malfunctions for the tool/equipment you will operate
Describe how to recognize wear and tear on equipment components
Describe how to select lubricants and coolants as applicable
Compare costs, advantages, and disadvantages of Computer Numerical Control (CNC) tools versus Manually set tools and equipment
List the safeguards that apply to the equipment used in your facility for tools, automated machines, material handling equipment, and lifts
List which tools and equipment require safety certification
Explain Lock Out/Tag Out indications and procedures in your facility

Comments:

Unit 3: Required Skills
Manufacturing Fundamentals

Competency

4. Practice quality assurance principles

Performance Standard Condition

Competence will be demonstrated

at the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

Inspect and/or test materials/piece/product at all stages of production to determine quality or condition

Monitor materials, processes, equipment, tools, and products throughout the production process for safety and quality specifications

Inspect final product/piece to ensure it meets specifications

Promptly identify and segregate materials and/or product that do not meet specification

Communicate with worksite professional if materials and/or product do not meet requirements

Document all quality checks

Learning Objectives

Explain and analyze the quality approval process used in the Manufacturing industry

Describe the roles and responsibilities for quality in your facility

List the major stages involved in producing products

Explain the procedures for rejecting sub-standard products

Define terms used in quality assurance

Explain quality systems such as SPC, Six Sigma, TQM, ISO9000

Describe the impact of quality standards on manufacturing

Describe the major components of the ISO 9000 standards

Describe how materials are selected and tested for product requirements

Comments:

Appendix K

MANUFACTURING
YOUTH APPRENTICESHIP

PRODUCTION PATHWAY
ASSEMBLY AND PACKAGING (UNIT 4)

Unit 4: Production Pathway
Assembly and Packaging

Competency

1. Read technical drawings and work orders

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review technical drawing
Gather reference materials as needed
Determine type of print and views used
Determine material specifications
Determine critical dimensions and tolerances
Analyze supplementary data
Determine product or job instructions and specifications
Interpret assembly and packaging symbols and procedures

Learning Objectives

Explain the need for technical drawings, also known as blueprints, schematics, part prints, or engineering drawings
Explain how technical drawings detail work piece design parameters, lay out and specifications
Explain how product design and production are related
Discuss different types of technical drawings
Identify terminology related to technical drawings
Describe how to interpret views, projections and elements from a technical drawing
Identify common terms, components, revisions, symbols, assembly sequence, dimensions, tolerances, scale, and list of materials from technical drawings or work orders

Comments:

Unit 4: Production Pathway
Assembly and Packaging

Competency

2. Interpret assembly and packaging symbols and procedures

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Interpret technical drawings accurately as needed for job task
Use appropriate terminology
Identify lines, views, symbols, and representations on the drawings
Interpret dimensions, tolerances, and scale on the drawings
Interpret threads, tapers, and shop notes on the drawings
Interpret the assembly and packaging plan from a technical drawing which includes tools, equipment, speeds, feeds, fixtures and holders as applicable

Learning Objectives

Define and explain the use of lines, views, symbols, dimensions, scale, and tolerances on technical drawings
Identify different lines by name, type, order of usage, and application such as object, hidden, center, section, dimension, extension, cutting plane, short break, long break, phantom
Demonstrate standard view placement practices
Compare pictorial format, orthographic projection, sectional views, and detail schedules
Discuss the standards for assembly and packaging document lines
Describe the standard usage of metric (SI) linear units in assembly drafting
Identify and interpret assembly drawings as to type, part name, part number, callouts, components, and part size dimensions
Determine the relationship of one part to another from assembly drawings
Determine procedure number cross-references to technical drawings

Comments:

Unit 4: Production Pathway
Assembly and Packaging

Competency

3. Identify set up for assembly

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Locate and review applicable technical drawings, work orders, and/or procedures for assembly processing

Plan sequencing, tools, and equipment needed for assembly

Identify set up needed

Consult with worksite professional to verify assembly schedule, deadlines, and timeframes

Learning Objectives

Describe how an assembly plan is developed from a technical drawing for process, equipment, tools, and holders

Explain how product design and the assembly are related

Identify terminology related to assembly and packaging

List characteristics of major types of assembly systems

Comments:

Unit 4: Production Pathway
Assembly and Packaging

Competency

4. Select tools and materials

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Select tools and assembly equipment to be used
Check assembly pieces needed against work order
Verify assembly pieces and materials meet specifications
Gather all resources needed at the workstation
Notify worksite professional of any discrepancies

Learning Objectives

List the various tools and equipment used in assembly and packaging at your worksite
Outline applications of each tool and equipment
Describe and demonstrate the safety requirements and safeguards for each tool and equipment
Explain the importance of pieces and materials meeting specifications prior to assembly

Comments:

Unit 4: Production Pathway
Assembly and Packaging

Competency

5. Perform safety checks

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review assembly procedure to be used

Review safety requirements of assembly procedure

Verify safety equipment and any Personal Protective Equipment (PPE) needed for assembly process

Inspect tools and work area for safety considerations

Examine assembly equipment labeling and safeguarding

Learning Objectives

List the types of labeling used on tools and equipment at your facility to indicate whether a tool or piece of equipment is functional and safe to use

List the situations which require you to obtain help to resolve problems with equipment or production

Comments:

Unit 4: Production Pathway
Assembly and Packaging

Competency

6. Perform assembly set up

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Assemble and adjust tools and assembly equipment as required
Verify assembly equipment is available for use and in working order
Verify assembly equipment is current for preventative maintenance and/or calibration
Set assembly equipment parameters as required for the procedure
Stage pieces and materials for assembly

Learning Objectives

List the types of labeling used on tools and equipment at your facility to indicate whether a tool or piece of equipment is functional and safe to use
Explain the purpose and importance of preventative maintenance and calibration
List the situations which require you to obtain help to resolve problems with equipment or production

Comments:

Unit 4: Production Pathway
Assembly and Packaging

Competency

7. Verify assembly set up

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Verify set up meets assembly requirements and product specifications
Examine first assembled final product for visual and/or dimensional specification
Make adjustments to ensure final assembly meets specification if needed
Verify repeatability of set up if applicable
Document assembly set up procedure for repeatability if applicable
Document start up/set up procedure if required

Learning Objectives

Define repeatability
Describe the importance of repeatability in manufacturing

Comments:

Unit 4: Production Pathway
Assembly and Packaging

Competency

8. Perform assembly

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Operate assembly equipment safely in the manner required for the job task
Operate assembly equipment according to machine requirements
Wear the required Personal Protective Equipment (PPE) at all times as required for the operation of the equipment
Monitor equipment for safe operation while operating
Inspect final assembled product
Make adjustments to ensure assembled product meets specification if needed
Document assembly procedure

Learning Objectives

Describe the assembly procedure
Describe advantages and limitations of automated assembly
List the safety rules associated with automated production and assembly systems
List the situations which require you to obtain help to resolve problems with equipment or production

Comments:

Unit 4: Production Pathway
Assembly and Packaging

Competency
9. Perform quality checks

Performance Standard Condition
Competence will be demonstrated
at the worksite

Performance Standard Criteria
Performance will be successful when learners:
Test assembled product for function and/or compliance
Label assembled products for compliance or non-compliance
Document quality control checks

Learning Objectives
Describe the uses of assembly and packaging data
List the quality checks performed as part of the assembly and packaging process
Explain why products are tested for quality and function
Explain why labeling and documentation are part of the quality check

Comments:

Unit 4: Production Pathway
Assembly and Packaging

Competency
10. Build packaging

Performance Standard Condition
Competence will be demonstrated
at the worksite

Performance Standard Criteria
Performance will be successful when learners:
Verify testing of assembled product(s) is complete
Identify package needed
Assemble package
Inspect package
Stage finished package

Learning Objectives
Identify the federal agencies that regulate packaging
Identify the basic aspects of packaging regulated by federal agencies
Explain why it is important to inspect the package after construction
Explain how product design and the packaging are related
List the situations which require you to obtain help to resolve problems with equipment or production

Comments:

Unit 4: Production Pathway
Assembly and Packaging

Competency
11. Package product

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Verify proper packaging procedure
Retrieve packaging
Use protective packaging materials as required
Use packaging methods that keep returns and claims for damaged and improperly packaged goods to a minimum
Place final compliant product in packaging
Seal package
Inspect sealed packaging for all relevant information against the work order
Handle package as required to prevent damage
Labeling meets regulatory and safety regulations
Package meets package and shipping specifications

Learning Objectives

Explain how customer shipping instructions determine packing requirements
Explain how packing materials determine packing requirements
Compare packing materials to determine the safest and most cost-effective method of shipping
List the situations which require you to obtain help to resolve problems with equipment or production

Comments:

Unit 4: Production Pathway
Assembly and Packaging

Competency

12. Process packaging documents

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Verify packaging documentation such as manuals, packing slips, warranties, inspection labels, start up instructions, are included and match the final packaged product as required

Apply all required documentation such as shipping tags as required

Handle package as required to prevent damage

Communicate package availability to proper parties in a timely manner

Documentation is legible

Documentation is complete

Documentation is in appropriate format

Documentation is stored or forwarded as required

Package is correctly stored or staged

Learning Objectives

Describe the importance of documenting the packaging process

State the purpose of an inspection label

Comments:

Unit 4: Production Pathway
Assembly and Packaging

Competency
13. Clean up

Performance Standard Condition
Competence will be demonstrated
at the worksite

Performance Standard Criteria
Performance will be successful when learners:
Select appropriate cleaning tools and equipment
Clean assembly and packaging tools/equipment as required
Clean work area as required
Store tools in proper location
Store materials in safe manner
Identify unsafe conditions and reports them promptly
Take corrective action to correct unsafe conditions
Ensure that workstation is clean and clear of safety hazards
Ensure workstation is organized for efficiency
Dispose of waste appropriately as required

Learning Objectives
Describe the cleaning procedures and materials used for the specific processes you perform

Comments:

Unit 4: Production Pathway
Assembly and Packaging

Competency

14. Monitor equipment for correct operation

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review equipment quality measures for trends and problems as required

Compare current equipment performance to optimal equipment operations on a regular basis

Report any noted deviations from expected performance

Ensure that equipment is properly labeled and pulled from production use if inoperative

Assist worksite professional to investigate abnormal equipment conditions in a timely manner

Assist worksite professional to follow up on repaired equipment to ensure that that corrective action solved the problem

Document all monitoring activities

Learning Objectives

Explain the meaning of common alarms on equipment at your facility

Explain how to read and review repair history records

Describe how trends for malfunctioning equipment might appear in production records

List the tools and equipment at your facility that must be monitored and maintained

Define Total Productive Maintenance (TPM)

Describe common electrical systems reliability issues including power supply connections, operations, series and parallel circuit function, circuit breaker function, electric motor control, and power overload

Describe common pneumatic system reliability issues including pressure gage readings, conductors, connectors, seals, gaskets, packing, quick-connect fittings, pneumatic cylinder and motor operations, air muffler operations, actuator power output, and pressure regulator operations

Describe common hydraulic system reliability issues including seals, gaskets, packing, and hydraulic fluids

Describe common automated machine reliability issues including computerized control processes, logic control circuits, solenoid-operated fluid power valves, electromechanical limit switches, time delay devices, manual controls, and interlock circuits

Comments:

Unit 4: Production Pathway
Assembly and Packaging

Competency

15. Document equipment use and/or operational problems

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Verify all internal and external communication with appropriate parties in a timely manner
Communicate maintenance and repair needs clearly
Use the correct reporting formats for communication
Document use, maintenance, and repair activities accurately
Report back and document any maintenance and repair issues in a timely manner
Maintenance communication is timely and accurate
Maintenance communication is documented

Learning Objectives

Explain the uses of equipment data
Discuss how to schedule repair and maintenance functions with respect to production requirements and production levels
Explain how communication for repair and maintenance issues demonstrates a knowledge of customer and business needs
List the parties that need to be involved of repair and maintenance issues
Describe the importance of documenting communications

Comments:

Appendix L

MANUFACTURING
YOUTH APPRENTICESHIP

PRODUCTION PATHWAY
MANUFACTURING PROCESSES (UNIT 5)

Unit 5: Production Pathway
Manufacturing Processes

Competency

1. Read technical drawings and work orders

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review technical drawing
Gather reference materials as needed
Determine type of print and views used
Determine material specifications
Determine critical dimensions and tolerances
Analyze supplementary data
Determine product or job instructions and specifications
Interpret symbols and procedures

Learning Objectives

Explain the need for technical drawings, also known as blueprints, schematics, part prints, or engineering drawings
Explain how technical drawings detail work piece design parameters, lay out and specifications
Explain how product design and production are related
Discuss different types of technical drawings
Identify terminology related to technical drawings
Describe how to interpret views, projections and elements from a technical drawing
Identify common terms, components, revisions, symbols, assembly sequence, dimensions, tolerances, scale, and list of materials from technical drawings or work orders

Comments:

Unit 5: Production Pathway
Manufacturing Processes

Competency

2. Interpret symbols and procedures

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Interpret technical drawings accurately as needed for job task
Use appropriate terminology
Identify lines, views, symbols, and representations on the drawings
Interpret dimensions, tolerances, and scale on the drawings
Interpret threads, tapers, and shop notes on the drawings
Interpret the production process plan from a technical drawing which includes tools, equipment, speeds, feeds, fixtures and holders as applicable

Learning Objectives

Define and explain the use of lines, views, symbols, dimensions, scale, and tolerances on technical drawings
Identify different lines by name, type, order of usage, and application such as object, hidden, center, section, dimension, extension, cutting plane, short break, long break, phantom
Demonstrate standard view placement practices
Compare pictorial format, orthographic projection, sectional views, and detail schedules
Discuss the standards for production document lines
Describe the standard usage of metric (SI) linear units in drafting
Identify and interpret drawings as to type, part name, part number, callouts, components, and part size dimensions
Determine the relationship of one part to another from assembly drawings
Determine procedure number cross-references to technical drawings

Comments:

Unit 5: Production Pathway
Manufacturing Processes

Competency

3. Identify set up

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Locate and review applicable technical drawings, work orders, and/or procedures for production processing

Plan sequencing, tools, and equipment needed for procedure

Identify set up needed

Consult with worksite professional to verify production schedule, deadlines, and timeframes

Learning Objectives

Describe how a processing plan is developed from a technical drawing for process, equipment, tools, and holders

Explain how product design and production are related

Identify terminology related to production

List characteristics of major types of production systems

Compare and contrast conventional production processes with automated production processes to produce a piece

Comments:

Unit 5: Production Pathway
Manufacturing Processes

Competency

4. Select tools and materials

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Select tools and production equipment to be used
Select appropriate work holding devices for work piece and equipment
Check raw materials needed against work order
Verify raw material(s) meet specifications
Gather all resources needed at the workstation
Notify worksite professional of any discrepancies

Learning Objectives

List the various tools and equipment used in production at your worksite
Outline applications of each tool and equipment
Describe and demonstrate the safety requirements and safeguards for each tool and equipment
Explain the importance of materials meeting specifications prior to processing
Identify, name, and explain the function of each specific control on equipment you operate
List typical work holding devices for each equipment type you use
Compare and contrast the different methods used in your process. For example, the different methods of casting

Comments:

Unit 5: Production Pathway
Manufacturing Processes

Competency

5. Perform safety checks

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review production procedure to be used

Review safety requirements of procedure

Verify safety equipment and any Personal Protective Equipment (PPE) needed for production process

Inspect tools and work area for safety considerations

Examine equipment labeling and safeguarding

Learning Objectives

List the types of labeling used on tools and equipment at your facility to indicate whether a tool or piece of equipment is functional and safe to use

List the situations which require you to obtain help to resolve problems with equipment or production

List the safety rule for the equipment you will be operating

Comments:

Unit 5: Production Pathway
Manufacturing Processes

Competency

6. Assist to perform set up

Performance Standard Condition

Competence will be demonstrated

at the worksite
while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

Assemble and adjust tools and production equipment as required
Verify production equipment is available for use and in working order
Verify production equipment is current for preventative maintenance and/or calibration
Calculate any control settings needed
Check equipment fluid, air, pressure levels as required
Set production equipment parameters as required for the procedure
Install work holding devices so they are secure
Stage pieces and raw materials for production

Learning Objectives

List the types of labeling used on tools and equipment at your facility to indicate whether a tool or piece of equipment is functional and safe to use
Explain the purpose and importance of preventative maintenance and calibration
List the situations which require you to obtain help to resolve problems with equipment or production
Identify the major components of equipment used in your production process and their functions
Identify variables that impact equipment settings

Comments:

Unit 5: Production Pathway
Manufacturing Processes

Competency
7. Verify set up

Performance Standard Condition
Competence will be demonstrated
at the worksite

Performance Standard Criteria
Performance will be successful when learners:
Verify set up meets process requirements and product specifications
Examine first piece/product or production run for visual and/or dimensional specification
Make adjustments to ensure piece/product meets specification if needed
Verify repeatability of set up if applicable
Document set up procedure for repeatability if applicable
Document set up procedure if required

Learning Objectives
Define repeatability
Describe the importance of repeatability in manufacturing

Comments:

Unit 5: Production Pathway
Manufacturing Processes

Competency

8. Perform start up

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Verify correct set up of equipment adjustments
Inspect piece/product
Document start up procedure

Learning Objectives

Describe the production process procedure to be completed
List the situations which require you to obtain help to resolve problems with equipment or production

Comments:

Unit 5: Production Pathway
Manufacturing Processes

Competency
9. Operate equipment

Performance Standard Condition
Competence will be demonstrated
at the worksite

Performance Standard Criteria
Performance will be successful when learners:
Wear the required Personal Protective Equipment (PPE) at all times as required for the operation of the equipment
Cycle equipment
Operate equipment safely in the manner required for the job task
Operate equipment according to machine requirements
Monitor equipment for correct operation while operating

Learning Objectives
Describe advantages and limitations of automated production
List the safety rules associated with automated production systems
List the situations which require you to obtain help to resolve problems with equipment or production
Identify how your production process is used to make pieces and products
Describe the techniques required to produce the piece to specified tolerance

Comments:

Unit 5: Production Pathway
Manufacturing Processes

Competency

10. Monitor product and process specifications

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Monitor piece/product produced for specification
Monitor the process and equipment for performance
Adjust the process for quality and/or productivity as needed
Take corrective actions to resolve problems as they occur
Replenish processing materials as needed
Test piece/product for function
Label pieces/products for compliance or non-compliance
Document quality control checks
Pieces are produced to specification

Learning Objectives

List the quality checks performed as part of the production process
Explain why products are tested for quality and function
List the situations which require you to obtain help to resolve problems with equipment or production
Explain why labeling and documentation are part of the quality check

Comments:

Unit 5: Production Pathway
Manufacturing Processes

Competency

11. Process production documents

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Document processing data on items such as labor, quality, quantity, and time
Verify fabrication and production documentation is completed
Documentation is legible
Documentation is complete
Documentation is in appropriate format
Documentation is stored or forwarded as required
Pieces are correctly stored or staged

Learning Objectives

Describe the uses of production data
Describe the importance of documenting the production process

Comments:

Unit 5: Production Pathway
Manufacturing Processes

Competency

12. Shutdown process

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review procedure to be used
Stop production process
Verify all equipment is shut down safely as required
Identify any process or equipment maintenance concerns with the production run
Take corrective action to report and correct maintenance concerns

Learning Objectives

Describe the shutdown procedures used for the specific production equipment you operate

Comments:

Unit 5: Production Pathway
Manufacturing Processes

Competency
13. Clean up

Performance Standard Condition
Competence will be demonstrated
at the worksite

Performance Standard Criteria
Performance will be successful when learners:
Select appropriate cleaning tools and equipment
Clean production tools/equipment as required
Clean work area as required
Store tools safely in proper location
Store materials in safe manner
Identify unsafe conditions and reports them promptly
Take corrective action to correct unsafe conditions
Ensure that workstation is clean and clear of safety hazards
Ensure workstation is organized for efficiency
Dispose of waste appropriately as required

Learning Objectives
Describe the cleaning procedures and materials used for the specific processes you perform

Comments:

Unit 5: Production Pathway
Manufacturing Processes

Competency
14. Monitor equipment for correct operation

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review equipment quality measures for trends and problems as required
Compare current equipment performance to optimal equipment operations on a regular basis
Report any noted deviations from expected performance
Ensure that equipment is properly labeled and pulled from production use if inoperative
Assist worksite professional to investigate abnormal equipment conditions in a timely manner
Assist worksite professional to follow up on repaired equipment to ensure that corrective action solved the problem
Document all monitoring activities

Learning Objectives

Explain the meaning of common alarms on equipment at your facility
Explain how to read and review repair history records
Describe how trends for malfunctioning equipment might appear in production records
List the tools and equipment at your facility that must be monitored and maintained
Define Total Productive Maintenance (TPM)
Describe common electrical systems reliability issues including power supply connections, operations, series and parallel circuit function, circuit breaker function, electric motor control, and power overload
Describe common pneumatic system reliability issues including pressure gage readings, conductors, connectors, seals, gaskets, packing, quick-connect fittings, pneumatic cylinder and motor operations, air muffler operations, actuator power output, and pressure regulator operations
Describe common hydraulic system reliability issues including seals, gaskets, packing, and hydraulic fluids
Describe common automated machine reliability issues including computerized control processes, logic control circuits, solenoid-operated fluid power valves, electromechanical limit switches, time delay devices, manual controls, and interlock circuits

Comments:

Unit 5: Production Pathway
Manufacturing Processes

Competency

15. Document equipment use and/or operational problems

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Verify all internal and external communication with appropriate parties in a timely manner
Communicate maintenance and repair needs clearly
Use the correct reporting formats for communication
Document use, maintenance, and repair activities accurately
Report back and document any maintenance and repair issues in a timely manner
Maintenance communication is timely and accurate
Maintenance communication is documented

Learning Objectives

Explain the uses of equipment data
Discuss how to schedule repair and maintenance functions with respect to production requirements and production levels
Explain how communication for repair and maintenance issues demonstrates a knowledge of customer and business needs
List the parties that need to be involved of repair and maintenance issues
Describe the importance of documenting communications

Comments:

ADDITIONAL Learning Objectives for Specific Production Processes

Casting

Describe the casting process
Compare the functions, advantages, disadvantages, and amorphous materials used for various mold components
Differentiate between sand, metal, and plaster/ceramic mold casting processes
Identify the function of the casting components
Identify common terminology used in casting
Interpret casting specifications on technical drawings
Compare hot and cold chamber processes
Determine the function of a die cast trim die
Identify standard mold bases and brushing sets
Identify runners, gates, and water lines that cool the mold

Conditioning

Compare the functions, advantages, disadvantages, and materials used for different conditioning processes such as hardening, tempering, and annealing
Explain the procedure for hardness testing
Describe characteristics, advantages and limitations of furnaces and hardness testing equipment
Identify common terminology used in conditioning
Interpret conditioning specifications on technical drawings

Filling

Compare the functions, advantages, disadvantages, and materials used for different filling processes

Finishing

Compare different finishing (coating) techniques such as spraying, powder, roll, electro-coating, and dipping, and their applications
Interpret finishing specifications on technical drawings
Explain how finishes are used to improve the look and performance of engineering materials

Forming

Compare the functions, components, advantages, disadvantages, and materials used with different metal forming and die sets
Identify pierce, form, draw, and progressive dies
Compare shears, brake presses, and roll formers
Calculate clearance and tonnage parameters
Describe various stripping methods
Distinguish between open die forging and closed die forging
Describe die construction
Compare casting and forging processes
Identify common terminology used in forming and forging
Interpret forming specifications on technical drawings

Joining/Combining

Compare different joining methods such as sewing, gluing, nailing and welding
Compare characteristics, advantages and limitations of welding, brazing, and soldering
Compare functions, advantages, disadvantages, and materials used for different welding types
Define how variables of such as current, voltage, polarity, arc length, speed, flux, flow rates, material, piece thickness, etc affect a weld
Compare the functions, advantages, disadvantages, and materials used for different brazing/soldering types
Interpret joining specifications on technical drawings

Molding

Compare the functions, advantages, disadvantages, and materials used for various mold components
Compare different molding techniques such as blown, injected, rotated, and vacuum-formed
Consult mold setup information that accompanies installed mold
Describe how set temperatures, pressures, position and timers affect the mold
Identify common terminology used in molding
Evaluate the characteristics, advantages and limitations of different types of thermo-plastics
Interpret molding specifications on technical drawings
Explain the importance of a parting line
Define the functions of cavities and cores
Describe the runner system
Identify how a part is released from a mold
Identify potential problems during the molding process

Separating

Compare the functions, advantages, disadvantages, and materials used for different separating processes
Interpret separating specifications on technical drawings

Appendix M

MANUFACTURING
YOUTH APPRENTICESHIP

PRODUCTION PATHWAY
MACHINING (UNIT 6)

Unit 6: Production Pathway
Machining

Competency

1. Read machining technical drawings & work orders

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review technical drawing
Gather reference materials as needed
Determine type of print and views used
Determine material specifications
Determine critical dimensions and tolerances
Analyze supplementary data
Determine machining instructions and specifications
Interpret machining symbols & procedure

Learning Objectives

Explain the need for technical drawings, also known as blueprints, schematics, part prints, or engineering drawings
Explain how technical drawings detail work piece design parameters, lay out and specifications
Explain how product design and production are related
Discuss different types of technical drawings
Identify terminology related to technical drawings
Describe how to interpret views, projections and elements from a technical drawing
Identify common terms, components, revisions, symbols, assembly sequence, dimensions, tolerances, scale, and list of materials from technical drawings or work orders

Comments:

Unit 6: Production Pathway
Machining

Competency

2. Interpret machining symbols & procedures

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Interpret technical drawings accurately as needed for machining tasks
Use appropriate terminology
Identify lines, views, symbols, and representations on the drawings
Interpret dimensions, tolerances, and scale on the drawings
Interpret threads, tapers, and shop notes on the drawings
Interpret the machining plan from a technical drawing which includes tools, equipment, speeds, feeds, fixtures & holders as applicable

Learning Objectives

Define and explain the use of lines, views, symbols, dimensions, scale, and tolerances on technical drawings
Identify different lines by name, type, order of usage, & application such as object, hidden, center, section, dimension, extension, cutting plane, short break, long break, phantom
Demonstrate standard view placement practices
Compare pictorial format, orthographic projection, sectional views, and detail schedules
Discuss the standards for production document lines
Describe the standard usage of metric (SI) linear units in drafting
Identify and interpret drawings as to type, part name, part number, callouts, components, and part size dimensions
Determine the relationship of one part to another from assembly drawings
Determine procedure number cross-references to technical drawings

Comments:

Unit 6: Production Pathway
Machining

Competency
3. Identify set up

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Locate and review applicable technical drawings, work orders, and/or procedures for machining process

Plan sequencing, tools, and equipment needed for machining process

Identify set up needed

Consult with worksite professional to verify production schedule, deadlines, and timeframes

Learning Objectives

Describe how a machining plan is developed from a technical drawing for process, equipment, tools, and holders

Explain how product design and production are related

Identify terminology related to machining

Compare and contrast conventional machining to automated machining

List characteristics of major types of machining systems

GRINDERS

- Describe conventional machining process characteristics, major components, advantages and limitations of grinding machines
- Describe automated machining process characteristics, major components, advantages and limitations of grinding machines
- Identify chip cutting theory and machineability
- Evaluate surface finish requirements and machineability of materials used at your facility
- Determine the importance of cutting fluids
- Identify types of cutting fluids and application methods
- Describe how to calculate pre-grinding tolerances

LATHES

- Describe automated machining process characteristics, major components, advantages and limitations of lathes and turning machines
- Identify chip cutting theory and machineability
- Evaluate surface finish requirements and machineability of materials used at your facility
- Determine the importance of cutting fluids
- Identify types of cutting fluids and application methods
- Describe different thread forms
- Identify and calculate general dimensions of a thread

MACHINE/MILLING CENTERS

- Describe automated machining process characteristics, major components, advantages and limitations of sawing, drilling, and milling machines
- Identify chip cutting theory and machineability

- Evaluate surface finish requirements and machineability of materials used at your facility
- Determine the importance of cutting fluids
- Identify types of cutting fluids and application methods

Comments:

Unit 6: Production Pathway
Machining

Competency
4. Select tools & materials

Performance Standard Condition
Competence will be demonstrated
at the worksite

Performance Standard Criteria
Performance will be successful when learners:
Select tools and machining equipment to be used
Select appropriate work holding devices for work piece and equipment
Check raw materials needed against work order
Verify raw material(s) meet specifications
Gather all resources needed at the workstation
Notify worksite professional of any discrepancies

Learning Objectives
List common machining tools and equipment
Identify, name and explain the function of common machining equipment
List typical work holding devices for each machine type
List advantages and disadvantages for various work holding devices
Outline applications of each tool and equipment
Describe and demonstrate the safety requirements and safeguards for common machining tools and equipment
Explain the importance of materials meeting specifications prior to processing
GRINDERS
- Identify various types of grinders and their applications
- Describe the advantages and limitations of grinders
- Identify types of grinding wheels and their applications
- Compare bond and grit characteristics
- Interpret wheel marking systems
- Describe dust hazards

LATHES
- Identify the major types of lathes and turning machines and their applications
- Describe the advantages and limitations of lathes
- Compare various lathe tool bits and their functions
- Identify various styles of boring bars
- List typical work holding devices for each machine type
- List advantages and disadvantages for various work holding devices

MACHINE/MILLING CENTERS
- Identify major types of sawing machines, drill presses, and milling machines and their applications
- Describe advantages and limitations of sawing machines, drill presses and milling machines
- List typical work holding devices for each machine type
- List advantages and disadvantages for various work holding devices

Comments:

Unit 6: Production Pathway
Machining

Competency

5. Perform safety checks

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review machining procedure to be used
Review safety requirements of procedure
Verify safety equipment and any Personal Protective Equipment (PPE) needed for machining process
Inspect tools and work area for safety considerations
Examine equipment labeling and safeguarding

Learning Objectives

List the types of labeling used on tools and equipment at your facility to indicate whether a tool or piece of equipment is functional and safe to use
List the situations which require you to obtain help to resolve problems with equipment or production
List the safety rules for grinders, lathes and milling machines

Comments:

Unit 6: Production Pathway
Machining

Competency

6. Assist to perform set up

Performance Standard Condition

Competence will be demonstrated

at the worksite

while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

Assemble and adjust tools and machining equipment as required

Verify machining equipment is available for use and in working order

Verify machining equipment is current for preventative maintenance and/or calibration

Calculate any control settings needed

Check fluid, oil, air, pressure levels

Set machining equipment parameters, such as speed and feed rates, as required for the procedure

Install work holding devices so they are secure, aligned, and do not interfere with the machining

GRINDERS

- Mount, dress, and balance selected grinding wheel for the operation

LATHES

- Select appropriate tool bit and holder for lathe process (turning, facing, tapering, boring, etc)

Sharpen punches, drill bits, and chisels

Stage pieces and raw materials for machining

Learning Objectives

List the types of labeling used on tools and equipment at your facility to indicate whether a tool or piece of equipment is functional and safe to use

Explain the purpose and importance of preventative maintenance and calibration

List the situations which require you to obtain help to resolve problems with equipment or production

GRINDERS

- Identify the major components of grinders and their functions
- Explain the importance of why a grinding wheel must be dressed, rung and balanced
- Identify variables for grinder speeds and feeds
- Identify set ups and adjustments for grinders

LATHES

- Identify the major components of lathes and their functions
- Identify variables for speeds and feeds

MACHINE/MILLING CENTERS

- Identify the major components of sawing machines, drill presses, and milling machines and their functions
- Identify variables for speeds and feeds

Comments:

Unit 6: Production Pathway
Machining

Competency
7. Verify set up

Performance Standard Condition
Competence will be demonstrated
at the worksite

Performance Standard Criteria
Performance will be successful when learners:
Verify set up meets machining requirements and product specifications
Examine first piece/product or production run for visual and/or dimensional specification
Make adjustments to ensure piece/product meets specification if needed
Verify repeatability of set up if applicable
Document set up procedure for repeatability if applicable
Document set up procedure if required

Learning Objectives
Define repeatability
Describe the importance of repeatability in manufacturing

Comments:

Unit 6: Production Pathway
Machining

Competency

8. Perform start up

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Verify correct set up of equipment adjustments
Inspect piece/product
Document start up procedure

Learning Objectives

Describe grinding, lathe, and milling processes
List the situations which require you to obtain help to resolve problems with equipment or production

Comments:

Unit 6: Production Pathway
Machining

Competency
9. Operate machining equipment

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Wear the required Personal Protective Equipment (PPE) at all times as required for the operation of the machining equipment
Cycle equipment
Operate equipment safely in the manner required for the job task
Operate equipment according to machine requirements
Monitor equipment for correct operation while operating

Learning Objectives

Describe advantages and limitations of automated production
List the safety rules associated with automated production systems
List the situations which require you to obtain help to resolve problems with equipment or production
Identify how machining processes are used to make parts and products
Describe conventional machining processes

GRINDERS

- Describe the motions between pieces and grinders
- Describe the techniques required to grind a piece to specified tolerance

LATHES

- Describe the motions between pieces, drills and lathes
- Explain techniques required to product a piece to specification

MACHINE/MILLING CENTERS

- Describe the motions between pieces and saws, drills, and milling machines

Comments:

Unit 6: Production Pathway
Machining

Competency

10. Monitor machining product & process specifications

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Monitor piece/product machined for specification
Monitor the machining and equipment for performance
Adjust the process for quality and/or productivity as needed
Take corrective actions to resolve problems as they occur
Replenish processing materials as needed
Test piece/product for function
Label pieces/products for compliance or non-compliance
Document quality control checks
Pieces are produced to specification

- Pieces are ground to specified tolerances
- Pieces show no sign of burn marks
- Pieces are smooth and free of burrs

Learning Objectives

List the quality checks performed as part of the production process
Explain why products are tested for quality and function
List the situations which require you to obtain help to resolve problems with equipment or production
Explain why labeling and documentation are part of the quality check

Comments:

Unit 6: Production Pathway
Machining

Competency
11. Process production documents

Performance Standard Condition
Competence will be demonstrated
at the worksite

Performance Standard Criteria
Performance will be successful when learners:
Document processing data on items such as labor, quality, quantity, and time
Verify fabrication & production documentation is completed
Documentation is legible
Documentation is complete
Documentation is in appropriate format
Documentation is stored or forwarded as required
Pieces are correctly stored or staged

Learning Objectives
Describe the uses of production data
Describe the importance of documenting the machining process

Comments:

Unit 6: Production Pathway
Machining

Competency
12. Shutdown machining process

Performance Standard Condition
Competence will be demonstrated
at the worksite

Performance Standard Criteria
Performance will be successful when learners:
Review procedure to be used
Stop production process
Verify all equipment is shut down safely as required
Identify any process or equipment maintenance concerns with the production run
Take corrective action to report and correct maintenance concerns

Learning Objectives
Describe the shutdown procedures used for the specific machining equipment you operate

Comments:

Unit 6: Production Pathway
Machining

Competency
13. Clean up

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Select appropriate cleaning tools and equipment
Clean production tools/equipment as required
Clean work area as required
Store tools safely in proper location
Store materials in safe manner
Identify unsafe conditions and reports them promptly
Take corrective action to correct unsafe conditions
Ensure that workstation is clean and clear of safety hazards
Ensure workstation is organized for efficiency
Dispose of waste appropriately as required

Learning Objectives

Describe the cleaning procedures and materials used for the specific processes you perform

Comments:

Unit 6: Production Pathway
Machining

Competency
14. Use hand tools

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Fabricate metal as needed using hand tools

- Cut metal stock with a hand hacksaw
- Cut threads with hand taps and dies
- Ream holes with hand reamer
- Tap holes using hand tools
- Deburr using hand tools

Piece(s) meet specification

Learning Objectives

Identify cutting and non-cutting hand tools

Compare basic tools and tool-holding devices

Distinguish between common hand tools including hammers, wrenches, pliers, punches, taps and dies, etc.

Comments:

Unit 6: Production Pathway
Machining

Competency
15. Use CNC equipment

Performance Standard Condition

Competence will be demonstrated

at the worksite OR in the classroom in a simulated setting. Simulation should ONLY be used IF there is no possibility of skill performance at the worksite.

Performance Standard Criteria

Performance will be successful when learners:

Review plan sheet/work order for work holding devices, cutting tools, reference points, and machining sequence
Develop a CNC set-up plan with appropriate program codes and coordinates
Select a part holding method
Select a reference point from a technical drawing
Calculate appropriate speed and feed
Select cutting tools with correct speeds and feed
Identify program codes
Write &/or test CNC program
Set machine parameters
Edit program as needed
Monitor and adjust tool wear offset
Machine a piece utilizing CNC methods
Pieces meet specification

Learning Objectives

Compare the difference between manual and CNC machines
Explain the features of CNC machining and turning centers
Interpret the Cartesian coordinate system
Identify program codes
Compare and contrast characteristics, advantages and limitations of computerized machining vs. conventional and automatic machining processes including conventional EDM, wire EDM, CNC milling, and CNC turning machines
Identify CNC tooling and types of tool changes
Explain the use of 3 axis coordinate systems and the reference point for identification
Contrast open and closed loop systems
Describe G & M codes
Describe how part geometry is analyzed to select appropriate cutting tools and fixturing devices
Compare efficiency of machining for large production runs

Comments:

Unit 6: Production Pathway
Machining

Competency
16. Monitor equipment for correct operation

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review equipment quality measures for trends and problems as required
Compare current equipment performance to optimal equipment operations on a regular basis
Report any noted deviations from expected performance
Ensure that equipment is properly labeled and pulled from production use if inoperative
Assist worksite professional to investigate abnormal equipment conditions in a timely manner
Assist worksite professional to follow up on repaired equipment to ensure that that corrective action solved the problem
Document all monitoring activities

Learning Objectives

Explain the meaning of common alarms on equipment at your facility
Explain how to read and review repair history records
Describe how trends for malfunctioning equipment might appear in production records
List the tools and equipment at your facility that must be monitored and maintained
Define Total Productive Maintenance (TPM)
Describe common electrical systems reliability issues including power supply connections, operations, series & parallel circuit function, circuit breaker function, electric motor control, and power overload
Describe common pneumatic system reliability issues including pressure gage readings, conductors, connectors, seals, gaskets, packing, quick-connect fittings, pneumatic cylinder and motor operations, air muffler operations, actuator power output, and pressure regulator operations
Describe common hydraulic system reliability issues including seals, gaskets, packing, and hydraulic fluids
Describe common automated machine reliability issues including computerized control processes, logic control circuits, solenoid-operated fluid power valves, electromechanical limit switches, time delay devices, manual controls, and interlock circuits

Comments:

Unit 6: Production Pathway
Machining

Competency

17. Document equipment use &/or operational problems

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Verify all internal and external communication with appropriate parties in a timely manner
Communicate maintenance and repair needs clearly
Use the correct reporting formats for communication
Document use, maintenance, and repair activities accurately
Report back and document any maintenance and repair issues in a timely manner
Maintenance communication is timely and accurate
Maintenance communication is documented

Learning Objectives

Explain the uses of equipment data
Discuss how to schedule repair and maintenance functions with respect to production requirements and production levels
Explain how communication for repair and maintenance issues demonstrates a knowledge of customer and business needs
List the parties that need to be involved of repair and maintenance issues
Describe the importance of documenting communications

Comments:

Appendix N

MANUFACTURING
YOUTH APPRENTICESHIP

PRODUCTION PATHWAY
WELDING (UNIT 7)

Unit 7: Production Pathway
Welding

Competency

1. Read welding technical drawings and work orders

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review technical drawing
Gather reference materials as needed
Determine type of required weld
Determine location of required weld
Determine filler metal required
Determine welding process to be used
Analyze supplementary data
Determine product or job instructions and specifications
Interpret welding symbols and procedure

Learning Objectives

Explain the need for technical drawings, also known as blueprints, schematics, part prints, or engineering drawings
Explain how technical drawings detail work piece design parameters, lay out and specifications
Explain how product design and production are related
Discuss different types of technical drawings
Identify terminology related to technical drawings
Describe how to interpret views, projections and elements from a technical drawing
Identify terms, components, revisions, symbols, assembly sequence, dimensions, tolerances, scale, and list of materials from technical drawings or work orders

Comments:

Unit 7: Production Pathway
Welding

Competency

2. Interpret welding symbols and procedures

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Interpret technical drawings accurately as needed for job task
Use appropriate terminology
Identify lines, views, symbols, and representations on the drawings
Interpret dimensions, tolerances, and scale on the drawings
Interpret the welding process plan from a technical drawing which includes tools, equipment, speeds, feeds, fixtures and holders as applicable

Learning Objectives

Define and explain the use of lines, views, symbols, dimensions, scale, and tolerances on technical drawings
Identify different lines by name, type, order of usage, and application such as object, hidden, center, section, dimension, extension, cutting plane, short break, long break, phantom
Demonstrate standard view placement practices
Compare pictorial format, orthographic projection, sectional views, and detail schedules
Compare characteristics, advantages and limitations of welding, brazing, and soldering
Identify common welding symbols and their meanings on technical drawings
Explain how weld types are indicated on technical drawings
Explain how weld positions are indicated on technical drawings
List supplementary data commonly found on welding drawings
Discuss how weld testing requirements and procedures are indicated on the technical drawing
Determine procedure number cross-references to technical drawings

Comments:

Unit 7: Production Pathway
Welding

Competency

3. Layout and plan work

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Read welding technical drawings and work orders

Interpret welding symbols and procedure

Review appropriate welding, cutting and/or fabricating procedures

Determine equipment, work pieces, and supplies needed

Determine metal type, electrode type, welding position, and metal thickness

Select jigs, holding fixtures, guides and stops if applicable

Obtain materials for work to be completed

Measure and mark weld or cut points and positions of components on work pieces, using rules, squares, templates, and scribes

Plan sequencing of work to be completed

Document measurements and layout

Learning Objectives

Describe how a work plan is developed from a technical drawing for process, equipment, tools, and holders

Explain the lay out process in metal fabrication

Describe tools used in the layout process

Covert measurements between US Standard and metric systems

Convert measurements from fractions to decimals and vice versa

Use estimation to verify reasonableness of calculated results

Explain how to measure with tape measures, rulers, and protractors

Demonstrate how to use precision measuring tools like micrometers

Discuss how parts are prepared using the principles of geometry, functions of angles and parts of a circle

Demonstrate the proper use of and interpretation of measuring devices to determine size, length, angle, and distance

Comments:

Unit 7: Production Pathway
Welding

Competency

4. Perform safety checks

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review welding procedure to be used

Review safety requirements of procedure

Verify safety equipment and any Personal Protective Equipment (PPE) needed for welding process

Verify equipment is available for use and in working order

Verify equipment is current for preventative maintenance and/or calibration

Conduct required safety checks prior to performing procedure

- Ensure area is dry and facilitates circulation of clean air
- Ensure workspace is clear and free from paints, solvents, chemicals and other flammable materials
- Assure safety equipment is close by and operational
- Check valves, valve protection, thread type and wrenches for equipment to be used
- Check grounding, cables, voltage/current transformation components
- Check ventilation and fume reduction requirements

Handle compressed gases safely

- Ensure protector cap is secure when moving cylinder
- Secure cylinder in vertical position
- Inspect valve, regulator and gauges for damage
- Connect and adjust tank pressure according to manufacturer

Report any wear, damage or failure of safety checks to worksite professional immediately

Learning Objectives

List the various tools and equipment used in layout, cutting and welding

Outline applications of common welding tools and equipment

Describe and demonstrate the safety requirements and safeguards of common welding tools and equipment

List the types of labeling used on tools and equipment at your facility to indicate whether a tool or piece of equipment is functional and safe to use AND/OR is not operational and not safe to use.

List the situations which require you to obtain help to resolve problems with equipment or production

Describe the common types of shielding for welding processes

Discuss smoke/fume, light/radiation and other hazards associated with common welding processes

Discuss electrical hazards and how to avoid electric shock

Demonstrate proper inspection and use of ventilation equipment to avoid welding fumes

Explain specific eye and face hazards associated with welding
List precautions necessary when welding different types of metals
List precautions necessary when welding in different positions
Compare safety precautions necessary when using different welding processes

Comments:

Unit 7: Production Pathway
Welding

Competency

5. Prepare base metal

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review procedures
Determine base metal or work piece preparation requirements
Obtain correct base metal type and thickness
Prepare base metal surfaces as required
Use cleaning solutions if needed
Examine edges of prepared base metal parts
Grind base carbon steel metal to bevel and/or remove surface irregularities
Check uniformity, proper fit-up, and base metal preparation
Pre-heat as applicable
Parts fit up and are preheated as needed

Learning Objectives

Explain the importance of materials meeting specifications prior to processing
Discuss common metallurgic principles that make metals ideal for welding
Compare types of metals and their qualities
Define alloy
Discuss common sources of metals
Compare common metal working processes used in welding
Explain the factors that limit or enhance the weldability of materials
Compare and contrast different metal preparation requirements
Explain use and safety restrictions for use of grinders to prepare base metal
Discuss cleaning solutions used to prepare commonly welded metals such as carbon steel, stainless steel and aluminum
Explain any safety restrictions of cleaning solutions for metals to be fabricated
Describe the fit-up process
Explain the need for pre-heating in some procedures

Comments:

Unit 7: Production Pathway
Welding

Competency

6. Set up to fabricate base metal

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

GENERAL SET UP

Layout and plan work

Perform safety checks

Assemble tools and equipment as required

Place parts and assemblies into fixtures

Set up equipment for fabrication

Document set up procedure if required

FIXTURE SET UP

Locate parts or subassemblies needed

Determine the order for the part or subassembly placement

Position, align, and bolt jigs, holding fixtures, guides, and stops onto machines

Position, align and/or clamp work pieces into jigs and/or holding fixtures

Tighten all holding and positioning clamps

Inspect assembly

CUTTING SET UP

Select torch tips, alloys, flux, coil, tubing, and wire, according to metal types and thicknesses

Dress electrodes with tip dressers, files, emery cloths, or dressing wheels

Move switch to correct polarity OR change electrode and ground cable positions

Adjust voltage and/or amperage per procedure

Select appropriate program if required

Set wire feed rate OR shielding gas flow/pressure at correct value

Sawing

- Adjust safety guards
- Adjust holding device as needed
- Place material in holding device
- Adjust blade velocity

Manual Oxy-fuel Cutting

- Select correct tip size and type
- Set regulator for tip, fuel gas and material
- Adjust pressures for steel thickness

Machine Oxy-fuel Cutting

- Select correct tip size and type
- Set regulator for tip, fuel gas and material
- Measure corner and align track mechanism
- Set appropriate travel speed

Air Carbon Arc Cutting
- Choose adequate power source selection
- Choose correct carbon electrode diameter
- Turn on air line and check air flow direction
- Adjust air pressure for material thickness
- Adjust amperage and current type for electrode diameter and material thickness

Manual Plasma Arc Cutting
- Select appropriate tip
- Set regulator for appropriate plasma gas
- Adjust amperage for material thickness

WELDING SET UP

Select torch tips, alloys, flux, coil, tubing, and wire, according to metal types and thicknesses, data charts, and records

Dress electrodes with tip dressers, files, emery cloths, or dressing wheels

Move switch to correct polarity OR change electrode and ground cable positions

Adjust voltage and/or amperage per procedure

Select appropriate program if required

Set wire feed rate OR shielding gas flow/pressure at correct value

Fill hoppers and position spouts to direct flow of flux or complete manually

Review technique and weld bead sequence

Determine joint requirements

Determine pre-heat and post-heat requirements

Shielded metal arc welding (SMAW)
- Select appropriate base and filler metal
- Adjust amperage and polarity

Gas metal arc welding (GMAW) and Flux-cored arc welding (FCAW)
- Select and install appropriate filler wire
- Set voltage
- Set wire speed (amperage)
- Set proper gas flow rate

Gas tungsten arc welding (GTAW)
- Select appropriate filler wire
- Select appropriate electrode and gas
- Set amperage and polarity
- Set proper gas flow rate

Learning Objectives

List the types of labeling used on tools and equipment at your facility to indicate whether a tool or piece of equipment is functional and safe to use

Explain the purpose of holding devices and subassemblies in welding

List typical work holding devices for each equipment type you use

Compare basic holding devices

List cutting processes such as shearing, sawing, Oxy-fuel, Arc, Plasma, and Laser and when each is used

List welding processes such as SMAW, GMAW, GTAW, FCAW, and Submerged arc welding (SAW), and when each is used

Identify the major components of equipment used in your welding and cutting processes and their functions

List common metals and materials used with each type of cutting and welding process

Compare cutting and welding techniques to complete fabrication
Identify variables that impact cutting and welding equipment settings
Define how variables such as current, voltage, polarity, arc length, speed, flux, flow rates, material, piece thickness, etc., affect a weld
Discuss the fundamental use of polarity with respect to equipment set up for process used
Define repeatability
Describe the importance of repeatability in manufacturing

Comments:

Unit 7: Production Pathway
Welding

Competency

7. Fabricate base metal

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Prepare base metal

Set up to fabricate base metal

Add or adjust safety guards

Verify machine settings for material

Verify blades, shears, dies, etc., appropriate for metal fabrication to be completed

Perform equipment pre-check

Make test cuts

Adjust holding devices, blade speeds, and metal positions safely as needed

Operate tools and equipment safely

Fabricate base metal

- Use hand tools such as brakes and hammers
- Use equipment such as such as grinders, saws, drills, drill presses, or brakes

Complete cuts

Inspect, measure, or test completed metal pieces

Shut down and secure equipment

Clean up

Report any discrepancies or equipment concerns to worksite professional immediately

Document cutting process if required

Learning Objectives

Compare and contrast different metal preparation and mechanical cutting methods

Outline applications and use for common hand tool and shearing, shaping and sawing equipment

Identify hand tools used in welding operations

Describe and demonstrate the safety requirements and safeguards for common hand tools and shearing, shaping and sawing equipment

Comments:

Unit 7: Production Pathway
Welding

Competency
8. Thermally/chemically cut metal

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Prepare base metal

Set up to fabricate base metal

Adjust voltage and/or amperage per procedure

Select appropriate program if required

Set wire feed rate OR shielding gas flow/pressure at correct value

Make test cuts

Adjust pressures, amperage, voltage, flow rates, torch angles, flame sizes, travel speed, etc. safely as needed

Operate tools and equipment safely

Manual Oxy-fuel Cutting

- Light and adjust flame to correct size
- Adjust pressures and torch angles as needed
- Cuts- straight/square edge and shape/square edge and straight/bevel edge in flat position; scarfing and gouging in flat and horizontal position
- On carbon steel

Machine Oxy-fuel Cutting

- Control gas flow and flame size
- Monitor travel speed
- Cuts- straight/square edge and straight/bevel edge in flat position
- On carbon steel

Manual Plasma Arc Cutting

- Adjust amperage for material thickness
- Adjust amperage and torch angles as needed
- Protect surroundings from spray
- Cuts- straight/square edge and shape/square edge in flat position
- On carbon steel, aluminum, and stainless steel

Air Carbon Arc Cutting

- Adjust amperage and torch angles as needed
- Cuts- Scarfing and gouging in flat and horizontal position
- On carbon steel

Complete cuts

Remove any slag or residue

Inspect, measure, or test completed metal pieces

Shut down and secure equipment

Clean up

Report any discrepancies or equipment concerns to worksite professional immediately

Document cutting process if required

Learning Objectives

Compare and contrast different metal preparation and thermal/chemical cutting methods

Discuss the advantages and disadvantages of one type of thermal/chemical cutting method over another

Outline applications and use of common thermal/chemical cutting equipment

Describe and demonstrate the safety requirements and safeguards of common thermal/cutting equipment

Comments:

Unit 7: Production Pathway
Welding

Competency

9. Tack work pieces

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Position the work pieces
Tack-weld them together lightly
Weld just enough to pin the work pieces together
Adjust and re-align assemblies as needed to keep pieces positioned
Remove slag or other material
Check that all required work pieces are tacked before attempting full welds
Check the pieces for appropriate geometry by measuring

Learning Objectives

Define tack
Explain the purpose of a tack
Compare welding techniques to bond pieces versus welding techniques to tack pieces
Explain how to measure with tape measures, rulers, and protractors
Demonstrate how to use precision measuring tools like micrometers
Discuss how parts are prepared using the principles of geometry, functions of angles and parts of a circle
Demonstrate the proper use of and interpretation of measuring devices to determine size, length, angle, and distance

Comments:

Unit 7: Production Pathway
Welding

Competency
10. Weld metal

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Prepare base metal

Set up to fabricate base metal

Verify and adjust settings for required process

Select appropriate program if required

Make test welds

Adjust pressures, amperage, voltage, flow rates, torch angles, flame sizes, travel speed, etc. safely as needed

Hold the welding gun appropriately to prevent weld wandering

Operate tools and equipment safely

Make fillet welds on plain carbon steel, stainless steel or aluminum in required positions

Make groove welds on plain carbon steel, stainless steel or aluminum in required positions

Monitor metal for appropriate welds

Flux-cored arc welding (FCAW)-gas

- Fillet welds in all positions on carbon steel
- Groove welds in all positions on carbon steel

FCAW- self-shielded

- Fillet welds in all positions on carbon steel
- Groove welds in all positions on carbon steel

Gas metal arc welding (GMAW)-S

- Fillet welds in all positions on carbon steel
- Groove welds in all positions on carbon steel

GMAW-Spray

- Fillet welds in 1F and 2F position on carbon steel
- Groove welds in 1G position on carbon steel
- Fillet welds in all positions on aluminum
- Groove welds in all positions on aluminum

GMAW-P (pulse)

- Fillet welds in all positions on carbon steel
- Groove welds in all positions on carbon steel

Gas tungsten arc welding (GTAW)- Carbon Steel

- Fillet welds in all positions
- Groove welds in all positions

GTAW- Stainless Steel

- Fillet welds in all positions
- Groove welds in all positions

GTAW- Aluminum
- Fillet welds in all positions
- Groove welds in all positions

Shielded metal arc welding (SMAW)
- Fillet weld all positions on carbon steel
- Groove weld in all positions on carbon steel

MECHANIZED WELDING
- Adjust pressures, amperage, voltage, flow rates, travel speed, etc. safely as needed
- Load or feed work pieces into welding machines to join or bond components if applicable
- Observe meters, gauges, and machine operations to ensure that processes meet specifications
- Monitor metal for appropriate welds
- Adjust equipment to correct for problems
- Turn and press knobs and buttons or enter operating instructions into computers to start and adjust welding machines
- Monitor, and adjust robotic welding production lines if applicable
- Remove completed work pieces and parts from machinery
- Add chemicals or materials to machine to cool or facilitate bonding OR immerse completed work pieces into water or acid baths to cool and clean components as required by procedure

Complete welds

Remove any slag or residue

Inspect, measure, or test completed metal pieces

Shut down and secure equipment

Clean up

Report any discrepancies or equipment concerns to worksite professional immediately

Document welding process if required

Learning Objectives

Identify how the welding process is used in production to make pieces and products

Compare and contrast common welding processes such as FCAW, GMAW, GTAW and SMAW

Discuss the advantages and disadvantages of one type of welding process over another

Compare different types of welding joints such as fillet, groove, T, Lap, Butt, etc.

Compare the different welding positions- Flat, Horizontal, Vertical, Overhead

Compare features of the common metals used in welding such as Carbon Steel, Stainless Steel and Aluminum

Define constant current (CC) and constant voltage (CV)

Demonstrate how GTAW current changes, electrode tip prep, torch angles and weld distance effect weld bead profiles and penetration

Discuss how FCAW and GMAW arc voltage changes affect weld bead profile

Explain how FCAW and GMAW tip to work distance affects amperage in CV applications

Describe and demonstrate the safety requirements and safeguards for common welding equipment

Describe methods of puddle control

Demonstrate different techniques for manual welding

Compare and contrast manual welding processes with automated welding processes

List the quality checks performed as part of the automated welding production process

Comments:

Unit 7: Production Pathway
Welding

Competency

11. Monitor product and process

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Monitor piece/product produced for specification
Recheck type of metal to be welded
Monitor the process and equipment for performance
Recheck required positioning of the weld gun or torch
Adjust the process for quality and/or productivity as needed
Take corrective actions to resolve problems as they occur
Replenish processing materials as needed
Label pieces/products for compliance or non-compliance
Document quality control checks
Pieces are fabricated to specified tolerances

Learning Objectives

List the quality checks performed as part of the welding process
Explain why products are tested for quality and function
List the situations which require you to obtain help to resolve problems with equipment or production
Explain why labeling and documentation are part of the quality check
Explain the purpose of welding procedures, procedure qualification and welder qualifications to produce a welded piece

Comments:

Unit 7: Production Pathway
Welding

Competency

12. Assist to inspect, measure, and/or test completed metal pieces

Performance Standard Condition

Competence will be demonstrated

at the worksite
while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

Ensure conformance to specifications, using visual inspection, measuring and testing devices
Examine edges and geometry of cut pieces
Examine tacks, root passes, intermediate layers, and completed welds
Check for weld discontinuity and defects visually
Check for proper weld size
Perform destructive or non-destructive checks as required
Label pieces/products for compliance or non-compliance
Document inspection and testing as required

Learning Objectives

Explain why welded products are tested for quality and function
Compare different welding standards and compliance codes
Determine features of good welds versus bad welds
Discuss common causes of bad welding
Describe causes of welding problems such as crater cracks, cold cracks, pinholes, porosity in welds
Discuss preventive measures taken to avoid bad welds
Discuss problems associated with weld contaminants
Compare destructive and non-destructive testing requirements for welds
Discuss the consequences of bad welds to a product or structure
Explain why labeling and documentation are part of the quality check
Compare common metal finishing processes such as annealing, grinding, buffing, polishing, sand blasting, priming, painting, heat treating, coating, plating, anodizing and galvanizing
Describe the purpose of metal finishing

Comments:

Unit 7: Production Pathway
Welding

Competency
13. Process production documents

Performance Standard Condition
Competence will be demonstrated
at the worksite

Performance Standard Criteria
Performance will be successful when learners:
Document processing data on items such as labor, quality, quantity, and time
Verify fabrication and welding documentation is completed
Documentation is legible
Documentation is complete
Documentation is in appropriate format
Documentation is stored or forwarded as required

Learning Objectives
Describe the uses of production data
Describe the importance of documenting the production process

Comments:

Unit 7: Production Pathway
Welding

Competency
14. Clean up

Performance Standard Condition
Competence will be demonstrated
at the worksite

Performance Standard Criteria
Performance will be successful when learners:
Select appropriate cleaning tools and equipment
Clean tools/equipment as required
Clean work area as required
Store tools safely in proper location
Store materials in safe manner
Identify unsafe conditions and report them promptly
Take corrective action to correct unsafe conditions
Ensure that workstation is clean and clear of safety hazards
Ensure workstation is organized for efficiency
Dispose of waste appropriately as required

Learning Objectives
Describe the cleaning procedures and materials used for the specific processes you perform
Discuss cleaning solutions used to clean welded metals such as carbon steel, stainless steel and aluminum
Explain any safety restrictions of cleaning solutions for welded metals

Comments:

Unit 7: Production Pathway
Welding

Competency

15. Monitor equipment for correct operation

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review equipment quality measures for trends and problems as required
Compare current equipment performance to optimal equipment operations on a regular basis
Report any noted deviations from expected performance
Assist worksite professional to investigate abnormal equipment conditions in a timely manner
Assist worksite professional to follow up on repaired equipment to ensure that corrective action solved the problem
Document all monitoring activities

Learning Objectives

Identify basic approaches to maintenance
Explain how to read and review repair history records
Describe how trends for malfunctioning equipment might appear in production records
List the tools and equipment at your facility that must be monitored and maintained
Define Total Productive Maintenance (TPM)

Comments:

Unit 7: Production Pathway
Welding

Competency

16. Perform routine preventive maintenance (PM)

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Perform preventative maintenance (PM) according to facility schedule
Communicate PM to production
Assure that alternative equipment is available if needed by production
Gather supplies to perform PM
Ensure that equipment is properly labeled and pulled from production use
Follow appropriate Lock Out/Tag Out procedures prior to performing PM
Follow all safety requirements and wears appropriate Personal Protective Equipment (PPE) as required
Assist worksite professional to follow PM schedule to calibrate and maintain equipment, tools and workstations

- Inspect lines, tank valves, regulators, gauges, fittings and connections on oxy-fuel equipment
- Inspect, clean, adjust, and replace (if needed) torch tips and torch nuts on oxy-fuel torches
- Inspect, clean, adjust, and replace (if needed) electrodes, ground cables, connections, fasteners, holders, clamps, switches and knobs on shielded arc welding equipment
- Inspect, clean, adjust, and replace (if needed) wire feeder, connections, fasteners, ground cable, gun assembly, gun nozzle, gas diffuser, contact tip, coil mounting, coil break, wire de-reeler, flowmeter, wire guides, and drive rollers on gas metal arc and flux core welding equipment.
- Remove weld spatter and foreign material from guns, torches, and/or electrode holders
- Inspect hand tools, fixtures, and/or tables
- Mount wire electrode coils if applicable

Inspect and clean work areas
Report any damage, wear, or missing safety equipment to worksite professional
Re-qualify equipment for operation
Document PM and preventative actions taken

Learning Objectives

Explain the purpose and importance of preventative maintenance and calibration
Describe how diagrams schematics, equipment manuals, and equipment specifications to determine the schedule and process for PM
List the situations which require you to obtain help to resolve problems with equipment or production

Explain routine maintenance procedures for common welding equipment
Explain how to change a liner on a GTAW, GMAW and/or FCAW gun if used at your worksite

Comments:

Unit 7: Production Pathway
Welding

Competency

17. Document equipment use, PM, and/or operational problems

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Verify all internal and external communication with appropriate parties in a timely manner
Communicate maintenance and repair needs clearly
Use the correct reporting formats for communication
Document use, maintenance, and repair activities accurately
Report back and document any maintenance and repair issues in a timely manner
Maintenance communication is timely and accurate
Maintenance communication is documented

Learning Objectives

Explain the uses of equipment data
Discuss how to schedule repair and maintenance functions with respect to production requirements and production levels
Explain how communication for repair and maintenance issues demonstrates a knowledge of customer and business needs
List the parties that need to be involved of repair and maintenance issues
Describe the importance of documenting communications

Comments:

Criteria for AWS Entry Level Welder

Welding Processes	Welds	Cutting Processes	Cuts
FCAW	FCAW-gas Fillet welds in all positions on carbon steel Groove welds in all positions on carbon steel FCAW-self-shielded Fillet welds in all positions on carbon steel Groove welds in all positions on carbon steel	Air Carbon Arc-manual	Scarfing and Gouging Flat and Horizontal position On Carbon Steel
GMAW (MIG)	GMAW-S (Short Circuit) Fillet welds in all positions on carbon steel Groove welds in all positions on carbon steel GMAW-spray Fillet welds in 1F and 2F position on carbon steel Groove welds in 1G position on carbon steel GMAW-P (Pulse) Fillet welds in all positions on carbon steel Groove welds in all positions on carbon steel GMAW-Spray Fillet welds in all positions on aluminum Groove welds in all positions on aluminum	Oxy-fuel-manual	Straight/square edge and Shape/square edge and Straight/bevel edge and Scarfing and Gouging (SandG) Flat position Horizontal position for SandG only On Carbon steel
GTAW (TIG)	Carbon Steel Fillet welds in all positions Groove welds in all positions Stainless Steel Fillet welds in all positions Groove welds in all positions Aluminum Fillet welds in all positions Groove welds in all positions	Oxy-fuel-machine	Straight/square edge and straight/bevel edge Flat position On Carbon steel
SAW	N/A for entry level certification	Plasma-manual	Straight/square edge and Shape/square edge Flat position On Carbon Steel, Stainless Steel and Aluminum
SMAW (STICK)	Fillet weld all positions on carbon steel Groove weld in all positions on carbon steel		

Appendix O

MANUFACTURING
YOUTH APPRENTICESHIP

PRODUCTION OPERATIONS MANAGEMENT PATHWAY
PRODUCTION OPERATIONS MANAGEMENT (UNIT 8)

Unit 8: Production Operations Management Pathway
Production Operations Management

Competency

1. Assist to purchase materials and supplies

Performance Standard Condition

Competence will be demonstrated

at the worksite

while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

Purchase only from pre-qualified suppliers

Track and maintain order and receipt schedules

Use re-order points to minimize back-orders

Assist worksite professional to inspect raw materials against quality specifications

Report material quality deviations to production

Release materials that meet specification to production

Report receipt of goods to correct parties

Document count and delivery accurately

Report back and documents any material and/or delivery issues to vendors

Learning Objectives

Describe the supplier qualification process

Define logistics

Compare logistics and supply chain management

Describe how logistics is used to keep costs low

Discuss/evaluate logistics industry trends

Explain the process used to manage order, receipt, and delivery externally and internally within a manufacturing facility

Explain the importance of tracking and documentation for inventory control and production processing

Describe how to read bills of lading and routing sheets

Explain how automated purchasing systems work to minimize waste

Describe how purchasing costs are negotiated

Comments:

Unit 8: Production Operations Management Pathway
Production Operations Management

Competency

2. Receive inventory

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Check containers to check for special handling, damage or contamination of materials
Verify that product matches the packing slip and original purchase order and description
Unpack containers as required
Identify any defective materials
Notify appropriate parties and takes appropriate corrective action when defective materials are identified
Store inventory received according to any special handling and production requirements
Store and/or dispose of packing material as required
Update records to document receipt

Learning Objectives

Identify the main types of inventory
Identify the elements of a supply chain
Explain how to read a production schedule and manufacturing work order

Comments:

Unit 8: Production Operations Management Pathway
Production Operations Management

Competency

3. Manage inventory levels

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Assist worksite professional to monitor master production schedule and inventory master file for ordering levels

Check that proper storage levels are maintained

Check that cycle counts for raw and finished goods meet established standards

Rotate raw materials and stock to minimize old and outdated inventory

Help prepare and distribute monitoring reports in a timely way

Assist worksite professional to perform inventory checks

- Do physical count for each item
- Use correct unit of measure to record inventory results
- Assist with inventory inaccuracies investigations

Keep inventory movement to a minimum

Learning Objectives

Explain the purpose of an inventory plan

Identify the costs of maintaining inventory

Define buffer management

List methods of productivity measurement and just-in-time inventory control

Explain the purpose of a physical inventory

Explain methods and reasons for monitoring inventory accuracy

Discuss the timing of inventory audits to production requirements

Describe your facility's policy in the event of inventory shortage

Comments:

Unit 8: Production Operations Management Pathway
Production Operations Management

Competency

4. Distribute materials and products

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Monitor location of pieces/products during production
Verify that most appropriate and cost-effective carrier or method is used to distribute product
Arrange for material or product transport
Handle order in manner to prevent damage
Ensure product is shipped on time
Track shipping of products sent
Document shipping activities
Assist worksite professional to follow up with customer to ensure no customer complaints about the shipment or damaged goods
Assist worksite professional to process claims as applicable

Learning Objectives

Explain the process used to manage order, receipt, and delivery externally and internally within a manufacturing facility
Explain the importance of tracking and documentation for inventory control and production processing
Identify the main methods of transporting products
Describe the role of the government in transportation of goods
Interpret tariffs
Compare packing materials to determine the safest and most cost-effective method of shipping
Discuss how to schedule logistic functions with respect to production requirements and production levels

Comments:

Unit 8: Production Operations Management Pathway
Production Operations Management

Competency

5. Assist to develop inventory forecasts

Performance Standard Condition

Competence will be demonstrated

at the worksite OR in the classroom in a simulated setting. Simulation should ONLY be used IF there is no possibility of skill performance at the worksite.

while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

Research to determine viability of ventures for sources of materials and services

Evaluate internal/external, local/global environments for threats or opportunities (economic, geography, history, political, competition, regulatory, cultural, technological)

Compare costs/benefits of utilizing local, national and/or international markets

Develop forecasts

Set lot sizes, inventory levels and order lead-time

Document forecasts using graphs and charts in written reports or master file for ordering levels

Learning Objectives

Identify major local, national and international trade regions

Define terms associated with trade regions

Construct an import flowchart

Construct an export flowchart

Explain the purpose and function of an inventory forecast

List the types of data needed for inventory forecasting

Define lot size, inventory level, re-order point and lead-time

Explain the importance of the maintaining inventory levels to minimize inventory value

Identify factors/variables for what, when and how much to order

Describe the costs involved for excess inventory, back orders, etc.

Discuss factors used to determine order lead-time

Determine most appropriate demand forecasting method

Comments:

Unit 8: Production Operations Management Pathway
Production Operations Management

Competency

6. Maintain inventory records

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Select appropriate forms/records
Code documents as required
File forms/records in appropriate location
Retrieve and replace files in correct position
Add, Edit, Verify and Query data in electronic files if applicable
Use appropriate computer codes, formatting, macros, charts, spreadsheets, etc.
Verify data prior to entry/storage
Maintain files

Learning Objectives

Demonstrate how electronic data is manipulated such as in a spreadsheet system
Explain how data and files are backed up
Identify and explain the role and function of software management systems
Explain how planning software and systems (Distribution Resource Planning (DRP), Enterprise Resource Planning (ERP), Materials Requirements Planning (MRP), and Warehouse Management System (WMS)) are utilized to manage logistics planning

Comments:

Unit 8: Production Operations Management Pathway
Production Operations Management

Competency

7. Assist to develop a production plan for customer order

Performance Standard Condition

Competence will be demonstrated

at the worksite OR in the classroom in a simulated setting. Simulation should ONLY be used IF there is no possibility of skill performance at the worksite.

while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

Review the scope and phases of the order with worksite professional

Participate in the following planning activities to develop and implement a production plan as able

- Map production flow of materials and processes
- Review the master production schedule
- Identify customer requirements
- Choose production strategy
- Develop schedules
- Manage and evaluate financial costs
- Identify interdependencies
- Identify critical milestones
- Coordinate work between departments
- Track critical milestones
- Track changes to production plan and costs
- Report resource plan status

Learning Objectives

Define the following resource planning terms: lean manufacturing, just-in-time production, process flow, lead time, build to demand, kanban, work cell design, and push-pull systems

Compare and contrast the different types of production process flow design advantages, constraints, and costs

Describe the purpose of a master production schedule

Relate the master production schedule to the customer order resource plan

Compare production strategies "make to stock" vs. "make to order"

Explain the impact of production, services, and maintenance on resource planning

Describe equipment specification issues and their impact on resource planning

Describe facility design issues and their impact on resource planning

Describe how new order requests are planned

Explain the impact of global trade on the order planning process

Explain supply chain management

Describe the role of sales and marketing operations in your facility

Comments:

Unit 8: Production Operations Management Pathway
Production Operations Management

Competency

8. Assist to record and summarize financial data

Performance Standard Condition

Competence will be demonstrated

at the worksite

while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

Assist worksite professional to process financial information such as bills of lading, accounts receivable, and accounts payable records

Calculate and summarize costs

- Estimate required resources including staff time, staff training, equipment time, equipment maintenance and repair costs, support services and staff required, facility modifications
- Estimate raw materials quantities needed including costs associated with handling, shipping and transport
- Estimate time requirements with times for approvals, delays, and repairs

Build an estimated budget for the production process

Assist worksite professional to prepare financial reports as requested

Learning Objectives

Define cost estimating, cost justification, cost rollup, and activity based costing

Describe the costs and need for sales and marketing in manufacturing

Compare tangible versus intangible costs and benefits in production

Define accounts receivable and accounts payable

Compare the objectives of lean manufacturing to cost containment and customer satisfaction

Describe how to calculate costs associated with staff, equipment, facilities, and raw materials

Explain how production timetables are developed from planning for required tools, materials, equipment, numbers of workers needed, and cost projections

Define types of payment in international trade

Comments:

Unit 8: Production Operations Management Pathway
Production Operations Management

Competency

9. Assist to coordinate work schedules and duty assignments

Performance Standard Condition

Competence will be demonstrated

at the worksite

while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

Determine amount of staff needed for services

Schedule staff according to hours required according to employee status and service coverage required

Schedule staff to minimize labor costs

Incorporate coverage for vacations or leaves

Communicate schedules to staff

Maintain changes to master schedule with worksite professional

Learning Objectives

Describe how budgeting is used to determine staffing levels

Describe how labor hours are calculated for levels of production in manufacturing

Distinguish between fixed and variable staff positions to develop work schedules

Define fixed labor and variable labor as it applies to various positions

Discuss how staff are scheduled in accordance with facility needs and staff needs

Describe how staffing levels are determined

Comments:

Unit 8: Production Operations Management Pathway
Production Operations Management

Competency
10. Use quality tools

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Define question/problem to be evaluated
Determine data analysis tool
Decide which data needs to be collected
Determine when and how to collect data
Collect data
Organize data using quality tools
- Check Sheet
- Pareto Chart
- Scatter Diagram
- Histogram
- Cause/Effect Diagram
- Flowchart
- Control Chart

Analyze data collected

Learning Objectives

Explain the purpose of quality tools
Identify the roles of management and workers regarding quality
Relate quality to internal and external customer needs
Explain the importance of producing quality products at the lowest possible cost
Determine how quality monitoring processes are built in to produce a quality product
Compare the 7 quality tools for purpose and best time to use
Explain the purpose of data collection and analysis to quality
Identify statistical tools used in process improvement

Comments:

Unit 8: Production Operations Management Pathway
Production Operations Management

Competency

11. Calibrate tools and equipment (W/S)

Performance Standard Condition

Competence will be demonstrated

at the worksite OR in the classroom in a simulated setting. Simulation should ONLY be used IF there is no possibility of skill performance at the worksite.

Performance Standard Criteria

Performance will be successful when learners:

Follow schedule to calibrate tools and equipment
Check tool/equipment certification regularly by reviewing documentation and through observation of use
Clean and adjust instruments before calibrating
Calibrate tools and instruments accurately and correctly
Promptly re-calibrate tools out of calibration or sent out for recalibration repairs according to procedure
Label tools and equipment that have been calibrated
Document all calibration activities

Learning Objectives

Define calibration and how it is performed
Compare and contrast accuracy versus precision
Explain tolerance
Describe how tolerances and precisions are developed for a piece/product
Explain how calibration precision and schedules are determined
Describe the proper use of selected precision measurement tools
Explain how to determine and control potential sources of measurement error
Discuss how to apply calibration methods to control product and process characteristics

Comments:

Unit 8: Production Operations Management Pathway
Production Operations Management

Competency

12. Assist to analyze production process for productivity

Performance Standard Condition

Competence will be demonstrated

at the worksite OR in the classroom in a simulated setting. Simulation should ONLY be used IF there is no possibility of skill performance at the worksite.

while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

Assist worksite professional/team to evaluate a production process

Use quality tools

Analyze the process to identify staff, tools, equipment, materials, environment, training, safety requirements, and procedures required to produce product

Calculate productivity and/or cycle time for the process

Assist worksite professional/team to identify gaps and brainstorm solutions in productivity

Learning Objectives

Identify trends in manufacturing

Describe potential impacts of current trends

List the major stages involved in producing products

Identify resources needed for production

Explain the impact of material specifications and delivery schedules to all internal and external customers

Identify factors that influence which production processes and technology are used

Describe how efficiency increases productivity

Explain how processes are designed around customer needs and product specifications

Compare and contrast advantages and disadvantages of different types of production principles such as Lean, Mass, Batch, Unit, Continuous, Kanban, Kaizan, etc.

Discuss how staffing, equipment, materials, and environment are analyzed in developing production processes

Explain the role of production in ensuring efficient use of resources

Calculate productivity and/or cycle time

Compare manual production with computer integrated manufacturing (CIM)

Explain how staff training and safety requirements impact production processes

Comments:

Unit 8: Production Operations Management Pathway
Production Operations Management

Competency

13. Monitor operations for product and process quality

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review process control data to ensure process is meeting product specifications
Evaluate process cycle time to ensure that customer and facility needs are met
Sample and test materials and products to ensure they meet customer specifications
Regularly compare current equipment performance to optimal equipment operations
Investigate and report abnormal equipment conditions in a timely manner
Continuously monitor equipment that is corrected to ensure that the corrective action solved the problem
Use quality tools and methods to monitor operations
Document all quality monitoring activities

Learning Objectives

List the key elements of a quality system
Describe the purpose of Standard Operating Procedures (SOPs) and version control
Define statistical distributions
Calculate mean, median, mode and standard deviation
List possible sources of variation inherent in data collection
Compare and contrast process vs. product control
Explain the main functions of feedback control as it is used in quality control
Identify the purpose of a control chart
Explain ways to spot data inaccuracies and respond to them
Describe how to create control charts (variables and attributes)
Describe different methods of destructive and non-destructive product testing

Comments:

Unit 8: Production Operations Management Pathway
Production Operations Management

Competency

14. Assist to investigate root causes of product and/or process failure

Performance Standard Condition

Competence will be demonstrated

at the worksite

while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

Participate on team investigation

Gather data as it pertains to the problem

- magnitude
- location
- timing

Review all relevant data and quality monitoring tools

Develop a detailed description of the problem or process failure

Develop a timeline or sequence of events to identify potential contributory relationships

Explore solution options

Take corrective action

Learning Objectives

Identify conditions that require preventive or corrective actions

Identify when to use preventive action and when to use corrective action

Describe the process of reporting and documenting preventive and corrective actions

Discuss why preventive/corrective records must be retained

Compare common root cause analysis techniques

List common categories of root cause classification such as materials, equipment, machine, environment, manpower, etc.

Comments:

Unit 8: Production Operations Management Pathway
Production Operations Management

Competency

15. Take corrective action to restore or maintain quality

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Apply problem solving steps to reported production issues

Use quality tools

Review previous documentation on similar production issues to identify possible solutions

Create an improvement plan at the worksite

Determine appropriate action for sub-standard piece/product

Correct the piece/product and/or process to meet quality standards and bring process back into control

Communicate quality problems

Suggest continuous improvements to process, piece/product, and/or maintenance to improve production and/or reduce waste

Document corrective actions and their outcome

Corrective actions occur in a timely manner

Corrective actions are supported by data

Continually monitor corrective action to validate effectiveness

Learning Objectives

Define Closed loop corrective action

Explain the process for root cause failure analysis

Categorize defect types to determine root cause

Know Pareto analysis to identify priorities for solving multiple sub-standard product problems

Comments:

Unit 8: Production Operations Management Pathway
Production Operations Management

Competency

16. Participate in quality improvement processes

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Use quality tools to map a production process
Identify performance and training issues related to quality
Identify performance indicators that should be monitored
Assist worksite professional to monitor production operations, equipment, and/or operator performance measures for product and process quality
Review quality measures for trends
Assist worksite professional to perform periodic internal quality audit activities including testing of raw materials, of product at different production stages, and prior to final release
Document the results of quality tests or audits
Assist worksite professional to evaluate customer feedback
Participate in the creation of an improvement plan
Improvement plan clearly outlines change
Improvement plan is supported by data

Learning Objectives

Explain why facilities become involved with improvement processes
Define continuous improvement
Explain the purpose of quality management systems
Describe the impact of Total Quality Management (TQM) principles and ISO9000 certification in manufacturing
Describe inspection and auditing procedures
Identify methods of inspecting materials, processes, and final products
Explain the purpose of documentation and record keeping for inspections
Explain the purpose of a quality audit
Describe the procedures of a quality audit
Describe how audit results are reported
Explain how to develop quality procedures, check lists and methods using standards

Comments:

Appendix P

MANUFACTURING
YOUTH APPRENTICESHIP

MAINTENANCE, INSTALLATION, AND REPAIR PATHWAY
INDUSTRIAL EQUIPMENT- BASIC AND ADVANCED (UNITS 9-10)

Unit 9: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Basic

Competency

1. Read technical drawings and work orders

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review technical drawing
Gather reference materials as needed
Determine type of print and views used
Determine material specifications
Determine critical dimensions and tolerances
Analyze supplementary data
Determine product or job instructions and specifications
Interpret equipment symbols and procedure

Learning Objectives

Explain the need for technical drawings, also known as blueprints, schematics, part prints, or engineering drawings
Explain how technical drawings detail work piece design parameters, lay out and specifications
Explain how product design and production are related
Discuss different types of technical drawings
Identify terminology related to technical drawings
Describe how to interpret views, projections and elements from a technical drawing
Identify common terms, components, revisions, symbols, assembly sequence, dimensions, tolerances, scale, and list of materials from technical drawings or work orders

Comments:

Unit 9: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Basic

Competency

2. Interpret equipment symbols and procedures

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Interpret technical drawings accurately as needed for job task
Use appropriate terminology
Identify lines, views, symbols, and representations on the drawings
Interpret dimensions, tolerances, and scale on the drawings
Interpret threads, tapers, and shop notes on the drawings
Interpret the maintenance, installation and/or repair plan from a technical drawing which includes tools, equipment, speeds, feeds, fixtures and holders as applicable

Learning Objectives

Define and explain the use of lines, views, symbols, dimensions, scale, and tolerances on technical drawings
Identify different lines by name, type, order of usage, and application such as object, hidden, center, section, dimension, extension, cutting plane, short break, long break, phantom
Demonstrate standard view placement practices
Compare pictorial format, orthographic projection, sectional views, and detail schedules
Discuss the standards for production document lines
Describe the standard usage of metric (SI) linear units in drafting
Identify and interpret drawings as to type, part name, part number, callouts, components, and part size dimensions
Determine the relationship of one part to another from assembly drawings
Determine procedure number cross-references to technical drawings

Comments:

Unit 9: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Basic

Competency

3. Maintain schedules, communication, and documentation

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Identify frequency of maintenance tasks, i.e., daily, every other day, weekly, monthly, yearly, etc.
Update schedules as maintenance is completed
Schedule preventive and repair maintenance with all internal and external parties with limited disruption to production
Communicate maintenance and repair needs clearly
Use the correct reporting formats for documentation and communication
Document maintenance and repair activities accurately
Report back and document any maintenance and repair issues in a timely manner
Maintenance is documented clearly and completely
Maintenance communication is timely and accurate
Maintenance communication is documented

Learning Objectives

Discuss how to schedule repair and maintenance functions with respect to production requirements and production levels
Explain how communication for repair and maintenance issues demonstrates a knowledge of customer and business needs
List the parties that need to be involved of repair and maintenance issues
Describe the importance of documenting communications
Describe the process of reporting and documenting preventive and corrective actions
Discuss why preventive/corrective records must be retained

Comments:

Unit 9: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Basic

Competency

4. Monitor equipment for correct operation

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review equipment quality measures for trends and problems as required
Compare current equipment performance to optimal equipment operations on a regular basis
Report any noted deviations from expected performance
Review all relevant data before making suggestions
Assist worksite professional to investigate abnormal equipment conditions in a timely manner
Continuously monitor equipment that is corrected to ensure that the corrective action solved the problem
Document all monitoring activities
Assure that repair history is complete, current and accurate

Learning Objectives

Identify basic approaches to maintenance
Explain how to read and review repair history records
Describe how trends for malfunctioning equipment might appear in production records
List common tools and equipment that must be monitored and maintained
Define Total Productive Maintenance (TPM)
Describe how monitoring and diagnostic device are used to find out which equipment is operating correctly
Define statistical distributions
Calculate mean, median, mode and standard deviation
List possible sources of variation inherent in data collection
Identify the purpose of a control chart
Identify conditions that require preventive or corrective actions
Explain ways to spot data inaccuracies and respond to them
Describe quality statistical tools such as histograms, CpK, X bar, and R charts and range

Comments:

Unit 9: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Basic

Competency

5. Identify maintenance requirements

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Locate and review applicable technical drawings, work orders, and/or procedures for maintenance work

Review procedure and any safety requirements

Identify set up needed

Consult with worksite professional to verify production schedule, deadlines, and timeframes to perform maintenance

Learning Objectives

Describe how a maintenance plan is developed from a technical drawing for process, equipment, tools, and holders

Identify terminology related to equipment systems, maintenance and repair

List function and characteristics of major types of equipment systems e.g., mechanical, hydraulic, pneumatic, electrical, etc.

Comments:

Unit 9: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Basic

Competency

6. Layout and plan work

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Identify maintenance requirements

Plan sequencing, tools, and equipment needed for maintenance procedure

Select tools and maintenance equipment to be used

Gather all resources needed at the workstation

Learning Objectives

List common tools and equipment used in equipment maintenance

Outline applications of each tool and equipment

Describe and demonstrate the safety requirements and safeguards for each tool and equipment

Identify, name, and explain the function of specific equipment you will maintain

Comments:

Unit 9: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Basic

Competency

7. Perform safety checks

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Layout and plan work

Review safety requirements of procedure

Verify safety equipment and any Personal Protective Equipment (PPE) needed for maintenance process

Inspect tools and work area for safety considerations

Examine equipment labeling and safeguarding

Ensure Lock Out/Tag Out procedures have been implemented as required prior to maintenance

Learning Objectives

List the common types of labeling used on tools and equipment to indicate whether a tool or piece of equipment is functional and safe to use

List the safety rules and PPE required for the equipment you will be maintaining

Comments:

Unit 9: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Basic

Competency

8. Use hand tools

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review safety procedures

Select the appropriate hand tool for the job

Use hand tools according to established guidelines for the task to be completed

- Cut metal stock with a hand hacksaw
- Cut threads with hand taps and dies
- Ream holes with hand reamer
- Tap holes using hand tools
- Deburr using hand tools

Piece(s) meet specification

Learning Objectives

Distinguish between common hand tools including hammers, wrenches, pliers, punches, taps and dies, etc.

Identify cutting and non-cutting hand tools

Compare basic tools and tool-holding devices

Comments:

Unit 9: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Basic

Competency

9. Perform preventive maintenance (PM)

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Complete scheduled preventive maintenance (PM) tasks in a timely manner
Communicate PM to production and other applicable parties
Assure that alternative equipment is available if needed by production
Consult worksite professionals, technical drawings, maintenance manuals, and equipment history for PM
Determine type of lubrication requirements
Gather equipment and supplies needed to perform PM
Ensure that equipment is properly labeled and pulled from production use
Follow appropriate Lock Out/Tag Out procedures prior to performing PM
Follow all safety requirements and wears appropriate Personal Protective Equipment (PPE) as required
Assist worksite professional to follow PM schedule to calibrate and maintain equipment, tools and workstations
Assist worksite professional to re-qualify equipment for operation
Document preventative actions completed
Evaluate PM through follow up

Learning Objectives

Discuss preventive maintenance methods
Compare preventive maintenance to predictive maintenance
Identify when to use preventive action and when to use corrective action
Explain why verification is essential to prevention and correction
Describe how diagrams schematics, equipment manuals, and equipment specifications to determine the schedule and process for PM

Comments:

Unit 9: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Basic

Competency
10. Perform lubrication procedures

Performance Standard Condition
Competence will be demonstrated
at the worksite

Performance Standard Criteria
Performance will be successful when learners:
Follow preventive maintenance and repair of equipment steps
Perform safety checks
Check lubricant levels
Check for and correct any leakages
Draw lubricant samples for analysis
Test lubricant for contamination and viscosity
Drain lubricant if required
Fill reservoir with correct lubricant
Use procedures to avoid contamination
Clean inlet strainer and filters if required
Add additional lubrication if required
Document lubrication procedures completed

Learning Objectives
Describe the different types of lubricants, their uses, storage, and disposal requirements
Discuss how to use a vicosimeter and grease gun
Identify bearings that do not require lubricant
Describe how to determine when a bearing has the correct amount of grease/lubricant
Determine type of lubrication requirements
Determine locations requiring lubrication
Determine proper type of lubricant for each location
Determine amount of lubricant required for each location

Comments:

Unit 9: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Basic

Competency

11. Assist with basic equipment problem identification and daignosis

Performance Standard Condition

Competence will be demonstrated

at the worksite

while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

Ensure that equipment is properly labeled and pulled from production use

Locate and interprets technical drawings for the equipment and process that is under investigation

Locate the equipment reference materials and manuals

Review previous preventative maintenance and repair history records on the equipment under investigation

Assist worksite professional to identify the components to be checked for proper operation

Ensure that appropriate safety devices and personal protective equipment are in place prior to diagnosis

Ensure that all labeling and Lock Out/Tag Out procedures are in place prior to diagnosis

Follow all safety requirements and wears appropriate Personal Protective Equipment (PPE) as required

Assist the worksite professional to take appropriate readings using meters and testing equipment

Assist the worksite professional in locating and determining the cause of the problems reported

Assist worksite professional to match suggested remedies with problems for the inoperative systems

Document testing and evaluation

Ensure that equipment is properly labeled, pulled from production, and communicated regarding repair

Investigation are complete, timely, and include indication of root cause

Learning Objectives

Describe how diagrams, schematics, equipment manuals, and equipment specifications are used to determine repair

Describe the most common causes of tool/equipment failure

Explain the meaning of common alarms on equipment

Compare common equipment and materials considered recyclable and not recyclable

Describe the purpose, function, and components of common diagnostic testing equipment

Comments:

Unit 9: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Basic

Competency

12. Assist with basic equipment repair

Performance Standard Condition

Competence will be demonstrated

at the worksite

while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

Identify equipment problems through malfunction or production or quality indicators

Communicate repair needs to production and other applicable parties

Assure that alternative equipment is available if needed by production

Consult worksite professionals, technical drawings, maintenance manuals, and equipment history for repair

Determine type of lubrication requirements

Gather equipment and supplies needed to perform repair

Ensure that equipment is properly labeled and pulled from production use

Follow appropriate Lock Out/Tag Out procedures prior to performing repair

Follow all safety requirements and wears appropriate Personal Protective Equipment (PPE) as required

Assist with basic equipment problem identification and diagnosis

Assist worksite professional to isolate system and component failure

Assist worksite professional to repair equipment problem

Assist worksite professional to identify root cause of problem and develop corrective action plan

Assist worksite professional to ***re-qualify equipment*** for operation

Document repairs completed

Evaluate repair work through follow up

Learning Objectives

Explain concepts of simple machines and how they apply to disassembly of equipment

Identify when to use preventive action and when to use corrective action

Explain why verification is essential to prevention and correction

Describe how diagrams schematics, equipment manuals, and equipment specifications are used to repair specific systems on equipment

Comments:

Unit 9: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Basic

Competency

13. Assist to re-qualify equipment

Performance Standard Condition

Competence will be demonstrated

at the worksite

while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

Review the requirements for requalification

Perform safety checks

Assist the worksite professional to re-qualify the equipment

- Level and fasten equipment as required
- Set up repaired equipment
- Perform a requalification run to test and validate the equipment operationally
- Verify repair completed solved equipment problem
- If equipment is customized or adjusted, test and validate for specific changes made
- Obtain requalification sample to analyze if required

Place equipment back into service

Notify production

Document requalification and update maintenance schedules

Learning Objectives

Define components of equipment requalification

Compare types of repair situations which would or would not require requalification

Distinguish between initial operational qualification of equipment and routine performance qualification

Describe the impact of Total Quality Management (TQM) principles and ISO9000 certification on equipment qualification

Identify statistical tools used in performance qualification

Identify methods of inspecting materials, processes, and final products in qualifying equipment

Explain the purpose of documentation and record keeping for equipment qualification

Explain the importance of testing and documenting customized or adjusted equipment

Comments:

Unit 10: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Advanced

Competency

1. Calibrate tools and equipment

Performance Standard Condition

Competence will be demonstrated

at the worksite OR in the classroom in a simulated setting. Simulation should ONLY be used IF there is no possibility of skill performance at the worksite.

Performance Standard Criteria

Performance will be successful when learners:

Follow schedule to calibrate tools and instruments
Perform safety checks
Check tool/instrument certification regularly by reviewing documentation and through observation of use
Clean and adjust instruments before calibrating
Calibrate tools and instruments accurately and correctly
Promptly re-calibrate tools out of calibration
Re-qualify tools and instruments sent out for recalibration or repairs
Label tools and equipment that have been calibrated
Document all calibration activities

Learning Objectives

Examine different types of precision measurement instruments and their uses
Define calibration and how it is performed
Compare and contrast accuracy versus precision
Explain tolerance
Describe how tolerances and precisions are developed for a piece/product
Explain how calibration precision and schedules are determined
Describe the proper use of selected precision measurement tools
Explain how to determine and control potential sources of measurement error
Discuss how to apply calibration methods to control product and process characteristics

Comments:

Unit 10: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Advanced

Competency

2. Set up and fabricate metal

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

GENERAL SET UP

Layout and plan work

Perform safety checks

Place parts and assemblies into fixtures

Set up equipment for fabrication

FIXTURE SET UP

Locate parts or subassemblies needed

Determine the order for the part or subassembly placement

Position, align, and bolt jigs, holding fixtures, guides, and stops onto machines

Position, align and/or clamp work pieces into jigs and/or holding fixtures

Tighten all holding and positioning clamps

Inspect assembly

FABRICATE METAL

Prepare base metal

Add or adjust safety guards

Verify machine or equipment settings for fabrication of metal material

Verify blades, shears, dies, etc., appropriate for metal fabrication to be completed

Perform equipment pre-check

Adjust holding devices, blade speeds, and metal positions safely as needed

Operate tools and equipment safely

Process metal according to specifications

- ***Use hand tools*** such as brakes and hammers
- Use equipment such as such as grinders, saws, drills, drill presses, or brakes

Inspect, measure, or test completed metal pieces

Shut down and secure equipment

Clean up

Report any discrepancies or equipment concerns to worksite professional immediately

Document fabrication process if required

Learning Objectives

Distinguish between common cutting, drilling and welding processes

Describe equipment components and safety features

Describe how to cut, drill, and/or weld metal to tolerances

Interpret cutting, forming, drilling, and welding symbols on schematics

Identify variables that impact cutting and welding equipment settings

List the types of labeling used on tools and equipment at your facility to indicate whether a tool or piece of equipment is functional and safe to use
Compare basic holding devices

Comments:

Unit 10: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Advanced

Competency

3. Mount a bearing

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Follow preventive maintenance and repair of equipment steps

Perform safety checks

Check running machine for signs (e.g., heat, noise, vibration, etc.) of malfunctioning bearings

Find the correct reference for bearing numbering

Verify the correct bearing for the application

Inspect bearing for condition and lubrication

Verify mounting clearances according to specification

Handle bearings properly to avoid contamination and damage

Assist worksite professional to remove used bearings carefully and correctly

Assist worksite professional to prepare all appropriate surfaces (the shaft and bore) as required

Assist worksite professional to mount bearing according to specifications

Assist worksite professional to analyze reason bearing failed

Document bearing installation

Learning Objectives

Identify bearing types and use

Explain how to match bearing number nomenclature to bearing type

Explain how to analyze bearings as to type and application

Discuss the need to prevent contamination of fluids and bearings

Describe proper function of bearings and couplings and their reliability issues including functioning of transmission equipment, and bearings, shafts, and couplings function

Comments:

Unit 10: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Advanced

Competency

4. Install mechanical fasteners

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Follow preventive maintenance and repair of equipment steps

Perform safety checks

Select the appropriate fastener for the application

Install various fasteners according to specifications

Use the correct tools to install mechanical fastener

Document fastener installation

Learning Objectives

Distinguish between screw thread types and sizes

Examine and identify different fasteners and their uses

Comments:

Unit 10: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Advanced

Competency

5. Assist with electrical circuit problem identification and diagnosis

Performance Standard Condition

Competence will be demonstrated

at the worksite

while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

Assist worksite profession to ***identify and diagnose equipment problem***

Interpret electrical schematics

Perform safety checks

Assist with electrical circuit testing

- Measure current draw
- Test circuit for specified readings to isolate possible causes of fault
- Test for voltage, resistance, open circuits and shorted elements if required

Utilize electrical tests logically in process of elimination

Assist worksite professional to identify specific cause of the problem in electrical circuits

Document electrical circuit testing completed

Learning Objectives

Compare sources of electricity

Compare AC and DC circuits

List units of measure for electrical quantities

Define voltage, current, and power (wattage)

Explain how to test voltage, current, and power (wattage)

Define/apply theory of Ohm's law

Calculate electrical quantities such as voltage, current, resistance, power and conductance

Determine how resistance affects an electrical circuit

Compare resistive series circuits, parallel circuits, and combination circuits

Compare conductors and insulators

Describe features, symbols and notations used on electrical schematics

Describe electrical circuit components and functions

Describe electrical systems reliability issues including power supply connections, operations, series and parallel circuit function, circuit breaker function, electric motor control, and power overload

Comments:

Unit 10: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Advanced

Competency

6. Assist with motor control problem identification and diagnosis

Performance Standard Condition

Competence will be demonstrated

at the worksite

while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

Assist worksite profession to ***identify and diagnose equipment problem***

Interpret single electric motor control diagrams

Perform safety checks

Assist worksite professional to take appropriate readings on motor control system using meters and testing instruments

Assist worksite professional in locating and determining the cause of problems in motor control system

Document motor control testing completed

Learning Objectives

Explain how motor action relates to the operation of electrical devices

Compare DC, 3-phase and single phase motors

Describe motor control circuit components, functions and reliability issues

Describe proper functioning of belts and chains and their reliability issues including belt drive, chain drive and roller chain drive functions

Describe features, symbols and notations used on motor control circuit diagrams

Describe automated machine reliability issues including computerized control processes, logic control circuits, solenoid-operated fluid power valves, electromechanical limit switches, time delay devices, manual controls, and interlock circuits

Comments:

Unit 10: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Advanced

Competency

7. Assist with hydraulic and/or pneumatic problem identification and diagnosis

Performance Standard Condition

Competence will be demonstrated

at the worksite

while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

Assist worksite profession to ***identify and diagnose equipment problem***

Interpret schematics for basic hydraulic system or pneumatic circuit

Perform safety checks

Assist in taking appropriate readings using meters and testing instruments

Check pressure in a hydraulic OR pneumatic system at the appropriate location

Assist worksite professional to locate and determine the cause of problems in a hydraulic or pneumatic systems

Document hydraulic and/or pneumatic system testing completed

Learning Objectives

Define the principles of hydraulics

Explain the purpose and function of hydraulic components

Describe hydraulic system reliability issues including seals, gaskets, packing, and hydraulic fluids

Define the principles of pneumatics

Demonstrate how and where to measure pressure in a pneumatic system

Describe pneumatic system reliability issues including pressure gage readings, conductors, connectors, seals, gaskets, packing, quick-connect fittings, pneumatic cylinder and motor operations, air muffler operations, actuator power output, and pressure regulator operations

Comments:

Unit 10: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Advanced

Competency

8. Maintain and repair mechanical drive system components

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Assist worksite profession to ***identify and diagnose equipment problem***

Interpret schematics for mechanical drive systems

Perform safety checks

Maintain and repair mechanical drives systems

- Check pulley and belts for tension, wear and damage
- Mount new pulleys to shafts if required
- Maintain, install, align, and adjust tension on a belt drive
- Clean, install, and align gear drives
- Maintain, install, align, and adjust tension a chain and sprocket drive
- Install and align couplings
- Check and corrects motor mounting for soft foot condition, angular and groove alignment
- Apply lubrication to mechanical drive system according to specifications
- Remove foreign debris from cooling towers
- Replace air filters

Document mechanical drive system maintenance

Learning Objectives

Locate the major components of a mechanical drive system including v-belts, pulleys and chain drives

Distinguish between various kinds of mechanical power transmissions

Recognize reliability issues for belt and chain drives

Determine proper belt deflection force required for tension

Comments:

Unit 10: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Advanced

Competency

9. Maintain and repair electrical control system components

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Assist worksite profession to ***identify and diagnose equipment problem***

Interpret schematics for electrical control systems

Perform safety checks

Maintain and repair electrical control systems

- Replace faulty lighting components
- Replace blown fuse or tripped circuit breaker
- Construct common control circuits using switches and relays
- Assist to adjust, repair or replace faulty circuit components
- Assist to install conduit and wiring

Document electrical control system maintenance

Learning Objectives

Describe special safety precautions needed when working with electrical components
Explain ground requirements
Compare lamp wattage, lumens, size and types of lighting and fixtures
Compare wire size and types
Compare conduit size and types
Determine bend radius and location
Describe how to assemble a wire bundle
Explain how to connect wires to termination points

Comments:

Unit 10: Maintenance, Installation, and Repair Pathway Industrial Equipment- Advanced

Competency

10. Maintain and repair hydraulic and/or pneumatic system components

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Assist worksite profession to ***identify and diagnose equipment problem***

Interpret schematics for hydraulic and/or pneumatic systems

Perform safety checks

Maintain and repair hydraulic and/or pneumatic systems

- Measure and adjust relief, unloading, and pressure control valves for proper pressure
- Measure and adjust flow controls for proper rates
- Check for system leaks

HYDRALICS

- Draw sample of hydraulic fluid for analysis
- Test hydraulic fluids for contamination and viscosity
- Drain hydraulic fluids if required
- Fill reservoir with correct hydraulic fluid
- Use procedures to avoid fluid contamination
- Clean inlet strainer and filters if required
- Check hydraulic power unit for proper performance
- Inspect and replaces seals and gaskets if required
- Inspect and replaces hoses, tubing and fittings if required
- Check operation of control valves and cylinders and replace if required

PNEUMATICS

- Measure and adjust pressure regulators and in-line filters and replace if required
- Check and repair lines for air leaks
- Check and manually operate all safety valves
- Check air dryer for proper operation
- Check operation of control valves and cylinders and replaces if required
- Align piston (rod) of pneumatic cylinder
- Check operation of water separator/drain as necessary
- Drain receiver tanks
- Drain and blow out mains and header pipes
- Inspect and fill air lubricators

Document hydraulic and/or pneumatic system maintenance

Learning Objectives

Interpret hydraulic schematics

Interpret pneumatic schematics

Differentiate between seals, packings, and gaskets on hydraulic systems
Identify hydraulic components, fittings (threads and types) and lines
Describe the use of different types of pneumatic conductors and connectors for a given system

Comments:

Unit 10: Maintenance, Installation, and Repair Pathway
Industrial Equipment- Advanced

Competency

11. Assist to install and qualify equipment

Performance Standard Condition

Competence will be demonstrated

at the worksite

while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

Identify and evaluate required technical, environmental, safety and performance features of equipment needed

Verify final selection of equipment from qualified vendor

Obtain manufacturer's recommendations for installation site requirements

Check the equipment operation site for the fulfillment of the manufacturer's recommendations

- Utilities such as electricity, water and gases
- Environmental conditions such as humidity, temperature, vibration level and dust
- Space for the equipment, related SOPs, operating manuals, logbooks and any software

Receive equipment and check for damage

Install equipment according to manufacturer recommendations

- Level and fasten installed equipment as required
- Test and validate the equipment operationally for all types of applications, stresses, and routine operation
- If equipment is customized or adjusted, test and validate for specific changes made

Determine performance start up qualification (criteria, procedures, critical parameters, test intervals) and sample analysis for each run or use

Determine cleaning, preventive maintenance (PM), routine servicing and authorized repair engineers

Update maintenance schedules with new equipment PM and servicing

Document qualification and installation such as initial calibration, initial operational testing, quality control procedures and parameters, customization and testing, determination of maintenance and servicing, list of authorized service engineers, etc.

Learning Objectives

Define the following components of equipment qualification: design qualification, installation qualification, operational qualification, performance qualification, maintenance qualification

Explain the role of the vendor and the role of the user in all phases of equipment qualification

List examples of technical, environmental and safety factors that need to be considered when purchasing industrial equipment

Describe the vendor qualification process

Distinguish between initial operational qualification of equipment and routine performance qualification

Describe the impact of Total Quality Management (TQM) principles and ISO9000 certification on equipment qualification
Explain the purpose of data collection and analysis to qualify equipment
Identify statistical tools used in performance qualification
Identify methods of inspecting materials, processes, and final products in qualifying equipment
Explain the purpose of documentation and record keeping for equipment qualification
Explain the importance of testing and documenting customized or adjusted equipment

Comments: