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: