



NCCER

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INDUSTRIAL MAINTENANCE MECHANIC

Competencies / Objectives

Level One

MODULE 32101-07 – ORIENTATION TO THE TRADE

1. Describe the types of work performed by industrial maintenance craftworkers.
2. Identify career opportunities available to industrial maintenance craftworkers.
3. Explain the purpose and objectives of an apprentice training program.
4. Explain the responsibilities and characteristics of a good industrial maintenance craftworker.
5. Explain the importance of safety in relation to industrial maintenance craftworkers.
6. Explain the role of NCCER in the training process.

MODULE 32102-07 – TOOLS OF THE TRADE

1. Explain the purpose of each of the tools commonly used by industrial maintenance craftworkers.
2. Describe how to maintain each of the tools used by industrial maintenance craftworkers.
3. Demonstrate the proper use and basic maintenance of selected industrial maintenance tools.

MODULE 32103-07 – FASTENERS AND ANCHORS

1. Identify and explain the use of threaded fasteners.
2. Identify and explain the use of non-threaded fasteners.
3. Identify and explain the use of anchors.
4. Select the correct fasteners and anchors for given applications.
5. Install fasteners and anchors.

MODULE 32104-07 – OXYFUEL CUTTING

1. Identify and explain the use of oxyfuel cutting equipment.
2. State the safety precautions for using oxyfuel equipment.
3. Set up oxyfuel cutting equipment.
4. Light and adjust an oxyfuel torch.
5. Shut down oxyfuel cutting equipment.
6. Disassemble oxyfuel cutting equipment.
7. Change empty cylinders.
8. Perform oxyfuel cutting:
 - Straight line and square shapes
 - Piercing and slot cutting
 - Bevels
 - Washing
9. Apply a rosebud flame to remove frozen components (also for preheat and expanding larger fittings).
10. Operate a motorized, portable oxyfuel gas cutting machine.

MODULE 32105-07 – GASKETS AND PACKING

1. Identify the various types of gaskets and explain their uses.
2. Identify the various types of gasket materials and explain their applications.
3. Lay out, cut, and install a flange gasket.
4. Describe the use of O-rings.
5. Explain the importance of selecting the correct O-ring for an application.
6. Select an O-ring for a given application and install it.
7. Describe the uses and methods of packing.

MODULE 32106-07 – CRAFT-RELATED MATHEMATICS

1. Identify and explain the use of special measuring devices.
2. Use tables of weights and measurements.
3. Use formulas to solve basic problems.
4. Solve area problems.
5. Solve volume problems.
6. Solve circumference problems.
7. Solve right triangles using the Pythagorean theorem.

MODULE 32107-07 – CONSTRUCTION DRAWINGS

1. Explain the basic layout of a blueprint.
2. Describe the information included in the title block of a blueprint.
3. Identify the types of lines used on blueprints.
4. Identify common symbols used on blueprints.
5. Understand the use of architect's and engineer's scales.
6. Demonstrate the use of an architect's scale.

MODULE 32108-07 – PUMPS AND DRIVERS

1. Identify and explain centrifugal pumps.
2. Identify and explain rotary pumps.
3. Identify and explain reciprocating pumps.
4. Identify and explain metering pumps.
5. Identify and explain vacuum pumps.
6. Explain net positive suction head and cavitation.
7. Identify types of drivers.

MODULE 32109-07 – INTRODUCTION TO VALVES

1. Identify types of valves that start and stop flow.
2. Identify types of valves that regulate flow.
3. Identify valves that relieve pressure.
4. Identify valves that regulate the direction of flow.
5. Explain how to properly store and handle valves.
6. Explain valve locations and positions.

MODULE 32110-07 – INTRODUCTION TO TEST EQUIPMENT

1. Explain the operation of and describe the following pieces of test equipment:
 - Tachometer
 - Pyrometers
 - Multimeters
 - Automated diagnostics tools
 - Wiggy® voltage tester
 - Stroboscope
2. Explain how to read and convert from one scale to another using the above test equipment.
3. Define frequency and explain the use of a frequency meter.

MODULE 32111-07 – MATERIAL HANDLING AND HAND RIGGING

1. Identify and describe the uses of common rigging hardware and equipment.
2. Inspect common rigging equipment.
3. Select, use, and maintain special rigging equipment, including:
 - Jacks
 - Block and tackle
 - Chain hoists
 - Come-alongs
4. Tie knots used in rigging.
5. Use and understand the correct hand signals to guide a crane operator.
6. Identify basic rigging and crane safety procedures.

MODULE 32112-07 – MOBILE AND SUPPORT EQUIPMENT

1. State the safety precautions associated with the use of motor-driven equipment in industrial plants.
2. Explain the operation and applications of the following motor-driven equipment commonly used in industrial plants:
 - Portable generators
 - Air compressors
 - Aerial lifts
 - Forklifts
 - Mobile cranes
3. Operate and perform preventive maintenance on the following equipment:
 - Portable generators
 - Air compressors
 - Aerial lifts

MODULE 32113-07 – LUBRICATION

1. Explain OSHA hazard communication as pertaining to lubrication.
2. Read and interpret a material data safety sheet (MSDS).
3. Explain the EPA hazardous waste control program.
4. Explain lubricant storage.
5. Explain lubricant classification.
6. Explain lubricant film protection.
7. Explain properties of lubricants.
8. Explain properties of greases.
9. Explain how to select lubricants.
10. Identify and explain types of additives.
11. Identify and explain types of lubricating oils.
12. Identify and use lubrication equipment to apply lubricants.
13. Read and interpret a lubrication chart.

Level Two

Module 32201-07 – Basic Layout

1. Identify layout tools and explain their uses.
2. Lay out base lines using the arc method.
3. Lay out base lines using the 3-4-5 method.
4. Scribe straight lines.
5. Scribe perpendicular lines to base lines using a square.
6. Scribe perpendicular lines to an edge using a combination square.
7. Lay out angled lines using a combination square and a protractor.
8. Lay out circles using dividers and trammel points.
9. Lay out perpendicular lines from base lines using dividers and reference points.
10. Bisect lines using dividers.
11. Divide a line into equal parts.
12. Divide a circle into equal parts.
13. Lay out equipment locations.

Module 32202-07 – Introduction to Piping Components

1. Identify and explain the types of piping systems.
2. Identify piping systems according to color-coding.
3. Explain the effects and corrective measures for thermal expansion in piping systems.
4. Explain types and applications of pipe insulation.

Module 32203-07 – Copper and Plastic Piping Practices

1. Identify types of materials and schedules of copper and plastic piping.
2. Identify proper and improper applications of copper and plastic piping.
3. Identify the material properties, storage, and handling requirements of copper piping.
4. Identify types of fittings and valves used with plastic piping.
5. Identify types of fittings and valves used with copper piping.
6. Identify and determine the types of hanging and supporting copper and plastic piping.
7. Identify the various techniques used in hanging and supporting copper and plastic piping.
8. Properly measure, cut, and join copper and plastic piping.
9. Explain proper procedures for the safe handling, storage, and protection of copper and plastic pipes.

Module 32204-07 – Introduction to Ferrous Metal Piping Practices

1. Identify the types of ferrous metal pipes.
2. Measure the sizes of ferrous metal pipes.
3. Identify the common malleable iron fittings.
4. Cut, ream, and thread ferrous metal pipe.
5. Join lengths of threaded pipe together and install fittings.
6. Describe the main points to consider when installing pipe runs.
7. Describe the method used to join grooved piping.

Module 32205-07 – Identify, Install, and Maintain Valves

1. Remove and install threaded valves.
2. Remove and install flanged valves.
3. Replace valve stem O-rings.
4. Replace bonnet gaskets.
5. Explain the purpose of valve packing.
6. Repack a valve.

Module 32206-07 – Hydrostatic and Pneumatic Testing

1. Perform pretest requirements.
2. Perform service and flow tests.
3. Perform head pressure tests.
4. Perform hydrostatic tests.
5. Explain how to perform steam blow tests.
6. Explain nondestructive examinations (NDE).

Module 32207-07 – Introduction to Bearings

1. Identify various types of bearings.
2. Identify and explain bearing materials.
3. Identify parts of bearings.

Module 32208-07 – Low-Pressure Steam Systems

1. Explain the terms and concepts used to describe steam and steam systems.
2. Describe the basic steam heating cycle.
3. Recognize the components of a basic steam heating system, including steam traps, and describe their function(s).
4. Describe the safeguards associated with the operation of a low-pressure steam system.
5. Explain how a blowdown system works.
6. Demonstrate how to install, troubleshoot, and maintain selected steam traps.
7. Describe how basic one-pipe and two-pipe steam heating systems work.

Module 32209-07 – High-Pressure Steam Systems and Auxiliaries

1. Describe the components and operation of a high-pressure steam system.

Module 32210-07 – Distillation Towers and Vessels

1. Identify all safety procedures for confined space entry in towers and vessels.
2. Identify all safety precautions for towers and vessels.
3. Explain the difference between coded and non-coded vessels.
4. Identify the various types of towers and their components.
5. Discuss the functions of various types of towers.
6. Identify the types of trays and their applications.
7. Identify materials, components, and layout of a tray.
8. Identify the types of packing and packing materials.
9. Explain the shakeout for a repair job.
10. Describe typical maintenance procedures on a tower, including:
 - Removal of trays
 - Cleaning and inspection
 - Installation of trays
 - Installation of demisters and ceramics

Module 32211-07 – Heaters, Furnaces, Heat Exchangers, Cooling Towers, and Fin Fans

1. Identify and describe the basic types of heaters and furnaces.
2. Explain the functions of heaters and furnaces within industry.
3. Identify various types of exchangers and cooling towers and their components.
4. Discuss the functions of various types of exchangers.
5. Describe the proper safety procedures and personal protective equipment associated with each type of equipment.
6. Explain how to remove and install an exchanger.
7. Describe the construction and operation of a cooling tower.

Module 32212-07 – Introduction to Tube Work

1. Identify rolling equipment.
2. Identify problem tubes.
3. Explain methods of rolling tubes, plugging tubes, and extracting tubes.

Level Three

Module 32301-08 – Advanced Trade Math

1. Use tables of equivalents.
2. Perform right angle trigonometry.
3. Calculate takeouts, using trigonometry.
4. Calculate weights of objects.

Module 32302-08 – Precision Measuring Tools

1. Use a level.
2. Use a feeler gauge.
3. Use calipers.
4. Use a micrometer.
5. Use a dial indicator.
6. Use a protractor.
7. Use gauge blocks.
8. Use speed measurement tools.
9. Use a pyrometer.
10. Describe the functions of thermal imaging, vibration analysis, and acoustic vibrations.

Module 32303-08 – Installing Bearings

1. Remove bearings.
2. Troubleshoot bearing failures.
3. Install bearings.

Module 32304-08 – Installing Couplings

1. Identify and explain coupling types.
2. Install couplings.
3. Remove couplings.

Module 32305-08 – Setting Baseplates and Prealignment

1. Establish baseplate and soleplate locations.
2. Install baseplates and soleplates.
3. Identify the proper anchor bolts for installation.
4. Field-verify a plate installation.
5. Set driven equipment.
6. Set a driver.

Module 32306-08 – Conventional Alignment

1. Explain types of misalignment.
2. Align couplings using feeler gauge, straightedge, and dial indicator methods.
3. Identify and eliminate coupling stress.

Module 32307-08 – Installing Belt and Chain Drives

1. Identify belt drive types.
2. Install a belt drive.
3. Identify chain drive types.
4. Install a chain drive.

Module 32308-08 – Installing Mechanical Seals

1. Identify types of mechanical seals and explain their applications.
2. Safely and accurately remove and inspect mechanical seals.
3. Safely and accurately install mechanical seals.

Level Four

Module 32401-09 – Preventive and Predictive Maintenance

1. Explain preventive and predictive maintenance.
2. Explain nondestructive testing.
3. Explain ultrasonics.
4. Explain radiography.
5. Explain eddy current inspection.
6. Explain visual and optical inspection.
7. Explain liquid penetrant inspection.
8. Explain magnetic particle inspection.
9. Explain acoustic emissions.
10. Explain infrared testing.
11. Explain vibration analysis.
12. Explain tribology.

Module 32402-09 – Advanced Blueprint Reading

1. Explain the use of a drawing numbering system.
2. Read and interpret foundation layout drawings.
3. Read and interpret assembly drawings.
4. Read and interpret all title block and bill of materials information.
5. Read and interpret detail drawings.
6. Identify and explain the parts of a machine drawing.
7. Locate an assembly drawing using a detail part.
8. Read and interpret P&IDs, GAs, and ISO piping drawings.

Module 32403-09 – Compressors and Pneumatic Systems

1. Explain compressed-air treatment.
2. Identify and explain pneumatic system components and symbols.
3. Explain pneumatic safety.
4. Explain the physical characteristics of gases.
5. Explain compressing gases.
6. Explain the pneumatic transmission of energy.
7. Explain the principles of compressor operation.
8. Identify and explain types of compressors.

Module 32404-09 – Reverse Alignment

1. Explain how machinery can be misaligned.
2. Explain the conditions that can cause misalignment.
3. Measure shaft runout, using a dial indicator.
4. Set up complex reverse dial indicator jigs.
5. Measure indicator sag using complex reverse dial indicator jigs.
6. Perform reverse dial indicator alignment, using a graphical alignment chart and using a mathematical equation.

Module 32405-09 – Laser Alignment

1. Explain lasers and laser alignment systems.
2. Operate a laser alignment system.
3. Align machinery trains.
4. Perform vertical alignment.
5. Explain soft foot, thermal growth, and coupling stress.
6. Troubleshoot repeatability and laser problems.

Module 32406-09 – Introduction to Supervisory Skills

1. Describe the skills necessary to be a supervisor.
2. List the characteristics and behavior of effective leaders, as well as the different leadership styles.
3. Explain the difference between problem solving and decision making.
4. Describe ways to deal with common leadership problems, such as absenteeism and turnover.
5. Identify a supervisor's safety responsibilities.
6. Describe the signals of substance abuse.
7. List the essential parts of an accident investigation.

Module 32407-09 – Troubleshooting and Repairing Pumps

1. Inspect a pump.
2. Troubleshoot a pump.
3. Prepare a pump for shutdown and repair.
4. Remove a pump from the system.
5. Disassemble a pump.
6. Reassemble a pump.
7. Install a pump.
8. Prepare a checklist for pump startup.

Module 32408-09 – Troubleshooting and Repairing Gearboxes

1. Identify and explain gearboxes.
2. Explain how gears operate and identify types of gears.
3. Identify types of gearboxes and use diagnostic charts.
4. Troubleshoot gearboxes.
5. Remove and disassemble gearboxes.
6. Identify gear wear patterns.
7. Measure and adjust backlash and bearing clearance.
8. Install and maintain gearboxes.