

08401

Advanced Blueprint Reading

Pipefitting Level Four

Overview

Pipefitters need to understand how to read piping and instrumentation drawings (P&IDs), which are also known as *blueprints* or *site plans*. These schematic diagrams show process flows, functions, equipment, pipelines, valves, instruments, and controls needed to operate the system. The blueprint package included in the *Appendix* of this module contains plans that demonstrate how P&ID information appears on the plans and what the information means.

Learning Objective 1

Successful completion of this module prepares trainees to:

Identify and describe the contents of piping and instrumentation drawings (P&IDs).

- a. Describe how process piping is depicted on P&IDs.
- b. Identify symbols used on P&IDs to represent piping components.
- c. Identify symbols used on P&IDs to represent process equipment.
- d. Identify symbols used on P&IDs to represent instrumentation.

Learning Objective 2

Successful completion of this module prepares trainees to:

Identify and describe the contents of piping arrangement drawings.

- a. Describe how control points are used on drawings to locate work areas horizontally.
- b. Describe how coordinates are used on drawings to define *geographic position*.
- c. Describe how elevations are used on drawings to locate work areas vertically.

Learning Objective 3

Successful completion of this module prepares trainees to:

Explain how to read and interpret P&IDs, piping arrangement drawings, and isometric drawings.

- a. Explain how to read and interpret P&IDs and piping arrangement drawings.
- b. Explain how to read and interpret isometric drawings.
- c. Explain how to follow a single line from one drawing to another.

Performance Tasks

1. Calculate the total line length from an ISO.
2. Sketch an ISO from a plan view.

Recommended Teaching Time: 50 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08401
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

Performance Task 1

- Appropriate PPE, as directed by the instructor or training facility provider
- Module Trainee Guides
- Calculators (optional)

Performance Task 2

- Appropriate PPE, as directed by the instructor or training facility provider
- Module Trainee Guides

08402

Advanced Pipe Fabrication

Pipefitting Level Four

Overview

Pipe fabrication involves the use of either ordinate tables or trigonometry to create fittings and pipe assemblies that suit a process application. Producing ordinates and using them to lay out miters and laterals is important, as are alternative methods for laying out the cuts for laterals, saddles, and mitered turns. In this module, formulas are provided for putting together multiple offsets around obstacles of both equal and unequal spread.

Learning Objective 1

Successful completion of this module prepares trainees to:

Explain how to calculate piping offsets.

- a. Explain how to calculate simple offsets.
- b. Explain how to calculate three-line, equal-spread offsets around a vessel.
- c. Explain how to calculate three-line, unequal-spread offsets.
- d. Explain how to lay out and fabricate tank heating coils.

Learning Objective 2

Successful completion of this module prepares trainees to:

Explain how to lay out and fabricate miter turns.

- a. Explain how to lay out ordinate lines and how to use *The Pipe Fitters Blue Book* in doing so.
- b. Explain how to lay out cutback lines and how to use *The Pipe Fitters Blue Book* in doing so.
- c. Explain how lay out mitered turns.
- d. Explain how to lay out and fabricate three-piece, 90-degree mitered turns.
- e. Explain how to lay out and fabricate four-piece, 90-degree mitered turns.
- f. Explain how to lay out the cutback for a wye.

Learning Objective 3

Successful completion of this module prepares trainees to:

Explain how to lay out and fabricate saddle and supports made out of pipe.

- a. Explain how to lay out and fabricate a saddle.
- b. Explain how to lay out and fabricate supports made out of pipe.

Learning Objective 4

Successful completion of this module prepares trainees to:

Explain how to lay out laterals without using references.

Performance Tasks

1. Calculate a three-line, 45-degree, equal-spread offset.
2. Calculate and lay out a tank coil.
3. Lay out and fabricate a three-piece mitered turn (degree to be determined by instructor).
4. Lay out and fabricate a four-piece, 90-degree mitered turn.
5. Lay out and fabricate a wye.
6. Using reference charts, lay out and fabricate a 45-degree lateral.
7. Lay out and fabricate a Type 1 pipe support.
8. Lay out a 45-degree lateral by performing a geometric layout.
9. Lay out and fabricate a saddle.

Recommended Teaching Time: 50 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08402
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key

- Module Examinations

Performance Task 1

- Appropriate PPE, as directed by the instructor or training facility provider
- Copies of *Figure 6*
- Calculators

Performance Task 2

- Appropriate PPE, as directed by the instructor or training facility provider
- Copies of *Figure 8*
- Copies of *Table 1*
- Calculators

Performance Task 3

- Appropriate PPE, as directed by the instructor or training facility provider
- Copies of *Figure 20*
- Calculators
- Rulers or tape measures
- Wraparounds
- Sufficient piping to fabricate each mitered assembly
- Right-angle grinders
- Suitable grinding wheels
- Ball peen hammers
- Center punches
- Soapstone
- Oxyacetylene cutting equipment, including gases and regulators
- Welding equipment and consumables suitable for the pipe in use
- Qualified welder

Performance Task 4

- Appropriate PPE, as directed by the instructor or training facility provider
- Copies of *Figure 24*
- Calculators
- Rulers or tape measures
- Wraparounds
- Sufficient piping to fabricate each mitered assembly
- Right-angle grinders
- Suitable grinding wheels
- Ball peen hammers
- Center punches

- Soapstone
- Oxyacetylene cutting equipment, including gases and regulators
- Welding equipment and consumables suitable for the pipe in use
- Qualified welder

Performance Task 5

- Appropriate PPE, as directed by the instructor or training facility provider
- Copies of *Figure 27*
- Calculators
- Rulers or tape measures
- Wraparounds
- Sufficient piping to fabricate each wye
- Right-angle grinders
- Suitable grinding wheels
- Ball peen hammers
- Center punches
- Soapstone
- Oxyacetylene cutting equipment, including gases and regulators
- Welding equipment and consumables suitable for the pipe in use
- Qualified welder

Performance Task 6

- Appropriate PPE, as directed by the instructor or training facility provider
- Copies of the appropriate ordinate references
- Calculators
- Rulers or tape measures
- Wraparounds
- Sufficient piping to fabricate each lateral
- Right-angle grinders
- Suitable grinding wheels
- Ball peen hammers
- Center punches
- Soapstone
- Oxyacetylene cutting equipment, including gases and regulators
- Welding equipment and consumables suitable for the pipe in use
- Qualified welder

Performance Task 7

- Appropriate PPE, as directed by the instructor or training facility provider

- Copies of *Figure 37*
- Calculators
- Rulers or tape measures
- Wraparounds
- Sufficient piping to fabricate each support
- Drill motor and appropriate bit (for weep hole; optional)
- Right-angle grinders
- Suitable grinding wheels
- Ball peen hammers
- Center punches
- Soapstone
- Oxyacetylene cutting equipment, including gases and regulators
- Welding equipment and consumables suitable for the pipe in use
- Qualified welder

Performance Task 8

- Appropriate PPE, as directed by the instructor or training facility provider
- Copies of *Figure 31*
- Calculators
- Rulers

Performance Task 9

- Appropriate PPE, as directed by the instructor or training facility provider
- Calculators
- Rulers
- Drawing scales
- Compass
- Wraparounds
- Sufficient piping to fabricate each saddle
- Right-angle grinders
- Suitable grinding wheels
- Ball peen hammers
- Center finder
- Soapstone
- Oxyacetylene cutting equipment, including gases and regulators
- Welding equipment and consumables suitable for the pipe in use
- Qualified welder

08403

Stress Relieving and Aligning

Pipefitting Level Four

Overview

Stress relieving is the process of preheating and post weld heat treatment to keep welds from distorting a pipe assembly. Proper alignment is the reason for stress relieving, because, if the pipe will not fit up accurately to machinery, dynamically balanced pumps will be unbalanced by the distortions of the piping attachments. A skilled pipefitter takes charge of these situations, working with millwrights and others to prevent misalignments and problems which stem from them.

Learning Objective 1

Successful completion of this module prepares trainees to:

Describe thermal expansion in piping systems and approaches to accommodating the imposed stress.

- a. Explain the role of flexibility in accommodating expansion.
- b. Explain the installation of expansion loops.
- c. Describe cold springing and how it accommodates expansion.

Learning Objective 2

Successful completion of this module prepares trainees to:

Identify and describe methods used to minimize stress in pipe welds.

- a. Describe the relationship between temperature and the structure of metal.
- b. Identify metals that require preheating prior to welding.
- c. Identify and describe metal-preheating methods.
- d. Identify and describe the results of various post weld heat treatment processes.
- e. Explain how pipe temperatures are best measured.

Learning Objective 3

Successful completion of this module prepares trainees to:

Describe how piping stress is avoided when a connection to rotating equipment is required.

- a. Explain the purpose of grouting and its roles in supporting machinery.
- b. Describe how preliminary alignments are completed on rotating equipment.

Performance Tasks

1. Identify three methods used to stress-relieve welds.
2. Indicate the area of a pipe that needs to be stress-relieved.

Recommended Teaching Time: 10 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08403
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

Performance Tasks 1 and 2

- Appropriate PPE, as directed by the instructor or training facility provider
- Access to an installed piping system or section of piping, OR
- Pipe drawings of a spool or section of a system

08405

In-Line Specialties

Pipefitting Level Four

Overview

Special fittings and instruments used in process piping equipment are known as *in-line specialties* and described in system documentation as “specials.” This category includes steam traps, desuperheaters, bursting discs, strainers, and related equipment. Steam traps protect the lines against water hammer while desuperheaters reduce the temperature of steam. Strainers are used with many types of fluids to keep solids from clogging pipes. Bursting discs provide emergency pressure relief to prevent very high-pressure surges from damaging equipment. Each in-line specialty item serves a specific purpose and must be installed, monitored, and removed by knowledgeable pipefitters who may be working in tandem with other professionals for coordinated activities across the pipe run.

Learning Objective 1

Successful completion of this module prepares trainees to:

Identify and describe the operation of various in-line specialties.

- a. Identify and describe the operation of snubbers.
- b. Identify and describe the operation of ball joints.
- c. Identify and describe the operation of bleed rings.
- d. Identify and describe the operation of drip legs.
- e. Identify and describe the operation of steam traps.
- f. Identify and describe the operation of expansion joints.
- g. Identify and describe the operation of filters and strainers.
- h. Identify and describe the operation of flowmeters.
- i. Identify and describe the operation of level measurement devices.
- j. Identify and describe the operation of flow pressure switches.
- k. Identify and describe the operation of rupture discs.
- l. Identify and describe the operation of thermowells.
- m. Identify and describe the operation of desuperheaters.
- n. State common safety and storage practices related to in-line specialties.

Learning Objective 2

Successful completion of this module prepares trainees to:

Explain how to troubleshoot and maintain steam traps.

- a. Explain and discuss diagnostic methods and maintenance procedures related to steam traps.

Performance Tasks

1. Identify a number of specialties at the discretion of the instructor.
2. Identify specific problems and corrective actions required for faulty steam traps.
3. Install steam traps.

Recommended Teaching Time: 20 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08405
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

Performance Task 1

- Appropriate PPE, as directed by the instructor or training facility provider
- A variety of in-line specialties for identification or photos of various in-line specialties

Performance Task 2

- Appropriate PPE, as directed by the instructor or training facility provider
- Prepared scenarios related to trap operation and failure

Performance Task 3

- Appropriate PPE, as directed by the instructor or training facility provider
- One or more types of steam traps
- Suitable piping system or purpose-built trainer into which the trap can be installed

- Necessary pipe fittings, including but not limited to nipples, unions, and ells
- Common hand tools
- Appropriately sized pipe wrenches
- Pipe thread compound rated for steam at the expected pressure
- Pyrometer (optional)

08406

Special Piping

Pipefitting Level Four

Overview

Pipefitters must be prepared to assemble small piping and tubing. While these jobs are infrequent, they still require a clear understanding of the skills needed to correctly and safely connect and route pipe on a smaller scale. Some of these skills include brazing, soldering, pipe bending, and installing various fittings made of copper, stainless steel, aluminum, and brass.

Learning Objective 1

Successful completion of this module prepares trainees to:

Explain how to assemble flared and compression joints using copper tubing.

- a. Describe flared and compression methods of joining tubing.
- b. Identify and describe flared and compression fittings.
- c. Explain how to assemble a flared joint.
- d. Explain how to assemble a compression joint.

Learning Objective 2

Successful completion of this module prepares trainees to:

Explain how to solder and braze copper tubing and fittings.

- a. Explain how to solder copper tubing and fittings.
- b. Explain how to braze copper tubing and fittings.

Learning Objective 3

Successful completion of this module prepares trainees to:

Explain how to lay out and create bends in pipe and tubing.

- a. Explain how to calculate pipe bends.

- b. Explain how to lay out pipe bends.
- c. Describe various methods of bending pipe and tubing.

Learning Objective 4

Successful completion of this module prepares trainees to:

Explain how to remove, install, and maintain glass-lined piping systems.

- a. Explain how to remove and install sections of glass-lined piping systems.
- b. Explain how to maintain glass-lined piping systems.

Learning Objective 5

Successful completion of this module prepares trainees to:

Identify and describe how to assemble Lokring[®] and other crimped joints on tubing.

- a. Identify and explain how to create Lokring[®] joints.
- b. Identify and explain how to create crimped joints on copper tubing.

Performance Tasks

1. Install flared fittings using copper tubing.
2. Install compression fittings using copper tubing.
3. Solder copper tubing joints.
4. Braze copper tubing joints.
5. Bend pipe or tubing to a specified radius.
6. Fabricate a Lokring[®] or a crimped copper-tubing joint.

Recommended Teaching Time: 25 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint[®] Presentations for Module 08406
- A variety of standard marker sizes
- Poster board
- Flip chart

- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

Performance Task 1

- Appropriate PPE, as directed by the instructor or training facility provider
- Copper tubing appropriate for flaring ($\frac{1}{4}$ "– $\frac{1}{2}$ " tubing size is suggested)
- Appropriate flare nuts for the tubing used
- Flare fittings, such as unions, male adapters, and ells
- Flaring tool sets
- Tubing cutters
- Tube reamers
- Common hand tools

Performance Task 2

- Appropriate PPE, as directed by the instructor or training facility provider
- Copper tubing appropriate for compression joints ($\frac{1}{4}$ "– $\frac{1}{2}$ " tubing size is suggested)
- Appropriate compression fittings and ferrules for the tubing used
- Tubing cutters
- Tube reamers
- Common hand tools

Performance Task 3

- Appropriate PPE, as directed by the instructor or training facility provider
- Copper tubing appropriate for soldering ($\frac{3}{8}$ "– $\frac{7}{8}$ " tubing size is suggested)
- Appropriate fittings for soldering, such as couplings and ells
- Tubing cutters
- Tube reamers
- Sand cloth or equal
- Appropriate solder filler metals and flux
- Air-acetylene, MAPP-Pro, or propane torch kit, with gases
- Striker
- Common hand tools

Performance Task 4

- Appropriate PPE, as directed by the instructor or training facility provider
- Copper tubing appropriate for brazing ($\frac{3}{8}$ "– $\frac{7}{8}$ " tubing size is suggested)
- Appropriate fittings for brazing, such as couplings and ells
- Tubing cutters

- Tube reamers
- Sand cloth or equal
- Appropriate brazing filler metals
- Brazing flux (not typically required for BCuP filler metals)
- Oxyacetylene or similar torch kit, with gases
- Torch tips appropriate for the tubing size in use
- Striker
- Common hand tools

Performance Task 5

- Appropriate PPE, as directed by the instructor or training facility provider
- Pipe or tubing for bending
- Tubing benders appropriate for the pipe/tubing selected
- Measuring tools, such as tape measures or steel rules

Performance Task 6

- Appropriate PPE, as directed by the instructor or training facility provider
- Appropriate tubing (steel is suggested for a Lokring[®] joint)
- Lokring[®] or crimped copper fittings
- Hydraulic or power tool required for chosen joining method, including the proper jaw set
- Tube squaring and facing tool (optional)
- 120- and 60-grit aluminum oxide sand cloth
- Common hand tools

08407

Hot Taps

Pipefitting Level Four

Overview

When it is necessary to connect to pipes that cannot be shut down or emptied, fluid pressure must be contained to prevent leaks. The method for doing this is referred to as hot tapping, and its procedures will vary according to what is being conveyed through the line. In some situations, it may be possible to temporarily stop the flow while connections are made; this is where line stop plugs, pipe freezing, and pipe plugging become important. Hot tapping is not a regular part of a pipefitter's career, but it is important to understand the environmental factors associated with it as well as ways to safely assist any contractors called on to perform it.

Learning Objective 1

Successful completion of this module prepares trainees to:

Explain how to hot tap existing piping.

- a. State potential hazards that must be addressed before a hot tap is made.
- b. Explain how to install the required hot tap fittings.
- c. Explain how to operate hot tap machines.
- d. Identify and describe various line stop plugs.

Performance Tasks

1. Identify mechanical joint stops and fittings.
2. Identify bolt-weld stops and fittings.
3. Identify split tee fittings.

Recommended Teaching Time: 10 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08407

- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

Performance Tasks 1 – 3

- Appropriate PPE, as directed by the instructor or training facility provider
- Examples of mechanical joint stops and fittings
- Examples of bolt-weld stops and fittings
- Examples of split tee fittings
- Photos of the all the above stops and fittings (alternate)

08408

Maintaining Valves

Pipefitting Level Four

Overview

Understanding the function and assembly of valves is essential to the pipefitter's career. While most valves are replaced rather than maintained, it is important to understand the procedures for both. Knowledge on valve maintenance contributes to troubleshooting issues within a pipe run, with the function of valves as a pivotal point.

Learning Objective 1

Successful completion of this module prepares trainees to:

Explain how to remove and install valves and bonnet gaskets.

- a. Explain the basics of removing and installing threaded and flanged valves.
- b. Explain how to replace bonnet gaskets.

Learning Objective 2

Successful completion of this module prepares trainees to:

Identify and describe how to replace valve-stem O-rings.

- a. Identify common O-ring materials.
- b. Explain how to replace valve-stem O-rings.

Learning Objective 3

Successful completion of this module prepares trainees to:

Identify and describe how to replace valve-stem packing.

- a. Identify and describe common packing materials.
- b. Explain how to repack valves.

Performance Tasks

1. Demonstrate how to remove and install threaded valves.
2. Remove and install flanged valves.
3. Replace bonnet gaskets.
4. Replace valve stem O-rings.
5. Demonstrate repacking a valve.

Recommended Teaching Time: 10 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08408
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

Performance Task 1

- Appropriate PPE, as directed by the instructor or training facility provider
- Suitable threaded valves installed or a location where they can be installed
- Appropriate pipe wrenches
- Common hand tools
- Pipe thread sealant

Performance Task 2

- Appropriate PPE, as directed by the instructor or training facility provider
- Suitable flanged valves installed or a location where they can be installed
- Necessary rigging, such as a chain fall, if required
- Common hand tools, including appropriate sockets for the flange bolts and nuts
- Drift pins
- Torque wrenches

- Penetrating oil

Performance Task 3

- Appropriate PPE, as directed by the instructor or training facility provider
- Valve assembly with a gasketed bonnet
- Appropriate gaskets to fit the valve bonnet
- Gasket lubricant, if required
- Torque wrench
- Gasket scraper
- Common hand tools

Performance Task 4

- Appropriate PPE, as directed by the instructor or training facility provider
- Valve assembly with stem O-rings
- Appropriate O-rings to fit the valve assembly
- O-ring lubricant
- Common hand tools

Performance Task 5

- Appropriate PPE, as directed by the instructor or training facility provider
- Valve assembly with a packed stuffing box
- Appropriate packing material for the valve and application
- Packing removal tools
- Valve stem lubricant
- Knife or similar tool to cut the packing
- Common hand tools

FUNDAMENTALS OF CREW LEADERSHIP

Module 46101 teaches skills needed to become an effective crew leader, as well as knowledge and abilities required to transition from craftworker to crew leader. The module also covers workforce diversity and organization, basic leadership skills, safety, and project control.

Objectives

Learning Objective 1

- Describe current issues and organizational structures in industry today.
 - a. Describe the leadership issues facing the construction industry.
 - b. Explain how gender and cultural issues affect the construction industry.
 - c. Explain the organization of construction businesses and the need for policies and procedures.

Learning Objective 2

- Explain how to incorporate leadership skills into work habits, including communications, motivation, team-building, problem-solving, and decision-making skills.
 - a. Describe the role of a leader on a construction crew.
 - b. Explain the importance of written and oral communication skills.
 - c. Describe methods for motivating team members.
 - d. Explain the importance of teamwork to a construction project.
 - e. Identify effective problem-solving and decision-making methods.

Learning Objective 3

- Identify a crew leader's typical safety responsibilities with respect to common safety issues, including awareness of safety regulations and the cost of accidents.
 - a. Explain how a strong safety program can enhance a company's success.
 - b. Explain the purpose of OSHA and describe the role of OSHA in administering worker safety.
 - c. Describe the role of employers in establishing and administering safety programs.
 - d. Explain how crew leaders are involved in administering safety policies and procedures.

Learning Objective 4

- Demonstrate a basic understanding of the planning process, scheduling, and cost and resource control.
 - a. Describe how construction contracts are structured.
 - b. Describe the project planning and scheduling processes.
 - c. Explain how to implement cost controls on a construction project.
 - d. Explain the crew leader's role in controlling project resources and productivity.

Performance Tasks

Performance Task 1 (Learning Objective 4)

- Develop and present a look-ahead schedule.

Performance Task 2 (Learning Objective 4)

- Develop an estimate for a given work activity.

Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids, including the PowerPoint® presentation, and these lesson plans, and to gather the required equipment and materials. Consider the time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the PowerPoint® presentations and Performance Profile Sheets from www.nccerirc.com. For information about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER's Registry is 70% or above for the module exam; performance testing is graded pass or fail.



Recommended Teaching Time: 22.5 hours

This Lesson Plan (LP) is divided into sections that correspond to the sections in the Trainee Guide module. As you plan your class times, review the objectives, content, and lesson plan outline for the section you plan to teach. Allow sufficient class time for demonstrations, laboratories, field trips, and testing. Each class period should also include time for administrative tasks and periodic breaks.

Be sure to gather the required equipment, materials, visual aids, and answer keys. Using your access code, download the PowerPoint® presentations and Performance Sheets for this module from NCCER's Instructor Resource Center at www.nccerirc.com.

It is advisable to assign the reading of a module section prior to the classroom instruction. The Section Review and Module Review questions may be assigned as homework. At their discretion, instructors may assign additional homework to meet the teaching objectives.

Performance Testing may be administered at any suitable time in the course of the module training. Tasks are graded pass/fail. Trainee performance and proficiency during practice sessions that meets or exceeds the standards for a task can be accepted as Performance Task completion. Complete the Performance Profile Sheet for each trainee.

The final class is generally reserved for a brief review and the written module examination. For information about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER's Registry is 70% or above for the written exam. Record the testing results for each trainee on the Registration of Training Modules form and submit the form to the Training Program Sponsor.

Classroom Equipment and Materials

Whiteboard	LCD projector and screen	Blank copies of takeoff and summary worksheets
Markers	Computer with Internet access during class (optional)	Module Review answer key
Pencils and paper		Module examinations
<i>Fundamentals of Crew Leadership</i>	Blank copies of a look-ahead schedule	Performance Profile Sheets
PowerPoint® Presentation		



Additional Resources

This module presents thorough resources for task training. The following reference material is recommended for further study.

- Construction Workforce Development Professional*, NCCER. 2016. New York, NY: Pearson Education, Inc.
- Mentoring for Craft Professionals*, NCCER. 2016. New York, NY: Pearson Education, Inc.
- Blueprint Reading for Construction*, James A. S. Fatzinger. 2003. New York, NY: Pearson Education, Inc.
- Construction Leadership from A to Z: 26 Words to Lead By*, Wally Adamchik. 2011. Live Oak Book Company.
- Generational Cohorts and their Attitudes Toward Work Related Issues in Central Kentucky*, Frank Fletcher, et al. 2009. Midway College, Midway, KY. www.kentucky.com
- It's Your Ship: Management Techniques from the Best Damn Ship in the Navy*, Captain D. Michael Abrashoff, USN. 2012. New York City, NY: Grand Central Publishing.
- Survival of the Fittest*, Mark Breslin. 2005. McNally International Press.
- The Definitive Book of Body Language: The Hidden Meaning Behind People's Gestures and Expressions*, Barbara Pease and Allan Pease. 2006. New York City, NY: Random House / Bantam Books.
- The Young Person's Guide to Wisdom, Power, and Life Success: Making Smart Choices*, Brian Gahran, PhD. 2014. San Diego, CA: Young Persons Press. www.WPGBlog.com

The following websites offer resources for products and training:

- Aging Workforce News, www.agingworkforcenews.com
- American Society for Training and Development (ASTD), www.astd.org
- Architecture, Engineering, and Construction Industry (AEC), www.aecinfo.com
- Equal Employment Opportunity Commission (EEOC), www.eeoc.gov
- National Association of Women in Construction (NAWIC), www.nawic.org
- National Census of Fatal Occupational Injuries (NCFI), www.bls.gov
- National Institute of Occupational Safety and Health (NIOSH), www.cdc.gov/niosh
- National Safety Council, www.nsc.org
- Occupational Safety and Health Administration (OSHA), www.osha.gov
- Society for Human Resources Management (SHRM), www.shrm.org
- United States Census Bureau, www.census.gov
- United States Department of Labor, www.dol.gov
- US Green Building Council (USGBC), www.usgbc.org/leed
- Wi-Fi® is a registered trademark of the Wi-Fi Alliance, www.wi-fi.org

There are a number of online resources available for trainees who would like more information on effective leadership skills and professionalism in the construction industry. A search for additional information may be assigned as homework to interested trainees.

Instructors should view any videos that may be identified in the lesson plan before using them to ensure their suitability. The videos can provide examples of both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Instructors are encouraged to locate additional audiovisual aids available on the internet, make personal videos, and take still pictures related to the subject matter and add them to the PowerPoint® presentations throughout the program.

