

Annotated Instructor's Guide**MODULE OVERVIEW**

This module explains and identifies the uses of conveyors, their operation, and the major parts of roller, belt, chain, screw, and pneumatic conveyors. It also describes the principles of conveyor safety.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Millwright Level One; Millwright Level Two; and Millwright Level Three.*

OBJECTIVES

Upon completion of this module, the trainee will be able to do the following:

1. Explain conveyor safety.
2. Identify and explain the use of roller conveyors and their components.
3. Identify and explain the use of belt conveyors and their components.
4. Identify and explain the use of chain conveyors and their components.
5. Identify and explain the use of screw conveyors and their components.
6. Identify and explain the use of pneumatic conveyors and their components.

PERFORMANCE TASKS

This is a knowledge-based module; there are no Performance Tasks.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Manufacturers' literature for various types of conveyors

Safety videos or CD and appropriate devices for viewing, guest speaker, or online safety training

Photographs or illustrations of various types of conveyors

Appropriate personal protective equipment

Samples of conveyor chains

Copies of the Quick Quiz*

Module Examinations**

* Located in the back of this module.

** Located in the Test Booklet.

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly.

ADDITIONAL RESOURCES

This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.

Rexnord Power Transmission and Conveying Components, Catalog #R85. Rexnord Inc. Atlanta, GA.

Goodyear Conveyor Maintenance. Goodyear Tire and Rubber Co. Akron, OH.

TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 5 hours are suggested to cover *Conveyors*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources.

Topic	Planned Time
Session I. Introduction; Safety; Conveyors I	
A. Introduction	_____
B. Conveyor Safety	_____
C. Roller Conveyors	_____
D. Belt Conveyors	_____
Session II. Conveyors II; Review and Testing	
A. Chain Conveyors	_____
B. Screw Conveyors	_____
C. Pneumatic Conveyors	_____
D. Review	_____
E. Module Examination	_____
1. Trainees must score 70% or higher to receive recognition from NCCER.	
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.	

MODULE OVERVIEW

This module explains how to maintain, troubleshoot, and repair conveyors, including how to splice belts and replace sprockets, bearings, and conveying devices.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Millwright Level One; Millwright Level Two; Millwright Level Three; and Millwright Level Four, Module 15401-08.*

OBJECTIVES

Upon completion of this module, the trainee will be able to do the following:

1. Maintain, troubleshoot, and repair belt and roller conveyors.
2. Maintain, troubleshoot, and repair chain conveyors.
3. Maintain, troubleshoot, and repair screw conveyors.
4. Maintain, troubleshoot, and repair pneumatic conveyors.

PERFORMANCE TASKS

Under the supervision of the instructor, the trainee should be able to do the following:

1. Splice a belt.
2. Repair one of the following:
 - Belt conveyor
 - Chain conveyor
 - Screw conveyor
 - Pneumatic conveyor

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Conveyor setups or broken or damaged conveyors for the repair of belt, chain, screw, or pneumatic conveyors
Transparencies	
Blank acetate sheets	Damaged drive rollers, sprockets, and bearings
Transparency pens	Damaged chains, sprockets, and carrying devices
Whiteboard/chalkboard	Maintenance manuals for belt, chain, screw, and pneumatic conveyors
Markers/chalk	Replacement links for chain conveyors
Pencils and scratch paper	Replacement belt materials
Appropriate personal protective equipment	Sling and hardware for rigging
Gloves	Tools for marking, measuring, cutting, and splicing conveyor belts
Straightedge	Tools for installing replacement links
Tape measures	Allen wrenches
Plywood or other suitable surface on which to cut and repair belts	Arbor press or length of pipe to install bearings
Mechanical belt fasteners or other splicing materials	Assorted screwdrivers

continued

Bearing pullers
Grease gun and lubricant
Needle-nose pliers
Torque wrenches

Copies of the Quick Quizzes*
Module Examinations**
Performance Profile Sheets**

* Located in the back of this module

** Located in the Test Booklet

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to repair conveyors. Ensure that all trainees are briefed on appropriate shop safety procedures. This module may require that the trainees visit job sites. Ensure that trainees are briefed on site safety policies prior to any site visits.

ADDITIONAL RESOURCES

This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.

Rexnord Power Transmission and Conveying Components, Catalog #R85, 1984. Atlanta, GA: Rexnord Inc.
Goodyear Belt Splicing Manual. Akron, OH: Goodyear Tire and Rubber Co.

TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 12½ hours are suggested to cover *Troubleshooting and Repairing Conveyors*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Sessions I and II. Introduction; Maintaining, Troubleshooting, and Repairing Belt and Roller Conveyors	
A. Introduction	_____
B. Maintaining and Repairing Belt and Roller Conveyors	_____
C. Laboratory	_____
Have trainees practice splicing a belt. This laboratory corresponds to Performance Task 1.	
D. Laboratory	_____
Have trainees practice repairing a belt conveyor. This laboratory corresponds to Performance Task 2.	
Sessions III and IV. Maintaining, Troubleshooting, and Repairing Chain, Screw, and Pneumatic Conveyors	
A. Chain Conveyors	_____
B. Laboratory	_____
Have trainees practice repairing a chain conveyor. This laboratory corresponds to Performance Task 2.	
C. Screw Conveyors	_____

D. Laboratory

Have trainees practice repairing a screw conveyor. This laboratory corresponds to Performance Task 2.

E. Pneumatic Conveyors

F. Laboratory

Have trainees practice repairing a pneumatic conveyor. This laboratory corresponds to Performance Task 2.

Session V. Review and Testing

A. Module Review

B. Module Examination

1. Trainees must score 70% or higher to receive recognition from NCCER.
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

MODULE OVERVIEW

This module explains the importance of precise alignment of machinery and equipment. It describes the various types of misalignment and covers aligning couplings using a straightedge and feeler gauge. It also covers adjusting face and OD alignment using a dial indicator, and eliminating coupling stress.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Millwright Level One; Millwright Level Two; Millwright Level Three; and Millwright Level Four, Modules 15401-08 and 15402-08.*

OBJECTIVES

Upon completion of this module, the trainee will be able to do the following:

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

PERFORMANCE TASKS

Under the supervision of the instructor, the trainee should be able to do the following:

1. Check for coupling stress.
2. Eliminate coupling stress.
3. Set up dial indicators.
4. Determine sag of a conventional alignment jig.
5. Level and align the driven on a base.
6. Adjust vertical offset and angularity using the straightedge and feeler gauge method.
7. Adjust horizontal offset and angularity using the straightedge and feeler gauge method.
8. Adjust vertical offset and angularity using dial indicators.
9. Adjust horizontal offset and angularity using dial indicators.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Old or broken equipment to demonstrate misalignment and coupling stress
Alignment simulator
Instruction manual for an alignment simulator

Samples of machines that have coupling stress from various causes
Dial indicators and bases
Instruction manual for dial indicators
Feeler gauges
Straightedges
Levels
Soft-faced hammers
Dial calipers
Copies of the Quick Quiz*
Module Examinations**
Performance Profile Sheets**

* Located in the back of this module.

* *Located in the Test Booklet.

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to work with alignment simulators and other equipment. Ensure that trainees are properly briefed on applicable safety procedures including the use of guards and emergency shut-offs, and precautions to take when working around rotating equipment.

ADDITIONAL RESOURCES

This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.

Ludeca, Inc.: <http://www.ludeca.com>

PeopleFlo™ Manufacturing, Inc.: http://peopleflo.com/index.php?option=com_content&task=view&id=27&Itemid=87

TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 30 hours are suggested to cover *Conventional Alignment*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Sessions I through III. Introduction; Misalignment; Coupling Stress	
A. Introduction	_____
B. Types of Misalignment	_____
C. Coupling Stress	_____
D. Laboratory Have trainees practice checking for coupling stress. This laboratory corresponds to Performance Task 1.	_____
E. Laboratory Have trainees practice eliminating coupling stress. This laboratory corresponds to Performance Task 2.	_____
Sessions IV through VII. Alignment: Straightedge and Feeler Gauge Method	
A. Adjusting Vertical Angularity	_____
B. Adjusting Vertical Offset	_____
C. Laboratory Have trainees practice leveling and aligning the driven on a base. This laboratory corresponds to Performance Task 5.	_____
D. Laboratory Have trainees practice adjusting vertical offset and angularity using the straightedge and feeler gauge method. This laboratory corresponds to Performance Task 6.	_____
E. Adjusting Horizontal Angularity	_____
F. Adjusting Horizontal Offset	_____
G. Laboratory Have trainees practice adjusting horizontal offset and angularity using the straightedge and feeler gauge method. This laboratory corresponds to Performance Task 7.	_____
H. Adjusting Vertical Angularity and Offset	_____
I. Adjusting Horizontal Angularity and Offset	_____

Sessions VIII through XI. Alignment: Dial Indicator Method

- A. Setting Up Dial Indicators _____
- B. Laboratory _____
Have trainees practice setting up dial indicators. This laboratory corresponds to Performance Task 3.
- C. Laboratory _____
Have trainees practice determining the sag on a conventional alignment jig. This laboratory corresponds to Performance Task 4.
- D. Taking Top View Measurements _____
- E. Taking Side View Measurements _____
- F. Taking Angularity and Offset Measurements _____
- G. Laboratory _____
Have trainees practice adjusting vertical offset and angularity using the dial indicator method. This laboratory corresponds to Performance Task 8.
- H. Laboratory _____
Have trainees practice adjusting horizontal offset and angularity using the dial indicator method. This laboratory corresponds to Performance Task 9.

Session XII. Review and Testing

- A. Review _____
- B. Module Examination _____
 - 1. Trainees must score 70% or higher to receive recognition from NCCER.
 - 2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.
- C. Performance Testing _____
 - 1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
 - 2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

Annotated Instructor's Guide**MODULE OVERVIEW**

This module explains centrifugal, rotary, reciprocating, metering, and vacuum pump operation and installation methods, as well as types of drivers. It also covers net positive suction head and cavitation.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Millwright Level One; Millwright Level Two; Millwright Level Three; and Millwright Level Four, Modules 15401-08 through 15403-08.*

OBJECTIVES

Upon completion of this module, the trainee will be able to do the following:

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. Install pumps.

PERFORMANCE TASKS

Under the supervision of the instructor, the trainee should be able to do the following:

1. Identify centrifugal pumps.
2. Identify rotary pumps.
3. Identify reciprocating pumps.
4. Identify metering pumps.
5. Identify vacuum pumps.
6. Install a pump.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Hot water bottle with small hose
Pump setups
Manufacturers' installation instructions for various types of pumps

Examples of of the following types of pumps:

Centrifugal
Rotary
Reciprocating
Metering
Vacuum

Assorted screwdrivers
Ball-peen hammer
Needle-nose pliers
Allen wrenches
Copies of the Quick Quizzes*
Module Examinations**
Performance Profile Sheets**

* Located in the back of this module.

**Located in the Test Booklet.

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module may require trainees to visit power plants or utility areas. Ensure that they are briefed on site safety procedures. This module requires trainees to install pumps. Ensure that they are briefed on appropriate shop safety procedures.

ADDITIONAL RESOURCES

This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.

ITT Fluid Technology: <http://www.ittfluidbusiness.com>

Flowserve: <http://www.flowserve.com>

Goulds Pumps: <http://www.goulds.com>

Siemens Corporation: <http://www.usa.siemens.com>

TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 20 hours are suggested to cover *Pumps*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Centrifugal Pumps	
A. Introduction	_____
B. Centrifugal Pumps	_____
C. Laboratory Have trainees practice identifying centrifugal pumps. This laboratory corresponds to Performance Task 1.	_____
Session II. Rotary Pumps	
A. Rotary Pumps	_____
B. Laboratory Have trainees practice identifying rotary pumps. This laboratory corresponds to Performance Task 2.	_____
Session III. Reciprocating Pumps	
A. Reciprocating Pumps	_____
B. Laboratory Have trainees practice identifying reciprocating pumps. This laboratory corresponds to Performance Task 3.	_____
Session IV. Metering Pumps	
A. Metering Pumps	_____
B. Laboratory Have trainees practice identifying metering pumps. This laboratory corresponds to Performance Task 4.	_____

Session V. Vacuum Pumps

A. Vacuum Pumps

B. Laboratory

Have trainees practice identifying vacuum pumps. This laboratory corresponds to Performance Task 5.

Sessions VI and VII. Cavitation; Pump Installation

A. Cavitation

B. Installing Pumps

C. Laboratory

Have trainees practice installing a pump. This laboratory corresponds to Performance Task 6.

Session VIII. Review and Testing

A. Module Review

B. Examination

1. Trainees must score 70% or higher to receive recognition from NCCER.
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

Annotated Instructor's Guide

MODULE OVERVIEW

This module covers how to inspect, troubleshoot, and prepare pumps for shutdown. It also covers removing pumps from the system, disassembly, and reassembly.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Millwright Level One; Millwright Level Two; Millwright Level Three; and Millwright Level Four, Modules 15401-08 through 15404-08.*

OBJECTIVES

Upon completion of this module, the trainee will be able to do the following:

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. Use a checklist for pump start-up.

PERFORMANCE TASKS

Under the supervision of the instructor, the trainee should be able to do the following:

1. Inspect and troubleshoot a pump.
2. Disassemble and reassemble a pump.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Arbor press or length of pipe to install bearings
Transparencies	Dial indicators
Blank acetate sheets	Assorted screwdrivers
Transparency pens	Ball-peen hammer
Whiteboard/chalkboard	Needle-nose pliers
Markers/chalk	Allen wrenches
Pencils and scratch paper	Bearing pullers
Appropriate personal protective equipment	Combination wrench sets
Company safety manual	Emery cloths and hones
Lock washers	Feeler gauges
Gaskets	Flare nut wrenches
O-rings	Grease gun
Various types of pumps	Snap-ring pliers
Pump setups	Socket sets
Old or broken pumps	Torque wrenches

continued

Shaft key wrenches
 Portable crane/rigging device
 Sling and hardware for rigging
 600-grit sandpaper
 Appropriate machine oil

Silicone lubricant
 Manufacturers' maintenance and repair manuals
 Copies of the Quick Quizzes*
 Module Examinations**
 Performance Profile Sheets**

* Located in the back of this module.

**Located in the Test Booklet.

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to work with pumps. Ensure that they are briefed on appropriate shop safety procedures.

ADDITIONAL RESOURCES

This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.

Flowserve: <http://www.flowserve.com/eim/Literature>

Goulds Pumps: http://www.gouldspumps.com/literature_ioms.html

TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 7½ hours are suggested to cover *Troubleshooting and Repairing Pumps*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Inspecting and Troubleshooting Pumps	
A. Introduction	_____
B. Inspecting Pumps	_____
C. Performing Preventive Maintenance on Pumps	_____
D. Troubleshooting Pumps	_____
E. Laboratory	_____
Have trainees practice inspecting and troubleshooting a pump. This laboratory corresponds to Performance Task 1.	
Session II. Disassembling and Reassembling Pumps	
A. Preparing a Pump for Shutdown and Repair	_____
B. Removing a Pump from the System	_____
C. Disassembling a Split-Casing Pump	_____
D. Laboratory	_____
Have trainees practice disassembling a pump. This laboratory corresponds to Performance Task 2.	
E. Reassembling a Pump	_____
F. Laboratory	_____
Have trainees practice reassembling a pump. This laboratory corresponds to Performance Task 2.	

Session III. Pump Start-Up Procedures; Review and Testing

- A. Installing a New or Removed Pump _____
- B. Pump Start-Up Procedures and Operational Testing _____
- C. Review _____
- D. Module Examination _____
 - 1. Trainees must score 70% or higher to receive recognition from NCCER.
 - 2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.
- E. Performance Testing _____
 - 1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
 - 2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

Annotated Instructor's Guide**MODULE OVERVIEW**

This module describes different types of compressors and explains how they operate. It includes information about intake filters, intercoolers, and aftercoolers, and discusses how to troubleshoot and repair air compressors.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Millwright Level One; Millwright Level Two; Millwright Level Three; and Millwright Level Four, Modules 15401-08 through 15405-08.*

OBJECTIVES

Upon completion of this module, the trainee will be able to do the following:

1. Explain pneumatic safety.
2. Explain the principles of compressor operation.
3. Identify and explain types of compressors.
4. Troubleshoot compressors.
5. Replace compressor components.

PERFORMANCE TASKS

Under the supervision of the instructor, the trainee should be able to do the following:

1. Identify various types of compressors.
2. Troubleshoot compressors.
3. Replace compressor components.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Samples of various lubricants, including:
Transparencies	Machine oil
Blank acetate sheets	Silicone lubricant
Transparency pens	Assorted screwdrivers
Whiteboard/chalkboard	Ball-peen hammers
Markers/chalk	Bearing pullers
Pencils and scratch paper	Carpenter's levels
Appropriate personal protective equipment	Pressure gauges
Safety video or DVD, or guest speaker	Feeler gauges
Video or DVD player	Wrenches
Various types of compressors, including:	Flare nut
Continuous flow	Allen
Reciprocating	Pipe
Compressor system setups	Shaft key
Old or broken compressors	Torque
Air filters	Needle-nose pliers
Grease gun	Sharp knives
	Antiseize compound

continued

Arbor press or length of pipe to install bearings
Gaskets
O-rings
Teflon® tape

Manufacturer's maintenance and repair manuals
Copies of the Quick Quizzes*
Module Examinations**
Performance Profile Sheets**

* Located in the back of this module.

** Located in the Test Booklet.

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to work with compressors. Ensure that they are briefed on appropriate shop safety procedures.

ADDITIONAL RESOURCES

This module is intended to present thorough resources for task training. The following references are suggested for both instructors and motivated trainees interested in further study. These are optional resources for continued education rather than for task training.

Industrial Pneumatic Technology, Bulletin 0275-B1, 1980. Cleveland, OH: Parker Hannifin Corporation.

Parker Hannifin Corporation: <http://www.parker.com> for training materials, products, and product information (literature, specifications, drawings).

Quincy Compressor: <http://www.quincycompressor.com> for training materials, products, and product information (literature, specifications, drawings).

Dresser-Rand Corporation: <http://www.dresser-rand.com>

TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 20 hours are suggested to cover *Compressors and Compressor Maintenance*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Compressor Safety	
A. Introduction	_____
B. Pneumatic (Compressed Air) Safety	_____
Session II. Principles of Compressor Operation	
A. Physical Characteristics of Gases	_____
B. Pneumatic Transmission of Energy	_____
C. Principles of Compressor Operation	_____
Sessions III and IV. Compressor Types	
A. Positive-Displacement Compressors	_____
B. Continuous Flow Compressors	_____
C. Compressor Support Systems	_____
D. Laboratory	_____
Have trainees practice identifying various types of compressors. This laboratory corresponds to Performance Task 1.	

Session V. Troubleshooting Compressors

- A. Drive Section Problems _____
- B. Compressor Section Problems _____
- C. Overall System _____
- D. Troubleshooting Reciprocating Compressors _____
- E. Laboratory _____
Have trainees practice troubleshooting compressors. This laboratory corresponds to Performance Task 2.

Sessions VI and VII. Repairing Compressors

- A. General Maintenance _____
- B. Preparing to Repair Components _____
- C. Removing Components _____
- D. Replacing Components _____
- E. Laboratory _____
Have trainees practice replacing compressor components. This laboratory corresponds to Performance Task 3.
- F. Performing Post-Repair Actions _____

Session VIII. Review and Testing

- A. Review _____
- B. Module Examination _____
 - 1. Trainees must score 70% or higher to receive recognition from NCCER.
 - 2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.
- C. Performance Testing _____
 - 1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
 - 2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

MODULE OVERVIEW

This module covers pneumatic safety, characteristics of gases and how they are compressed, pneumatic transmission of energy, and pneumatic system components and their symbols.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Millwright Level One; Millwright Level Two; Millwright Level Three; and Millwright Level Four*, Modules 15401-08 through 15406-08.

OBJECTIVES

Upon completion of this module, the trainee will be able to do the following:

1. Explain compressed-air treatment.
2. Identify and explain pneumatic system components and symbols.

PERFORMANCE TASK

Under the supervision of the instructor, the trainee should be able to do the following:

1. Identify at least four components of basic pneumatic equipment.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Pressure gauges

Manufacturer's literature on intercoolers and aftercoolers

Company safety manual, including lockout/tagout procedures

In-line filters or manufacturer's literature on in-line filters

Compressed-air treatment devices

Pneumatic system actuators

Pneumatic system mufflers

Pneumatic system valves

Pneumatic system intake filters

Schematic diagram of a pneumatic system with pneumatic symbols

Copies of the Quick Quizzes*

Module Examinations**

Performance Profile Sheets**

* Located in the back of this module.

** Located in the Test Booklet.

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to

use it properly.

ADDITIONAL RESOURCES

This module is intended to present thorough resources for task training. The following references are suggested for both instructors and motivated trainees interested in further study. These are optional resources for continued education rather than for task training.

Industrial Fluid Power, Vol. 1, 2, and 3, 2005. Womack and Hedges. Dallas, TX: Womack Educational Publications.

Industrial Pneumatic Technology, Bulletin 0275-B1. 1980. Cleveland, OH: Parker Hannifin Corporation.

Parker Hannifin Corporation: <http://www.parker.com> for training materials, products, and product information (literature, specifications, drawings).

MFD Pneumatics: <http://www.mfdpneumatics.com> for pneumatic products and product information (literature, specifications, drawings).

TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 7½ hours are suggested to cover *Basic Pneumatic Systems*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Pneumatic Safety; Physical Characteristics of Gases	
A. Introduction	_____
B. Pneumatic Safety	_____
C. Physical Characteristics of Gases	_____
Session II. Pneumatic Systems	
A. Distribution and Treatment of Compressed Air	_____
B. Pneumatic System Components	_____
C. Laboratory	_____
Have trainees practice identifying pneumatic equipment components. This laboratory corresponds to Performance Task 1.	
Session III. Pneumatic Symbols; Review and Testing	
A. Pneumatic Symbols	_____
B. Review	_____
C. Module Examination	_____
1. Trainees must score 70% or higher to receive recognition from NCCER.	
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.	
D. Performance Testing	_____
1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.	
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.	

MODULE OVERVIEW

This module teaches trainees how to perform preventive maintenance on pneumatic equipment, inspect components, and read schematic diagrams. It includes troubleshooting and repair procedures for pneumatic systems.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Millwright Level One; Millwright Level Two; Millwright Level Three; and Millwright Level Four*, Modules 15401-08 through 15407-08.

OBJECTIVES

Upon completion of this module, the trainee will be able to do the following:

1. Perform pneumatic system preventive maintenance procedures.
2. Inspect pneumatic system components.
3. Read pneumatic system schematic diagrams.
4. Troubleshoot pneumatic systems.
5. Repair pneumatic system components.

PERFORMANCE TASKS

Under the supervision of the instructor, the trainee should be able to do the following:

1. Inspect pneumatic system components.
2. Disassemble components.
3. Reassemble components.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Set of flare nut wrenches
Transparencies	Assorted screwdrivers
Blank acetate sheets	Emery cloths and hones
Transparency pens	Needle-nose pliers
Whiteboard/chalkboard	Set of Allen wrenches
Markers/chalk	Manufacturers' maintenance and repair manuals
Pencils and scratch paper	Sample troubleshooting charts
Appropriate personal protective equipment	Copies of the Quick Quiz*
Company safety manual	Module Examinations**
Pneumatic system to inspect	Performance Profile Sheets**
Pneumatic system components to disable/repair	

* Located in the back of this module.

** Located in the Test Booklet.

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to disassemble and reassemble pneumatic system components. Ensure that they are briefed on appropriate shop safety procedures.

ADDITIONAL RESOURCES

This module is intended to present thorough resources for task training. The following references are suggested for both instructors and motivated trainees interested in further study. These are optional resources for continued education rather than for task training.

Industrial Pneumatic Technology, Bulletin 0275-B1, 1980. Cleveland, OH: Parker Hannifin Corporation.

Parker Hannifin Corporation: <http://www.parker.com> for training materials, products, and product information (literature, specifications, drawings).

MFD Pneumatics: <http://www.mfdpneumatics.com> for pneumatic products, and product information (literature, specifications, drawings).

TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 10 hours are suggested to cover *Troubleshooting and Repairing Pneumatic Equipment*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Preventive Maintenance; Inspection of Pneumatic Equipment	
A. Introduction	_____
B. Preventive Maintenance	_____
C. Inspecting Pneumatic System Components	_____
D. Laboratory	_____
Have trainees practice inspecting pneumatic system components. This laboratory corresponds to Performance Task 1.	
Session II. Reading Pneumatic Schematic Diagrams; Troubleshooting	
A. Reading Pneumatic Schematic Diagrams	_____
B. Troubleshooting Pneumatic Systems	_____
C. Pneumatic System Troubleshooting Charts	_____
Session III. Repairing Pneumatic System Components	
A. Preparing the System for Shutdown and Repair	_____
B. Repairing and Overhauling Components	_____
1. Removing Components from the System	_____
2. Disassembling Components	_____
3. Reassembling Components	_____
C. Laboratory	_____
Have trainees practice disassembling and reassembling pneumatic system components. This laboratory corresponds to Performance Tasks 2 and 3.	
D. Replacing Pneumatic Gauges	_____

Session IV. Review and Testing

A. Review

B. Module Examination

1. Trainees must score 70% or higher to receive recognition from NCCER.
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

MODULE OVERVIEW

This module covers hydraulic system safety and the basic principles of hydraulics, including Pascal's law and Bernoulli's principle. It also explains the function of hydraulic fluids, system parts, pumps, and motors.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Millwright Level One; Millwright Level Two; Millwright Level Three; and Millwright Level Four*, Modules 15401-08 through 15408-08.

OBJECTIVES

Upon completion of this module, the trainee will be able to do the following:

1. Explain hydraulic system safety.
2. Explain the principles of hydraulics.
3. Identify and explain hydraulic fluids.
4. Identify and explain hydraulic system parts.
5. Identify and explain hydraulic pumps.
6. Identify and explain hydraulic motors.

PERFORMANCE TASKS

Under the supervision of the instructor, the trainee should be able to do the following:

1. Identify hydraulic pumps and motors.
2. Identify at least four hydraulic system components.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Various types of hydraulic pumps or manufacturers' literature on pumps
Transparencies	Various types of hydraulic motors or manufacturers' literature on motors
Blank acetate sheets	Hydraulic hoses
Transparency pens	Hydraulic valves
Whiteboard/chalkboard	Hydraulic cylinders and seals
Markers/chalk	Various types of piping, tubing, and fittings
Pencils and scratch paper	Specialty fittings
Appropriate personal protective equipment	Strainers and filters
Samples of hydraulic fluids	Copies of the Quick Quizzes*
MSDS for several hydraulic fluids	Module Examinations**
Hydraulic accumulators or manufacturers' literature on accumulators	Performance Profile Sheets**
Hydraulic reservoirs or manufacturers' literature on hydraulic reservoirs	

* Located in the back of this module.

** Located in the Test Booklet.

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to work with hydraulic system components. Ensure that they are briefed on appropriate shop safety procedures.

ADDITIONAL RESOURCES

This module is intended to present thorough resources for task training. The following references are suggested for both instructors and motivated trainees interested in further study. These are optional resources for continued education rather than for task training.

Industrial Hydraulic Technology, Second Edition, Bulletin 0232-B1, 1997. Cleveland, OH: Parker Hannifin Corporation.

Parker Hannifin Corporation: <http://www.parker.com> for training materials, products, and product information (literature, specifications, drawings).

Hydraulic Fittings Company: <http://www.discounthydraulicchase.com> for products, and job aids.

Viking Pump, Inc.: <http://www.vikingpump.com> for products and product information (literature, specifications, drawings).

Bosch Rexroth Corporation: <http://www.boschrexroth-us.com> for training materials, products, and product information (literature, specifications, drawings).

TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 10 hours are suggested to cover *Basic Hydraulic Systems*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction to Hydraulic Systems; Hydraulic Fluids	
A. Introduction	_____
B. Hydraulic System Safety	_____
C. Principles of Hydraulics	_____
D. Hydraulic Fluids	_____
Session II. Hydraulic System Parts	
A. Strainers and Filters	_____
B. Reservoirs	_____
C. Accumulators	_____
D. Piping, Tubing, and Fittings	_____
E. Directional-Control Valves	_____
F. Pressure-Control Valves	_____
G. Cylinders	_____
H. Laboratory	_____
Have trainees practice identifying hydraulic system components. This laboratory corresponds to Performance Task 2.	

Session III. Hydraulic Pumps and Motors

A. Hydraulic Pumps

C. Hydraulic Motors

D. Laboratory

Have trainees practice identifying hydraulic pumps and motors. This laboratory corresponds to Performance Task 1.

Session IV. Review and Testing

A. Review

B. Module Examination

1. Trainees must score 70% or higher to receive recognition from NCCER.
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

MODULE OVERVIEW

This module explains how to inspect, troubleshoot, and repair hydraulic systems and components. It also includes information about reading system schematic diagrams.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Millwright Level One; Millwright Level Two; Millwright Level Three; and Millwright Level Four, Modules 15401-08 through 15409-08.*

OBJECTIVES

Upon completion of this module, the trainee will be able to do the following:

1. Inspect hydraulic system equipment.
2. Read hydraulic system schematic diagrams.
3. Explain the basic hydraulic principles that must be considered before troubleshooting.
4. Troubleshoot hydraulic systems.
5. Repair or replace hydraulic system components.

PERFORMANCE TASKS

Under the supervision of the instructor, the trainee should be able to do the following:

1. Inspect hydraulic system components.
2. Troubleshoot and repair or replace at least three of the following:
 - Hydraulic fluid reservoirs
 - Filters and strainers
 - Hydraulic pumps
 - Hydraulic motors
 - Control valves
 - Cylinders
 - Hoses
 - Fittings
 - Gauges

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Hydraulic system components to inspect and troubleshoot
Transparencies	Hydraulic system components to repair/replace
Blank acetate sheets	Set of flare nut wrenches
Transparency pens	Assorted screwdrivers
Whiteboard/chalkboard	Emery cloths and hones
Markers/chalk	Needle-nose pliers
Pencils and scratch paper	Set of Allen wrenches
Appropriate personal protective equipment	Copies of the Quick Quiz*
Manufacturers' maintenance and repair manuals	Module Examinations**
Sample troubleshooting charts	Performance Profile Sheets**
Hydraulic schematic diagrams	

* Located in the back of this module.

**Located in the Test Booklet.

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to inspect, troubleshoot, and repair or replace hydraulic system components. Ensure that they are briefed on appropriate shop safety procedures.

ADDITIONAL RESOURCES

This module is intended to present thorough resources for task training. The following references are suggested for both instructors and motivated trainees interested in further study. These are optional resources for continued education rather than for task training.

Industrial Hydraulic Technology, Second Edition, Bulletin 0232-B1. Cleveland, OH: Parker Hannifin Corporation.

Parker Hannifin Corporation: <http://www.parker.com> for training materials, products, and product information (literature, specifications, drawings).

Hydraulic Fittings Company: <http://www.discounthydraulichose.com> for products and job aids.

Eaton Hydraulics: <http://www.eaton.com/hydraulics> for training materials, products, and product information (literature, specifications, drawings).

Hosecraft USA: <http://www.hosecraftusa.com> for products and product information (literature, specifications, drawings).

TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 7½ hours are suggested to cover *Troubleshooting and Repairing Hydraulic Equipment*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Inspecting Hydraulic System Components; Schematic Diagrams	
A. Introduction	_____
B. Inspecting Hydraulic System Components	_____
C. Laboratory	_____
Have trainees practice inspecting hydraulic system components. This laboratory corresponds to Performance Task 1.	
D. Reading Hydraulic System Schematic Diagrams	_____
Session II. Troubleshooting and Repairing	
A. Troubleshooting Hydraulic Systems	_____
B. Repairing Hydraulic System Components	_____
C. Laboratory	_____
Have trainees practice troubleshooting and repairing or replacing hydraulic system components. This laboratory corresponds to Performance Task 2.	

Session III. Review and Testing

A. Review

B. Module Examination

1. Trainees must score 70% or higher to receive recognition from NCCER.
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

Annotated Instructor's Guide

MODULE OVERVIEW

This module covers gearboxes and how to inspect, remove, reassemble, install, and maintain them. It also includes information about gear types, gear operation, and measuring and adjusting backlash and bearing clearance.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Millwright Level One; Millwright Level Two; Millwright Level Three; and Millwright Level Four, Modules 15401-08 through 15410-08.*

OBJECTIVES

Upon completion of this module, the trainee will be able to do the following:

1. Identify and explain gearboxes.
2. Explain how gears operate and identify types of gears.
3. Identify types of gearboxes.
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.

PERFORMANCE TASKS

Under the supervision of the instructor, the trainee should be able to do the following:

1. Identify types of gears.
2. Identify types of gearboxes.
3. Troubleshoot a gearbox.
4. Disassemble and reassemble a gearbox.
5. Identify gear wear patterns.
6. Measure backlash and bearing clearance.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Manufacturer's service manuals

Non-working gearboxes for troubleshooting and disassembly

Rags

Lockout/tagout devices

Various types of gears, including:

Spur

Helical

Double helical

Herringbone

Worm

Bevel

Spiral bevel

Hypoid bevel

Zerol bevel

Various types of gearboxes, including:

Parallel

In-line

Right angle drive

Shaft mount

continued

Wrenches
 Pans for oil
 Cleaning solvent
 Solvent MSDS
 High-spot blue and applicator
 Dead-blow hammer
 Dial indicator
 Feeler gauge
 Gear pullers

Heating torch
 Hydraulic press
 Lifting devices
 Bearing heater
 Video or DVD on chemical safety
 Video or DVD player
 Copies of the Quick Quizzes*
 Module Examinations**
 Performance Profile Sheets**

* Located in the back of this module.

**Located in the Test Booklet.

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to troubleshoot, disassemble, and reassemble gearboxes. Ensure that they are briefed on appropriate shop safety procedures.

ADDITIONAL RESOURCES

This module is intended to present thorough resources for task training. The following references are suggested for both instructors and motivated trainees interested in further study. These are optional resources for continued education rather than for task training.

Mobil Brief Product Descriptions, Mobil Oil Corporation, published annually.

Maintenance Resources, Inc.: <http://www.maintenanceresources.com/references/referencelibrary/gears/gearing.htm>

Plant Services: <http://www.plantservices.com/articles/2004/393.html>

TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 20 hours are suggested to cover *Troubleshooting and Repairing Gearboxes*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction to Gearboxes	
A. Introduction	_____
B. Understanding Gearboxes	_____
C. Gear Types	_____
D. Laboratory Have trainees practice identifying gear types. This laboratory corresponds to Performance Task 1.	_____
E. Types of Gearboxes	_____
F. Laboratory Have trainees practice identifying types of gearboxes. This laboratory corresponds to Performance Task 2.	_____

Session II. Troubleshooting Gearboxes

A. Troubleshooting Gearboxes _____

B. Laboratory _____

Have trainees practice troubleshooting gearboxes. This laboratory corresponds to Performance Task 3.

Sessions III and IV. Disassembling and Reassembling Gearboxes

A. Repairing Gearboxes _____

B. Removing Gearboxes _____

C. Disassembling and Reassembling Gearboxes _____

D. Laboratory _____

Have trainees practice disassembling and reassembling gearboxes. This laboratory corresponds to Performance Task 4.

Session V. Gear Wear Patterns

A. Identifying Gear Wear Patterns _____

B. Laboratory _____

Have trainees practice identifying gear wear patterns. This laboratory corresponds to Performance Task 5.

Sessions VI and VII. Repairing Gearboxes

A. Measuring and Adjusting Backlash _____

B. Measuring and Setting Bearing Clearance _____

C. Laboratory _____

Have trainees practice measuring backlash and bearing clearance. This laboratory corresponds to Performance Task 6.

D. Installing Gearboxes _____

E. Maintaining Gearboxes _____

Session VIII. Review and Testing

A. Review _____

B. Module Examination _____

1. Trainees must score 70% or higher to receive recognition from NCCER.
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing _____

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

